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Editorial

The Future Role of Medical Teachers as Influencers

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A few weeks ago, I was invited to an international conference to deliver a plenary talk on the future of medical education and how medical schools and teachers can meet the forthcoming societal expectations worldwide. Given the complexity and the great uncertainty about the near future, it was not surprising that my first slide was: "I don't know!". I could have sent my response via email in advance, instead of travelling all the way for about 2,000 KM to declare my ignorance. To avoid disappointing the audience, I shared a few thoughts on the potential future of medical education, without any promises that my prediction will be true. My talk discussed the anticipated learning ecosystem, medical students' preferences, the evolving scope of medical schools, the business model governing medical education, and eventually the future role of medical teachers. This Editorial will shed some light on some of these humble expectations.

A few years ago, I published an Editorial on the evolving roles of physicians in the era of Artificial Intelligence (AI), presenting three scenarios focusing on accuracy, empathy, and trust.[1] It's about time to address the other side of the coin and reflect on the roles of educators who will graduate future physicians. Let's start with medical students, because their demographics and preferences will shape the future of medical education.

The new generations of medical students

The new generations of medical students, including Gen Z (born from 1990s to 2010), Gen Alpha (born from 2010 to 2024), and Gen Beta (born this year onwards) are different from the past generations in many ways.[2] As we used to advocate interactive collaborative learning strategies like Team-based learning (TBL) and Problem-based learning (PBL), the new generations have concerns on excessive screen time and the need for updated information, often referred to as the Fear of Missing Out (FoMO), which triggers learning in silos, not in groups.[3] Social learning is being replaced by individualized learning pathways, more electives, tailored courses, and just-in-time learning. This is amplified by the advancement of AI learning agents to fit their personal preferences and inclinations as lifelong (solo), autonomous learners in a highly competitive market. That said, medical teachers need to adopt new roles to meet the expectations of new generations of medical students and residents of the future. But what is known about the roles of medical teachers in the literature?

In its silver jubilee, I will revisit the iconic AMEE guide 20, which indicated twelve roles of medical teachers, coupled in six pairs, namely: Information Provider, Resource Developer, Planner, Assessor, Facilitator, and Role-model.[4] Four recent trends are relevant to this topic and may guide our reflection. First, medical students are not used to meeting their teachers (or even their peers) and they tend to learn as solo learners, as indicated earlier. This is reinforced by the second trend of Precision Medical Education (PME), which aims to systematize individualized and efficient learner competency development for enhanced patient care.[5] Third, the shift in the ecosystem of medical schools from face-to-face to embracing more distance, online, or blended learning in many undergraduate and postgraduate programs. The fourth trend is about reconciling the tension between the 'global' and the 'local' in medical education and its impact on the role of medical teachers,[6] which may need further elaboration.

The tension between localization vs. globalization

The social accountability requires medical schools to direct their activities to local priorities, but they also compete for international applicants who may go back to practice in their home countries or move to practice medicine in a global space. "We are living in a small village". I bet you have read/heard this quote many times, but our village is getting even smaller, which endorses the concept of 'global accountability' for medical schools to solve universal (not local) health issues.[7] We need to offer our medical students (and graduates) opportunities to develop their intercultural skills to learn and practice across contexts at any point in their careers. For instance, when they move to Rome, they have to act like Romans, and also Romans should help visitors to meet societal expectations.[8] Likewise, medical teachers are getting more

engaged with international commitments beyond their local institutions and act as global educators. This is evident by their contribution as speakers at webinars, online courses, and as visiting faculty in international (sometimes dual) degrees.

To summarize the above four trends, we can say that future medical students are solo, autonomous learners, empowered with AI learning agents, but they still may seek guidance from global educators, mainly at a distance or via online channels. Given this interplay between students and teachers in a new learning ecosystem, some of the given roles of AMEE Guide 20 may survive, vanish, or be transformed.

Revisiting the roles of medical teachers

The traditional, face-to-face lectures to large groups of students may not be appealing for the new generations of students, who prefer to learn alone or in ultra-small groups. With open access to content, it seems that students can learn anything online, right? Actually, the so-called: Googlification of (medical) education is a myth that was busted by Kirschner and van Merriënboer.[9] Did you hear about the Paradox of Choice? It's when you have a huge number of options to choose from, which leads to more confusion and uncertainty. Therefore, learners can choose from a limited number of options recommended by the expert. It's a two-step process known as: Shared Control between the teacher and the learner.

Consequently, the roles of medical teachers as Information Providers and Resource Developers may disappear or need to be adjusted. There's no need to provide (new) information or develop (new) learning content, but future medical teachers may have an alternative role as learning resource optimizers to validate and select the most relevant online content to address the learning needs of their students.

The role of Planner might be occupied by learners themselves to develop individualized learning trajectories throughout the continuum of medical education using micro-credentials and on-demand courses and electives, from day one to specialization and beyond. Their pathways can be dictated/moderated by societal expectations and the evolving market needs. While the role of Assessor can be easily secured by AI assistants and platforms that can offer individualized feedback on the understanding and performance of individual students. Now we are left with two roles of the medical teachers, namely as Learning Facilitators and as Role Models, which will remain, but to be offered in a new format, with a global impact.

Medical teachers as influencers

Students still need guidance from experts, but (global) medical teachers can support and mentor thousands of students worldwide if they act as bloggers or influencers, how? Besides creating high-quality content, successful medical educators need to master digital marketing, entrepreneurship, and social media. They also need to monitor analytics, engage with their audience, and build a strong online presence. Their success can be easily measured by the number of followers and the quality of feedback on their ultra-short presentations, tutorials, and reels. The good news is that future medical teachers and learners belong to the same generations; they both lived most of their lives on Wi-Fi, and they are all familiar with online education. The role of educators as influencers is not limited to presenting content in a tempting fashion, but they also have other responsibilities. Influencers can advocate the significance of their subjects/specialties and guide candidates to make informed career choices by discussing personal qualities and professional attributes for successful candidates in specific domains, e.g., psychiatry, laboratory medicine, surgery, etc. Advocating the profession (not the content) is like those authentic reviews in unboxing videos on launching new products. They will gain credibility by offering sincere advice addressing the strengths and limitations of different specialties.

Alternatively, medical teachers can create groups and online communities to discuss venues for integration between disciplines and/or professions to support interprofessional education and practice. Clinical educators may share real-life scenarios to support decision-making in professionalism dilemmas that are usually context-specific. Some educators may go beyond that and collaborate with industry as subject matter experts (SME) to develop AI learning agents and applications in their specialties, e.g., forensic medicine, surgery, anesthesiology, or physiology.

To conclude, technology and AI are not expected to replace medical teachers, but the traditional classroom model and social learning may not be effective for the new generations of learners. The role of (global) educators as online bloggers and social media influencers may be more effective in engaging (global) learners with short (and ultra-short) learning episodes, presented in YouTube Shorts, Instagram/TikTok Reels, and Snapchat Spotlights. It's time to rethink medical education in the digital era and plan faculty development programs to empower medical teachers of the future.

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Journal of University College of Medicine & Dentistry

Original Article

A Comparative Study of Mesh Fixation and Non-Fixation in Open Inguinal Hernia Repair

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Abstract

Objective: To compare mesh fixation and non-fixation in open inguinal hernia repair concerning operative time, hospital stay, and post-operative complications.

Methodology: This clinical experimental study was conducted from January to June 2022, at the Department of General Surgery, Pakistan Institute of Medical Sciences, Islamabad. A total of 100 patients aged 18 - 60 years with unilateral inguinal hernia scheduled for repair were selected using probability sampling method. Patients with bilateral, recurrent, obstructed hernias were excluded. The participants were randomly assigned to two groups: mesh fixation (n=50) and non-fixation (n=50). Outcomes assessed included operative duration, hospital stay, post-operative pain, scrotal swelling, wound infection, and recurrence. Data analysis was performed using SPSS version 22.

Results: The mean patient age was 39.86±8.52 years, with a male predominance (95 males, 5 females). The mean operative time was significantly shorter in the non-fixation group (68.36±4.77 min) compared to the fixation group (91.04±6.29 min, p=0.00). Similarly, the mean hospital stay was shorter in the non-fixation group (1.10±0.30 days) compared to the fixation group (2.12±0.33 days, p=0.000). Post-operative pain was also significantly lower in the non-fixation group (2.46±0.65) compared to the fixation group (4.92±0.60, p=0.000). No significant difference in recurrence rates was observed between the two groups.

Conclusion: Non-fixation of mesh in inguinal hernia repair offers advantages such as reduced operative time, shorter hospital stay, and lower post-operative pain without increasing the risk of recurrence.

Keywords: Inguinal hernia, mesh fixation, non-fixation, post-operative pain, operative time, hospital stay, recurrence

Introduction

Inguinal hernia, a common surgical issue that many practitioners encounter constitutes 75% of all abdominal hernias, and are more frequently observed in males than females.[1,2] The condition often requires surgical intervention, and advancements in surgical techniques have significantly improved the outcomes for patients undergoing hernia repair. Inguinal hernia repair is a common surgical procedure. Both open and laparoscopic techniques employ a prosthetic mesh to achieve tension-free repair.

Globally, approximately twenty million inguinal hernia surgeries are performed annually. However, 8-16% of these patients experience chronic pain post-surgery.[3] There are various surgical methods to address inguinal hernias, broadly categorized into open inguinal hernia repair and laparoscopic inguinal hernia repair, with the former being more commonly practiced. The use of mesh in these repairs has gained popularity as it significantly reduces recurrence rates.[4]

Inguinal hernia mesh repair without fixation offers several advantages over mesh fixation, including significantly lower surgical costs, similar post-operative complications, hospital stays, operative times, and no increase in recurrence rates.[5] This is because, after 24 to 48 hours post-surgery, the mesh is primarily held in place by the local inflammatory response rather than the fixation device. While mesh fixation is widely used to prevent recurrence, it often leads to complications such as chronic groin pain.[6]

Mesh fixation remains a controversial issue and there is difference of opinion among surgeons. The comparison of mesh fixation and non-fixation in inguinal hernia repair reveals nuanced outcomes regarding postoperative pain, recurrence rates, and operational efficiency.[7] Studies indicate that both techniques yield similar postoperative pain levels, but non-fixation may lead to higher recurrence rates and chronic pain over time.[8] In contrast, while non-fixation may offer operational advantages, the potential for increased recurrence necessitates careful consideration of surgical technique and patient-specific factors.[9]

This study aims to compare mesh fixation and non-fixation in open inguinal hernia repair within our setting, focusing on operative time, hospital stay, and post-operative complications such as pain, wound infection, scrotal edema, and recurrence rates. While most existing studies focus on laparoscopic approaches[10] open method mesh repair is more commonly used in our country, necessitating an evaluation of the effectiveness and benefits of the non-fixation mesh repair technique in open inguinal hernia repair compared to the fixation method.

Methodology

This clinical experimental study was conducted over six months, from January 2022, to June 2022, at the Department of General Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad after taking ethical approval from the institute (F.1-1/2015/ERB/SZAMU/720). All patients aged 18 to 60 years admitted to the general surgery ward with a diagnosis of unilateral inguinal hernia, classified as American Society of Anaesthesiologists (ASA) physical status I or II, and scheduled for elective open inguinal hernia repair were included in the study after obtaining informed consent. Patients with recurrent hernia, bilateral hernias, complicated hernias (e.g., strangulated, incarcerated) and patients with coagulopathies or other systemic diseases contraindicating surgery were excluded.

Patients were selected through probability convenient sampling and randomly assigned to two groups of 50 each using the lottery method. The Fixation Group (FG) underwent open inguinal hernia repair with mesh fixation, while the Non-Fixation Group (NFG) underwent the procedure without mesh fixation. In FG, the surgical procedure involved standard Lichtenstein tension-free hernioplasty. The mesh was fixed using non-absorbable sutures at multiple points to ensure its stability and prevent migration, while in NFG, the mesh was placed over the defect without sutures. The inherent local inflammatory response was relied upon to secure the mesh in place postoperatively.

All data were collected using a standardized proforma, assessing operative time, hospital stay, post-operative pain, scrotal swelling, wound infection, and recurrence. Operative time was recorded in minutes from skin incision to closure, while hospital stay was measured in days following surgery. Post-operative pain was evaluated on the first post-operative day using a visual analog scale (VAS). Scrotal swelling was documented as present or absent based on post-surgical observation. Wound infection was identified by the presence of erythema, discharge, or fever within 30 days post-surgery. Recurrence was assessed through clinical examination at follow-up visits conducted at 1, 3, and 6 months.

Results

All patients with uncomplicated open inguinal hernia repair were discharged after 24hours by the consultant.

The mean age of the patients was 39.86±8.52 years. There were 95 males and 5 females. The baseline characteristics of the study population are presented in Table I.

Table 1: Baseline Characteristics of Study Groups

Characteristics	Non fixation group (n=50)	Fixation group (n=50)	p value
Age (years)	40.12±8.74	39.60±8.30	0.786
Gender			
Male	47	48	0.793
Female	03	02	
BMI (kg/m2)	27.67±4.46	26.39±4.87	0.180
ASA status			
I	15	22	0.17
II	35	28	
Side of hernia			
Right	25	45	0.43
Left	08	22	
Type of hernia			
Direct	06	09	0.28
Indirect	41	44	
Operative Time (minutes)	68.36±4.77	91.04±6.29	0.00
Hospital stay (days)	1.10±0.30	2.12±0.33	0.00

Table 2: Comparison of Postoperative Pain in Both Groups

	N	Non fixation Group	Fixation Group	p value
Age (years)				
21 - 40	53	2.46 ± 0.70	4.96 ± 0.51	0.00
41 - 60	47	2.45 ± 0.58	4.86 ± 0.69	0.00
Side of hernia				
Right	70	2.46 ± 0.64	4.65 ± 0.67	0.00
Left	30	3.13 ± 0.74	5.10 ± 0.48	0.00
Type of hernia				
Direct	15	2.00 ± 0.00	4.66 ± 0.57	0.008
Indirect	85	2.47 ± 0.65	4.93 ± 0.60	0.00
ASA				
I	67	2.73 ± 0.79	4.96 ± 0.57	0.00
II	33	2.34 ± 0.53	4.86 ± 0.63	0.00
BMI				
< 30	39	2.63 ± 0.76	4.85 ± 0.58	0.00
> 30	61	2.35 ± 0.55	4.96 ± 0.61	0.00

Table 3: Comparison of Postoperative Scrotal Swelling in Both Groups

	N	Non fixation Group	Fixation Group	p value
Age (years)				
21 - 40	53	01	01	0.69
41 - 60	47	01	03	0.40
Side of hernia				
Right	70	01	02	0.19
Left	30	00	01	0.50
Type of hernia				
Direct	15	00	00	----
Indirect	85	01	03	0.30
ASA				
I	67	00	02	0.41
II	33	01	01	0.62
BMI				
< 30	39	00	02	0.00
> 30	61	01	01	0.74

Table 4: Comparison of :Postoperative Wound Infection in Both Groups

	N	Non fixation Group	Fixation Group	p value
Age (years)				
21 - 40	53	00	00	----
41 - 60	47	02	03	0.21
Side of hernia				
Right	70	02	02	0.35
Left	30	00	01	0.50
Type of hernia				
Direct	15	00	01	0.50
Indirect	85	01	03	0.30
ASA				
I	67	01	02	0.38
II	33	01	01	0.62
BMI				
< 30	39	00	02	0.40
> 30	61	01	02	0.34

Discussion

In this study, our aim was to evaluate the effectiveness of mesh repair without fixation in open inguinal hernia repair compared to the fixation method. The motivation for this comparison arises from the fact that while many studies focus on laparoscopic techniques, open mesh repair remains predominantly practiced in our country.[11] Thus, it is essential to establish the efficacy and advantages of non-fixation mesh repair in open inguinal hernia surgeries.[12] There are several known risk factors for inguinal hernia formation, such as advanced age, male sex, lower body mass index, abnormalities in matrix metalloproteinase, patent processus vaginalis, chronic obstructive pulmonary disease, and prostatectomy history.

Despite the fact that male sex is a well-established predictor of inguinal hernia, previous research has not established whether there is a sex-specific risk factor. Evidence showed that males have a much higher prevalence of inguinal hernias than females[13] which is similar to this study where 95% were males and 5% were female patients with inguinal hernias. (Table I) Inguinal hernias are much more common in men than in women, with lifetime risks of 27% and 3%, respectively.[14]

Inguinal hernias are more common in older age group, as in this study more patients are older than 40 years of age (Table 1). Yen HC et al reported that the majority of inguinal hernias (67.9%) occurred in people over 65, and 90.5% of cases were in men.[15] According to another report, the prevalence of inguinal hernias is 5% in the lowest age group (25–34 years old) and 45% in men 75 years of age and beyond.[16]

There is a relatively high risk of complications after hernia repair, such as postoperative pain, wound seroma/haematoma, wound infection, urinary retention and recurrence. This study evaluates the postoperative complication between the two groups. A study from India indicates that non-fixation of the mesh offers significant cost benefits without increasing postoperative complications or recurrence rates. The study suggests that the local inflammatory process rather than the fixation device primarily holds the mesh in place post operative.[17]

Our study's findings align with these observations, showing that non-fixation of the mesh significantly reduces operative time and hospital stay. The mean operative time for the non-fixation group was substantially lower than that for the fixation group. Similarly, patients in the non-fixation group

experienced shorter hospital stays compared to those in the fixation group. These outcomes are critical as they imply faster recovery and reduced healthcare costs.[18]

Post-operative pain, a crucial factor influencing patient quality of life and recovery, was also notably lower in the non-fixation group. (Table 2) This finding is consistent with previous studies, such as by Lv Y et al., which reported that patients undergoing non-fixation mesh repair experienced less postoperative pain compared to those with mesh fixation. Reduced postoperative pain can significantly enhance patient comfort and satisfaction, making non-fixation an attractive option for inguinal hernia repair.[19] Additionally, research by Acar et al., from Turkey highlighted that while mesh fixation is common to prevent hernia recurrence, it can lead to chronic groin pain, a significant postoperative complication.6 Another study provides strong evidence that mesh non-fixation does not increase recurrence rates and may reduce chronic pain in laparoscopic inguinal hernia repair.[20] The same principles could be applied to open inguinal hernia repair, encouraging further research into whether non-fixation is a viable option to improve patient outcomes.

Regarding postoperative complications, our study found no significant difference in wound infection rates between the two groups. (Table 4) This outcome is corroborated by other studies which also reported similar infection rates for both fixation and non-fixation technique. The comparable infection rates suggest that the non-fixation technique does not compromise the procedure's safety concerning this particular complication.[21]

Scrotal edema, another postoperative complication, showed no significant difference between the groups in our study. (Table 3) This aligns with the findings of studies such as those by Kumar et al., which also observed no substantial difference in scrotal edema incidence between fixation and non-fixation groups. Thus, the non-fixation approach does not increase the risk of this complication.[22]

One of the most critical outcomes to consider in hernia repair is the recurrence rate. Our study found no significant difference in hernia recurrence rates between the fixation and non-fixation groups. This result is in line with the findings of other studies which reported similar recurrence rates for both techniques.[23,24] This parity in recurrence rates underscores the effectiveness of the non-fixation method in maintaining long-term repair integrity.

In summary, non-fixation of the mesh in open inguinal hernia repair offers significant advantages over mesh fixation, including reduced operative time, shorter hospital stays, and lower postoperative pain. The rates of wound infection, scrotal edema, and hernia recurrence are comparable between the two techniques, indicating that non-fixation does not compromise the procedure's safety or effectiveness. These findings support the adoption of non-fixation mesh repair as a preferable approach in open inguinal hernia surgeries, providing benefits to both patients and healthcare systems.[25]

Limitations

Our study has few limitations, including a short follow-up period of six months, which may be insufficient to assess long-term recurrence and complications. The small sample size of 100 patients and the significant gender imbalance (95 males, 5 females) may limit the generalizability of our findings. The lack of blinding introduces potential bias in subjective outcomes such as post-operative pain. Additionally, certain methodological details, including the type of anesthesia used, surgeon experience, and pain assessment scale, have not been specified. Furthermore, post-discharge complications were not reported. Lastly, the study does not include a cost-effectiveness analysis, which could have further strengthened its clinical relevance.

This study demonstrates that non-fixation of mesh in open inguinal hernia repair is associated with shorter operative time, reduced hospital stay, and lower post-operative pain compared to mesh fixation. However, both techniques show similar recurrence rates, making non-fixation a preferable option for reducing immediate post-operative morbidity.

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Original Article

Neurological Complications of Intrathecal Methotrexate in Children: A Prospective Study

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Abstract

Objective: To determine the neurological complications of Intrathecal Methotrexate (MTX) in pediatric patients receiving treatment for childhood malignancy in a tertiary care hospital of Islamabad, Pakistan.

Methodology: This prospective observational study was conducted at the Pediatric Oncology Department of the Children's Hospital, Pakistan Institute of Medical Sciences (PIMS) Islamabad from January to December 2024. During the study period, 96 patients aged 1–13 years received 796 intrathecal (IT) MTX administrations under aseptic conditions. We recorded both minor and major neurological complications occurring within 3 days following administration of IT MTX. The minor complications were defined as headaches, dizziness, or mild sensory disturbances, while major complications comprised serious neurological effects such as seizures, paralysis, or profound cognitive impairments.

Results: The mean age of patient was 5.37 years, with 56.3% aged 3–5 years and 68.8% being male. Acute Lymphoblastic Lymphoma (ALL) was the primary diagnosis in 91.7% of patients, with 61.5% receiving a 12 mg dose of IT MTX. Neurological side effects were reported in 28.9% (n=231) of IT MTX administrations. No major neurological complications such as seizures or paralysis were observed. Minor side effects included fever (5.0%), nausea (4.5%), vomiting (4.1%), and dizziness (3.8%). Most symptoms manifested within 24 hours and were treated within 7 days.

Conclusion: While our study reported no major toxic neurological events but only minor neurological effects developed after administration of chemotherapy. IT MTX plays an important role in pediatric oncology, but its neurotoxic potential requires close monitoring and management especially in children receiving IT chemotherapy for therapeutic or prophylactic purposes.

Keywords: Methotrexate, Intrathecal, pediatric oncology, drug-related side effects and adverse reactions, Islamabad, Pakistan.

Introduction

Methotrexate (MTX) is a critical antimetabolite drug in treating various pediatric diseases, including acute lymphoblastic leukemia (ALL), non-Hodgkin lymphoma (NHL), brain tumors, osteosarcoma, inflammatory myofibroblastic tumor (IMT), juvenile scleroderma (JS), and juvenile idiopathic arthritis (JIA). MTX acts as a folate antagonist by inhibiting dihydrofolate reductase (DHFR), an enzyme essential for the synthesis of tetrahydrofolate. This disruption impairs DNA synthesis, repair, and cellular replication, particularly affecting rapidly dividing cells. Despite its efficacy, MTX resistance poses significant challenges, particularly in pediatric oncology, where it undermines the ability to achieve sustained therapeutic effects, resulting in reduced therapeutic efficacy and poor prognosis.[1]

MTX is used as a chemotherapeutic agent via different routes whether intravenous, oral or Intrathecal. It is commonly used via Intrathecal route for Central Nervous System (CNS) prophylaxis in ALL and Non-Hodgkin's Lymphoma (NHL). Initially, cranial irradiation was done for prophylaxis and treatment of CNS leukemia. However, radiation was associated with secondary cancers, growth retardation, and developmental delay. [2] Presently, MTX alone, as well as with other drugs like hydrocortisone and cytarabine is used to prevent and treat CNS leukemia and lymphoma. However, MTX can cause significant acute and long-term neurotoxicity in children undergoing chemotherapy.[3]

The clinical presentation of MTX-induced neurotoxicity includes altered mental status, seizures, and stroke-like symptoms. But patients may also present with mild symptoms like headache, backache, sleep disturbances etc.[4] MTX related neurotoxicity occurs in approximately in 3-7% of patients treated for ALL. Sub-acute neurotoxicity that occurs after 5-14 days of IT or intravenous (IV) MTX administration has been reported in 3−15% of cases.[5] The pathophysiology MTX-induced neurotoxicity is multifactorial. Long term deficits occur through induction of oxidative stress, immune system modulation, inhibition of neurogenesis and altered neurotransmission through the N-methyl-D-aspartate (NMDA) receptor.[6] Some studies also indicated that the neurotoxicity is due to increased adenosine concentration in the

cerebrospinal fluid. This further leads to cerebral vasodilatation that slows neurotransmitter release at presynaptic junction and thus alters the neuronal discharge.[7,8]

MTX is an effective mode of treatment in children for different cancers but it also carries potential side effects. The side effects may include headache, vomiting, nausea, back pain, allergic reaction, fever, fits, decrease in appetite and sleep disturbance. Some major adverse effects that may occur are weakness or paralysis of limbs, spinal fluid leakage, paresthesia, numbness and intra cranial hemorrhage.[9] There are certain long-term manifestations of the treatment as well, comprising of difficulty in neuro-cognitive function and working memory. Cases of cancer survivors developing leukoencephalopathy, transient ischemic attacks and altered mental status have also been reported.[10]

Despite the clear global evidence of MTX-related neurotoxicity, there is a critical gap in localized data, especially from Pakistan, where variations in patient genetics, treatment practices, nutritional status, and access to healthcare services may influence the occurrence and severity of neurological adverse effects. The scarcity of data on the neurological complications following IT MTX use in pediatric patients limits the ability of healthcare providers to anticipate, monitor, and manage these effects efficiently. Conducting a study on the neurological adverse effects of IT MTX is crucial to determine the severity, magnitude, and impact of these complications on pediatric cancer survivors, ultimately informing strategies for early detection, prevention, and management to improve treatment outcomes. This study aims to determine the adverse neurological effects of IT MTX in the pediatric population at a tertiary care hospital in Islamabad, Pakistan.

Methodology

This prospective observational study was conducted at the Pediatric Oncology Department of the Children's Hospital, Pakistan Institute of Medical Sciences (PIMS), a renowned tertiary care hospital in Islamabad, Pakistan, from January to December 2024. This study was approved by the Institutional Ethical Review Board of PIMS prior to its initiation (Ref: F.1-1/2025/ERB/SZAMBU/826), and included all children aged 1-13 years who received IT MTX for therapeutic or prophylactic purposes under standardized treatment guidelines such as the Pakistan Society of Pediatric Oncology (PSPO)-2018 and Children Cancer Leukemia Group (CCLG) protocols, depending on the diagnosis and disease risk stratification. Inclusion and exclusion criteria were not fundamental to this observational study, as the objective was to document neurological outcomes in a real-world clinical setting. Therefore, all children aged 1 to 13 years who received IT MTX during the study period—regardless of diagnosis, treatment intent (therapeutic or prophylactic), or other clinical characteristics were included, provided that informed consent was obtained from their parents or guardians.

During the study period, a total of 796 IT MTX administrations were performed in 96 patients. Written informed consent was obtained from parents or guardians, who were informed about the procedure, potential side effects, benefits, and post-treatment care. The procedures for Intrathecal therapy at the Operating Theatre (OT) of the Children's Hospital are performed under strict aseptic conditions by a skilled and trained pediatric hemato-oncologist, assisted by an experienced medical house officer and nurse. IT MTX is typically administered via lumbar puncture (LP) using a 25G spinal needle at the L2-L3 or L3-L4 interspace, with patients in the lateral decubitus position and under general anesthesia. Following the procedure, patients are monitored in the recovery room for one hour and advised to rest without a pillow for 24 hours.

Neurological adverse effects were monitored and recorded during follow-up visits 3 days post-administration using a standardized proforma. Parents were also instructed to report

Table 1: Neurological Complications Categorized by Severity in Pediatric Patients Receiving IT MTX[11-13]

Type of Complication	Category	Clinical Manifestations
Headache	Minor	Mild to moderate pain in the head, often transient
Backache	Minor	Localized lumbar pain post-procedure
Nausea/Vomiting	Minor	Gastrointestinal upset, often self-limiting
Fever	Minor	Low-grade fever post-lumbar puncture or due to aseptic reaction
Dizziness	Minor	Lightheadedness or unsteadiness
Paresthesia	Major	Tingling, burning sensations, or numbness in limbs
Nuchal rigidity	Major	Stiffness in the neck, possible sign of chemical meningitis
Seizures	Major	Convulsions, altered consciousness
Paralysis	Major	Partial or complete loss of motor function
Cranial nerve palsy	Major	Impaired eye movement, facial droop, or hearing loss
Chemical arachnoiditis	Major	Severe meningeal irritation, headache, photophobia, neck pain
Hypertension	Major	Elevated blood pressure potentially related to neurotoxic or systemic stress response
Posterior reversible encephalopathy syndrome (PRES)	Major	Seizures, headache, visual disturbances, altered mental status

any symptoms observed after therapy. Both minor and major complications were tracked, with minor complications including symptoms such as dizziness and headache, and major complications including more severe symptoms such as seizures and paralysis. This study adopted broader diagnostic criteria which allowed for the inclusion of a wider range of neurotoxic symptoms. Specifically, minor neurological complications were defined as headache, backache, fever, nausea, or vomiting. In contrast major neurological complications were defined as more severe symptoms, including nuchal rigidity, paresthesia, cranial nerve palsy, paralysis, or chemical arachnoiditis[11-13] (Table 1).

Statistical analysis was performed using SPSS. Results were presented as frequencies and percentages for categorical variables, and means with standard deviations for continuous variables. The onset and duration of symptoms were analyzed using chi-square tests to assess associations, with p-values less than 0.05 considered statistically significant.

Results

The patients' mean age was 5.37 years (SD = 2.502), the median age was 5.1 years, with 56.3% aged 3–5 years. Males comprised 68.8% of the cohort. The primary diagnosis was ALL, affecting 91.7% of patients, who predominantly received a 12 mg dose of IT MTX (61.5%). At the time of

Table 2: Demographic and Clinical Characteristics of Patients who Received IT MTX

Variables	Categories	Frequency (n)	Percent (%)
Age	< 3 years	5	5.2
	3-5 years	54	56.3
	6-12 years	37	38.5
Gender	Male	66	68.8
	Female	30	31.3
Diagnosis	ALL	88	91.7
	NHL	8	8.3
Dose of IT MTX	8 mg	3	3.1
	10 mg	17	17.7
	12 mg	59	61.5
	15 mg	17	17.7
Phases of chemotherapy	Prophase	3	3.1
	Induction	5	5.2
	Consolidation	19	19.8
	Interim Maintenance	16	16.7
	Delayed Intensification	18	18.8
	Maintenance	24	25.0
	COP	4	4.2
	COPADM	2	2.1
	CYM	5	5.1
Neurological side effects	Yes	230	28.9
	No	566	71.1

IT MTX administration, 25.0% of patients were in the Maintenance phase, 19.8% in the Consolidation phase, and 18.8% in the Delayed Intensification phase of chemotherapy. Out of 796 IT MTX administrations, neurological side effects were reported on 230 occasions (28.9%), while 566 administrations (71.1%) were without reported neurological side effects as shown in the Table 2.

COP: Cyclophosphamide, Oncovin (Vincristine), and Prednisone, COPADM: Cyclophosphamide, Oncovin (Vincristine), Prednisone, Adriamycin (Doxorubicin), and Methotrexate. CYM: Cyclophosphamide, Cytarabine, and Methotrexate

We found that none of the patients developed major neurological side effects, such as seizures, allergic reactions, neck rigidity, paresthesia, paralysis, hypertension, spinal fluid leakage, or anaphylaxis. Additionally, no patient underwent MRI brain imaging to assess neurological toxicity. However, minor neurological side effects were observed. The most common side effects were fever (40 occasions, 5.0%), nausea (36 occasions, 4.5%), vomiting (33 occasions, 4.1%), and dizziness (30 occasions, 3.8%). Other symptoms reported included headache (22 occasions, 2.8%), sleep disturbance (18 occasions, 2.3%), decreased appetite (19 occasions, 2.4%), back pain (17 occasions, 2.1%), and numbness (7 occasions, 0.9%).

The onset and duration of symptoms following IT MTX administration showed significant patterns (p-value < 0.05). Most side effects, including fever, dizziness, nausea, and vomiting, presented acutely within the first 24 hours. Additionally, sleep disturbances and headache also developed within this timeframe. The duration of symptoms was generally short, with the majority managed within 7 days. The symptoms developed after administration of IT MTX are presented in Table 3.

Out of a total of 796 IT MTX doses administered, hospital admission was required on 72 (9.1%) occasions due to neurological symptoms, and on 21 (2.6%) occasions, patients missed their next scheduled doses (Figure I).

Table 3: Neurological Side Effects that Developed after IT MTX Administration

Neurological side effects	Episodes		Onset of symptoms							
			0–24 hrs		24–48 hrs		48–72 hrs		>72 hrs	
	N	%	N	%	N	%	N	%	N	%
Dizziness	30	3.8	12	40.0	10	33.3	5	16.7	3	10.0
Fever	40	5.0	26	65.0	8	20.0	5	12.5	1	2.5
Sleep disturbance	18	2.3	14	77.8	3	16.7	1	5.6	0	0.0
Headache	22	2.8	10	45.5	7	31.8	3	13.6	2	9.1
Nausea	36	4.5	20	55.6	10	27.8	3	8.3	3	8.3
Numbness	7	0.9	3	42.9	2	28.6	2	28.6	0	0.0
Decreased appetite	19	2.4	4	21.1	3	15.8	5	26.3	7	36.8
Back pain	17	2.1	8	47.1	5	29.4	2	11.8	2	11.8
Vomiting	33	4.2	15	45.5	10	30.3	6	18.2	2	6.0

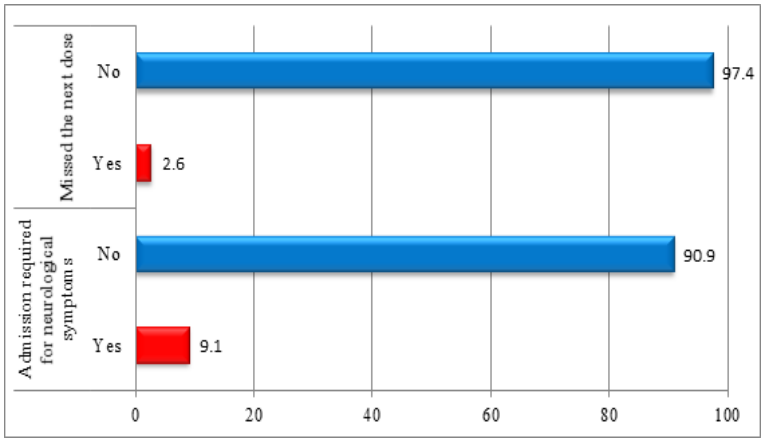

Figure I: Hospital Admissions and Missed Scheduled due to Neurological Symptoms

Discussion

IT MTX remains a cornerstone in pediatric cancer treatment, providing both therapeutic and prophylactic benefits, especially in the prevention and management of CNS involvement. We report our experience with adverse neurological events following IT MTX administration over a one-year period at our pediatric oncology center. No major neurotoxicity such as seizures, paralysis, or chemical arachnoiditis was observed in any patient. Minor neurological side effects were reported, with symptoms including fever, nausea, vomiting, and dizziness. These symptoms typically occurred within 24 hours of IT MTX administration and managed within 2 to 7 days.

In our study, neurological side effects were observed on 230 occasions (28.9%) out of 796 IT MTX administrations in 96 pediatric patients, as shown in Table 2. The majority of these events were classified as minor, yet clinically relevant. While several local studies have reported neurological complications associated with IT MTX, few have quantified their incidence in pediatric populations. For instance, Razi et al. (2021) described that children with ALL receiving IT MTX developed acute and sub-acute neurological dysfunction in approximately 3–15% of cases.[14] Similarly Hussain et al. (2022) presented a severe case of methotrexate-induced leukoencephalopathy in a 19-year-old patient with ALL, indicating the potential severity of such events.[15] Khan et al. (2020) reported three pediatric cases of posterior reversible encephalopathy syndrome (PRES) following IT MTX administration, highlighting rare but serious outcomes.[16]

The comparatively higher incidence observed in our cohort may reflect the broader diagnostic criteria adopted in this study (detailed in Table 1), which included a wide range of both minor and major neurological symptoms. This inclusive approach may include neurotoxic events that are typically underreported or unrecognized in previous studies, such as those reported by Hussain et al. (2022) and Khan et al. (2020) which mainly focused on major neurological complications.
Globally, the reported incidence of methotrexate-induced neurotoxicity varies significantly. Bhojwani et al. (2014) identified clinical neurotoxicity in 3.8% of children with ALL receiving high-dose MTX.[17] Mateos et al. (2021) reported a 7.6% incidence among 1,251 children across six pediatric oncology centers in Australia,[18] while Harris et al. (2023) found a 10% incidence in a cohort of 351 pediatric patients.[19] These discrepancies likely reflect differences in treatment protocols, genetic susceptibility, supportive care practices, and the diagnostic criteria used to define neurotoxicity. Collectively, these findings highlight the critical need for standardized definitions, uniform monitoring protocols, and early intervention strategies for neurotoxicity in pediatric oncology.

Despite the relatively high incidence of neurotoxic symptoms in our cohort, IT MTX was generally well tolerated. Notably, no major neurological complications were observed, such as seizures, allergic reactions, neck rigidity, paresthesia, paralysis, hypertension, spinal fluid leakage, or anaphylaxis. This aligns with the findings of Byrnes et al. (2016) and De la Riva et al. (2017), who also reported a low frequency of severe neurotoxic events in pediatric patients undergoing Intrathecal chemotherapy, reaffirming the general safety of the treatment in this population.[20, 21]

However, minor neurological complications were relatively common. As illustrated in Table 3, fever (5.0%), nausea (4.5%), vomiting (4.1%), and dizziness (3.8%) were the most frequently reported adverse neurological events. These findings are consistent with those of Sonia et al. (2021), who reported headaches, nausea, vomiting, back pain, and fever as the most prevalent minor side effects in their cohort.[22] Other symptoms observed in our patients included headache (2.8%), sleep disturbances (2.3%), decreased appetite (2.4%), back pain (2.1%), and numbness (0.9%), albeit at lower frequencies. Recognition and proactive management of these neurological symptoms are essential to minimize discomfort and ensure adherence to treatment regimens.

Importantly, our findings revealed a significant pattern in the onset and duration of these symptoms ($p < 0.05$), as detailed in Table 3. Most adverse effects, including fever, dizziness, nausea, vomiting, headache, and sleep disturbances, appeared acutely within the first 24 hours following IT MTX administration. These symptoms were largely transient, resolving within seven days in most cases. This observation aligns with findings by Rijmenams et al. (2021), who found that neurological symptoms typically manifested shortly after IT chemotherapy and resolved within a few days.[23] The acute and self-limiting nature of these symptoms reinforces their manageable profile in the clinical setting.

Nonetheless, the clinical implications of these neurological side effects should not be underestimated. In our cohort, 72 out of 796 (9.1%) IT MTX administrations required hospital admission due to neurological symptoms, and 21 administrations (2.6%) resulted in missed subsequent scheduled doses (Figure I). These findings highlight the potential for even minor neurological side effects to disrupt treatment adherence and impose a significant burden on healthcare resources. The 9.1% hospitalization rate underscores the need for close monitoring post-administration, particularly during the acute phase when symptoms are most likely to emerge. Byrnes et al. (2016) similarly noted that while severe neurotoxicity was rare, minor side effects occasionally required additional medical management and contributed to treatment delays.[20] Therefore, early recognition and management of neurotoxic symptoms are essential to maintaining the continuity and effectiveness of therapy.

Limitations

While this study has few limitations, including a single-cohort focus and lack of control group, but it informs policy implications for improving patient care and suggests avenues for further research, including multicenter trials to validate findings and assess preventive measures. Future multicenter studies are needed to validate these findings, optimize preventive strategies including pharmacologic prophylaxis, and explore long-term cognitive impacts of repeated IT MTX exposure.

Conclusion

This study found that IT MTX in pediatric cancer patients is generally well-tolerated, with mild and transient side effects such as fever, nausea, and headache. No major toxic events

were observed. However, oncologists should remain vigilant about the potential for mild complications and ensure that patients and caregivers are informed about the possible side effects. Furthermore, maintaining high standards of aseptic techniques during chemotherapy administration is crucial to prevent serious neurological complications. These practices are essential for minimizing the risk of severe adverse events and enhancing patient safety during treatment.

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Journal of University College of Medicine & Dentistry

Original Article

Impact of Early Mobilization Versus Immobilization on Pain and Mobility After Total Hip Replacement

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Abstract

Objective: To evaluate the impact of early range of motion (ROM) exercises versus initial immobilization on postoperative pain and joint mobility in patients undergoing total hip replacement (THR).

Methodology: This single-centre, comparative experimental study was conducted at the Orthopaedic Surgery Department, Continental Medical College, Lahore, from 1st of October, 2024 till 30th of March, 2025. Forty adults aged 40–70 years undergoing unilateral or bilateral THR for advanced (Grade 4) primary osteoarthritis were randomly assigned into two groups: Group A (Early Mobilization, n=20) initiated supervised ROM exercises within 24 hours of surgery, while Group B (Immobilization, n=20) remained immobilized for the first postoperative week before starting the same protocol. Patients undergoing THR for fractures, tumours, infections, or revision surgery, or with comorbidities precluding early mobilization, were excluded. Pain was assessed using the Visual Analogue Scale (VAS), and hip mobility using the ROM subsection of the Harris Hip Score. Assessments were conducted at the 1st, 3rd, and 6th postoperative weeks by a blinded physiotherapist. Statistical analysis was done using SPSS v23, with significance set at $p<0.05$.

Results: Patients in the early mobilization group demonstrated significantly greater reductions in VAS pain scores (Week 1: 5.0 vs 6.0; Week 3: 3.1 vs 5.0; Week 6: 1.0 vs 4.0; all $p<0.05$) and superior ROM scores (Week 1: 3.1 vs 2.0; Week 3: 4.1 vs 3.3; Week 6: 4.7 vs 4.0; all $p<0.05$) compared to the immobilization group. No adverse events were reported in either group.

Conclusion: Early ROM exercises following THR result in faster pain relief and improved hip mobility compared to initial immobilization. Early mobilization should be incorporated into postoperative rehabilitation protocols to enhance recovery and patient outcomes.

Keywords: Total Hip Replacement, Early Mobilization, Immobilization, Range of Motion, Visual Analogue Scale, Harris Hip Score, Postoperative Rehabilitation

Introduction

Joint replacement surgery is increasingly performed to improve quality of life in patients with debilitating diseases. Among the lower limb joints, the hip is the most commonly replaced, followed by the knee.[1] Early range of motion (ROM) exercises, initiated as early as postoperative day zero, have shown promising results in accelerating functional recovery and reducing hospital stay. Previous studies have highlighted the benefits of early mobilization after total hip arthroplasty (THA), demonstrating improvements in physical function, balance, gait speed, and quality of life.[2] Such interventions have also been associated with reduced pain, fewer complications, and shorter hospital stays without increasing the risk of adverse outcomes.

THA places a heavy financial load on the healthcare system, and it is, therefore, essential to optimize the available resources to speed up recovery and cut down the length of stay without sacrificing surgical outcomes and patient experience and satisfaction.[3] Research showed that customized postoperative early range of motion is well tolerated by patients and are effective in improving early recovery of physical function after total hip arthroplasty.[4] Application of these exercises is statistically significant for improvements in gait speed, and balance ability even after a single treatment session. This approach may serve as an effective intervention for patients recovering from total hip replacement.[5] Task-oriented, early full-weight-bearing exercise programmes have been shown to reduce disability and pain while enhancing activities of daily living and overall quality of life after total hip replacement.[6] Studies also report that beginning mobilisation within 24 hours of surgery shortens hospital stay by roughly 1.8 days without raising complication rates.[7] Importantly, early mobilisation does not alter discharge destination, nor does it increase adverse events when compared with conventional care.[8]

Accordingly, the present study evaluates whether initiating gentle, controlled hip range-of-motion exercises on the first

postoperative day improves pain relief and joint mobility relative to an initial period of hip immobilisation.

Methodology

This comparative experimental study was was carried out in the Department of Orthopaedic Surgery, Continental Medical College and Teaching Hospital, Lahore Pakistan, over a six-month period, from 1st of October, 2024 till 30th of March, 2025. Forty consecutive patients were recruited prospectively on a rolling basis as they presented for THR. After obtaining consent, patients meeting the inclusion criteria were enrolled from the Orthopedic Department. Patients were followed up at 1, 3, and 6 weeks postoperatively.

The sample size of 40 patients was determined based on Tabachnick and Fidell's guideline recommending a minimum of 10 participants per predictor variable in multivariate analyses.[7] It is important to note that patients were not enrolled in the study simultaneously; rather, they were included on a rolling basis as they underwent surgery. Patients who underwent total hip replacement for pathological conditions such as tumors or infections were excluded from the study.

Adults aged 40–70 years who underwent unilateral or bilateral primary THR for grade-4 osteoarthritis were eligible for inclusion. Patients were excluded if THR was performed for fracture, tumour, infection, prior ipsilateral hip surgery, or if severe comorbidity contraindicated early mobilisation. Randomisation was 1:1, generated in permuted blocks of four by an independent statistician and concealed in sequentially numbered opaque envelopes opened post-surgery. Group A began early mobilisation within 24 h: hourly ankle pumps and quadriceps sets, twice-daily passive-assisted hip flexion ≤60°, abduction ≤30°, external rotation ≤20°, bedside sitting at 24 h, walker-assisted ambulation from day 2, and 30-minute physiotherapy sessions twice daily for week 1 then daily to week 6. Group B kept hips in neutral with an abduction wedge for seven days, after which the identical graded protocol used for Group A commenced. All sessions were supervised by the same senior physiotherapist and adherence logged.

Pain was measured with a 10-cm visual-analogue scale (VAS).[8] Active hip ROM used the Harris Hip Score ROM subsection.[9] Outcomes were recorded at postoperative weeks 1, 3, and 6, alongside time to unaided 10-metre walk, hospital length of stay, and a 5-point Likert questionnaire assessing confidence in mobility and fear of dislocation (1 = strongly disagree to 5 = strongly agree).

Data collection: Written informed consent was obtained from every participant. Institutional approval was granted by the Continental Medical College IRB (63/IRB/CMC), obtained on 25th of January, 2025. Baseline data, including age, sex, BMI, laterality, Charlson comorbidity index, and pre-operative Harris Hip Score, and VAS data were collected to confirm group comparability.

Data Analysis: Data were analysed in SPSS v23. Normality was assessed with Shapiro–Wilk. Continuous variables are presented as mean ± SD; categorical variables as n (%). Independent-sample t tests or Mann–Whitney U tests compared groups, while χ^2 analysed categorical data. Repeated-measures ANOVA evaluated VAS and ROM across time points. A two-tailed $p < 0.05$ denoted statistical significance.

Results

A total of 40 patients were equally divided into two groups to evaluate the impact of early hip ROM exercises following total hip replacement: Group A received early mobilization, and Group B followed hip immobilization protocols, and were mobilized on the 8th day after surgery.

Table 1: Comparison of Postoperative Pain Scores Between Group A and B

Time Point	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Week 1	5.0 ± 1.2	6.0 ± 1.3	0.014
Week 3	3.1 ± 0.9	5.0 ± 1.1	0.001
Week 6	1.0 ± 0.7	4.0 ± 1.2	<0.001

Table 2: Comparison of Hip Range of Motion Scores Between Group A and Group B

Time Point	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Week 1	3.1 ± 0.7	2.0 ± 0.6	0.015
Week 3	4.1 ± 0.6	3.3 ± 0.5	0.020
Week 6	4.7 ± 0.5	4.0 ± 0.4	0.018

Patients in the early mobilization group demonstrated earlier normalization of gait patterns—reflected in cadence and step symmetry—by Week 6 compared to the immobilization group (Figure 3).

The Group A (early mobilization) reported a consistent reduction in pain scores: 4.5 at Week 1, 3.1 at Week 3, and 1.0 at Week 6, while Group B (immobilization) had higher scores: 6.0, 4.7, and 3.6 respectively.

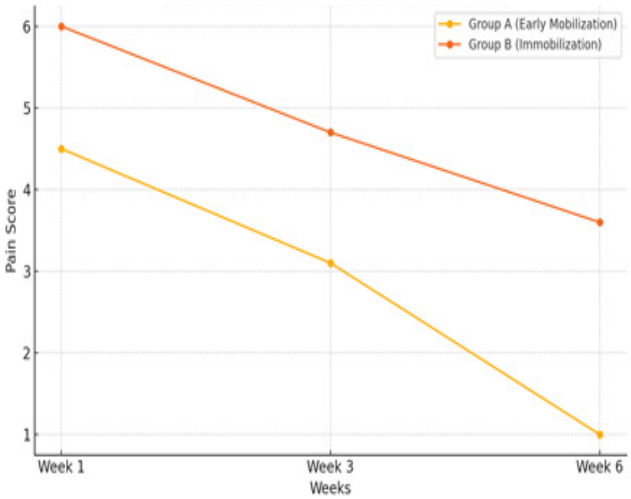

Figure 1: Visual Analogue Scale Trend for Pain Scores Over 6 Weeks

Table 3: Time to Achieve Functional Independence Based on 10-Meter Walk Test

Group	Mean Time to Walk 10 m Without Aid (days)
Group A	4.2
Group B	8.3

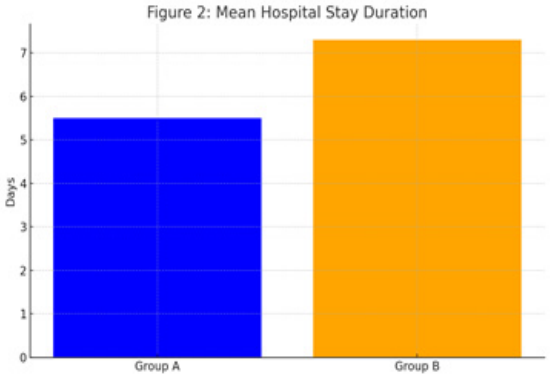

Figure 2: Mean Hospital Stay Duration (in days)

Group A (early mobilization) had a shorter average hospital stay (5.5 days) compared to Group B (immobilization) (7.3 days).

Prior to presenting patient perceptionsin table 4 below , it should be noted that these scores were derived from a 5-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree). Each participant rated two items—"I feel confident walking without support" and "I am worried about dislocating my new hip." Group means were then calculated to quantify overall confidence in mobility and fear of dislocation.

Table 4: Patient Confidence and Fear of Dislocation Scores on Likert Scale

Measure	Group A (Mean ± SD)	Group B (Mean ± SD)
Confidence in Mobility	4.6 ± 0.5	3.3 ± 0.7
Fear of Dislocation	2.0 ± 0.6	3.8 ± 0.8

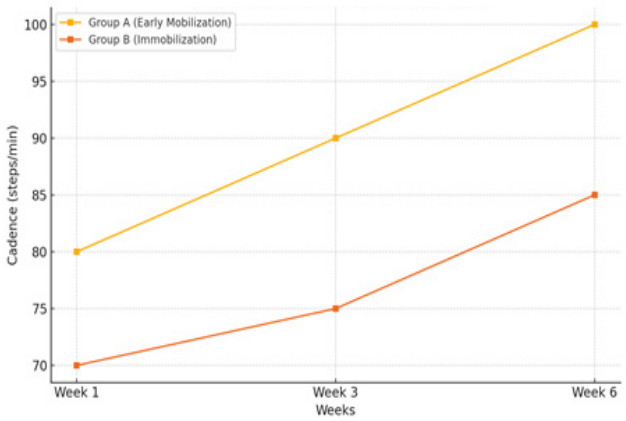

Figure 3: Gait Symmetry and Cadence Measured via Inertial Sensors

Group A patients demonstrated earlier normalization of gait patterns—reflected in cadence and step symmetry—by Week 6 compared to Group B.

Discussion

This study evaluated whether initiating gentle hip ROM drills on post-operative day 1 confers measurable advantages after THR. Comparing 20 patients who began structured exercises within 24 hours (Group-A) to 20 who remained immobilised for the first week (Group-B), our findings show that early movers recovered faster, achieved greater hip mobility and functional independence, reported markedly less pain, and left hospital sooner. These benefits align with a growing international consensus that early mobilisation is integral to contemporary arthroplasty care rather than an optional adjunct.

The pain scores (Figure 1; Table 1) showed a clear and steady drop in patients who started moving early. By Week 6, their average pain score dropped from 4.5 to 1.0, while those who stayed immobile had a slower improvement, ending at 3.6. Importantly, none of the early movers needed extra painkillers after the third day, suggesting that early movement worked well with the pain control plan. Similar pain relief with early walking has been reported by Ali and Abo El Fadl (2021)[10] and supported by a review by Guerra et al. (2015).[11]

Higher-quality of life has been linked to prompt movement in lower-limb surgery, as highlighted by Aprisunadi et al. (2023).[12] Consistent with those findings, patient confidence scores were higher and fear-of-dislocation scores lower (Table 4). Clinical observations from Akbar and Supriyadi (2023) likewise showed greater patient satisfaction when "hour-zero" bedside exercises were standardised.[13]

Functional recovery mirrored symptomatic improvement. The ROM subsection of the Harris Hip Score (Table 2) rose from 3.1 ± 0.7 at Week 1 to 4.7 ± 0.5 at Week 6 in Group A, whereas controls reached only 4.0 ± 0.4. These data align with the prospective cohort of Oberfeld et al. (2021), who documented a 25° flexion advantage by Day 3 when immediate hip drills were used.[14] Early ROM also accelerated unaided ambulation: the 10-metre walk test was passed in 4.2 ± 0.9 days versus 8.3 ± 1.4 days (Table-3). A similar 40 % boost in direct-home discharge after mobilisation within 24 h was noted by Chua et al. (2017).[15] Ultrasound monitoring by Iwakiri et al. (2020) has shown that such early motion limits effusion and muscle atrophy, offering a plausible mechanistic explanation.[16] Motion sensor data in our study (Figure-3) showed that patients who started moving early regained a normal walking rhythm and balance sooner, similar to the results reported by Boekesteijn et al. (2022).[17]

Resource utilisation improved in parallel: mean length of stay fell by 1.8 days (Figuren 2). Oberfeld et al. (2021) estimated a USD 1 200 saving per case from a similar reduction,[14] and Hankins and Moloney (2022) later demonstrated that early physiotherapy could halve 30-day mortality in fragility-fracture patients, signifying the systemic value of moving early.[18,19] None of the patients in Group A had hip dislocations or wound troubles. This matches the work of Dawson-Amoah et al. (2018), who

tested safe hip-movement limits after surgery and found that gentle exercises kept below 90° of bending and 30° of inward crossing do not make the joint unstable.[20] It also agrees with Alito et al. (2023), who followed patients given faster surgery plus closely supervised rehab and saw better function without any hardware failures.[21]

Taken together, our findings and the wider literature show that initiating structured hip movement within 24 hours of THR is both safe and cost-effective, and should be adopted as routine practice to optimise recovery and resource use.

Limitations

Despite its valuable insights, our study has certain limitations. Firstly, the follow-up period was relatively short, which limits our ability to assess long-term functional outcomes or quality of life impacts. Secondly, the sample size was modest, which may affect the generalizability of results. Thirdly, no stratification or adjustment was made for confounding factors such as age, sex, BMI, comorbidities, or preoperative functional status. Additionally, patient adherence to exercise regimens was not objectively monitored, which could have influenced outcomes.

Conclusion

Our study suggests that patients who started early range of motion exercises had better pain scores & hip joint movement at first, third, and six weeks post operative as compared to patients who were advised hip immobilization.

Clinical Implications

The findings of this study have meaningful implications for postoperative care protocols. Early mobilization appears to be a cost-effective, safe, and clinically beneficial approach to enhance postoperative recovery in THR patients. Implementation of early ROM protocols can potentially reduce the length of hospital stay, decrease healthcare costs, and improve patient satisfaction and functional independence. Future rehabilitation programs should consider integrating structured early movement schedules as standard care.

Future Directions

To build upon our findings, future research should involve multicenter randomized controlled trials with larger sample sizes, longer follow-up durations, and patient-reported outcome measures. Incorporating objective metrics such as gait analysis, quality-of-life indices, and functional independence measures would provide a more comprehensive understanding of long-term rehabilitation success.

Authors' Contributions: IM: study conception, design, and supervision of data collection; RKL: corresponding author, manuscript drafting, and submission; MM: literature review, follow-up, and statistical analysis; JK: data acquisition and clinical evaluation; IR: formatting and reference compilation. All authors approved the final manuscript.

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Original Article

Assessing Postgraduate Surgical Training Needs at Two Private Tertiary Care Hospitals: A Descriptive Study

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Abstract

Objective: To assess the perceived learning needs and challenges faced by postgraduate surgical residents at two private tertiary care hospitals, with the aim of identifying areas for improvement in the structure and delivery of surgical training programs.

Methodology: A cross-sectional, descriptive observational study was conducted from May 2023 to January 2024 at two private medical colleges offering structured residency programs in Surgery and Allied specialties. Postgraduate residents from years one to four were recruited through purposive sampling after obtaining ethical approval and informed consent. A 23-item questionnaire, developed from literature and pilot-tested for clarity, was administered via Google Forms to 57 residents. Responses were collected using a 5-point Likert scale and subsequently grouped into three categories: disagree (1–2), neutral (3), and agree (4–5). Participants were stratified into junior (years 1–2) and senior (years 3–4) groups. Data were analyzed using SPSS version 24. Chi-square or Fisher's exact tests were applied, with a p-value of <0.05 considered statistically significant.

Results: Overall, 87% of respondents reported receiving specific learning objectives at the start of each rotation—80% of juniors and 93.3% of seniors. Although 65.5% felt they achieved the expected learning outcomes, only 29% perceived the training to be well-structured. A majority (76.3%) expressed dissatisfaction with opportunities to serve as primary surgeons. Feedback was limited; only 30% reported receiving supervisor feedback. While over 60% of residents were familiar with the curriculum and had access to educational resources, only 20% received a formal orientation. Confidence in achieving learning goals was reported by 61.8%, with overall training satisfaction noted in 60% of juniors and 56.7% of seniors.

Conclusion: The study highlights key gaps in surgical training, including inadequate operative exposure, limited feedback mechanisms, and the need for structured evaluation and orientation practices.

Keywords: Postgraduate surgical training, learning needs, trainee feedback, residency programs, clinical education

Introduction

A clinician's educational journey is ongoing, a process of lifetime learning that is essential to improve patient care by enhancing one's knowledge and abilities. Continuing medical education is a means by which healthcare providers continue to learn.[1] All medical education programs, both undergraduate and graduate, must establish a framework for continuous analysis, policy development, and evaluation of the outcomes resulting from the implementation of their strategies. Sadly, scarcity of research in our region leads to inconsistent quality of teaching and learning leaving many trainee doctors feeling unsupported, stressed, and resorting to ineffective coping mechanisms.[2] A surgical error has the potential to permanently change a patient's life; hence educating a surgeon is extremely important and should be of the greatest caliber. For a considerable amount of time, medical educators have maintained that postgraduate surgical trainees should have access to a well-organized system that facilitates the acquisition and improvement of fundamental surgical skills. Before they begin operating on patients, they must receive thorough training.[3] The College of Physicians and Surgeons Pakistan (CPSP) created and organized the Primary Surgical Skills Workshop with this in mind. The CPSP surgical supervisors are directly in charge of organizing this workshop. These workshops were conducted at Pakistan Institute of Medical Sciences (PIMS), Islamabad and delivered to postgraduate surgical trainees from March 2018 to February 2019. It included 107 participants. The College of Physicians and Surgeons Pakistan (CPSP) and Shaheed Zulfiqar Ali Bhutto Medical University (SZABMU) collaboratively developed the educational material or curriculum for the workshop. The standardized and obligatory program for trainees in postgraduate surgery and related fields in Pakistan is this workshop. Since 1996, CPSP has carried it out nationwide through its regional centers.[2] As future consultants, residents-in-training must be provided with a conducive learning environment to ensure they acquire the necessary knowledge and skills. A supportive and encouraging atmosphere is essential for a training program to be successful since it will ultimately lead to better patient care. Post-graduate medical education has been standardized and overseen globally to provide a satisfactory

level of training.[4,5]

Regrettably, a substantial number of our competent medical graduates are compelled to leave the country due to limited learning opportunities, non-conducive environments, and lower remuneration.[6,7] It is essential to restructure residency programs to cater high-quality learning opportunities and standardized financial compensation thus providing medical graduates with compelling reasons to stay in the country and contribute to its healthcare and simultaneously meet global standards in surgical practice.[8,9] Surgery demands precision, where errors are not permissible. Because of this and its inherent qualities, the medical industry is extremely competitive, drawing in the most driven and resilient individuals. It is a field that is likewise evolving predictably quickly and consistently.[10,11]

This study's primary objective is to explore the learning requirements and obstacles faced by the trainees to enhance the efficacy, efficiency and caliber of surgical training programs. The main goal was to find out how trainees felt about the quality and content of surgical training, as well as how this affected how satisfied they felt about the program's ability to help them acquire new skills and knowledge.

Methodology

A cross-sectional descriptive observational study was conducted at two private medical colleges in Karachi, Pakistan, offering structured residency programs in surgery and allied disciplines. These institutions were selected based on the authors' workplace affiliations. After approval from the ethical committee of both institutions with reference number: 5970523NSSUR and IRB/61 respectively, post graduate students enrolled in surgical and allied residency program from year one to year four were included in the study through purposive sampling, after obtaining their written consent. We excluded those with incomplete information. The time period for the study was from May 2023 to January 2024. A preliminary version of the survey form was developed based on literature review and a validated tool. It was then pilot tested by six postgraduate residents via email. The final survey consisted of 23 items structured on a 5- point Likert scale but for the sake of convenience in analyzing the results we merged strongly agree and agree and strongly disagree and disagree (1= disagree, 2= neutral and 3= agree). The survey covered demographic data (gender and year of residency) and four domains including learning objectives for trainees, training in knowledge and skills, techniques for assessment and feedback, and general issues pertaining to training. After piloting, the finalized survey was distributed to 57 postgraduate surgical residents from years one to four via Google Forms. Residents in years one and two were categorized as junior residents, while those in years three and four were classified as senior residents. To maximize response rates, reminders were sent weekly following the initial invitation. Participants were informed about the study's objectives and assured of voluntary participation and data anonymity.

Data was coded and analyzed using SPSS version 24. Descriptive statistics were reported as frequencies and percentages. The Chi-square test of association or Fisher's exact test was applied, where appropriate, to compare responses between junior and senior residents, with statistical significance set at $p < 0.05$.

Results

The survey form was provided to 57 postgraduate students enrolled in the surgical residency program and was completed with a response rate of 97% including 16 (29.1%) males and 39 (70.9%) females. The number of residents at each level of training was 8 (14.5%), 17 (30.9%), 10 (18.2%), and 20 (36.4%) for the years I, II, III, and IV respectively (Figure 1).

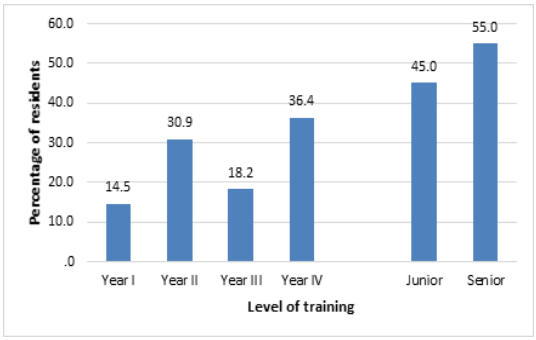

Figure 1: Percentage of residents in each year of training and combined into the junior and senior group

The year I and II residents were classified into junior 25 (45%) while years III and IV were combined into senior 30 (55%) groups. Also, for the analysis purpose, the response options strongly disagreed and disagreed were merged into "Disagreed" and strongly agreed and agreed into "Agreed". The statement-wise analysis was carried out using the three response categories disagreed, neutral, and agreed for each of the domains separately (Table 1).

Table 1: Item-Wise Responses for Each Domain by the Level of Training

Items	Level	Response f (%)			p-value
		Disagreed†	Neutral	Agreed†	
Learning objectives for trainees					
1. Clear learning objectives are provided at the start of each rotation.	Junior	6 (24)	7 (28)	12 (48)	0.445*
	Senior	7 (23.3)	13 (43.3)	10 (33.3)	
2. Specific learning goals are set before each rotation begins.	Junior	4 (16)	1 (4)	20 (80)	0.286‡
	Senior	2 (6.7)	0	28 (93.3)	
3. I achieve the expected learning outcomes by the end of each rotation.	Junior	5 (20)	4 (16)	16 (64)	0.846‡
	Senior	7 (23.3)	3 (10)	20 (66.7)	

Training in knowledge and skills					
4. I frequently get the opportunity to perform as the primary surgeon.	Junior	10 (40)	8 (32)	7 (28)	0.282*
	Senior	8 (26.7)	16 (53.3)	6 (20)	
5. The technical/operative training is well-structured.	Junior	6 (24)	9 (36)	10 (40)	0.148*
	Senior	5 (17.2)	18 (62.1)	6 (20.7)	
6. I often feel competition for surgical opportunities.	Junior	4 (16)	3 (12)	18 (72)	0.256ɬ
	Senior	10 (33.3)	5 (16.7)	15 (50)	
7. I receive sufficient surgical exposure to meet my learning objectives.	Junior	9 (36)	2 (8)	14 (56)	0.926ɬ
	Senior	11 (36.7)	4 (13.3)	15 (50)	
Techniques for assessment and feedback					
8. Supervisors provide regular informal feedback.	Junior	7 (28)	11 (44)	7 (28)	0.384*
	Senior	4 (13.3)	17 (56.7)	9 (30)	
9. Supervisors offer formal feedback after rotations.	Junior	7 (28)	10 (40)	8 (32)	0.324*
	Senior	4 (13.3)	17 (56.7)	9 (30)	
10. I get to review and sign my assessment form at the end of each rotation.	Junior	8 (32)	9 (36)	8 (32)	0.214*
	Senior	4 (13.3)	16 (53.3)	10 (33.3)	
11. There is a formal system to provide feedback on supervisors.	Junior	8 (32)	8 (32)	9 (36)	0.415*
	Senior	12 (40)	12 (40)	6 (20)	
12. There is a system to evaluate the training center and rotations.	Junior	10 (40)	10 (40)	5 (20)	0.873*
	Senior	13 (43.3)	10 (33.3)	7 (23.3)	
General issues pertaining to training					
13. I fully understand my program's curriculum design.	Junior	3 (12)	5 (20)	17 (68)	0.060ɬ
	Senior	10 (33.3)	1 (3.3)	19 (63.3)	
14. I am aware of my program's educational requirements.	Junior	7 (28)	2 (8)	16 (64)	0.277ɬ
	Senior	7 (23.3)	0	23 (76.7)	
15. Teaching tools and materials are easily accessible.	Junior	9 (36)	3 (12)	13 (52)	0.455ɬ
	Senior	7 (23.3)	2 (6.7)	21 (70)	
16. An orientation is provided before each rotation.	Junior	8 (32)	12 (48)	5 (20)	0.955*
	Senior	9 (30)	14 (46.7)	7 (23.3)	
17. I can choose elective rotations to support my learning.	Junior	5 (20)	5 (20)	15 (60)	0.331ɬ
	Senior	9 (30)	2 (6.7)	19 (63.3)	
18. My academic half-day is well-protected during rotations.	Junior	8 (32)	4 (16)	13 (52)	0.807ɬ
	Senior	8 (26.7)	4 (13.3)	18 (60)	

19. Evaluating supervisors and training institutes enhances training.	Junior	2 (8)	1 (4)	22 (88)	0.715ǂ
	Senior	5 (16.7)	1 (3.3)	24 (80)	
20. My knowledge improves by the end of each rotation.	Junior	6 (24)	3 (12)	16 (64)	0.801ǂ
	Senior	8 (26.7)	5 (16.7)	17 (56.7)	
21. My clinical skills improve by the end of each rotation.	Junior	7 (28)	10 (40)	8 (32)	0.923*
	Senior	7 (23.3)	13 (43.3)	10 (33.3)	
22. I acquire the necessary knowledge by the end of each rotation.	Junior	2 (8)	7 (28)	16 (64)	0.467ǂ
	Senior	6 (20)	6 (20)	18 (60)	
23. I am satisfied with my residency training.	Junior	4 (16)	6 (24)	15 (60)	0.865ǂ
	Senior	4 (13.3)	9 (30)	17 (56.7)	

* Chi-square test of association
ǂ Fisher Exact test

For the first domain "Learning objectives for trainee", 48% of juniors and 33.3% of seniors acknowledged receiving specific learning objectives at the start of each rotation. Overall, 87% had defined objectives, but only 65.5% felt they met their learning expectations. No significant difference was found between groups (p = 0.445, 0.286, 0.846).

The second domain comprised four questions about "The training in knowledge and skills", 40% juniors and 20.7% seniors agreed that technical training was well-structured, yet 76.3% felt they lacked frequent opportunities as primary surgeons. Competition among trainees was reported by 72% of juniors and 50% of seniors (p = 0.256). Half of both groups found their surgical training adequate (p = 0.926).

For the third domain "Techniques for assessment and feedback", 30% in both groups received formal/informal feedback and had opportunities to discuss assessments. A formal system for trainee feedback on supervisors was supported by 36% of juniors and 20% of seniors (p = 0.415), with similar responses for training center evaluations (p = 0.873).

In the fourth domain, namely "general issues pertaining to training", Over 60% understood the curriculum and had access to teaching materials, but only 20% of juniors and 23.3% of seniors reported an orientation before rotations. Around 80% believed evaluating supervisors would enhance training. By rotation end, 64% of juniors and 56.7% of seniors felt their knowledge improved (p = 0.801), though only 30% saw enhanced clinical performance. Confidence in achieving learning objectives stood at 61.8%. Satisfaction levels were similar across groups: ~60% satisfied, ~15% dissatisfied, and ~25% neutral.

Discussion

This study assessed the perceived learning needs and challenges among postgraduate surgical residents at two private tertiary care hospitals, revealing key gaps in the structure and delivery of residency training. While a majority of residents reported having defined learning objectives and felt they learned as expected, less than one-third believed their training was well-structured. Significant dissatisfaction was noted regarding limited opportunities to act as primary surgeons and the lack of regular feedback from supervisors. Although most residents understood the curriculum and had access to teaching materials, very few received formal orientation before rotations. These findings highlight the need for improvements in hands-on surgical exposure, structured teaching, and systematic feedback mechanisms to enhance the overall quality of surgical training.

This study provides insights into the current state of surgical residency in Pakistan from the perspective of trainees, offering valuable input that can contribute to effectiveness in our residency programs. To establish appropriate ways to improve training outcomes, the results of our assessment could be used as indicators of the evaluation of the training programs.[12]

The significant finding from this study is the lack of structured hands-on surgical opportunities (Table 1). There has been widespread use of simulation-based training in residency programs, however our findings showed that trainees still experience competition for hands on opportunities and very minimal primary surgeon roles. Progressive autonomy has been identified as a crucial factor for graduating residents' confidence stepping in independent practice after completion of residency.[13] Subjective reports from trainees have advocated that autonomy facilitates building confidence by enhancing their clinical decision-making abilities, which increases their educational experience.[14] There is enough literature to suggest that a rise in autonomy optimizes retention of learning outcomes.[15] A survey conducted by Fillmore et al., autonomy was found to be aligned with enhanced confidence and satisfaction of residents.[16]

Another key issue is the lack of a structured mechanism for giving feedback, with only 30% of trainees being provided with regular feedback. Constructive feedback is crucial for the professional growth of trainees, and according to

international standards, workplace-based assessment with structured debriefing sessions is mandatory to reinforce productive learning.[17] Within structured training programs, feedback is deliberately incorporated, encouraging continuous improvement and refinement of surgical skills. By initiating structured faculty training for constructive feedback and assessment frameworks, they could substantially improve training outcomes. Fadelalla MG study confirms that good feedback can shorten the time it takes for trainees to master psychomotor skills.[18] Psychomotor skill is the most important component of surgical training and solely depends on genuine feedback. Using the Kirkpatrick model, a large academic general surgery residency program with 42 residents was sequentially surveyed in 2022 to evaluate the efficacy of a feedback faculty and trainee. The percentage of residents who thought their faculty was giving feedback successfully rose from 23% to 54% following feedback training. Surgical trainees' educational abilities are dramatically improved by formal feedback.[19] According to research by Harrison et al., in 2016, an environment that only have assessments with summative goal will not generate a culture of learning and improving skills.[20]

Additionally, while majority of trainees comprehended their curriculum, the lack of structured orientation programs could lead to instability in training expectations. Opposite to this, surgical training programs across globally maintain comprehensive orientation sessions, guidance or mentorship sessions, and individual trainee learning plans to strengthen transparency and accountability. Proving orientation before each rotation and mentoring session could handle obstacles and concerns of trainees and enhance overall effectiveness of rotation learning outcomes. Each new clinical environment in rotations requires trainees to navigate a diverse set of complex communication to engage in safe patient care while receiving training from live patients. Orientation before each rotation forms the foundation of trainees learning.[21,22]

The study also highlights that most residents perceived vast improvement in their clinical knowledge at the end of each rotation. But there was also a significant void between knowledge comprehension and application of practical knowledge. This was evident by 30% of the students highlighted increase clinical performance. This gap revealed that theoretical knowledge is being delivered effectively, there may be unsatisfactory hands-on training experiences or opportunities, less or inadequate supervision, or a lack of constructive feedback mechanism. According to Azim, 2021, the quality of surgical training is impacted by the growing number of residents, less operating room training chances, and ethical concerns. The quality of surgical training is being impacted by these factors globally, to differing degrees.[23]

Based on these findings, we must enhance the educational experience for both junior and senior residents. It is crucial to address identified gaps in surgical training and feedback mechanisms. Implementing structured orientations for new rotations can ensure trainees are adequately prepared and aware of their learning objectives. Increasing opportunities for residents to perform as primary surgeons may foster confidence and skill development, thereby enhancing technical proficiency. Establishing a formal feedback system for supervisors and training centers can encourage open communication, allowing residents to voice their concerns and suggestions. Lastly, ongoing assessments of curriculum effectiveness and the provision of teaching resources should be prioritized to align training with residents' learning needs, ultimately leading to improved satisfaction and performance in residency training.

Limitations

The sample size is relatively small, consisting of only 57 residents from two private institutions, which limits the generalizability of the findings to a broader population of surgical trainees. Additionally, the study relies solely on self-reported data from trainees, which may introduce response bias and does not include faculty perspectives that could provide a more balanced evaluation of the training programs.

Conclusion

This study identifies deficiencies in postgraduate surgical training, such as a lack of opportunity for hands-on practice, structured learning, and feedback systems. Residency programs, satisfaction of trainees, and patient care can all be improved by bolstering competency-based training, structured feedback, and surgical exposure. Faculty viewpoints should be included in future research for a more thorough assessment.

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Original Article

Ultrasound-Estimated Index Versus Measured Volume of Amniotic Fluid at Caesarean Delivery: Accuracy and Perinatal Outcomes

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Abstract

Objective: To assess the reliability of ultrasound-based amniotic fluid index (AFI) in estimating amniotic fluid volume by comparing it with intraoperative findings during caesarean section, and to evaluate its association with neonatal clinical outcomes in low-risk term pregnancies.

Methodology: This prospective observational study was conducted at the Department of Obstetrics and Gynaecology, Shalamar Hospital, Lahore, from January to June 2024. A total of 100 pregnant women between 37 and 40 weeks of gestation who underwent caesarean section, were enrolled. Participants were divided into two groups based on AFI measured by ultrasound: Group 1 with low AFI (<5 cm) and Group 2 with normal AFI (5–25 cm). Intraoperative amniotic fluid volume was estimated using a suction apparatus. Neonatal outcomes, including Apgar scores at 1 and 5 minutes and NICU admissions, were recorded and compared.

Results: In the low AFI group, 74% of patients had low amniotic fluid volume confirmed during surgery, while 26% had normal levels. In the normal AFI group, 80% had normal intraoperative fluid volume, and 20% showed reduced levels. Poor Apgar scores at 1 minute were seen in 62% of neonates in the low AFI group versus 16% in the normal group. At 5 minutes, 12% in the low AFI group and 2% in the normal group had low scores. NICU admission was required in 34% of neonates in the low AFI group compared to 8% in the normal group ($p < 0.05$).

Conclusion: This prospective observational study demonstrates a moderate correlation between AFI and intraoperative fluid volume. Low AFI is associated with adverse neonatal outcomes, supporting its role in antenatal risk assessment.

Keywords: Amniotic Fluid Index (AFI), Cesarean Section, NICU Admission, Neonatal Outcomes, OLIGOHYDRAMNIOS, ULTRASOUND.

Introduction

Amniotic fluid is a clear liquid contained within the amniotic sac that surrounds the fetus in the pregnant uterus, providing a protective and supportive environment throughout gestation. It plays a vital role in fetal well-being by cushioning the fetus from external trauma, preventing umbilical cord compression, and allowing space for movement and growth. In addition, its bacteriostatic properties help protect the intra-amniotic environment from infection.[1,2]

The amount of amniotic fluid can be assessed non-invasively using ultrasonography, making it a key parameter in monitoring fetal health. Amniotic fluid is one of the major determinants of the fetal biophysical profile and is predictive of pregnancy outcomes.[3]

Most commonly for determining amniotic fluid volume via ultrasound the AFI is measured. In this technique, the maternal abdomen is divided into four quadrants using the midline and umbilicus as reference points. The transducer is held perpendicular to the floor and the deepest vertical pocket of fluid is measured in each quadrant—excluding pockets containing fetal extremities or the umbilical cord.[3] The sum of these four measurements yields the AFI. Values between 8 and 25 cm are considered normal, 5–8 cm are considered low normal, and values less than 5 cm indicate oligohydramnios.[4]

AFI measurement has become an essential component of antepartum surveillance programs aimed at reducing the risk of intrauterine fetal demise.[5] The detection of oligohydramnios during the antenatal period has been associated with increased risks of meconium-stained liquor, abnormal fetal heart rate patterns, and operative deliveries due to fetal distress.[6,7] Therefore, routine AFI assessment is particularly important in women at risk.

However, despite its widespread use, the reliability of ultrasound-based AFI in accurately reflecting actual amniotic fluid volume remains a subject of debate. Variations in technique, operator dependency, and the indirect nature of the estimation can all influence AFI accuracy. In order to address these concerns and provide context-specific evidence, we conducted this study to assess the relationship between AFI measured antenatally by ultrasound and the actual volume of amniotic fluid observed during caesarean section. This investigation, carried out in a low-risk term pregnancy population, aims to evaluate the reliability of AFI as a diagnostic tool for oligohydramnios and its association with neonatal outcomes. The findings are

intended to support clinical decision-making and contribute to the optimization of fetal surveillance practices in our local population.

Methodology

This was a prospective study which was conducted in the Department of Obstetrics and Gynaecology at Shalamar Hospital, Lahore, from January to June 2024, after obtaining approval from the Institutional Review Board of Shalamar Medical and Dental College (Ref: SMDC-IRB/AL/22/2022). A total of 100 pregnant women between 37 and 40 weeks of gestation, with singleton pregnancies and intact membranes, undergoing caesarean section, were included. Women were excluded if they had ruptured membranes, multiple gestation, diabetes, pregnancy-induced hypertension, chronic medical conditions, or gestational age outside the 37–40-week range. Participants were recruited through convenient sampling and divided into two groups based on the AFI measured by ultrasound within 24 hours prior to delivery. Group 1 included 50 women with low AFI (<5 cm), while Group 2 comprised 50 women with normal AFI (ranging from 5 to 25 cm). A detailed medical history was obtained for all participants, followed by general physical and obstetric examinations. Ultrasound was performed within 24 hours prior to the caesarean section to measure the AFI. Patients were followed up until delivery, at which point intraoperative findings and neonatal outcomes were recorded.

At the time of caesarean section, amniotic fluid volume was collected using a suction apparatus immediately upon rupture of membranes. This intraoperative fluid volume was compared with the preoperative ultrasound-based AFI to assess concordance. Neonatal outcomes which were measured included Apgar scores at 1 and 5 minutes, and the need for NICU admission. Data analysis was conducted using Microsoft Excel and SPSS version 25.To summarise variables, descriptive statistics were described by mean, standard deviation, frequencies, and percentages. Student's t-test was applied to assess differences in amniotic fluid volume, and a p-value <0.05 was considered statistically significant.

Results

A total of 100 patients were included in the study, with 50 women in the low AFI group and 50 in the normal AFI group. The mean gestational age was 37.93 ± 0.91 weeks. The majority of participants were primigravida (55%), while the highest recorded parity was 5, observed in 1% of the study population.

Table 1. Demographic Characteristic of Participants

Characteristic	Mean
Age (years)	29.5
Parity	2.4
Gestational age (weeks)	37.93

Out of 50 patients who had low AFI on ultrasound, 74% were found to have low amniotic fluid volume intraoperatively. In the second group of patients with normal AFI on ultrasound, 80% of them had normal amniotic fluid volume calculated at the time of c-section and 20% were found to have low amniotic fluid volume.

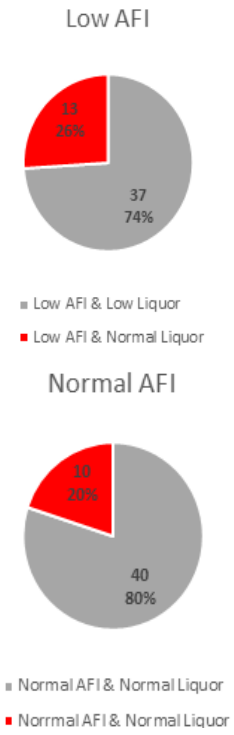

Figure 1: Comparison of Amniotic Fluid Index Determined by Ultrasound and Amniotic Fluid Volume Measured at the Time of C-Section

Moreover, 62% of neonates born to mothers in the low AFI group had poor Apgar scores at 1 minute, compared to 16% in the normal AFI group. At 5 minutes, 12% of neonates in the low AFI group continued to have low Apgar scores, whereas only 2% in the normal AFI group showed similar findings.

Figure 2: Apgar Scores at 1 Minute in Normal and Low AFI Groups

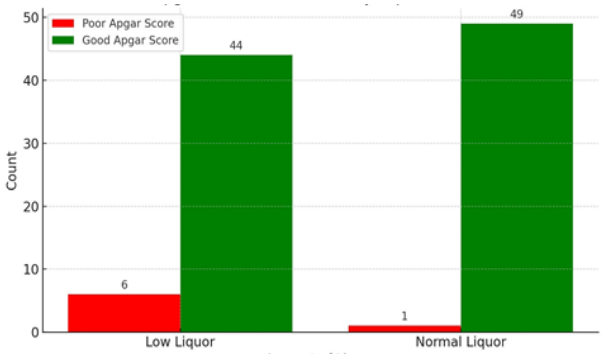

Figure 3: Apgar Scores at 5 Minute in Normal and Low AFI Groups

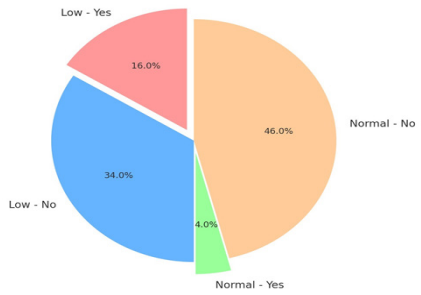

Figure 4: NICU Admission by Amount of Liquor in ml

Out of the total, 34% neonates of low AFI group needed NICU admission, and in normal AFI group 8% needed NICU admission.

Discussion

This prospective study assessed the accuracy of ultrasound-based AFI in reflecting actual amniotic fluid volume observed during caesarean section and to correlate both with neonatal outcomes in low-risk term pregnancies. Hundred pregnant females were divided into two groups—those with low AFI and those with normal AFI. The primary objective was to explore whether ultrasound alone is sufficient for fetal surveillance or if intraoperative findings offer additional value in predicting perinatal outcomes.

Our results revealed, as shown in Figure 1 by pie chart, a moderate correlation between antenatal ultrasound findings and intraoperative fluid volume. Among women with low AFI on ultrasound, 74% were confirmed to have low amniotic fluid volume at the time of caesarean section, while 26% had normal volumes. In the normal AFI group, 80% had normal intraoperative volumes, while 20% unexpectedly had low fluid. These findings affirm the value of ultrasound as a clinical standard but also highlight its limitations. As Everett et al. concluded, AFI is a reasonable third-trimester screening tool for detecting oligohydramnios, though not infallible. Other studies have similarly stressed the clinical significance of low AFI. Our findings align with those of Wax et al. (2022), who critically evaluated the clinical implications of using the amniotic fluid index (AFI) to diagnose oligohydramnios. In their study, they questioned the diagnostic reliability and clinical relevance of isolated AFI measurements, particularly in low-risk pregnancies. This supports our conclusion that clinical decisions should not rely solely on AFI but must consider the broader maternal-fetal context.[9] A cross-sectional study was conducted from November 2019 to March 2020 in Mbarara Regional Referral Hospital in Southwestern Uganda also emphasized enhanced surveillance at term to enable early detection and management of oligohydramnios.[10] Our data support these findings. Figure 2 and 3 elicits the association of apgar scores in low and normal AFI groups.In the low AFI group, 62% of neonates had poor Apgar scores at 1 minute compared to 16% in the normal AFI group. Low amniotic fluid volume has traditionally been regarded as a marker of placental insufficiency and fetal compromise, often prompting obstetric intervention. [11]

Regarding 5-minute Apgar scores, 12% of neonates in the low AFI group had poor scores compared to just 2% in the normal AFI group. These outcomes align with previous research, which reported a high frequency of poor Apgar scores, NICU admissions, low birth weight, and respiratory distress among pregnancies with AFI <5 cm.[12] NICU admission rates in our study further underscore the significance of AFI. Among neonates of mothers with low AFI, 34% required NICU admission, while 68% were roomed-in with the mother. In contrast, only 8% of neonates in the normal AFI group required NICU care. This finding is comparable to a study by Lajber et al. (2019–2020), which reported a NICU admission frequency of 12.5% in the low AFI group and none in the normal group.[13]

A descriptive study conducted at Lady Reading Hospital, Peshawar, in collaboration with Karachi Metropolitan University, observed adverse pregnancy events in 59% of oligohydramnios cases, including 30% caesarean deliveries, 15% fetal distress, 8% stillbirths, 11% meconium-stained liquor, 18% NICU admissions, and 18% of neonates with Apgar scores < 7 at 5 minutes.[14] Another study at Cantt general Hospital, Rawalpindi from October 2022 to March 2023 involving 224 pregnant woman, concluded that the frequency of AFI <50 mm in term pregnancies was quite high and was associated with poor Apgar scores.[15]

Furthermore, a large retrospective analysis involving 12,940 participants from Guatemala, Pakistan, Zambia, and the Democratic Republic of the Congo demonstrated a significant association between oligohydramnios and adverse perinatal outcomes, including stillbirth, neonatal death within 28 days, low birth weight, and preterm birth.[16] In obstetrics, detection of oligohydroamnios always indicate the need for close monitoring and specialised antenatal care. An observational study was conducted from July 2019 to June 2020 among pregnant women admitted to the labour room or antenatal ward of a tertiary care hospital in Nizamabad, Telangana, India.[17] The study included women with a gestational age of more than 37 weeks and an AFI of ≤ 5 cm. Outcomes assessed which were assessed included the onset of labour whether induced or spontaneous, mode of delivery, Apgar scores at 1 and 5 minutes, birth weight, NICU admissions, and perinatal mortality. The findings of this study indicate that patients with oligohydramnios face an increased risk of maternal complications and adverse perinatal outcomes. Therefore, assessing the amniotic fluid index should complement other fetal monitoring techniques to help identify infants at greater risk for poor perinatal outcomes.[17] Obstetric ultrasound contributes significantly in antepartum surveillance and World health organisation recommends ultrasound as part of routine antenatal care to improve maternal and fetal outcomes.[18] Use of ultrasound in the management of pregnancies in low-income countries is always beneficial. However, the ultimate goal of improving perinatal outcome can not be achieved only by this diagnostic tool. Scientific approach is essential.

Although ultrasound remains the gold standard for estimating amniotic fluid volume, our findings suggest that intraoperative fluid assessment—while not standardized—may offer important supplementary information, especially when AFI results are borderline or discordant with clinical presentation. Fetal outcomes should thus be evaluated not solely on ultrasound findings, but in conjunction with intraoperative observations and overall clinical context to improve perinatal care. This approach may help clinicians make more informed decisions,

Limitations

This research was carried out at a single tertiary care facility, which may restrict the broader applicability of its findings. The sample size was relatively small, and intraoperative fluid volume was measured using a suction apparatus, which is not a standardized method and may introduce observer variability. Additionally, AFI was measured by different sonologists, which may have introduced interobserver

variation. Nonetheless, the study provides valuable insight into the real-world reliability of AFI and highlights the importance of using multimodal assessment for better neonatal outcomes.

Conclusion

Our study demonstrated that ultrasound-based estimation of amniotic fluid volume using AFI correlates reasonably well with intraoperative findings and serves as a reliable tool for fetal surveillance. Pregnancies complicated by low AFI were significantly associated with poor Apgar scores, higher NICU admission rates, and overall adverse fetal outcomes. These findings support the use of AFI as a quick, non-invasive, and dependable predictor of neonatal risk. However, given its limitations, AFI should be interpreted in conjunction with intraoperative assessments and clinical context. Patients identified with low AFI should be closely monitored, and appropriate neonatal care arrangements should be made in advance to ensure timely intervention and improved perinatal outcomes.

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Original Article

Perspectives of ICU Physicians on Antibiotic Use in Critically Ill Patients: A Qualitative Study from a Developing Country

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Abstract

Objective: To explore the experiences and perceptions of ICU consultants regarding antibiotic prescribing practices in critically ill patients within resource-limited healthcare settings.

Methodology: This qualitative study, based on a phenomenological approach, was conducted between January 1 and December 30, 2023, at the National Hospital & Medical Center and DHA Medical Center, Lahore, Pakistan. Six ICU consultants with more than two years of post-fellowship experience were recruited through purposive sampling. Data were collected via face-to-face, semi-structured interviews, audio-recorded with consent. Thematic analysis was performed until data saturation was achieved.

Results: Six major themes emerged. First, early initiation of antibiotics without confirmed diagnosis was reported as a routine and often necessary practice due to diagnostic uncertainty and delays in culture results. Second, barriers to antimicrobial stewardship (AMS) were noted, including the absence of formal AMS policies, poor interdepartmental coordination, and limited access to antibiograms—particularly in government hospitals. Third, factors influencing antibiotic selection included infection site, comorbidities, and family pressure, with variation between open and closed ICU models. Fourth, pharmaceutical incentives were largely deemed irrelevant in ICU prescribing due to the critical nature of decisions. Fifth, inflammatory markers like CRP and procalcitonin were valued for guiding antibiotic de-escalation, though high cost limited routine use. Finally, all participants expressed concern over the rise of antimicrobial resistance (AMR), highlighting the need for better microbiology infrastructure, public education, and regulated antibiotic access.

Conclusion: ICU antibiotic prescribing is shaped by clinical urgency, systemic limitations, and contextual pressures. To mitigate the threat of AMR in low-resource settings, it is crucial to strengthen AMS programs, expand diagnostic capacity, and enforce locally adaptable prescribing protocols.

Keywords: ICU, Critically Ill Patients, Antimicrobial Resistance, Antibiotic Prescribing, Antimicrobial Stewardship

Introduction

Intensive care units (ICUs) are high-stakes environments where clinicians must make urgent and complex decisions about antibiotic use under significant diagnostic uncertainty.[1] While signs of infection such as fever, leukocytosis, or elevated inflammatory markers may be present in ICU patients, these are often non-specific and may reflect non-infectious etiologies.[2] Differentiating bacterial from non-bacterial causes is essential, as inappropriate antibiotic use can lead to adverse outcomes such as Clostridioides difficile infections, disruption of normal flora, and the acceleration of antimicrobial resistance (AMR).[3] Conversely, delayed antibiotic administration in confirmed bacterial infections can significantly increase mortality.[4]

AMR is particularly alarming in ICUs due to the frequent use of broad-spectrum antibiotics, invasive procedures, immunocompromised states, and extended hospital stays.[5] While high-income countries have implemented structured antimicrobial stewardship (AMS) programs supported by real-time diagnostics, infectious disease consultation, and electronic prescribing systems, many low- and middle-income countries (LMICs) lack such infrastructure.[6] In LMIC settings, barriers such as limited microbiology capacity, delayed culture reports, and lack of standardized AMS policies hinder rational antibiotic use.[7] Additionally, external pressures—including expectations from patients and families for rapid clinical improvement—often lead to the overuse of antibiotics, particularly in private sector ICUs.

Despite growing global awareness of AMR, studies continue to report that up to 70% of ICU patients receive antimicrobials, with nearly half lacking microbiological confirmation.[8] This over-reliance on presumptive therapy is especially problematic in resource-constrained health systems where stewardship oversight is minimal. In response to this urgent need for contextualized insights, this study explores ICU clinicians' perspectives on presumptive antibiotic therapy, AMS barriers, external influences, and the perceived threat of AMR in a developing country context. It focuses on understanding the beliefs, attitudes, and decision-making patterns of ICU physicians

managing antibiotic use in critically ill patients in Pakistan.

Methodology

This qualitative study was conducted from 1st of January to 30th of December, 2023, at National Hospital & Medical Center, Lahore, and DHA Medical Center, Lahore, each with over 100 general beds and a minimum of 6 ICU beds. Both hospitals catered to a broad spectrum of critically ill patients, providing an appropriate setting to explore antibiotic prescribing practices in ICUs.

Study Design and Participants

A phenomenological approach was used to explore ICU consultants' lived experiences and decision-making processes regarding antibiotic use. Purposive sampling was employed to recruit six ICU with more than two years of post-fellowship clinical experience in critical care. Recruitment was stopped at six interviews, as thematic saturation was reached by the seventh, indicating no new insights were emerging. Participants included both senior ICU consultants and ICU physicians (senior and junior clinicians involved in daily ICU management). Only those actively prescribing antibiotics for ICU patients were selected to ensure relevance to the study objective. This diversity in roles and experience levels allowed for a broader range of perspectives.

Data Collection

Semi-structured, face-to-face interviews were conducted using an interview guide designed to explore key domains such as antibiotic prescribing behaviours, perceptions of AMR, and barriers to AMS. Interviews were conducted by an experienced ICU physician who had no affiliation with the participating hospitals. This outsider status helped reduce hierarchical influence and social desirability bias. All interviews were audio-recorded with participant consent, transcribed verbatim, and anonymized to maintain confidentiality. Informed consent was obtained from all participants. Ethical approval for the study was granted by the Institutional Review Board (IRB No. NHMC/021/8).

Given the sensitivity of prescribing decisions, particular attention was paid to minimizing bias. The Necessity-Concerns Framework (NCF) was used as a guiding lens to understand how ICU physicians balance the need for immediate antibiotic therapy with concerns about overuse and AMR.[9] A reflexive journal was maintained to document the research team's assumptions and reflections throughout the process. The study did not include member checking to preserve participant confidentiality in the small ICU physician community.

Data Analysis

Thematic analysis was performed using Braun and Clarke's six-step framework.[10] Transcripts were independently coded by three researchers using NVivo 12 software. An initial codebook was developed collaboratively after coding two transcripts, and the remaining transcripts were analyzed using this shared framework. Coding discrepancies were resolved through discussion until consensus was reached.

Themes were derived inductively, based on the data rather than preconceived categories. The final themes were refined through iterative review and verified against the original transcripts. To enhance credibility, data triangulation was achieved by involving multiple analysts, and an independent qualitative research expert reviewed the final thematic structure.

Results

A total of six ICU consultants and physicians participated in semi-structured interviews. Thematic saturation was achieved by the seventh interview. Analysis revealed six key themes related to antibiotic prescribing practices, AMS implementation, and perceptions of AMR in intensive care settings.

Table 1: Thematic Analysis of ICU Clinicians' Perspectives on Antibiotic Use

Theme	Key Insights	Supporting Quotes
1. Necessity of Early Antibiotic Initiation	-Empiric antibiotic therapy is routine due to delays in lab results and rapid clinical deterioration. - Clinical urgency often outweighs concerns of overtreatment.	"Almost 50% of the cultures we send are negative, but we still need to complete the course, we can't take the risk." (Consultant 2) "Broad-spectrum antibiotics are often started because outcomes can be grave if we delay." (Consultant 4) "It's not ideal, but we don't always have time to wait—our decisions are often based on experience and urgency." (Consultant 6)
2. Challenges in Implementing Antimicrobial Stewardship	- Lack of AMS policies, interdepartmental coordination, and antibiograms. -Government hospitals face resource constraints; private hospitals lack centralized protocols. - Public setups may enforce AMS better if leadership is committed.	"In government hospitals, there's often no stewardship program, no antibiograms, and labs are frequently unavailable."(Consultant 1) "Even in private hospitals, we lack centralized AMS policies." (Consultant 3) "Government hospitals can sometimes implement protocols better—there's more control and structure if leadership is committed." (Consultant 6)

3. Factors Influencing Antibiotic Selection	-Decisions based on comorbidities, infection site, previous antibiotic use, and clinical condition. - Family pressure in private hospitals often influences aggressive treatment. - ICU structure (open vs. closed) affects consistency in prescribing.	"Families want results fast—they push for stronger drugs even before we get labs." (Consultant 4) "In closed ICUs, protocols are easier to follow, but in open setups, every consultant may have their own approach." (Consultant 6)
4. Limited Role of Pharmaceutical Incentives in ICU Prescribing	-Pharma influence is minimal in ICUs due to focus on clinical urgency. - Influence may still be present in outpatient or non-critical care settings.	"Pharma influence is minimal in the ICU—we focus on what's clinically needed." (Consultant 1) "There's very little space for that in ICU—decisions are fast, high-stakes, and based purely on clinical need." (Consultant 6)
5. Use of Inflammatory Markers in Guiding Therapy	-CRP and PCT aid de-escalation but are limited by cost and availability. - These markers should support, not replace, clinical judgment.	"CRP and PCT are useful, but not practical for daily use due to cost." (Consultant 3) "We monitor them in respiratory illnesses, but they're part of the whole picture, not the decision-makers." (Consultant 6)
6. Perceptions and Impact of Antimicrobial Resistance	- AMR is a major concern linked to antibiotic misuse. - Need for stronger labs, proper diagnostics, and public education. - Resistance increasing even in first-line drugs.	"AMR is huge—we need stronger labs, proper antibiograms, and education from top to bottom." (Consultant 2) "We're now seeing resistance to drugs we used to rely on—soon we'll run out of options if this continues." (Consultant 6)

Discussion

This qualitative study explored how ICU physicians in a developing country context make decisions about antibiotic prescribing, their perceptions of AMR, and the systemic barriers to implementing AMS programs. Conducted in two private tertiary care hospitals in Lahore, the study captured the nuanced perspectives of experienced critical care physicians working under diagnostic and infrastructural constraints.

The findings illustrate that early antibiotic initiation—prior to microbiological confirmation, is a widely accepted and often unavoidable practice in ICU settings (Table 1). Clinicians emphasized that in critically ill patients, the cost of delayed therapy is too high, and diagnostic support is frequently insufficient. Blood culture results are often delayed or negative, which further necessitates relying on clinical acumen. This aligns with global literature indicating that in resource-limited ICUs, physicians often prioritize immediate clinical response over adherence to diagnostic-confirmed prescribing protocols. For example, a multi center study in Middle Eastern ICUs reported that over 60% of antibiotics were initiated before culture results, largely due to delays and unavailability of timely diagnostics.[11] Similarly, in Southern Europe, clinicians acknowledged the pressure to act fast even when culture data were lacking.[12] Unlike many high-income countries that benefit from real-time polymerase chain reaction (PCR)-based diagnostics, automated blood cultures, and infectious disease consult support, our participants described a reliance on empirical decision-making driven by patient acuity and the limitations of available lab services. This reflects a broader trend in LMICs, where weak laboratory infrastructure forces clinicians to favour immediate over ideal care.[13]

Despite understanding the importance of AMS, the participants consistently described significant challenges in its implementation. These included the absence of hospital-wide stewardship policies, lack of standardized antibiograms, poor interdepartmental coordination, and minimal administrative engagement. While private hospitals had better laboratory services than public-sector institutions, they too lacked centralized AMS programs and oversight committees. This also resonates with findings from Arab countries where stewardship is hindered by similar structural and leadership deficits.[14] In a review of stewardship efforts across the Middle East, Balkhy and colleagues (2016) noted that even where policies exist, their execution is hampered by fragmented healthcare governance and poor interprofessional collaboration.[15] In contrast, some Gulf Cooperation Council (GCC) nations have invested in national AMR surveillance systems and inter-hospital stewardship networks, which allow for shared guidelines and data-driven decision-making.[15] The lack of such regional frameworks in Pakistan highlights broader disparities in health system preparedness, even among resource-constrained countries.

The participants also expressed unanimous concern about the growing threat of AMR, identifying it as an escalating public health crisis that is already affecting ICU treatment outcomes. There was particular alarm over resistance to last-resort antibiotics, such as colistin, and the rising prevalence of multidrug-resistant organisms, including Acinetobacter baumannii and Klebsiella pneumoniae. Their observations align with global surveillance reports, such as those from the World Health Organization, which identify ICUs as hotspots for resistant infections due to high antibiotic consumption and vulnerable patient populations.[16] For instance, carbapenem-resistant Enterobacteriaceae have been shown to increase mortality in ICU patients by up to 40%, particularly when delays in initiating effective therapy occur.[17] The rapid spread of plasmid-mediated resistance enzymes like NDM-1 (New

Delhi Metallo-β-lactamase) in South Asia adds to the urgency, highlighting the interconnected nature of community misuse and hospital resistance patterns.

Our findings further suggest that external pressures, including expectations from families, inconsistent laboratory support, and limited staff availability, significantly shape antibiotic decision-making (Table 1). Physicians in private hospitals particularly noted that patients and families often demand immediate relief, which leads to the selection of broad-spectrum agents even before diagnostic data are available. This dynamic, while common in LMICs, remains underexplored in qualitative literature. The lack of dedicated personnel and funding remains a key challenge in implementing effective antimicrobial stewardship (AMS) programs, particularly in resource-constrained settings. Pulcini et al. (2017) emphasized that accurate human resource estimates and sustainable financing are urgently required to support AMS teams globally.[18] This complexity is further exacerbated in unregulated healthcare systems like Pakistan, where the lack of national prescription monitoring mechanisms facilitates inappropriate antimicrobial use not only in hospitals but also at the community level. As highlighted by Davey and Aveyard (2022), the effective involvement of nurses in antimicrobial stewardship within hospitals is often hindered by systemic gaps, including insufficient institutional support and undefined roles—challenges likely intensified in resource-limited and poorly regulated settings.[19]

The challenges of AMS in LMICs are well documented. Abdel-Aziz et al. (2025) highlighted that AMS implementation in resource-limited hospitals is often hindered by infrastructural deficits, lack of diagnostic support, and inadequate policy-level prioritization.[20] Our findings reinforce this, particularly regarding the limited use of inflammatory markers like C-reactive protein and procalcitonin, which, although deemed helpful by participants for guiding de-escalation, remain underutilized due to cost and limited availability, pointing to a persistent disparity between LMICs and high-income countries where such markers are routinely employed.[20]

Zay et al. (2022) observed that the COVID 19 pandemic further disrupted AMS efforts across both COVID 19 and non-COVID 19 settings, leading to increased empirical antibiotic use and a rise in antimicrobial resistance.[21] Our study echoes this concern, as participants reflected on post-pandemic ICU practices characterized by heightened reliance on broad-spectrum agents and diminished stewardship oversight.

The global recommendation for serial PCT measurements to support antibiotic de-escalation remains impractical in LMIC settings without subsidized access and strong institutional backing. Nielsen et al. (2023) emphasized that even in well-resourced ICUs, decisions around stopping antibiotics in critically ill patients are complex and highly context-dependent. Participants in our study echoed this complexity, stressing that biomarkers should never replace clinical judgment but instead be interpreted within the broader clinical context.[22]

This study, guided by the Necessity Concerns Framework (NCF), captured the psychological tension among ICU physicians who described antibiotic prescribing as a cognitive balancing act—between the perceived necessity to act promptly and concerns about long-term consequences like resistance. These internal conflicts, rarely examined in critical care research, are especially pronounced in unpredictable ICU environments in LMICs where any delay could have serious implications.[23]

While the study is limited to two tertiary care centers and a small sample of clinicians, the findings align with broader regional trends and provide insights applicable to comparable LMIC contexts.[20] Member checking was not conducted to preserve anonymity within close-knit ICU teams; nonetheless, credibility was strengthened through triangulation across researchers, external expert review, direct participant quotations, and alignment with international literature.

In conclusion, this study illustrates how systemic limitations, resource constraints, and post-pandemic pressures shape ICU antibiotic decisions in a developing country. It underscores the urgent need for AMS frameworks that are practical, policy-supported, and grounded in frontline clinician experience. Strengthening institutional stewardship policies, improving access to essential diagnostics, and addressing sociocultural drivers of misuse are critical steps to mitigate the rising threat of antimicrobial resistance in Pakistan and similar LMICs.[20,23]

Limitations

The small sample size, involving only six ICU consultants from two private tertiary care hospitals in a single city, restricts the diversity of perspectives and limits the transferability of findings to other ICU contexts, such as public-sector, rural, or lower-tier facilities. Additionally, participants were drawn exclusively from private institutions, which may not reflect the systemic constraints or prescribing behaviours prevalent in government hospitals.

The absence of member checking is another limitation. While it was intentionally avoided to protect the confidentiality of participants in a small, closely connected clinical community, it does limit the ability to verify the accuracy of researchers' interpretations from the participants' standpoint. Social desirability bias may also have influenced responses, given the sensitive nature of antibiotic prescribing practices. Although the interviewer was an external ICU physician, participants may still have provided idealized accounts.

Finally, the study focused only on physicians and did not include perspectives from pharmacists, microbiologists, or nursing staff who are also key stakeholders in antimicrobial stewardship. Including their voices could have offered a more comprehensive understanding of AMS dynamics in ICU settings.

Conclusion

Clinical urgency, limited diagnostic support, and external pressures often compel physicians to initiate treatment without microbiological confirmation, within a resource-limited healthcare environment. While clinicians are aware of antimicrobial resistance, structural and contextual challenges limit adherence to optimal prescribing practices.

Recommendations

- Strengthen diagnostic laboratory services to support timely and accurate infection identification.
- Establish dedicated antimicrobial stewardship committees with clear leadership and accountability structures.
- Develop AMS protocols tailored to local resource availability and ICU workflows.
- Educate clinicians, patients, and the broader community on responsible antibiotic use to reduce external pressures and misuse.
- Include multidisciplinary perspectives—including pharmacists and microbiologists—in stewardship planning and implementation.

Authors' Contributions: MK contributed to study design and manuscript writing; AT reviewed methodology; MAA assisted with data acquisition and generation of codes, and themes; FI contributed to theme validation and discussion writing; NL managed ethical approval, recruitment, and manuscript editing; all participants conducted interviews and thematic analysis.

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Original Article

The Role of Vitamin E in Enhancing the Efficacy of Tamoxifen on Sperm Parameters in Male Infertility: A Clinical Experimental Study

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Abstract

Objective: To compare the outcome of tamoxifen versus tamoxifen plus vitamin E on the semen quality of infertile males with abnormal semen parameters.

Methodology: This clinical experimental study was done in the Department of Obstetrics and Gynecology, Sharif Medical City, Lahore for 6 months after approval from the hospital's ethical review board from January 15, 2024 till July 15, 2024. A total of 110 infertile males provided written consent and underwent semen analysis. Infertile married males aged 20 to 40 years and diagnosed with abnormal semen parameters were included in this study. Patients having leukocytospermia, diminished testicular volume, severe oligospermia were excluded from the study. Demographics and baseline data were recorded and participants were divided into group A which received oral Tamoxifen 10mg twice daily for three months, while Group B received Tamoxifen 10mg plus capsule vitamin E 400mg once a day orally. After three months, semen analysis was repeated to assess changes in sperm parameters. Data collection adhered to a pre-designed proforma.

Results: The mean age in both the groups was 29.40+3.89 years; sperm count in Group A increased from 6.13+0.92 to 16.31+1.33 and in Group B 6.16+0.90 to 19.83+1.58 (p=0.000), and motility increased from 13.98+1.00 to 30.58+2.13 in Group A and 14.05+1.04 to 34.69+1.90 in Group B, (p=0.001)

Conclusion: Our study findings strongly support the synergistic effect of combining tamoxifen with vitamin E in enhancing sperm motility, providing valuable insights for potential therapeutic interventions in male infertility.

Keywords: Male infertility, tamoxifen, semen analysis, oligospermia, vitamin E, sperm motility.

Introduction

Infertili ty is defined as the failure of a couple to conceive after one year of regular and unprotected coitus.[1] Within the couple, both partners are equally responsible for this delay in conception and the dictum must change in Pakistan that males are not responsible and it is only women who should be treated.[2] There is a recent rise in male factor identification in the workup of infertile couples, possibly more because of increased awareness and increased participation of men in the investigations and not due to an increase in male infertility.[3] The medical management of reduced sperm count is very contentious, with many hormonal and non-hormonal remedies available. Several studies have shown benefits with different treatWment protocols using single or multiple drugs such as L-carnitine, tamoxifen, pentoxifylline, coenzyme Q10, follicle-stimulating hormone, and kallikein.[4] Endocrine and systemic disorders, including hypogonadotropic hypogonadism, account for approximately 5–15% of male infertility cases.[5] Primary testicular defects in spermatogenesis are the most common cause, responsible for 70–80% of cases.[6] Sperm transport disorders contribute to 2–5% of cases, while idiopathic male infertility accounts for 10–20%.[7] Certain medications, cancer and hypothalamic-pituitary disorders can cause male factor infertility.[8,9]

For male factor infertility semen analysis is one of the simple test. Single semen analysis report is not relied upon, there should be a gap of at least one week between two samples with 3 days of abstinence.[10] Collection of semen is done by masturbation or by the use of non toxic condoms.[9] The success of male factor infertility is dependent on results of semen anlysis and female fertility status.[10] The semen is evaluated for volume, pH, leukocytes, immature germ cells, and liquefaction, while the sperm is assessed for count, concentration, vitality, motility, progression, debris, and morphology.[7] The Semen Analysis adapted from WHO 2 includes ejaculate volume of 1.5 mL (1.5 – 5 ml), pH > 7.2, Sperm concentration 15 million per ml, Total sperm count of 39 million per ejaculate (33 – 46 million), Sperm Morphology (normal) forms > 4%, Motility 40% (38 – 42%, Vitality of 58% with progressive motility of 32% and total motility of > 40%.

Tamoxifen (TX) is the selective anti-estrogen receptor modulators (SERM) drug category. It has been used in the treatment

of infertile men with idiopathic infertility, oligospermia, and nonobstructive azoospermia.[4] Daily use of 20 mg TX in men with sexual dysfunction for six consecutive months increased the sperm count in the ejaculate.[5] Several studies have reported improved total sperm count, sperm morphology, and increases in pregnancy rates after treatment with tamoxifen.[8,9] Various antioxidants have been claimed in literature which improve semen parameters like vitamin C, Co enzyme Q 10 and L- carnitine and vitamin E. We chose vitamin E (α-tocopherol) 400mg as prescribing drug as it improves sperm motility and morphology by reducing reactive oxygen species, which are commonly elevated in cases of male infertility. Increasing doses of vitamin E are claimed to have harmful effect by increasing the reductive stress which is as detrimental as oxidative stress. This dosage is both efficacious and safe for prolonged use and has been documented in similar studies assessing its impact on male fertility.[10] Vitamin E is widely available, cost-effective, and has an established safety profile, making it a practical choice in clinical settings, especially in low-resource environments like Pakistan.[11]

Male infertility is increasingly recognized as a major contributor to infertility among couples in Pakistan. Despite its growing prevalence, local data on male infertility and the effectiveness of available treatment options remain scarce. Infertility affects approximately 21.9% of couples in Pakistan, with male factors contributing to nearly 40% of these cases. Tamoxifen is commonly prescribed for idiopathic oligospermia due to its affordability and accessibility; however, emerging evidence suggests that its efficacy may be enhanced when combined with Vitamin E as adjunct therapy.[12] Given the mixed findings in existing literature, this study was conducted to generate reliable local evidence that could guide the selection of more effective treatment regimens for improving male fertility outcomes in clinical practice.

Methodology

This clinical experimental study was done in the Department of Obstetrics and Gynecology, Sharif Medical City, Lahore, for a duration of 6 months, from January 15, 2024 to July 15, 2024. It included a 3-month intervention phase followed by a 3-month follow-up to assess sustained effects and monitor any delayed responses or side effects. We lost 3 patients from follow-up. The sample size was 110 with a non-probability consecutive sampling technique. The sample was divided into 2 groups with 55 in each group calculated with a 95% confidence level, 80% power of the study, and mean sperm count i.e. 19.3+2.04 with tamoxifen plus Capsule vitamin E per oral once a day and 17.77+3.56 with tamoxifen alone.[10]

We excluded the infertile married male of age 20 to 40 years diagnosed with abnormal semen parameters, patients having leukocytospermia, diminished testicular volume (< 12 cm^3 as depicted by ultrasonography), severe oligospermia (sperm count <5 million per ml), history of epididymo-orchitis, prostatitis, genital trauma, testicular torsion, inguinal or genital surgery, urinary tract infection or previous hormonal therapy, cryptorchidism or varicocele, occupational and environmental exposure to potential reproductive toxins, history of use of cancer chemotherapy, testosterone, antiandrogens, and tobacco.

After approval from the hospital's ethical review board with letter number SMDC/SMRC/141-20, a total of 110 infertile males were included after written informed consent. Demographics like name, age, BMI, and duration of infertility were noted. A semen sample was obtained for semen analysis. The sample was collected in a private room, wide-mouth container kept at body temperature, after abstaining from any sexual activity for 3 to 7 days. The sample was collected by masturbation with avoidance of any lubricants. The sample was then incubated at 37°C until complete liquefaction occurred. All samples were sent to the laboratory for measurement of sperm parameters. Randomization was done by lottery method to divide the patients into two groups. Group A received Tamoxifen 10 mg twice daily for three months, while Group B was given Tamoxifen 10 mg along with Vitamin E 400 mg daily for the same duration. After 3 months, the semen sample was taken again and semen analysis was done to determine changes in semen parameters, including sperm count, and motility (as per operational definition). All the research data was taken on a pre-developed proforma.

Data analysis was done using SPSS 20. Quantitative variables such as age, BMI, duration of infertility, pre- and post-treatment sperm count, and motility, were analyzed as mean and standard deviation was calculated. Categorical variables like smoking, socioeconomic status, and occupation were analyzed as frequency and percentage. Independent sample t-test was used to compare changes in semen parameters in both groups. P-value < 0.05 was taken as significant. Data was stratified for age, BMI, duration of infertility, smoking, socioeconomic status, and occupation. Post-stratification, an independent sample test was used to compare the change in semen parameters in both groups in each stratum. P-value <0.05 was taken as significant.

Result

A total of 110 (55 in each group) cases fulfilling the selection criteria were enrolled to compare the outcome of tamoxifen versus tamoxifen plus vitamin E on the semen quality of infertile males with abnormal semen parameters. Descriptive statistics of age, BMI, duration of infertility, occupation, and smoking are shown in Table 1. Comparison of the outcome (sperm count) of tamoxifen versus tamoxifen plus vitamin E on semen quality of infertile males with abnormal semen parameters shows that at baseline sperm count was 6.13+0.92 in Group A and 6.16+0.90 in Group B, P-value was 0.835 whereas after 3 months it improved as 16.31+1.33 in Group A and 19.83+1.58 in Group B, p-value=0.001 (Table 6). Comparison of the outcome (motility) of tamoxifen versus tamoxifen plus Vitamin E on semen quality of infertile males with abnormal semen parameters shows that motility at baseline in Group A was 13.98+1.00 and in Group B 14.05+1.04, P value=0.711 whereas after 3 months it improved as 30.58+2.13 in Group A and 34.69+1.90 in Group B, P-value=0.001 (Table 3). The data was stratified for age, BMI, duration of infertility, smoking, socioeconomic status, and occupation. Post-stratification, an independent sample test was used to compare the change in semen parameters in both groups in each stratum. P-value <0.05 was taken as significant.

Table 1. Comparison of Baseline Demographic Characteristics Between Group A and B

Demographic variables		Group A (n=55)	Group B (n=55)
Age (Years)		29.40± 3.89	29.03±3.82
BMI (Kg/m^2)		27.44±3.47	27.82±3.39
Duration of infertility（Years)		2.64±0.70	2.65±0.71
Occupation	Office Job	37 (67.3%)	37 (67.3%)
	Labourer	18 (32.7|%)	18 (32.7|%)
Smoking	Yes	12 (21.8%)	10 (18.2%)
	No	43 (78.2%)	45 (81.8%)

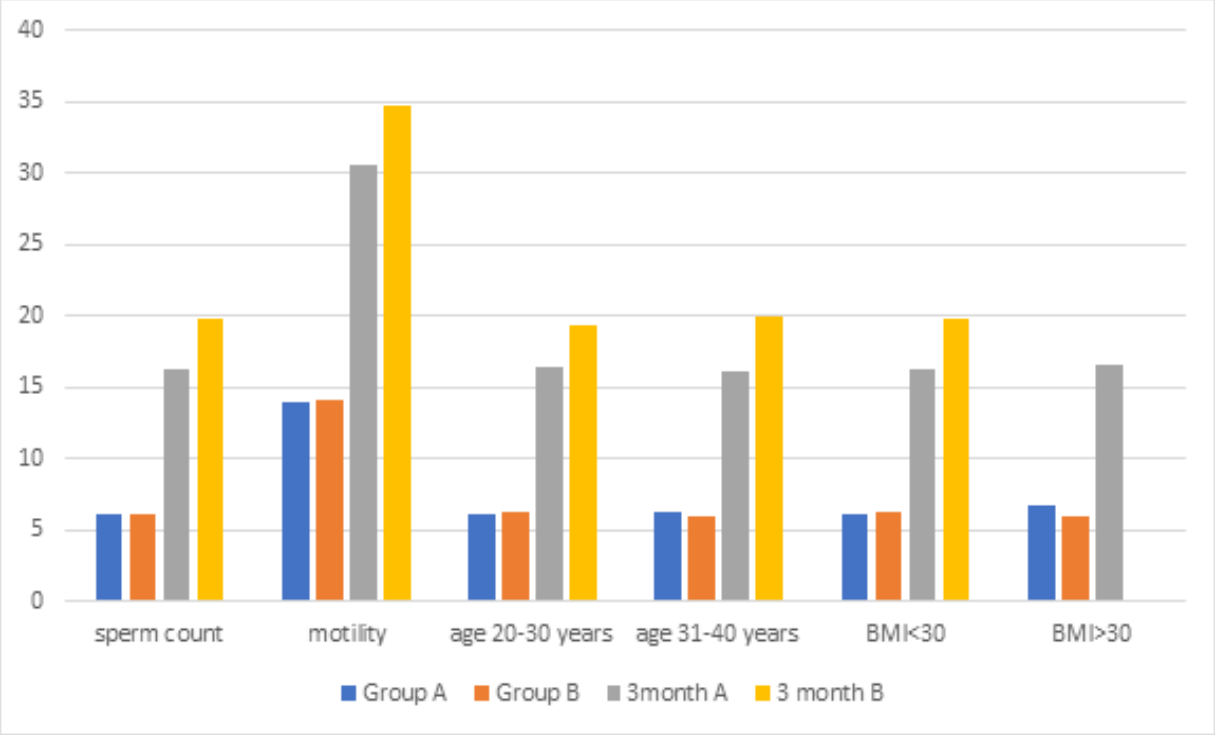

Figure 1: Trends in Semen Quality Parameters Over 3 Months in Groups A and B

Table 2. Statistical Comparison of Groups A and B at Baseline and After 3 Months of Treatment

		Group A (n=55)	Group B (n=55)	P-value
Sperm count	Baseline	6.13±0.92	6.16±0.90	0.835
	After 3 months	16.31±1.33	19.83±1.58	0.000
Motility	Baseline	13.98±1.00	14.05±1.04	0.711
	After 3 months	30.58±2.13	34.69± 1.90	0.00
Age				

20-30 years	Baseline	6.06±0.85 (n=34)	6.28±0.88 (n=36)	0.295
	3 months	16.44±19.78 (n=34)	1.39±1.64 (n=36)	0.00
31-40 years	Baseline	6.24±1.04 (n=21)	5.95±0.91 (n=19)	0.886
	3 months	16.10±1.22 (n=21)	19.95±1.51 (n=19)	0.00
BMI				
<30	Baseline	6.04±0.88 (n=47)	6.21±0.90 (n=42)	0.366
	After 3 months	16.26±1.34 (n=47)	19.79± 1.46	0.00
>30	Baseline	6.63±1.06 (n=8)	6.00±0.91 (n=13)	0.168
	After 3 months	16.63±1.30 (n=47)	20.00±2.00 (n=42)	0.00

Table 3. Comparison of the duration of infertility, occupation, smoking status, and socioeconomic status as a baseline and 3 months following treatment in groups A and B on semen quality of infertile males with abnormal semen parameters.

Variables		**Group A Mean (SD)**	**Group B Mean (SD)**	**P-value**
Duration of Infertility				
3 years	Baseline	6.02±0.91	6.27±0.89	0.178
	After 3 months	16.31±1.36	19.69±1.43	0.00
> 3 years	Baseline	6.86±0.69	5.43±0.53	0.001
	After 3 months	16.29±1.25	20.86±2.27	0.001
Occupation				
Office job	Baseline	6.11±0.91	6.14±0.92	0.899
	After 3 months	16.49±1.30	19.84±1.71	0.00
Laborer	Baseline	6.17±0.99	6.22±0.88	0.859
	After 3 months	15.94±1.35	19.83±1.34	0.000
Smoking status				
Smoker	baseline	6.58±0.73	6.00±0.67	0.080
	After 3 months	16.50±1.38	20.00±1.05	0.00
Nonsmoke**r**	baseline	6.00±0.93	6.20±0.94	0.319
	After 3 months	16.26±1.33	19.80±1.69	0.000
Socioeconomic Status				
Low	baseline	6.16±1.00	6.17±0.78	0.960
	After 3 months	16.31±1.34	20.13±1.63	0.000

Middle	baseline	6.16±0.90 (n=19)	6.24±0.99 (n=21)	0.79
	After 3 months	16.47±1.35(n=19)	19.24±1.30(n=21)	0.000
High	baseline	5.80±0.45 (n=5)	6.00±1.0(n=11)	0.679
	After 3 months	16.80±1.30(n=5)	20.36±1.75(n=11)	0.000

Discussion

The study aimed to examine the effects of a therapy regimen that includes vitamin E and tamoxifen on improving semen parameters in men with oligospermia.[13] The main objective is to find out whether this combination treatment method can significantly enhance sperm characteristics. It is believed that the use of tamoxifen in conjunction with vitamin E would improve sperm parameters, which in turn will increase the likelihood of conception and the likelihood of a successful pregnancy.[14] The baseline descriptive statistics of our study provide a snapshot of the study population, emphasizing the demographic characteristics of participants in both Group A and Group B. The mean age in group A and B was 29.40±3.89 and 29.03±3.82 as shown in table 1. BMI, duration of infertility, occupation a smoking status in group A and B was comparable, these finding align with the previous work done in other studies.[14] The comparison of baseline sperm counts and motility between Group A (tamoxifen alone) and Group B (tamoxifen plus vitamin E) reveals a P-value of 0.000 which is statistically significant (Table 2) . These findings are supported by the Shen Cheun Khaw by comparing L- carnitine with placebo in their study with marked improvement on sperm concentration in L-carnitine group.[15]

The subsequent three-month analysis demonstrates a noteworthy improvement in sperm count and motility in both groups. However, the more pronounced increase in Group B suggests that the addition of vitamin E enhances the effects of tamoxifen (Table 2). This aligns with findings of Kun Peng Li where use of antioxidant led to improvement in semen parameter as compared to the placebo.[5,16] where tamoxifen alone led to a significant rise in sperm concentration. The comparison of age and BMI in different groups showed marked improvement after 3 months of treatment with a P-value of 0.00 (Table 2). Duration of infertility, occupation, smoking status and socioeconomic status in both groups has P-value of 0.00-0.001 which is significant (Table 3). these finding align with finding by other authors.[16,17]

The tamoxifen did not adversely affect traditional semen parameters, it increased the percentage of sperm cells with abnormal morphology and abnormal chromatin as supported by study done in Taiwan by Yao-cheng Wu.[17] This underscores the importance of considering not only conventional semen parameters but also aspects of sperm quality that directly impact fertility. The combination of tamoxifen with vitamin E in our study might address or mitigate these concerns, given vitamin E protective effects on sperm DNA integrity. The finding of our study show a positive impact of tamoxifen and vitamin E on total sperm count, sperm concentration, and motility as shown in Table 1, was also supported by Pallav et al in a study done in India.[18] The observed improvements are attributed to the alleviation of oxidative stress and enhanced sperm mitochondrial functionality. This aligns with the rationale behind combining tamoxifen with vitamin E in our study, suggesting a potential synergistic effect that contributes to the overall improvement in semen quality.[19] The increase in mean sperm count and motility in the combination group compared to tamoxifen alone across different studies strengthens the argument for the synergistic effects of this combination. The detailed analysis underscores the promising potential of tamoxifen, particularly when combined with vitamin E, as a therapeutic option for male infertility with abnormal semen parameters.[20]The combined treatment approach appears to yield superior results in terms of sperm count and motility compared to tamoxifen alone. While acknowledging these positive outcomes, the potential impact on sperm morphology and chromatin integrity warrants careful consideration.[20,21]

Insights from the comparison with previous literature highlight the multifaceted benefits of tamoxifen, which extend beyond traditional semen parameters to include enhancements in oxidative stress reduction and mitochondrial function. This holistic perspective strengthens the case for tamoxifen as a potential intervention for male infertility. However, it's crucial to approach these findings with a nuanced understanding, considering potential side effects and long-term implications. Future research should delve into optimal dosages, long-term effects, and the broader applicability of this treatment approach.[22] Moreover, a careful evaluation of the trade-offs, including potential adverse effects on sperm morphology and chromatin integrity, should guide the development of clinical recommendations.[23] In summary, our study contributes meaningfully to the evolving landscape of male infertility treatment, aligning with existing evidence and paving the way for further exploration of tamoxifen-based interventions with vitamin E supplementation.[24-26] This detailed analysis provides a comprehensive view, laying the groundwork for future investigations and potential advancements in the field.

Limitations

The sample size of the study was small which may limit the generalization of the results and it was a single-centered study. There was a short follow up period of 3 months only which is also one of the major limitations. Future studies with a large sample size and long-term follow-up are required.

Conclusion

Our study findings strongly support the synergistic effect of combining tamoxifen with antioxidants in enhancing sperm motility, providing valuable insights for potential therapeutic interventions in male infertility

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ST: Final write-up and proofreading; AF: Final proofreading.

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Original Article

Frequency and Patterns of Congenital Heart Defects in Neonates of Diabetic Mothers at a Tertiary Care Hospital

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Abstract

Objective: To assess the incidence and spectrum of Congenital Heart Defects (CHDs) in neonates born to mothers with Gestational Diabetes Mellitus (GDM), compared to those born to non-diabetic mothers.

Methodology: This retrospective comparative study was conducted at the Department of Pediatric Cardiology, Bahawal Victoria Hospital, Bahawalpur, over one year from September 2023 to September 2024. A total of 260 neonates were included and divided into two groups: 130 born to mothers with GDM and 130 to non-diabetic mothers. Inclusion required complete maternal antenatal and neonatal records. Neonates with syndromic features or known chromosomal anomalies were excluded. Maternal glycemic status was verified from antenatal clinic files, and CHD diagnosis was based on echocardiography performed within the first week of life. The frequency and types of CHDs were recorded and compared. Data were analyzed using SPSS version 26.0, with $p < 0.05$ considered statistically significant.

Results: CHDs were significantly more common among neonates of diabetic mothers (15.4%) compared to non-diabetic mothers (4.6%) ($p < 0.01$). Patent foramen ovale (PFO) and atrial septal defect (ASD) were significantly higher in the diabetic group—10% vs. 3.1% and 11.5% vs. 3.8%, respectively. Although not statistically significant, increased frequencies of ventricular septal defect (VSD), patent ductus arteriosus (PDA), dextro-transposition of the great arteries (dTGA), and tetralogy of Fallot (TOF) were also noted in neonates of diabetic mothers.

Conclusion: Neonates born to mothers with GDM are at a significantly higher risk of developing congenital heart defects, emphasizing the need for early fetal cardiac evaluation and targeted postnatal screening in this high-risk group.

Keywords: Congenital Heart Defects, Gestational Diabetes, Neonatal Outcomes, Echocardiography, Maternal Hyperglycemia.

Introduction

Congenital heart defects (CHDs) represent the most frequently occurring structural anomalies present at birth, with global estimates suggesting they affect roughly 1 in every 100 live births.[1] Among the established risk factors, maternal diabetes—whether pre-existing or gestational—has consistently been linked to a heightened risk of CHDs, largely due to disruptions in embryonic development triggered by elevated blood sugar levels during early pregnancy.[2,3] While this association is well-documented in international research, much of the available evidence originates from high-income countries, where access to comprehensive prenatal care and effective glycemic control is more readily available.[4,5]

In contrast, there remains a significant gap in research from low- and middle-income countries, including Pakistan. There are very few documented studies in regions such as Southern Punjab where maternal diabetes is linked to fetal heart anomaly, where healthcare resources are not well distributed and antenatal services are not available. The relative increase in occurrence of DM among women of child bearing age, late diagnosis of gestational DM, lack of, or poor prenatal monitoring as well as lack of access to diagnostic tools including fetal echocardiography suggest that the incidence of CHDs may be underreported or mischaracterized in these populations.[6]

This study aims to address a critical gap in regional data by investigating the occurrence and characteristics of CHDs in neonates born to diabetic mothers at a cardiac tertiary care facility in Bahawalpur, a major city in southern Punjab, Pakistan. Unlike earlier studies that primarily relied on birth records or limited diagnostic tools, this research utilizes comprehensive clinical and echocardiographic data to ensure a more accurate assessment. The inclusion of a comparison group comprising neonates born to non-diabetic mothers allows for the identification of diabetes-specific patterns of CHDs within this population. Beyond contributing to the limited national data, these findings aim to determine whether the prevalence and types of CHDs among diabetic pregnancies in this setting align with global patterns or exhibit unique trends shaped by local environmental, genetic, and healthcare factors.[7,8] Ultimately, this

work may support the development of regionally tailored screening strategies and inform public health policies aimed at improving maternal and fetal outcomes.

Methodology

This retrospective comparative study was conducted in the Department of Paediatric Cardiology at Bahawal Victoria Hospital, Bahawalpur, using patient records from September 2023 to September 2024. The institutional ethical clearance, vide letter 2457/DME/QMC was obtained. A written informed consent was taken by every one of the members or their guardians in participation prior to information assortment. The study was conducted in strict accordance with the Declaration of Helsinki principles and under the Human Subject Protection Approval. The patient records were anonymized before analysis to protect patients confidentiality.

According to a study conducted by Arendt in 2021, CHD occurs in 8% of children of diabetic mothers.[9] Using it as our reference study, we used an alpha of 0.05 and 80% power and determined that the study therefore requires around 130 per group. We, therefore, targeted to enroll at least 130 children in each group for our study from the hospital records.

In this study, all neonates from birth to 28 days who were brought to the Pediatric Cardiology Department for echocardiography during the study period were included. Only those who were born at Bahawal Victoria Hospital or were referred shortly after birth, with complete maternal and neonatal records, were considered eligible. The neonates were categorized into two groups. The study group consisted of those born to mothers with a documented diagnosis of diabetes, either gestational or pre-gestational, as recorded in antenatal files. The control group included neonates born to mothers without any documented history of diabetes.

Echocardiographic evaluation was performed in all cases using the Vivid E95 machine. These assessments were carried out by a consultant pediatric cardiologist experienced in diagnosing congenital heart defects. Neonates were excluded if their medical or maternal histories were incomplete or missing. Those with confirmed chromosomal abnormalities, such as Down syndrome or other genetic conditions, were not included. Neonates with congenital infections, such as those related to the TORCH group, identified through antenatal or postnatal screening, were also excluded. In addition, those with severe systemic conditions unrelated to congenital heart disease—such as birth asphyxia, neonatal sepsis, or metabolic disorders—were not considered for the study. These criteria were applied to reduce confounding factors and to ensure that reliable comparisons between the two groups could be made.

Both pre-gestational diabetes mellitus (PGDM) and gestational diabetes mellitus (GDM) cases were included in the study. Pre-gestational diabetes was defined as diabetes diagnosed before pregnancy, either type 1 or type 2, and confirmed through the mother's pre-pregnancy or early antenatal records. Gestational diabetes was diagnosed using WHO criteria during the second trimester. A patient was said to have gestational diabetes mellitus when a 75g oral glucose tolerance test (OGTT) was conducted between 24 and 28 weeks of gestation. GDM was diagnosed if any one of the following plasma glucose values was met or exceeded: fasting ≥92 mg/dL, 1-hour ≥180 mg/dL, or 2-hour ≥153 mg/dL.

The study participants were children of diabetic mothers, both pre-gestational and gestational diabetes (study group, n = 130) and children born to non-diabetic mothers (control group, n = 130). Socio-demographic profile of the neonates, age of neonate at presentation, gender, weight of neonate, term or preterm birth, mode of delivery, diabetes in mother and congenital heart defect in newborn were studied and data obtained was analyzed using SPSS version 22. The frequencies of congenital heart defects were compared between the study and control groups using chi-square tests. All statistical tests were two-sided. $P < 0.05$ was considered to be statistically significant.

Results

The study was conducted involving 260 neonates, divided into two equal groups: 130 neonates born to diabetic mothers and 130 born to non-diabetic mothers. Demographic and clinical variables were evaluated using appropriate statistical tests for categorical, continuous, and mixed variables. All analyses were performed with a significance threshold set at $p < 0.05$ and 95% confidence intervals (CI) where applicable.

The results provide compelling evidence of a significant association between maternal diabetes and the occurrence of CHDs in neonates. Despite demographic similarities between the two groups, including gestational age, gender, and mode of delivery, a marked difference was identified in the prevalence of CHDs. The significantly higher rate of CHDs in the diabetic group—15.4% compared to 4.6% in the control group—highlights maternal glycemic status as a potentially critical factor in fetal cardiac development.

The logistic regression model strengthens this observation, indicating that neonates born to diabetic mothers were approximately 3.8 times more likely to develop CHDs. The 95% confidence interval and low p-value (<0.001) confirm both statistical and clinical significance. This insight aligns directly with the research objective of evaluating whether maternal diabetes independently increases the risk of cardiac anomalies in neonates.

Among the subtypes of CHDs, atrial septal defect (ASD), patent foramen ovale (PFO), and ventricular septal defect (VSD) were more frequently observed in the diabetic cohort, indicating a possible spectrum of structural anomalies commonly associated with intrauterine hyperglycemia. These patterns support prior evidence that glucose dysregulation during the critical phases of organogenesis may interfere with cardiac septation and valve formation.

Maternal age and parity were notably higher in the diabetic group. While maternal age showed a statistically significant association with CHD occurrence via correlation analysis ($r = 0.18$, $p = 0.009$), the strength of this relationship was weak, suggesting it may act as a minor contributing factor rather than a primary driving agent. However,

older maternal age often correlates with increased rates of diabetes and other comorbidities, which may confound this relationship.Hypertension was also more prevalent among diabetic mothers (Table 2).

Interestingly, no significant differences were found in neonatal birth weight, gestational age, or mode of delivery between the groups. This suggests that these perinatal variables did not mediate the relationship between maternal diabetes and CHDs. Such findings refine the understanding that the cardiac anomalies observed were not secondary to premature birth or low birth weight but rather directly related to maternal metabolic status.

The absence of hypertrophic cardiomyopathy in both groups is noteworthy. While some literature suggests an association between maternal diabetes and myocardial hypertrophy, its absence in this study may reflect sample characteristics or timing of echocardiographic evaluation.

In conclusion, these results underscore the need for heightened prenatal surveillance among diabetic pregnancies, including targeted fetal echocardiography. The statistically significant relationship between maternal diabetes and neonatal cardiac defects reinforces the imperative for stringent glycemic control and early fetal monitoring to improve neonatal outcomes. The findings are consistent with the hypothesis that maternal diabetes is a major independent risk factor for CHDs, fulfilling the study's core objective.

Table 1. Neonatal Characteristics by Maternal Diabetic Status

Variable	Diabetic Group (n, %)	Non-Diabetic Group (n, %)	Adjusted OR (95% CI)	p-value
Age at Presentation <15 days	110 (84.6)	98 (75.4)	1.64 (0.80–3.35)	0.076
Male Gender	70 (53.8)	68 (52.3)	1.01 (0.61–1.69)	0.80
Low Birth Weight <2.5 kg	35 (26.9)	30 (23.1)	1.18 (0.66–2.11)	0.47
Preterm Birth	40 (30.8)	38 (29.2)	1.06 (0.61–1.84)	0.88
Spontaneous Vaginal Delivery	86 (66.2)	89 (68.5)	0.94 (0.54–1.63)	0.70

Table 2. Maternal Characteristics and Risk Factors Among Diabetic and Non-Diabetic Mothers

Variable	Diabetic Group (n, %)	Non-Diabetic Group (n, %)	Adjusted OR (95% CI)	p-value
Multiparous	88 (67.7)	63 (48.5)	2.12 (1.21–3.72)	0.007
Hypertension	50 (38.5)	12 (9.2)	5.91 (2.81–12.41)	<0.001
Teratogenic Drug Use	0 (0)	0 (0)	—	—
Insulin Use	90 (69.2)	N/A	—	—

Table 3. Distribution of CHDs among Infants Born to Diabetic and Non-Diabetic Mothers

CHD Type	Diabetic Group (n, %)	Non-Diabetic Group (n, %)	Adjusted OR (95% CI)	p-value
Any CHD	42 (15.4)	17 (4.6)	3.54 (1.85–6.78)	<0.001
Atrial Septal Defect (ASD)	15 (11.5)	5 (3.8)	3.10 (1.06–9.08)	0.017
Patent Foramen Ovale (PFO)	13 (10)	4 (3.1)	3.25 (1.02–10.38)	0.023
Ventricular Septal Defect (VSD)	10 (7.7)	3 (2.3)	3.24 (0.88–11.98)	0.031
d-TGA or TOF	4 (3.1)	0 (0)	—	0.043

Table 1 presents neonatal characteristics, showing no significant differences in early presentation, gender, birth weight, gestational age, or delivery mode between neonates of diabetic and non-diabetic mothers. Table 2 outlines maternal variables and highlights that diabetic mothers were more likely to be multiparous and hypertensive, both with significant odds ratios, indicating higher risk profiles. Table 3 shows a significantly increased prevalence of CHDs in neonates of diabetic mothers. Odds ratios for total CHDs and individual defects like ASD, PFO, and VSD were significantly elevated, even after adjustment for maternal factors. Rare anomalies like d-TGA and TOF occurred only in the diabetic group. These findings collectively confirm a strong association between maternal diabetes and neonatal cardiac anomalies, independent of other perinatal factors.

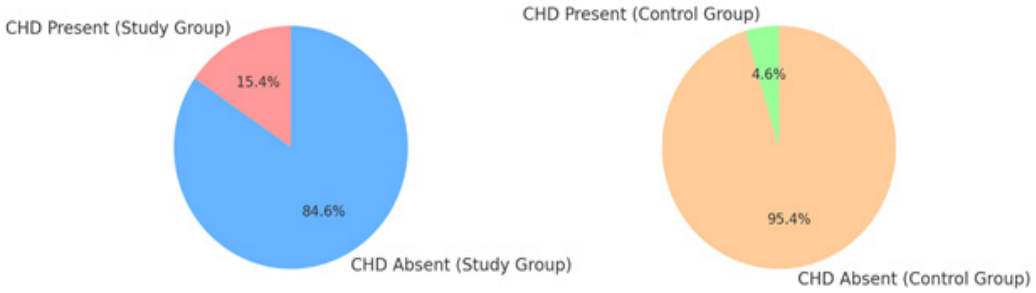

Figure 1. Comparison of CHDs prevalence between diabetic (study) and non-diabetic (control) groups.

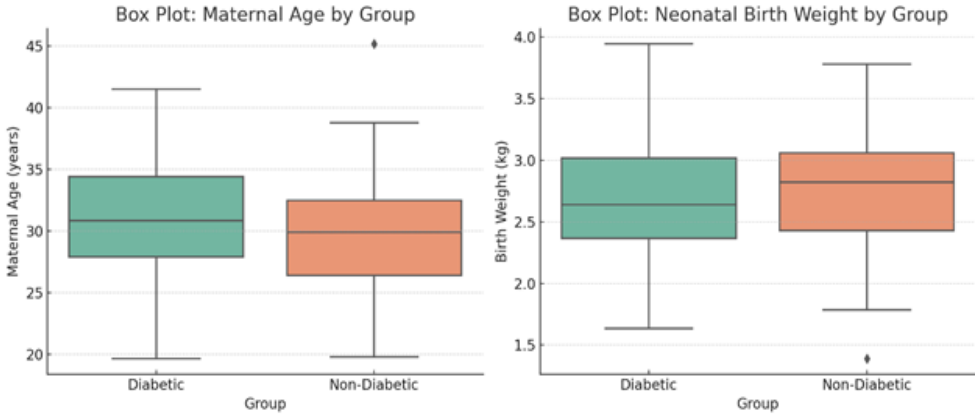

Figure 2. Comparison of maternal age and neonatal birth weight between diabetic and non-diabetic mothers.

The box plot shows that maternal age was significantly higher in the diabetic group, with greater variability. In contrast, neonatal birth weight distributions were similar across both groups, with overlapping medians and interquartile ranges, indicating no significant difference. This highlights maternal age as a distinguishing factor between groups.

Discussion

This study sought to explore the incidence and associated patterns of congenital heart defects in the neonates born to diabetic mothers as compared to those in neonates born to non-diabetic mothers. Our findings show a greatly increased incidence of CHDs (15.4%) in the study group vs control group (4.6%). This difference is consistent with the well accepted hypothesis that maternal diabetes is a strong risk factor of cardiac anomalies arise during gestation.[10-12] The comparative analysis of maternal and neonatal characteristics highlights the broader clinical context in which maternal diabetes influences pregnancy outcomes (Table 1 and 2). In line with this, previous large-scale epidemiological studies have also demonstrated similar patterns. For example, Hoang et al. reported a 16.5% incidence of CHDs in neonates born to diabetic mothers, closely aligning with our findings, though slight differences in prevalence were observed.[13]As in their work, Page et al. (2021) also showed that maternal diabetes increases CHD risk statistically significantly.[14] Likewise, this was also true in our study population: the most common lesions were ASDs and VSDs (Table 3). Our alignment with findings from numerous international studies on maternal hyperglycemia further reinforces the evidence that elevated maternal blood glucose levels negatively impact fetal cardiovascular development.[15,16] Additionally, Sterne et al. report that other common lesions in diabetic neonates are ASD and VSD, which is consistent with the reproducibility of this lesion pattern from population to population and study design.[17] In addition, the cumulative proportion of patients within our diabetic cohort of 15.4% is similar to pooled global CHD incidence estimates in such populations, as recent meta-analyses[18] have reported, 16%.

However, other research shows lower prevalence rates. For instance, DerSimonian et al. (2019) report incidence below 11%, which could imply regional or methodological differences.[19] These discrepancies may be explained on the basis of variability in the definition of diabetes, variation in screening protocols for CHDs, sample size, maternal glycemic control, or gestational age at diagnosis. Although there are variations in this risk, the risk of congenital cardiac anomalies in offspring is substantially increased when mothers have diabetes.[20-22]The basis for this

association is likely pathophysiological and likely includes maternal hyperglycemia, which has been shown to disrupt normal embryonic development during the critical period of cardiac organogenesis.[23] In a study published in 2018 by Darke et al. (2018), they showed a strong association between raised maternal blood glucose level and increased CHD risk.[24] Biological plausibility of our findings is thus supported and the significance of early and tight glycemic control during pregnancy is underscored.[25]

In our study, hypertensive disorders were significantly more prevalent among diabetic mothers (38.5%) compared to non-diabetic mothers (9.2%), with an adjusted odds ratio of 5.91 (95% CI: 2.81–12.41, $p < 0.001$), highlighting a strong association between maternal diabetes and comorbid hypertension (Figure 1 & 2). While the direct role of hypertension in CHD formation was not tested independently, it is a known risk enhancer for adverse perinatal outcomes. The clustering of maternal comorbidities further emphasizes the complex, multifactorial etiology of congenital anomalies, where diabetes may interact with other physiological stressors to potentiate fetal risks. The findings of this study taken together add to the growing body of evidence supporting the modifiable risk of maternal diabetes for CHDs. These results emphasize the importance of comprehensive preconception counselling, strict glucose control during pregnancy, and very early fetal echocardiographic screening to identify and manage known or potential anomalies before delivery.[26,27]

Limitations

Despite the valuable findings in this study, it should be acknowledged that there are a couple of limitations to it. The sample size was however limited, it was drawn from a single center and may hence limit the broadness of the results. These findings should be confirmed in larger multicenter studies in different regions and healthcare settings. Second, a variable had to be used to identify congenital heart defects, for which medical records and diagnostic reports were used, and dependability and timing of diagnostic methods may vary. If cardiac anomalies had not been detected during the initial neonatal period, some may have been missed, although they are all minor or delayed onset. Third, maternal diabetes was classified in a non-discriminate manner for pre gestational versus gestational. The risk profile for CHDs associated with these two conditions may not be the same, and subgroup analysis of each type may result in more significant insight into associated risks. Fourth, the study did not control for other potential confounding factors such as maternal obesity, hypertension, medication use, or glycaemic control levels during pregnancy, all of which could influence foetal cardiac development.[28,29]

Lastly, the study design was observational and cross-sectional, limiting the ability to establish causality. Another limitation of our study is that we did not separately analyze pre-gestational and gestational diabetes cases. Since these subgroups carry different levels of CHD risk, separate analysis could provide more detailed insights. Future studies with larger sample sizes should explore these differences to strengthen clinical understanding and prevention.

Although a strong association was observed between maternal diabetes and CHDs, longitudinal studies are required to confirm temporal relationships and underlying mechanisms.[30,31] Future research should address these limitations through larger, prospective studies with detailed maternal health profiles and comprehensive follow-up of neonatal outcomes.

Conclusion

One implication of the finding that more children are dying after CHD repair surgery is that focus on early identification and management of diabetes in pregnancy, potentially targeting glycemic control or prophylaxis for adverse effects on developing organs such as the heart, might have a favorable long-term impact on congenital heart malformations. It can eventually help reduce the number of cases for such birth defects if we apply some preventive measures through early screening. Findings underscore the continued need for research and clinical focus in addressing risks resulting from maternal diabetes to improve infant outcomes.

Authors' Contributions: FR: Conceptualized, designed and interpreted the study; SA: Manuscript writing, draft work and data analysis; AH: Data acquisition and interpretation; IA and AZ: Critically revised the article for intellectual content; US and FR: Supervised and approved the final version.

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Conflict of Interest: The authors have no conflicts of interest to declare.

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Journal of University College of Medicine & Dentistry

Original Article

Clinical and Functional Outcomes of Percutaneous Locking Plate as an External Fixator in Extra-Articular Proximal Tibia Fractures

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Abstract

Objective: To evaluate the clinical and functional outcomes of using a percutaneous locking plate as an external fixator in extra-articular proximal tibia fractures, with particular emphasis on pain reduction, fracture union, and progressive recovery of knee range of motion (ROM).

Methodology: This prospective interventional study was conducted in the Department of Orthopedic Surgery at Hayat Memorial Hospital, affiliated with Continental Medical College, Lahore, over a 12-week period from January to March, 2025. A total of 30 patients, aged 18 to 75 years, with open extra-articular proximal tibia fractures were included using consecutive non-probability sampling. Fracture stabilization was performed using a 12- or 19-hole locking compression plate applied externally. Pain was assessed at 1, 3, 6, and 12 weeks postoperatively using the Wong-Baker Faces Pain Rating Scale, while ROM was measured using a goniometer. Radiographic evaluation for union was conducted at the same intervals. Data were analyzed using SPSS version 23, with $p < 0.05$ considered statistically significant.

Results: The study included 30 patients (mean age 43.5 ± 12.2 years; 21 males and 9 females). Average pain scores showed a statistically significant decline from 6.0 in the 1st week to 1.5 by the 12th week ($p < 0.05$). ROM also improved progressively: at the 1st week, most patients were limited to 30°–60°, whereas by the 12th week, the majority (n=23) achieved near-normal ROM (120°–135°). Radiographic union was observed in all patients by the end of 12 weeks.

Conclusion: Percutaneous application of a locking compression plate as an external fixator appears to be an effective treatment option for extra-articular proximal tibia fractures. It offers stable fixation, reduces pain significantly, and facilitates early functional recovery in terms of knee mobility.

Keywords: Percutaneous locking plate, external fixator, proximal tibia fracture, knee range of motion, orthopedic trauma, minimally invasive fixation.

Introduction

The tibia is one of the most frequently fractured bones, with proximal extra-articular fractures commonly affecting the upper third of the bone.[1,2] Various treatment methods exist, including non-surgical management, external fixation, intramedullary nailing, and plate fixation. External fixation offers immediate stabilization, making it particularly useful for fractures with soft tissue injuries. However, it is often associated with discomfort, malunion, pink-track infection, and loss of reduction.[3,4] Plate fixation is another widely used approach, requiring extensive soft tissue dissection for direct fracture visualization.[5] Advancement in minimally invasive techniques and soft tissue-friendly approaches have significantly improved patient outcomes.[6-8] LCP has proven promising results as an external fixator for subcutaneous bones like the tibia, with outcomes comparable to traditional external fixation but with fewer complications.[9-11]

In Pakistan, particularly in urban centers like Lahore, proximal tibial fractures are frequently encountered, often resulting from high-energy trauma such as road traffic accidents, falls from height, and industrial injuries. Despite the growing incidence, there is a notable lack of published epidemiological data quantifying the burden of these fractures in the local population. Moreover, many healthcare facilities face significant resource constraints, including limited availability of trained orthopedic surgeons, inadequate access to fully equipped operating theaters, and the high cost of standard internal fixation implants. These limitations are further compounded in cases involving open fractures with poor soft tissue conditions and delayed presentation, where the risk of infection makes internal fixation less viable. In such scenarios, external fixation becomes a more practical alternative. Although LCPs have been successfully used as external fixators internationally, their application and outcomes in the Pakistani context remain underexplored. Therefore, this study seeks to fill this critical gap by evaluating the clinical and functional outcomes of LCPs used as external fixators in extra-articular proximal tibial fractures

within a resource-constrained tertiary care setting in Lahore.

Studies have highlighted its advantages, including improved wound healing, better cosmetic acceptability, and ease of mobilization.[12] A study conducted in Ningbo, China, and the Universities of Toledo, Ohio involving 116 tibial fractures (85.0 closed & 31.0 Open) demonstrated promising results with LCP as an external1fixator. Additionally, LCP removal can be performed under local anesthesia, further enhancing patient comfort.[13] The rationale of the study is to evaluate the clinical outcomes of using a percutaneous locking plate as an external fixator for treating extra-articular proximal tibia fractures. The findings will aid in optimizing treatment strategies for better patient recovery and functional outcomes.

Methodology

A prospective interventional study was conducted in the Department of Orthopedic Surgery at Continental Medical College, Hayat Memorial Hospital, Lahore, over a 12-week period from January to March 2025. Ethical approval for the study was obtained from the Institutional Ethical Review Board (IRB No: 64/FRB/CMC, 25/01/2025), and written informed consent was obtained from all participants prior to their inclusion.

A total of 30 patients of either gender, aged between 18 and 70 years, presenting with open extra-articular fractures of the proximal one-third of the tibia (Gustilo-Anderson Grade II and Grade III-A), were included in the study. Patients were recruited using a consecutive non-probability sampling technique. Exclusion criteria included closed fractures, neurological or paralytic disorders, and severely contaminated open fractures with inadequate soft tissue coverage (Gustilo-Anderson Grade III-B and III-C). All procedures were performed by a single experienced orthopedic surgeon under spinal anesthesia in a sterile operating room environment. Fracture stabilization was achieved using a locking compression plate (either 12-hole or 19-hole), applied externally as a fixator using percutaneous techniques. Postoperative care followed a standardized protocol, including the administration of intravenous antibiotics for 48 hours, oral analgesics, wound dressing changes, and physiotherapy-guided mobilization.

Pain was assessed using the Wong-Baker Faces Pain Rating Scale—a simple visual tool originally developed for children but also used in adult orthopedic settings—while knee joint ROM was measured using a standard goniometer. Results were classified according to the Maitland grading system—a method traditionally used in manual therapy to describe joint movement. For this study, it was adapted to categorize ROM into defined segments (e.g., 0–30°, 30–60°, 60–90°, etc.), providing a structured framework for evaluating mobility progression.

Postoperative weight-bearing protocols were individualized based on fixation stability. Patients began toe-touch or partial weight-bearing between the 4th and 6th week post-surgery. By the 6th week, partial weight-bearing with a walker was encouraged. Full weight-bearing was permitted after 12 weeks, contingent upon radiographic confirmation of bone healing and alignment. Follow-up evaluations were conducted at 6 weeks, 3 months, 6 months, and 1 year. At each visit, pain and ROM were reassessed using the same validated tools. Radiographic imaging was performed at every follow-up to monitor fracture union and alignment. All assessments were conducted by an independent orthopedic resident to minimize observer bias.

Data were analyzed using SPSS version 25. Descriptive statistics, including means, standard deviations, and frequency distributions, were calculated for all key variables. To evaluate changes in pain scores and range of motion (ROM) across the follow-up intervals (1st, 3rd, 6th, and 12th weeks), the Friedman test was applied as a non-parametric method suitable for repeated measures within subjects. For post-hoc pairwise comparisons between time points, the Wilcoxon signed-rank test was used with Bonferroni correction to control for type I error. A p-value of <0.05 was considered statistically significant. These tests were specifically chosen due to the ordinal nature of the Wong-Baker Pain Scale and the structured ROM categories, as well as the small sample size. No patients were lost to follow-up, and all completed the planned follow-up schedule.

Results

A total of 30 patients were included in the study, with a mean age of 43.5 ± 12.2 years. There were 21 males and 9 females. The side of fracture was right-sided in 17 patients and left-sided in 13. According to the Gustilo-Anderson classification, 18 patients had Grade II and 12 had Grade III-A open extra-articular proximal tibia fractures.

Table 1: Patient Demographics and Baseline Characteristics

Characteristic	Value
Mean Age (years)	43.5 ± 12.2
Gender (M/F)	21 males, 9 females
Side of Fracture (Right/Left)	11 right-sided, 9 left-sided
Gustilo Grade (II / III-A)	12 Grade II, 8 Grade III-A

Pain Assessment Over Time

Pain was assessed using the Wong-Baker Faces Pain Rating Scale at the 1st, 3rd, 6th, and 12th postoperative weeks. The mean pain score declined from 6.0 at week 1 to 5.0 at week 3, 4.0 at week 6, and 3.0 at week 12, demonstrating progressive pain relief (Figure 3).

A Friedman test revealed a statistically significant difference in pain scores across the four time points ($p < 0.001$). Pairwise Wilcoxon signed-rank tests confirmed that each reduction between consecutive time intervals was statistically significant after Bonferroni correction ($p < 0.0125$). The initial pain severity distribution is presented in Figure 1. Of the 30 patients, 1 reported no pain, 4 experienced mild pain, 2 reported moderate pain, 5 reported severe pain, 8 reported very severe pain, and 10 experienced worst possible pain (Figure 1).

Assessment of ROM

Knee joint ROM was measured using a goniometer and categorized using the Maitland classification. In the 1st week, most patients had restricted ROM between 30° and 60°, while by the 12th week, the majority achieved near-normal ROM between 120° and 135° (Figure 4).

The mean ROM scores showed a significant increase across time points, as confirmed by the Friedman test ($p < 0.001$). Subsequent Wilcoxon signed-rank tests demonstrated significant improvements between weeks 1 and 6, and between weeks 6 and 12 ($p < 0.05$) (Figure 4). As shown in Figure 2, 1 patient had ROM limited to 30°, 2 patients reached 30°–60°, 3 reached 60°–90°, 4 achieved 90°–120°, and 10 patients achieved full ROM up to 135°. The remaining 10 patients demonstrated intermediate values.

Radiological Healing

Serial radiographs confirmed satisfactory fracture union in all patients by the 12th week. No cases of malalignment, nonunion, or hardware failure were observed.

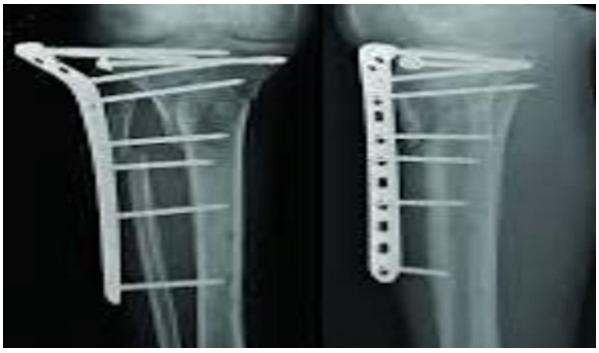

Figure 1: Anteroposterior and lateral radiograph showing percutaneous application of locking compression plates as external fixators for a right-sided extra-articular tibia fracture, demonstrating stable fixation with multiple cortical screws.

Data Analysis

Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize pain scores and ROM measurements. Frequencies and graphical presentations were used for data visualization. A Friedman test was performed to detect differences in pain scores across the four time points, and a Wilcoxon signed-rank test was used for pairwise comparisons. A p-value of <0.05 was considered statistically significant.

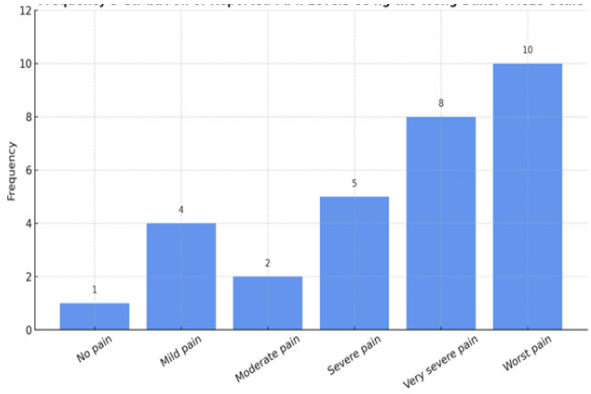

Figure 2: Frequency distribution of reported pain levels among 30 patients using the Wong-Baker FACES Pain Rating Scale. Pain severity ranges from "No pain" to "Worst pain," with the highest number of patients (n=10) reporting the worst possible pain and only one patient reporting no pain.

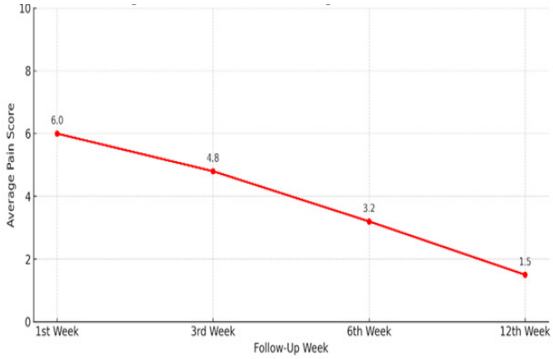

Figure 3: Average pain scores at each follow-up interval, demonstrating a consistent decline in pain over the 12-week postoperative period.

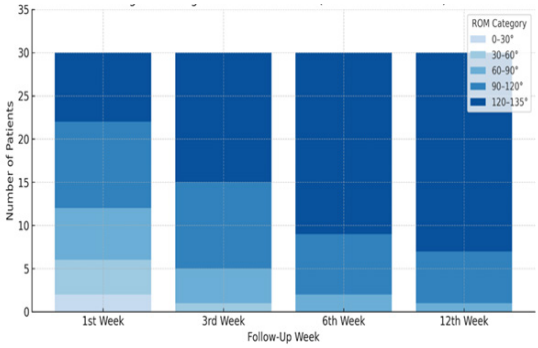

Figure 4: Illustrates the progressive improvement in ROM among 30 patients across 1st, 3rd, 6th, and 12th weeks based on the Maitland classification.

Discussion

This study evaluated the use of a locking compression plate applied externally and fixed through the skin using percutaneous screws, functioning as an external fixator for the treatment of extra-articular proximal tibia fractures. The objective was to assess pain relief, fracture healing, and restoration of knee joint mobility. Over the 12-week follow-up period, patients showed a marked reduction in pain, with scores decreasing from 6.0 to 1.5, and a steady improvement in knee range of motion. By the end of the study, most patients achieved near-complete flexion. These findings support the effectiveness of this minimally invasive technique in promoting clinical and functional recovery, particularly in resource-limited settings.

Radiological assessment confirmed satisfactory fracture union in all cases by the 12th week, with no instances of malalignment, nonunion, or implant failure. These findings highlight the mechanical reliability of the percutaneously applied locking compression plate used as an external fixator, which provided adequate stability while preserving soft tissue (Figure 1). As shown in Figure 2, the average pain score, assessed via the Wong-Baker Faces Pain Rating Scale, decreased from 6 in the first week to 3 by the twelfth week. This consistent decline in pain over the 12-week period indicates effective pain control and ongoing healing. Improvements in knee ROM were similarly encouraging (Figure 2). By the 12th week, 50% of patients had achieved near-complete ROM (120°–135°), compared to week 1, where most were restricted to 30°–60°, indicating significant functional recovery (Figure 2; Table 2). The

improvements prove the efficacy of the LCP external fixator in restoring functional mobility. The percutaneous locking plate technique offers a minimally invasive approach that preserves soft tissue integrity while allowing early mobilization. Studies have demonstrated promising outcomes with this method. Traditional external fixators are typically used in high-grade open fractures to avoid infections related to internal fixation devices. However, they are bulky and uncomfortable for patients. The LCP system, by contrast, offers angular stability, minimal profile, and the convenience of outpatient removal, making it a more patient-friendly option. Our findings align with those reported by Hidayat et al. (2022) who emphasized the functional benefits and acceptability of LCP as an external fixator.[22] Their study showed that patients experienced better postoperative mobilization and comfort due to the device's lower profile. Moreover, Luo et al. reported that 90% of patients had minimal pain by six weeks, and 95% regained full ROM by week 12—figures that mirror our own outcomes. Based on this data and comparison with previous literature, we conclude that LCP as an external fixator is a viable and effective treatment option for proximal tibial fractures, especially in resource-constrained settings. It provides not only structural stability and good healing outcomes but also improves patient comfort and facilitates early mobilization, which are critical components of functional recovery. The percutaneous locking plate technique offers a minimally invasive approach, aiming to preserve soft tissue integrity and promote early mobilization. Studies have demonstrated promising results with this method.[6]

Conventional external fixator constructs are used either for temporary or as definitive fixation in high-grade open fractures to provide stability while avoiding infection of an internal fixation device.[14] However, these frames are often bulky and movement with a lower limb fixator frame in-situ is awkward. As highlighted by Kaushik et al. (2020), surgeons often express reluctance to perform internal fixation in cases of open tibial fractures, particularly Grades II to III b, due to the elevated risk of infection and compromised soft tissue conditions. Instead, alternative fixation strategies—such as the use of locking compression plates as external fixators—have gained attention for their ability to provide stable fixation while minimizing soft tissue disruption.[15]

Kerkhoffs et al in 2003 firstly described that they used a locked compression plate (LCP) as an external fixation for treating open fractures.[16] LCPs offer the advantage of angular stability through their locking-head screw mechanism and low-profile design, making them particularly effective as external fixators in managing open tibial fractures. Ma et al. (2017) demonstrated favorable clinical outcomes and biomechanical strength using metaphyseal LCPs externally, highlighting their ability to maintain stable fixation even under dynamic loading conditions.[17] Similarly, Wu et al. (2013) reported superior functional recovery and reduced complication rates when comparing LCP external fixators to standard external fixators, attributing this to the biomechanical rigidity and soft tissue preservation offered by the locking construct.[18] Zhang et al. (2015) further supported this approach by utilizing a femoral LISS plate externally for proximal tibial metaphyseal fractures, achieving effective fracture stabilization with minimal soft tissue disruption and early mobilization.[19]

Recently, the locking plates used as an external fixator have been reported by several surgeons throughout the world.[20] Thus, LCPs are being used as external fixator with increasing frequency.[19, 20] In this study two variables were assessed after application of LCP for proximal tibial closed fracture for example, i.e pain and range of motion of the knee (figure 3 and 4). A study by Hidayat et al. (2022) found application of the LCP can be considered as an alternative to standard external fixator, it is low profile and more acceptable to patient than bode better for the postoperative mobilization and functionality.[21] Due to their angular stable screw fixation, these plates possess ideal properties for use in external fixation. This approach, known as the super percutaneous splinting techniques, enhances stability and support in fracture management.[9]

A systematic review by Luo et al. (2017) proposed that using LCP as a definitive external fixator is an effective approach for managing tibial fractures. The technique was noted to offer high patient compliance due to its comfort, convenience and slim profile, which allows it to be discreetly worn under clothing, such as trousers.[22] Its minimal bulk reduces the risk of striking the opposite limb during the swing phase of the gait cycle. Additionally, it can be easily removed under local anesthesia, enhancing patient comfort and recovery. Another study recommends the use of LCP as external as a fixator extensae for better compliance with a patient due to its predictable outcome of reduction of pain as the weeks pass. Most of the patients are pain-free or have a mild pain at six weeks 90% Similarly most Patient 95% achieve full range of motion by 12 weeks so our study recommends the use of LCP for closed proximal tibial fracture keeping in view its good outcome for early pain relief and excellent return of range of motion at knee joint.[23]

Limitations

This study has several limitations that should be acknowledged. First, although 30 patients were included, the sample size remains relatively small, which may limit the generalizability of the findings and reduce the statistical power to detect subtle differences or rare complications. Being a single-center study conducted at Hayat Memorial Hospital, the outcomes may be influenced by institution-specific practices, and all cases handled by a single surgeon, and may not be widely applicable to other clinical settings. Additionally, the use of repeated non-probability sampling introduces the possibility of selection bias, as the enrolled participants may not fully represent the broader population with proximal tibia fractures. The lack of a control or comparison group restricts the ability to determine whether the observed benefits are superior to or comparable with conventional treatment modalities such as internal fixation or traditional external fixators. Moreover, the follow-up duration was limited to 12 weeks, which may be insufficient to assess long-term outcomes such as post-traumatic arthritis, delayed union, or sustained functional improvement. The evaluation of functional outcomes relied primarily on range of motion measurements, without incorporating validated knee-specific scoring systems or quality-of-life assessments. Furthermore, the study did not stratify outcomes based on fracture severity using standardized classifications such as Gustilo-Anderson, and potential observer bias may have affected the subjective assessment of pain and joint mobility.

Conclusion

The conclusion of the study demonstrated that use of a percutaneous locking plate as an external fixator in extra-articular proximal tibia fractures leads to significant pain reduction and progressive improvement in knee range of motion over 12 weeks.

Authors' contributions: IM is principal investigator and help in manuscript writing. RKL did data collection and improve complications. MM assist in manuscript writing. JK help in manuscript screening and reference management. IR perform statistical analysis. MM did proof reading and grammar improvements.

Conflict of interest: none

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Original Article

Arthrocentesis Versus Pharmacological Therapy for the Management of Patients with Temporomandibular Joint Disc Displacement Disorders

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Abstract

Objective: To compare the effectiveness of arthrocentesis versus pharmacological therapy in improving maximal mouth opening (MMO) in patients with temporomandibular joint (TMJ) disc displacement disorders.

Methodology: This clinical experimental study was conducted at the Department of Oral and Maxillofacial Surgery, Lahore Medical and Dental College, from June 20 to December 20, 2024. Patients aged 16 to 65 years with TMJ disc displacement, characterized by pain (VAS >3) and restricted mouth opening (<20 mm) for more than one month, were included after providing written informed consent. Exclusion criteria were hypersensitivity to pregabalin, prior TMJ surgery, connective tissue or metabolic disorders (e.g., diabetes, hypertension), and pregnancy. Sixty patients were randomly assigned to two groups: Group A received pregabalin 75 mg twice daily for four weeks, while Group B underwent arthrocentesis. MMO was recorded at baseline and after one month.

Results: Among 60 enrolled patients, 30 were male and 30 female. Most participants (78.3%) were aged 21–40 years, and 68.3% had symptoms for less than 12 months. No significant differences in baseline demographics were observed between groups ($p > 0.05$). The mean improvement in MMO was significantly higher in the arthrocentesis group (8.98 mm) than in the pregabalin group (5.25 mm) ($p < 0.001$). The improvement was particularly significant among younger patients, both genders, and those with symptom duration under 12 months ($p < 0.001$).

Conclusion: Arthrocentesis resulted in significantly greater improvement in maximal mouth opening compared to pregabalin, especially in younger patients and those with recent-onset TMJ disorders.

Keywords: Temporomandibular Joint Disorders, Arthrocentesis, Pharmacological Therapy, Maximal Mouth Opening.

Introduction

The temporomandibular joints (TMJs) are the two synovial joints responsible for articulation between mandible and skull.[1] An intermediate fibrocartilaginous disc separates the joint space into upper and lower parts and helps in the normal function of TMJ.[2] It is approximately 70% water by weight. Injury or degeneration of this fibrocartilaginous disc results in various TMJ disorders.[3] According to an American Academy of Orofacial Pain the TMJ disorder are a set of conditions including the masticatory muscles, the TMJ, and the connected structures.[4] TMJ disorders are the most prevalent reason of orofacial pain of non-dental origin.[5] The etiological factors that lead to TMJ disorders can be occlusal, psychological, hormonal, macro trauma, parafunctions, joint hypermobility, and hereditary.[6]

The most common presentation is pain, followed by restricted mandibular movements, and noises that include crepitus and clicking.[6,7] Six different types of intra-articular TMJ disorders have been reported. These include disc displacement (DD) having reduction and intermittent locking, subluxation and degenerative joint disease.[8] Among these, disc displacement with reduction (DDWR) accounts for 41% of the clinically diagnosed cases[9] with 33% being the asymptomatic.[9] In these patients, the articular disc is displaced relative to the condyle when the mouth is closed, but returns to its normal position between the condyle and the articular tubercle when the mouth is open.[4,10]

The aim of managing TMJ disorders is to eliminate or reduce pain and joint sounds and to restore normal joint function. Treatment includes both pharmacological and interventional approaches.[11] Pharmacological treatments are often the first line of treatment to manage pain and inflammation. These include non-steroidal anti-inflammatory medicines, muscle relaxants, and analgesics. In some cases, neuromodulators such as pregabalin, are used to address nerve pain or associated anxiety.

The current study was executed to compare the mean change in MMO, following treatment with arthrocentesis versus pharmacological therapy using a neuromodulator in patients with TMJ disc displacement disorders. The rationale was to fill the knowledge gap and variations in literature regarding the effectiveness of the proposed treatment options, in patients

with disc displacement disorders. No local study has been conducted so far that can help oral and maxillofacial surgeons to individualize treatments for their patients. The study shall gather evidence from local settings to improve the practice and benefit patients in terms of complications, effectiveness, cost, and quality of life.

Methodology

This clinical experimental study was done at Oral & Maxillofacial Surgery OMFS) Department; LMDC i.e. Lahore Medical and Dental College, Lahore. The study was completed in Six months after the approval of synopsis [June 20, 2024 till December 20, 2024]. The sample size was calculated based on previous study and it turned out as 60 (30 cases in each group) was calculated with 95% confidence interval, 80% power of study, and taking mean change in Mouth opening after pharmacological therapy vs arthrocentesis as 1.94± 0.6 vs 0.63 ± 0.14mm, respectively.[12] Data was collected using purposive-sampling was used.

The study included both male and female participants aged between 16 and 65 years who presented with TMJ disc displacement disorders, characterized by pain (Visual Analog Scale score >3) in the muscles attached to the TMJ and a reduction in mouth opening to less than 20 mm during TMJ movement for a duration of more than one month. Individuals were excluded if they had a known hypersensitivity to Pregabalin or related compounds, a history of TMJ surgery, any diagnosed connective tissue disorder, metabolic disorders requiring regular medication such as diabetes mellitus or hypertension, or if they were pregnant.

Data collection procedure

After taking approval for Study protocol from the Ethical Committee at Lahore Medical & Dental College [FD/462/23], A total of 60 patients fulfilling selection criteria were included in this study through OPD of the Oral and Maxillofacial Surgery Department. Informed consent was taken from each patient before intervention. MMO was defined as the largest distance incisal edge of mandibular central incisor to incisal edge of maxillary central incisor after mouth is fully opened as wide as possible without pain or as inter incisal distance plus the overbite. It was labeled as (T-0) at the start of study and the sample population was distributed randomly and equally between two groups with help of lottery method. After randomization in group A, patients received pregabalin 75mg per orum, twice daily for 4 weeks. Whereas in group B, patients underwent arthrocentesis (a procedure during which the jaw is washed with normal saline and steroid, by introduction of the needle and injection of saline to fill the joint space and establish the flow of saline solution and steroid). MMO was measured again 1 month after the intervention, labeled as T-1. Data was recorded on Pro forma and change in MMO was calculated & labeled as T-C.

Data analysis

Data was analyzed by the SPSS software (version 26.0). Normality of the data was checked using Kolmogorov Smirnov test. Quantitative variables like age, duration of TMJ disorder, pre and post treatment MMO were presented in the form of mean ± SD where data was normal, and median (interquartile range) where data was not normal. Qualitative variables such as age groups, and gender were presented in the form of frequency and percentage, and were compared using Chi-square test. MMO change was calculated, and both the groups were compared for mean change in MMO, by using independent sample T-test if data was normal or Mann-Whitney U test in case of non-normally distributed data. P value (≤ 0.05) was considered as significant. Data was stratified for age, gender, duration of TMJ disc disorder and laterality. Post stratification, independent sample t-test was applied to compare mean change in MMO and p-value of ≤ 0.05 was considered significant.

Results

The comparison between the two study groups, each comprising of 30 patients, showed no significant differences based on age, gender, or duration of disease, as shown in table 1. In the 21–40 years age group, 83.3% of Arthrocentesis patients and 73.3% of Pharmacological therapy patients were represented, while in the 41–52 years group, 16.7% and 26.7%, respectively, were represented. Regarding gender, 46.7% of Arthrocentesis patients were male, compared to 53.3% of Pharmacological therapy patients, with 53.3% and 46.7% being female in each group. For disease duration, 60.0% of Arthrocentesis patients had a disease duration of less

Table1. Comparison of Age Groups, Gender and Duration of Disease in Both Groups

		Study groups		**p-value***
		Arthrocentesis n=30 (%)	**Pharmacological therapy (n=30)**	
Age groups (years)	21–40	25 (83.3)	22 (73.3)	0.347
	41–52	5 (16.7)	8 (26.7)	
Gender	Female	16 (53.30)	14 (46.7)	0.606
	Male	14 (46.70)	16 (53.3)	
Duration of disease (months)	<12	18 (60.0)	23 (76.7)	0.165

n = number of patients; *None of the p-value was significant as p-value > 0.05.

than 12 months, compared to 76.7% in the Pharmacological therapy group, with 40.0% and 23.3% having a disease duration of 12 months or more, respectively. The p-values for all comparisons indicated that these differences were not statistically significant (Table 1).

The Table 2 indicates significant differences between the Arthrocentesis and Pharmacological therapy groups in various terms. While the median age (31 years) and duration of disease (9 months vs. 7 months) were similar between the groups (p-values of 0.694 and 0.145, respectively), the CMMO showed a significant difference overall, with the Arthrocentesis group achieving a higher mean (8.98 mm) compared to the Pharmacological therapy group (5.25 mm) and a p-value of <0.001. This difference was most pronounced in younger patients (21-40 years), males, females, and those with a disease duration of less than 12 months, p <0.001 each.

Table 2A shows the baseline comparison of age, disease duration, and improvement in mouth opening between the two groups. Only the change in maximum mouth opening (CMMO) showed a statistically significant difference.

Table 2A. Main Comparison Between Arthrocentesis and Pharmacological Therapy

Variable	Arthrocentesis (n = 30)	Pharmacological Theapy (n = 30)	p-value	Test Used
Age (years), Median (IQR)	31 (11.75)	31 (14.25)	0.694	Mann-Whitney U test
Duration of Disease (months), Median (IQR)	9 (8.0)	7 (6.75)	0.145	Mann-Whitney U test
CMMO (mm), Mean ± SD	8.98 ± 2.82	5.25 ± 1.73	<0.001	Independent sample t-test

Table 2B presents subgroup comparisons showing significantly greater improvements in change in MMO in the arthrocentesis group across younger age groups, both genders, and shorter disease duration. The numbers in brackets indicate the percentages.

Table 2B. Subgroup Analysis of Change in Maximal Mouth Opening

Subgroup	Arthrocentesis Mean ± SD	Pharmacological Therapy Mean ± SD	p-value	Test Used
Age 21–40 years	9.29 ± 2.73	4.86 ± 1.64	<0.001	Independent sample t-test
Age 41–52 years	6.88 ± 2.59	5.73 ± 1.95	0.377	Independent sample t-test
Male	9.43 ± 3.61	5.65 ± 1.35	0.001	Independent sample t-test
Female	8.41 ± 1.88	4.44 ± 1.93	<0.001	Independent sample t-test
Disease <12 months	7.97 ± 2.04	5.35 ± 1.76	<0.001	Independent sample t-test
Disease ≥12 months	10.25 ± 3.32	4.23 ± 1.39	<0.001	Independent sample t-test

Discussion

This study was done to compare effectiveness of arthrocentesis with pharmacological therapy in improving maximal mouth opening in patients with TMJ disorders. There were no significant variations (p-value >0.05) in age, gender, or disease duration in both groups (Table-1). However, mean change in MMO was significantly more in Arthrocentesis group (8.98 mm) compared to pregabalin group (5.25 mm). This difference was most notable in younger patients (21-40 years), both males and females, and those with a disease duration of less than 12 months (p <0.001, each). (Table-1, Table 2A, 2B).

Interventional treatments are considered when pharmacological approaches are insufficient or when there is a need for more targeted intervention. Arthrocentesis, a minimally invasive procedure that comprises of the lavage of joint to remove inflammatory mediators, is commonly used for TMJ inflammation and to improve joint function. A study conducted by Kim et al. in 2019 compared the effects of pharmacological therapy with arthrocentesis and showed that the mean mouth opening of 24.1 ± 5.6mm increased to 42.7 ± 4mm after arthrocentesis. However, no substantial variation was seen after pharmacological intervention. [13] Another study showed the mean mouth opening of 29.89±4.8 increased to 31.83mm ± 5.41 after non-surgical treatment using pharmacological treatment. Additionally, MMO increased from 31.2 ± 7.03 to 31.83 ± 7.1 in arthrocentesis group.[12]

Temporomandibular joint disorders are prevalent worldwide with a prevalence of approximately 31%.14 Various treatment modalities have been used to manage these disorders and improve the quality of life of the patients. However, there is dearth of local data on the outcomes of the commonly used treatment options. So, this study was designed to compare the effectiveness of arthrocentesis and pregabalin in treating TMJ disorders with a focus on MMO as a primary outcome.

The results demonstrated that both treatments had a positive impact on improving MMO. However, better results were observed in arthrocentesis group. (Table 2A, 2B). As seen in the results, arthrocentesis showed a marked improvement in MMO across the study groups ($p<0.01$). (Table 2) This outcome is consistent with previous research suggesting that arthrocentesis can relieve negative pressure on the TMJ disc, reduce adhesion, and minimize surface friction, leading to improved joint mobility and reduced pain.[15-17] A meta-analysis reported that arthrocentesis resulted in a significant reduction in pain at 1 month compared to conservative therapy. However, no significant difference was observed in MMO between two groups.[15]

Another study performed by Rajput et al. in 2022 revealed that arthrocentesis was more effective for pain relief and increasing maximum mouth opening, while PRP was more effective in reducing joint noise and jaw deviation.[18] These findings supported arthrocentesis as an effective treatment for TMJ disorders. The significant improvement in MMO is mainly attributed to the mechanical effect of joint lavage, which improves disc displacement and restores normal jaw movement. Similar to our study, Kumar et al. compared the effectiveness of duloxetine, arthrocentesis, and their combination in treating TMJ disorders in 45 patients. Arthrocentesis group showed significantly greater pain relief and mouth opening improvements in comparison with Group who received duloxetine (30 mg twice daily). Whereas maximum pain relief and mouth opening improvements was observed in group who received both treatments.[19]

A systematic review of seven RCTs with 6-month follow-up showed that arthrocentesis led to a statistically greater increase in mouth opening (1.12 mm) and borderline improvement in pain reduction compared to conservative therapy. However, these differences were not considered clinically significant.[20] However, Demir et al. performed a retrospective study in 2023 and assessed the effectiveness of arthrocentesis in improving MMO and reducing pain in intra-articular TMD cases. Arthrocentesis significantly improved MMO and decreased VAS scores across all groups ($p < 0.05$). Adjunctive treatments, including splints, medication, and physiotherapy, showed no additional benefit ($p > 0.05$). Arthrocentesis alone was effective in managing TMD-related pain and dysfunction.[21]

Moreover, another recent systemic review reported that all included cohorts showed improved mouth opening, but significant pain reduction occurred only with arthrocentesis alone or combined with intra-articular injectable. Injectable alone were ineffective for pain relief.[22] In contrast, neuromodulators such as pregabalin appears to provide moderate relief in reducing pain and improving jaw function, but it does not achieve the same level of improvement in MMO as arthrocentesis.[13]

Limitations

The short duration of the follow-up in this study limits the ability to assess the long-term efficacy and complications of arthrocentesis compared to pharmacological therapy. Future studies with longer follow-up periods and a more comprehensive evaluation of other functional aspects of TMJ are necessary to understand the full impact of these treatments over time.

Conclusion

Overall, while pregabalin offers pain relief, arthrocentesis improves maximal mouth opening and addresses the underlying structural issues associated with temporomandibular joint disorders. The findings highlight the choice of specific treatment based on the severity and type of disorders of this joint. It also suggests that arthrocentesis should be considered for patients with more advanced joint dysfunction. Further long-term studies are required to confirm these results and explore the optimal combination of treatments.

Authors' Contributions: AA contributed to data collection, abstract writing, and critical analysis; AS supervised the study and provided critical input during the analysis phase; FA participated in data analysis and helped finalize the discussion; AMR assisted in topic selection and critical analysis; ZA served as the corresponding author, contributed to abstract writing, and helped in manuscript finalization; AAH contributed to data collection and discussion writing.

Conflict of Interest: None

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Original Article

Assessment of Clinical Skills and Knowledge in Ophthalmology in Undergraduate Medical Students

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Abstract

Objective: To evaluate the self-perceived competence and exposure of undergraduate medical students to clinical skills and theoretical knowledge in ophthalmology.

Methodology: A descriptive cross-sectional study was carried out at Fauji Foundation Hospital, Rawalpindi. A detailed online questionnaire was circulated amongst fourth-year medical students between October 2023 and February 2024 who had completed their end-of-year examination. We included in the analysis 189 out of 204 respondents who had fully completed the questionnaire. A validated, pilot-tested questionnaire with good internal consistency (Cronbach's alpha = 0.82) was used to collect data on demographics, ophthalmology training exposure, clinical skills competence, ability to recognize ocular emergencies, surgical observation, and research participation.

Results: A total of 189 students responded (mean age: 22.75 ± 0.84 years), two-thirds (66.7%) of which were female. Over 70% of students reported confidence in performing basic ophthalmic skills, including extraocular muscle function, visual acuity, pupillary examination, history taking, visual fields, and squint assessment. However, only 52.7% had hands-on exposure to direct ophthalmoscopy, and a mere 18% had participated in any ophthalmology-related research activities.

Conclusion: The findings highlight a limited and uneven exposure to essential ophthalmic skills among undergraduate students. Key deficiencies, particularly in direct ophthalmoscopy and research participation, highlight the need for structured curriculum enhancements to improve clinical preparedness in ophthalmology.

Keywords: Medical Profession, Ophthalmoscopy, Slit Lamp Examination.

Introduction

Ophthalmology is an important field of study for medical students, even if they do not plan to become practicing ophthalmologists. Understanding ophthalmology is necessary for providing comprehensive patient care, as eye health can impact overall well-being and determine quality of life.[1] Eyes are delicate organs, and many systemic diseases can manifest ocular symptoms which makes it all the more important for primary healthcare physicians. Whether it's diagnosing common conditions like refractive errors or more complex issues like glaucoma and diabetic retinopathy, a solid foundation in ophthalmology enhances a medical student's ability to and manage various health conditions.[2]

Despite the importance of ophthalmology, studies across the globe are reporting a decreasing trend vis a vis the teaching and learning of ophthalmological skills, decreasing length of clinical rotations in eye, and lack of undergraduate students' satisfaction, knowledge and confidence in handling eye diseases.[3] Ophthalmology is taught in most medical institutes in Pakistan in the 4th year of medical college, as per the guidelines of Pakistan Medical and Dental Council, through interactive lectures, teaching sessions in the eye ward and through observation in the operation theatre. At the start of the course, lectures on the anatomy and physiology of the eye are given, followed by lectures on different ocular diseases and their treatment. After that, the students are taught history taking for ocular conditions, vision testing (distant vision, near vision, and color vision), examining anterior segment using a torch, testing ocular movements, assessing intraocular pressure and fundus examination using a direct ophthalmoscope.[4] This teaching is followed by an end-of-rotation exam.

Assessment techniques employed by educators play an important role in the overall learning experience of students.[5] By using a variety of assessment methods, educators can comprehensively evaluate undergraduate students' skills and knowledge in clinical ophthalmology, ensuring they are well-prepared for further post-graduate training or professional practice in the field.[6,7] The assessment methods used at our medical college and indeed in most medical institutions in Pakistan include written examinations, assessment of clinical skills, and objective structured practical examinations (OSPE).[8] To address these issues, we conducted this study

to explore the current state of ophthalmology education within our local context, with the goal of identifying existing knowledge gaps and areas for improvement. As ophthalmology is both taught and assessed during the fourth year of medical school, fourth-year students were selected as the study population to ensure that findings would accurately reflect the outcomes of current teaching practices and assessment methods.

Methodology

Following institutional ethical review board permission (Ref No.893/RC/FFH/RWP), this cross-sectional investigation was carried out at the Fauji Foundation Hospital, Rawalpindi. Between October 2023 and February 2024, fourth-year medical students that had completed their end-of-year examination were administered a structured online questionnaire through convenience sampling.

The questionnaire was developed after a thorough review of existing literature on undergraduate ophthalmology education and was reviewed by three subject experts in ophthalmology and medical education to ensure content validity. A pilot test was conducted with a group of 20 fourth-year students (not included in the final sample) to assess clarity, relevance, and internal consistency of the questions. Based on their feedback, minor modifications were made to improve comprehension. The questionnaire was filled anonymously. The questionnaire included sections on students' exposure to ophthalmic clinical skills, confidence in performing key ophthalmology examinations, ability to diagnose and manage common ophthalmic conditions, recognition of ocular emergencies, surgical observation during clinical rotation, factors influencing learning experiences, and access to research opportunities in ophthalmology.

The students were explained the rationale of the study and were asked to sign a consent form to participate voluntarily, excluding those who did not consent. A total of 189 respondents who had fully completed the questionnaire were included in the final analysis, out of 204 total participants. This exceeded the recommended sample size of 165, which had been calculated based on a 95% confidence level, 7% absolute precision, and an expected response proportion of 70%.9 Statistical analysis was conducted using SPSS version 16, including calculations of means, standard deviations, and frequencies.

Results

Out of 189 responses, 126 (66.7%) were from female students and 63 (33.3%) from male students, with a mean age of 22.75 ± 0.84 years. Over 70% of students reported being taught extraocular muscle examination (160; 84.6%), visual acuity assessment (154; 81.4%), pupillary examination (146; 77.1%), history taking (140; 73.9%), visual field assessment (140; 73.9%), and squint assessment (134; 70.7%). In contrast, fewer students reported exposure to direct ophthalmoscopy (99; 52.7%) and slit-lamp examination (86; 45.5%). Figure. 1 summarizes these findings.

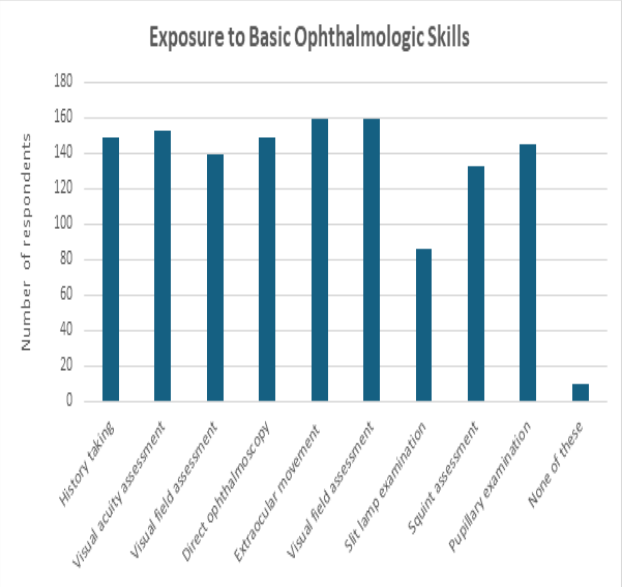

Figure 1: Self-reported exposure to clinical skills in ophthalmology. The x-axis shows different clinical skills; the y-axis shows the number of students and corresponding percentages.

When asked what made their learning experience beneficial, the majority of students (151, 79.9%) said they would rather be taught by a senior physician. Additionally, almost half of the respondents said that having enough clinical exposure had a good effect (103, 54.5%), followed by having enough instructional hours (92, 48.7%). Just 63 respondents (33.3%) said that having access to sufficient resources improved their learning. Conversely, the major causes of a poor learning experience were reported to be lack of resources (52, 28.1%) and insufficient clinical exposure (78, 42.2%) as the main causes of a poor learning experience.

We also inquired about students' self-assessment of their clinical skills in ophthalmology. A significant majority of students (149, 78.8%) expressed confidence in taking history related to eye problems, while an even larger number (164, 86.8%) felt confident in assessing visual acuity. Similarly, a substantial portion of students (140, 74.5%) reported confidence in examining the anterior segment of the eye using a torchlight, and 166 (88.3%) were confident in performing the swinging flashlight test to detect relative afferent pupillary defects. Additionally, 177 (93.7%) students felt confident in assessing extraocular movements, and 157 (83.1%) were confident in evaluating the visual field using the confrontation method. However, fewer than half of the students reported confidence in performing a fundus examination with a direct ophthalmoscope (91, 48.1%), and fluorescein corneal staining (76, 41.1%) while only a little more than half reported confidence in using digital tonometry to assess intraocular pressure (114, 60.6%).

Figure 2 lists the surgeries that the students observed. As anticipated, the majority of students (154; 81.5%) observed cataract surgery. In contrast, 30 students (15.9%) reported that they did not witness any surgeries during their clinical rotation.

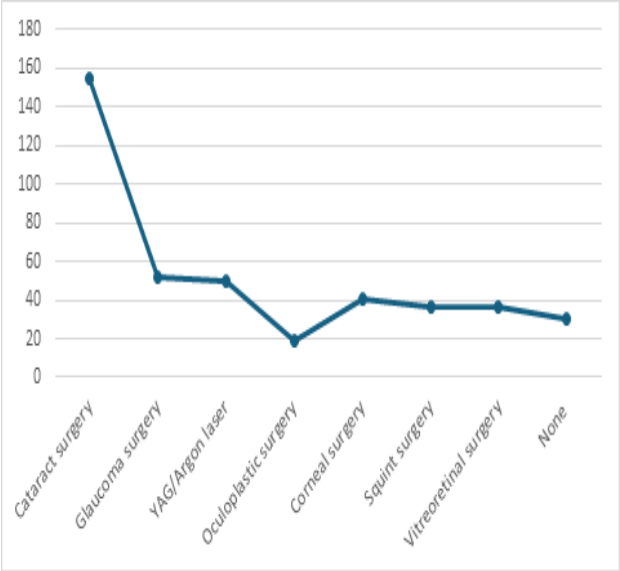

Figure 2: List of surgeries observed by students. The x-axis shows types of surgeries observed; the y-axis shows the percentage of students.

As shown in Figure. 3 below, students' self-reported ability to manage ocular conditions follows a similar trend to diagnosing them. We can see that the four conditions where there is a large gap between ability to diagnose and manage are cataract, glaucoma, pterygium and squint. Such a response is expected as these conditions require expert surgical intervention.

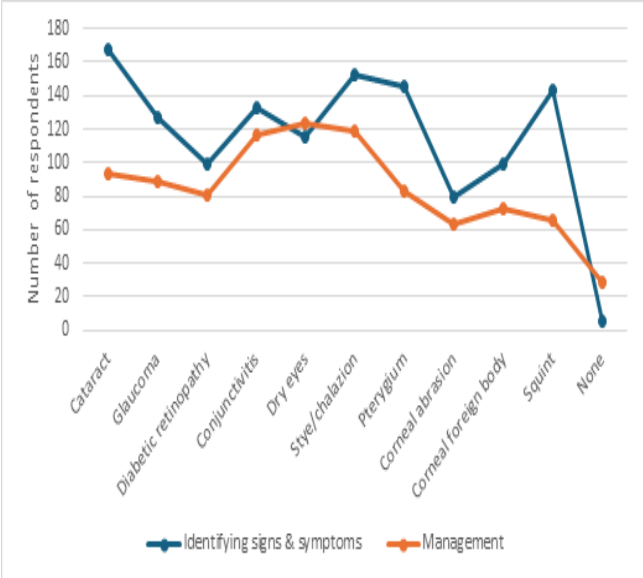

Figure 3: The x-axis shows common ophthalmic conditions; the y-axis shows the number of students and corresponding percentages reporting ability to diagnose or manage each condition.

As shown in Table 1, the respondents' self-reported ability to recognize the signs and symptoms various ocular emergencies. We can see from this table that between 40.7% (retinal detachment) and 63.5% (orbital cellulitis) of the respondents report confidence in being able to identify emergencies.

Table 1: Competency in recognizing ocular emergencies via signs and symptoms:

Ocular emergencies	Frequency (%)
Chemical injuries	99 (52.4)
Acute congestive glaucoma	105 (55.6)
Orbital cellulitis	120 (63.5)
Central retinal artey occlusion	88 (46.6)
Retinal detachment	77 (40.7)
Corneal ulcer	107 (56.6)
Hyphema	108 (57.1)
None	14 (7.4)

The pie-chart in Fig. 4 reveals that only 18% of the students surveyed reported access to research opportunities, indicating that perhaps this aspect of medical education needs to be addressed urgently.

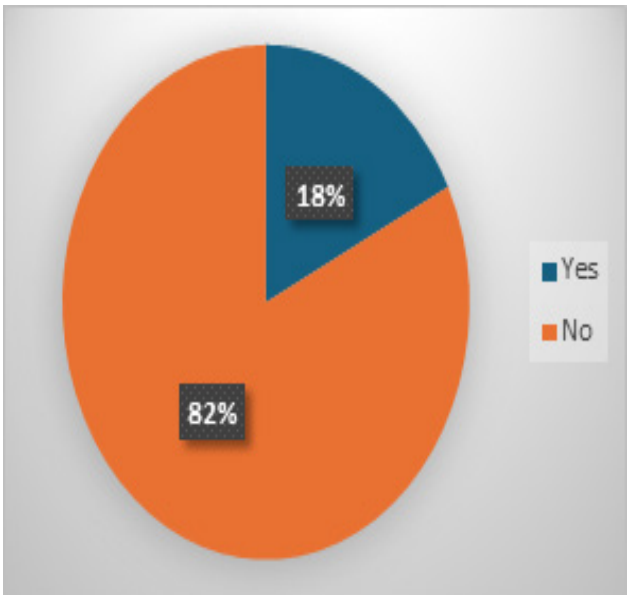

Figure 4: Student responses regarding access to research opportunities in ophthalmology.

Discussion

This study was conducted to evaluate the self-perceived competence and exposure of undergraduate fourth year medical students to clinical skills and theoretical knowledge in ophthalmology. We have been able to identify inadequate exposure to direct ophthalmoscopy which we think has tremendous diagnostic potential in the hands of a general medical practitioner. In addition, we have pieced together a picture of students' understanding (albeit self-reported) of clinical and surgical ophthalmological skills. Further, our data shows the potential for improvement in providing access to undergraduate research opportunities.

All medical professionals need a strong foundation in eye anatomy, physiology, common eye illnesses, and how to treat them, which is provided by undergraduate ophthalmology education. Knowing these fundamentals aids in the diagnosis and treatment of a variety of illnesses that may impact a patient's general health. Future family doctors and general practitioners are prepared to offer primary eye care through basic ophthalmology training.[9,10] In situations where access to specialized care is limited, this involves conducting eye exams, identifying prevalent eye issues, and administering preliminary or primary therapy. According to our research (Figure 1), students report a reasonable level of exposure to clinical skills in the areas of pupil examination (77.1%), visual acuity assessment (81.4%), and extraocular movement (84.6%).

On the other hand, exposure to direct ophthalmoscopy (52.7%) and slit lamp examination (45.5%) remains insufficient (Figure 1). This is concerning, given that direct ophthalmoscopy is a critical skill at the undergraduate level, as it enables medical practitioners to promptly identify and triage serious or life-threatening conditions. It is not uncommon for accident victims to arrive at primary healthcare units or emergency departments with limited or no access to a trained ophthalmologist. In such scenarios, it is essential that the attending physician is adequately trained in direct ophthalmoscopy. Unfortunately, many doctors are often unable to perform this medically vital procedure. Several studies have highlighted the declining proficiency of medical students in direct ophthalmoscopy, resulting in a lack of confidence and a demand for additional training in this area.[11-13] Some studies even suggest a growing tendency among medical educators to consider the teaching of direct ophthalmoscopy less feasible at the undergraduate level.[14] The primary reason cited is that such a delicate and complex skill cannot be fully mastered within the short clinical rotation period of 4-6 weeks.

Nevertheless, we feel that ophthalmologists must emphasize the importance of direct ophthalmoscopy more actively in medical education councils and work diligently to make it an essential component of undergraduate training.[15,16] As future medical practitioners, students will find this skill invaluable not only for managing their patients' eye health but also for accurately triaging many systemic diseases. To address this challenge, Bruner's theory of the spiral curriculum can be applied.[17] This approach suggests that a particularly challenging concept or skill should be introduced early in medical education with a simplified explanation for beginners. The same concept or skill should then be revisited and expanded upon in later years, allowing learners to gradually unravel and consolidate their understanding.

In our study, as many as 80% of students reported that they learned more effectively when taught by a senior ophthalmologist compared to a junior one. However, other studies suggest that while students perceive senior ophthalmologists as more knowledgeable, they also value the unique perspective offered by junior doctors. Junior doctors are often better at providing simplified, step-by-step guidance for practical skills, patient interaction, and offering more realistic advice regarding career choices and opportunities.[18]

Additionally, 42.2% of students felt that a lack of direct patient interaction and practical examination hindered their learning process. They believed that increased opportunities for student-patient interaction could enhance their learning experience. Whereas a majority of the students (81.5%) we surveyed did observe cataract surgery, 15.9% of them did not witness any surgeries while on clinical rotation (Figure 2). These findings are supported by a study by Yu et al, which highlighted that students desired more chances to directly examine patients, observe surgeries in operation theaters, and perform simple independent procedures to improve their skills.[19] Several studies suggest that a more skills-based teaching approach could address these concerns. For instance, Nema et al advocated for a Competency-Based Curriculum, which shifts the focus from theoretical knowledge acquisition to the practical application of skills.[20] It is expected that such changes will improve student learning outcomes as shown in Figure 3. Similarly, Liao et al supported the Cognitive Load Theory, emphasizing that teaching ophthalmic skills in conjunction with diseases from other medical disciplines can help solidify students' understanding of ophthalmology.[12] Some studies also recommend incorporating ophthalmology-related questions into Objective Structured Practical Examinations (OSPEs) at various difficulty levels and across different subjects.[12,21]

Students in our study identified several other factors that hindered their skill development. These included limited time for senior doctors to supervise their patient examination skills and insufficient feedback. They also noted that in large batches, it was challenging for a single trainer to monitor each student effectively. Additionally, students found it demoralizing when junior clinic staff displayed an unwelcoming attitude toward them. Furthermore, 28.1% of students cited a lack of resources for practicing clinical skills as another significant obstacle.

Addressing the challenges faced by undergraduate students in learning ophthalmology is crucial. Ophthalmologists in teaching institutions must make significant efforts to create a supportive and well-organized hospital environment for students. This includes developing feasible schedules for consultants to directly supervise students' ophthalmological skills, forming smaller student groups for more effective skills-based teaching, and advocating for the importance of basic ophthalmic skills in educational committees to maximize students' time in wards and operating theaters.[22] Also, providing realistic career counseling for students interested in pursuing ophthalmology at the postgraduate level is essential.[13]

What is also crucial is for medical professionals to encourage students to engage in research opportunities, a feature currently lacking as pointed out in our study (Figure 4).

In particular, we feel strongly that the survey indicates the medical curriculum in vogue does not adequately prepare students with the knowledge and skills to deal with ocular emergencies (Table 1). This is certainly suggested by the majority of our respondents who feel inadequately prepared to handle such situations. This is an area of improvement which should be focused on by medical practitioners and educators alike and deserves a specialized study to investigate the corrective measures needed.

With the growing advancements in artificial intelligence within the medical field, tools such as virtual electives, online dry labs, and virtual group discussions can serve as effective methods to bridge gaps in ophthalmology education and ensure equal attention for all students.[23,24] Equipping future generations of doctors with knowledge in ophthalmology will enable them to address eye-related public health issues more comprehensively, deliver basic care for common eye conditions, reduce the burden of preventable and irreversible blindness, and screen patients with systemic diseases that have ophthalmic manifestations.

Limitations

This study works with a small sample size and relies on self-reporting by the students which obviously introduces bias due to factors such as overconfidence, and perhaps not wanting to disappoint the teaching staff. Further, a larger multi-center study would be needed to see if the current findings scale to the national level.

Conclusion

This study highlights the declining emphasis on teaching basic ophthalmology to medical students. There is a clear need to strengthen ophthalmology education to ensure that future general practitioners are competent in providing primary eye care. The findings underscore significant gaps in exposure to key clinical skills, such as direct ophthalmoscopy, which only 52.7% of respondents reported having practiced. Strengthening core ophthalmic training during undergraduate education is essential for improving primary eye care delivery.

Recommendations

We recommend that medical curricula be revised to better integrate essential ophthalmic skills, particularly direct ophthalmoscopy, into mandatory clinical rotations. Additionally, greater emphasis should be placed on preparing students to recognize and manage ocular emergencies, an area that remains underexplored in current teaching frameworks. Future studies should specifically examine how the curriculum addresses the management of ocular emergencies to further guide targeted educational reforms.

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Original Article

Knowledge, Confidence & Experience of Dental Professionals in Treating Patients with Autism Spectrum Disorder

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Abstract

Objective: To assess the knowledge, self-perceived confidence, and experiences of dental professionals in managing patients with autism spectrum disorder (ASD).

Methodology: A mixed-methods study was conducted among 384 dental professionals at Sardar Begum Dental College, Peshawar. Participants were selected using a simple convenience sampling technique. Data were collected using a semi-structured questionnaire that included both closed-ended and open-ended items. Closed-ended questions assessed knowledge and self-perceived confidence in managing patients with ASD, while open-ended questions explored participants' experiences and perceived challenges. Quantitative data were analyzed using descriptive statistics to report percentages for categorical variables. Thematic analysis of qualitative responses was conducted using Braun and Clarke's framework.

Results: More than half of the respondents (64.9%) reported never having interacted with a patient diagnosed with ASD. Overall, respondents demonstrated a moderate level of knowledge about the condition. Notably, 34.8% of dentists expressed no confidence in treating children or adults with ASD. Challenges related to patient compliance and communication were identified as significant barriers to providing effective dental care for individuals with ASD.

Conclusion: Most dentists reported limited experience in treating patients with ASD, demonstrated moderate understanding of the condition, and expressed low confidence in managing their care. Common challenges included communication barriers and lack of adequate training.

Keywords: Autism Spectrum Disorder, Dental professionals, Knowledge, Confidence, Communication barriers.

Introduction

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder marked by persistent difficulties in social interaction, communication, and behavior.[1] The etiology of autism is not yet known but it is thought to be a combination of neurological, genetic and environmental factors, leading to a diverse range of experiences and challenges.[2] The prevalence of autism is increasing worldwide, and there is evidence suggesting that it is not influenced by geographic, ethnic, or cultural differences.[3] About 1 in every 68 children in United States is diagnosed with ASD.[4]

The link between ASD and oral health is complicated. It is influenced by factors such as sensory sensitivities, behavioral issues and communication imapirments.[5] Individuals with autism frequently experience sensory processing difficulties, which can involve heightened or diminished responses to sensory stimuli in their environment.[4] Difficulties with social interactions, resistance to change, and limited manual dexterity can make it challenging for parents and caregivers to teach and implement effective oral hygiene routines in children with autism. If oral hygiene practices are not part of a child's established daily routine or are performed inconsistently by different caregivers, the child may resist due to their aversion to change.[6]

Evidence states that people who suffer from ASD, across all age groups have a higher prevalence of oral health diseases. The most common oral diseases are dental caries and periodontal problems.[7] Other most commonly reported oral diseases in these individuals are dry mouth, non-nutritive chewing and self-inflicted injury etc.[8] Additionally people with ASD are more likely to suffer from gingival problems, tooth injury and other oral health problems such as lip biting, tongue thrusting and bruxism.[5] People with autism may find dental visits stressful due to factors such as sensory sensitivities to light, noise, and touch, as well as challenges with social interactions and communication. These factors can lead to anxiety, behavioral outbursts, and difficulty cooperating with dental procedures.[9] Effective dental care for children with ASD demands specialized training, a comprehensive understanding of the disorder, and the application of appropriate behavioral management strategies. In certain cases, protective stabilization, sedation, or general anesthesia may be required to facilitate dental treatment.[10] Although sedation and restraint may be necessary for certain dental procedures in individuals with ASD, they are not without risks. Pharmacological sedation can be expensive and may have adverse health effects, while physical

restraint can lead to psychological and physical trauma, particularly in individuals with intellectual disabilities.[11]

Considering the increased prevalence of oral health issues among individuals with ASD, it is essential for dental professionals to be adequately trained to address their specific needs. This study aimed to assess the knowledge, confidence, and experience of dental professionals in managing patients with ASD.

Methodology

A mixed-methods study was conducted on-site among 384 dental professionals at Sardar Begum Dental College, Peshawar, using convenience sampling. Data was collected through a semi-structured, self-administered questionnaire comprising both closed-ended items (quantitative) and open-ended questions (qualitative). Data collection was initiated after obtaining ethical approval from the ethical review board of Gandhara University (Certificate No GU/2024/157). The sample size was calculated assuming a 50% proportion, a 5% margin of error, and a 95% confidence level. A total of 384 dental students and practitioners participated in this study. The study population comprised faculty members, house officers, trainee medical officers, and clinical year dental students. Faculty members from the basic sciences department who were not engaged in clinical practice were excluded from this investigation. Participants were recruited in this study via simple convenience sampling technique. Informed written consent was obtained from each participant. Data was collected by means of a self-administered semi-structured questionnaire adapted from a study conducted in the United Kingdom.[12] The questionnaire was reviewed by subject experts for content validity, cultural relevance, and clarity, and no modifications were made. In the first section, demographic information such as gender, designation, age and years of clinical experience was obtained from them. In the second section, assessment of participants' knowledge in treating an individual with autism was done. Participants were required to respond to a series of dichotomous (true/false) items. Each correct response was assigned one point. The aggregate score of correct responses served as an indicator of knowledge of autism. Knowledge was assessed using a 14-item questionnaire with true/false statements regarding common facts and misconceptions about ASD. Each correct answer was awarded one point, while incorrect or unanswered items received zero points. Thus, the total possible score ranged from 0 to 14. A mean score was calculated across participants, with a higher score indicating better knowledge.

In the third section, participants were asked to rate their level of confidence in eight specific areas related to the treatment of patients with autism. A 7-point Likert scale was used, ranging from 1 (not at all confident) to 7 (extremely confident). Frequencies for each confidence level were reported per item, but no composite score was calculated due to the variability across dimensions of confidence.

Experience was assessed through quantitative measures (frequency and nature of contact with ASD patients) and qualitative exploration using open-ended questions. Participants were asked to list specific techniques they employed when treating patients with autism and to describe their successes, challenges, and overall experiences in working with this patient population. The data was entered and analyzed using SPSS version 26. Frequency tables and percentages were generated for the categorical variables. To analyze the qualitative data, thematic analysis was employed. This involved a systematic approach based on the framework outlined by Braun and Clarke. An inductive approach was adopted, enabling the identification and description of emergent themes directly from the data set.

Results

The mean age of the participants was 24.25 + 3.36 years. The demographic information of the participants is shown in Table 1. Approximately 12.3% of dentists had contact with children with ASD, 7.4% with adults with autism, and 15.4% with both adults and children. Over half (64.9%) of dentists indicated they had never encountered an autistic patient.

Table 1: Demographic nformation of the Participants

Demographic Information	Percentage (n)
Gender	
Male	45.7 (175)
Female	54.3 (209)
Practice setting	
Private teaching hospital	94.6 (363)
Both hospital and private clinic	5.4 (21)
Qualification	
BDS	52.6 (202)
Postgraduate	1.4 (5)
Final year student	33.1 (127)
3rd year student	12.9 (50)
Years of practice	
Less than one year	58.6 (225)
1–3 years	28.9 (111)
3–6 years	11.4 (44)
6–10 years	0.3 (1)
More than 10 years	0.9 (3)
Department	
OPD	8.9 (34)
Periodontics	7.4 (28)
Pedodontics	7.1 (27)
Operative dentistry	10.6 (41)
Oral & Maxillofacial surgery	21.7 (83)
Prosthodontics	26.9 (103)
Orthodontics	17.4 (67)

Table 2: Knowledge Assessment of Dental Professionals about ASD

Statement	Correct Response (True/False)	Percentage of Correct Responses (n)
People with autism can be interested in social interaction.	True	43.7 (168)
Independent living is not possible for autistic people.	False	42.9 (165)
People with autism feel no empathy or affection.	False	70.3 (270)
A lack of eye contact is necessary for a person to be considered autistic.	False	50 (192)
Autism cannot be diagnosed in adulthood.	False	70.9 (272)
Most people with autism also have intellectual disabilities.	False	43.7 (168)
Females are more difficult to diagnose with autism than males.	True	50.3 (193)
People with autism always display challenging behaviors.	False	26.6 (102)
Autistic people have difficulty with non-literal language and non-verbal communication (e.g. body language and gesture).	True	74.6 (286)
Additional mental health conditions (e.g. anxiety, depression) are more prevalent in individuals diagnosed with autism than in the general population.	True	72.9 (280)
People with autism can show unusual reactions to sensory experiences (e.g. lights, touch, sounds etc.).	True	78.6 (302)
Autistic people are more prone to interpersonal violence than non-autistic people.	False	33.1 (127)
Change in routine and uncertainty are often upsetting for autistic people.	True	78.9 (303)
More than half of people diagnosed with autism do not talk.	False	44.0 (169)

The average knowledge score of the participants was 7.8 out of 14 which shows a moderate level of knowledge.

Table 3: Confidence Levels of Dental Professionals in Managing Patients with ASD

Statement	**1 (Not at all confident)**	**2**	**3**	**4 (Somewhat confident)**	**5**	**6**	**7 (Extremely confident)**
Recognizing autism in children (%)	27.7	9.1	10.3	40.5	4.8	1.7	5.7
Recognizing autism in adults (%)	20.8	14.0	15.4	31.9	7.1	4.6	6.3
Treating autistic children (%)	34.8	14.5	12.3	25.6	4.3	2.0	6.3
Treating autistic adults (%)	34.8	13.4	10.9	24.3	7.1	2.6	6.9
Finding guidance on autism care (%)	23.1	12.0	10.3	36.8	8.3	2.8	6.9
Knowing treatment adjustments (%)	25.9	14.0	11.4	29.9	6.6	5.4	6.8
Making practice adjustments (%)	27.8	9.7	10.0	32.5	6.0	3.1	10.9
Knowing local autism services (%)	27.7	9.4	10.0	33.3	5.7	2.6	10.5

The overall distribution of responses indicated low confidence across most domains in treating adults and children with ASD.

Two main themes emerged from the open-ended responses, as illustrated in Figure 1: (1) Techniques for managing patients with ASD, and (2) Experiences of dental professionals in treating these patients.

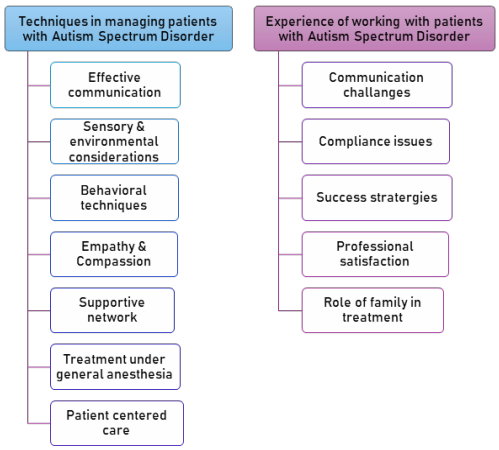

Figure 1: Themes and Sub-Themes Identified from Open-Ended Responses on Techniques and Experiences in Managing Patients with Autism Spectrum Disorder

In describing techniques for successful dental visits, respondents emphasized communication tailored to the patient's needs, including sign language, verbal counseling, and engaging the patient during procedures. Many highlighted the value of sensory-friendly environments—such as dimmed lighting and reduced noise levels. As one participant shared:

"No noise, no direct light on eyes, calming down the patient before seating on dental unit." (Participant 05)
Behavioural strategies like tell-show-do, pre-visit orientation, and psychological support were frequently mentioned. Dentists also underscored the importance of empathy, patience, and personalized care.

"Learn what makes them comfortable, talk to them in a way that most of society doesn't, make them feel like they are normal." (Participant 69)
Family involvement was seen as vital, offering emotional support and assisting with communication. Some dentists felt that in uncooperative cases, treatment under general anesthesia might be necessary.

The second theme focused on practitioners' experiences. Many reported challenges stemming from communication barriers, non-compliance, and the time-intensive nature of care. Others cited insufficient training and financial limitations. Still, several professionals described a deep sense of fulfillment in treating patients with ASD.

"Treating these patients requires education of the whole family." (Participant 105)

Discussion

This study was conducted to assess the knowledge, confidence and experience of dental professionals and clinical dental students in managing a patient with ASD. In this study, more than half of the dentist had never examined a patient suffering from ASD. While only 12.3% of the participants had dealt with a child suffering from autism in their dental setting. This is in contrast to a study conducted in United States, in which around 74% of the dental professionals stated that they have treated a child suffering from ASD.[13] Furthermore, a study conducted in Turkey stated that only 52.2% of the dentists had examined or treated individuals with ASD. The significant disparity in experience treating ASD patients between the regions highlights a need for increased training and awareness among dental professionals in Pakistan.[14] This discrepancy may be due to variations in ASD prevalence, healthcare systems, cultural attitudes, and access to specialized care.

The average knowledge score of 7.8 out of 14 indicates a moderate level of understanding among the participants regarding the topic. This suggests that while participants possess some knowledge, there is potential for further improvement and deeper understanding of the subject matter. However, a study conducted in United Kingdom using the same scale for assessment of knowledge reported that dental professionals had good knowledge about ASD.12 In this study, approximately 50.3% of participants correctly identified that females are more difficult to diagnose with ASD. Similarly, a study conducted in Saudi Arabia found that more than half of the dentists surveyed also responded correctly to this statement.[15]
A significant number of dentists, approximately 34.8%, expressed a complete lack of confidence in their ability to treat individuals with ASD. This lack of confidence highlights a significant gap in the dental profession's preparedness to care for this vulnerable population. Only 6.8% of dentists in our study were extremely confident that they knew what adjustments could be made to facilitate treatment for people with autism. This finding mirrors the results of a Turkish study, where only 4.8% of dentists were aware of special arrangements for individuals with ASD.[14] These results collectively highlight a significant gap in the knowledge and skills of dental professionals regarding the treatment of patients with autism.

The use of a sensory friendly dental setup in which lights and noise are minimized was recommended as a technique for managing patients with ASD. Evidence shows that sensory adapted dental setup affects patients in a positive way.[16]

Dental professionals in our study suggested that general anesthesia may be necessary for patients with ASD due to their uncooperative behavior during treatment. This aligns with findings from another study, which reported that behavioral challenges in individuals with ASD often require general anesthesia to facilitate dental procedures.[17] These findings reflect a gap in non-invasive management strategies, emphasizing the need for further development of desensitization techniques and specialized training for dental professionals to reduce reliance on general anesthesia. Participants highlighted the importance of effective communication, empathy, patient-centered care, and active family involvement in achieving successful dental outcomes for individuals with ASD. These factors help build trust, alleviate anxiety, and create a supportive clinical environment. The findings underscore the value of a collaborative approach that combines professional skills with the support of the patient's family.

Limitations

This study was limited to a single dental teaching hospital, potentially limiting the generalizability of the findings. Future research should include data from a wider range of dental settings, such as dental clinics and more dental teaching hospitals. Additionally, a non-probability sampling technique was used in this study which further limits the generalizability of the results.

Conclusion

Most dentists reported having limited experience in treating patients with ASD, along with moderate knowledge and low confidence in managing their care. Common challenges include insufficient training, time constraints, and communication barriers. To address these, it is recommended that dental school curricula and continuing education programs incorporate training on ASD management, communication strategies, and caregiver collaboration.

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Original Article

Frequency of Postoperative Maxillomandibular Fixation Following Open Reduction and Internal Fixation in Maxillofacial Fractures

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Abstract

Objective: To determine the frequency of postoperative maxillomandibular fixation (MMF) required after open reduction and internal fixation (ORIF) for restoring premorbid occlusion in patients with maxillary and mandibular fractures.

Methodology: This cross-sectional analytical study was conducted in Department of Oral & Maxillofacial Surgery, Ghurki Trust Teaching Hospital, Lahore. Patients aged 12 to 60 years of either gender presenting with maxillary or mandibular fractures were included in the study. ORIF procedure was performed under General Anesthesia with nasal intubation in all cases of maxillary and mandibular fractures under inclusive criteria. Then patients were followed-up in OPD for 2 weeks and evaluated for postoperative malocclusion, and MMF was done for 4 weeks under local anesthesia to restore premorbid occlusion

Results: A total of 382 patients that met the study criteria were included in this study. Out of these, 240 (62.8%) were men and 142 were women. Mean age of the patients was 30.34±9.40 years. The maxilla was the site of fracture in 180 cases (47.1%), while among mandibular fractures, the parasymphyseal region was involved in 172 cases (45.3%) and the angle in 29 cases (7.6%). The overall frequency of postoperative MMF was 53.9%. Among the complications observed, wound dehiscence occurred in 4.5% of cases with MMF and 2.6% without it; infection rates were 6.3% with MMF and 3.9% without. Malocclusion was reported in 0% of cases with MMF compared to 0.8% without MMF.

Conclusion: The findings of this study support the use of post-operative MMF after ORIF of patients with malocclusion in maxillary and mandibular fractures. This treatment modality may offer a safe, effective, and reliable means of achieving optimal occlusal outcomes and improving patient satisfaction; however, further controlled studies are needed to establish its role in standard care.

Keywords: Maxillomandibular Fixation, Maxillofacial Fractures. Open Reduction Internal Fixation.

Introduction

Mandibular fractures are among the most frequent face wounds that necessitate surgical treatment.[1] Maxillofacial trauma accounts for approximately 15% to 58% of all injuries globally.[2] About 38% of all maxillofacial fractures are mandibular fractures.[3] Because of the teeth, mandibular fractures are treated differently from those involving long bones.[3] The procedure, which can be either closed or open reduction and internal fixation (ORIF), is often carried out in a hospital environment by oral and maxillofacial surgeons or other pertinent surgical specialities.[4] In general, ORIF is regarded as a safe and successful technique. However, a number of perioperative complications might arise, including bleeding, surgical site infection, non-union of the osseous segments, bone necrosis, soft tissue damage, malocclusion, abscess, hardware exposure, temporomandibular joint abnormalities, and inferior alveolar nerve injury.[5]

For many years, MMF has been utilized to treat mandibular fractures in order to maximize surgical results in terms of normal anatomical shape, occlusion, function, and aesthetics.[6] The majority of surgeons who repair mandibular fractures put their patients in postoperative MMF to guarantee that the restored occlusion is maintained and that occlusal pressures do not interfere with the restoration. Arch bars, eyelet wiring, self-drilling MMF screws, cast metal splints, and self-tapping MMF screws are some methods for achieving MMF.[7] Following maxillofacial fracture surgery, a number of problems may arise. These usually consist of issues with the teeth, soft tissues, temporomandibular joints, nonunion, malunion, malocclusions, facial asymmetry, nerve damage, osteonecrosis, and infection.[8, 9]

The purpose of this study is to determine the frequency of post-operative MMF to correct malocclusion after treating maxillary and mandibular fractures by open reduction and internal fixation using titanium miniplates. Results of this study will guide to modulate treatment plan for future surgical procedures, there by decreasing overall patient morbidity.

Methodology

This cross-sectional analytical study was conducted in the Department of Oral & Maxillofacial Surgery, Ghurki Trust Teaching Hospital, Lahore in 6 months duration.A total of 382 patients, aged 12-60 years of either gender who presented with displaced, unfavorable fractures on clinical and radiographic examinations of Maxilla or Mandible, were included in study. Sample size calculated by WHO calculator at 95% confidence level, anticipated proportion of MMF as 54.24% at 5% margin of error.[10] Edentulous patients, condylar fractures, dentoalveolar fractures, infected fractures, pathological fractures, gunshot injuries and medically unfit for surgery were excluded. After taking approval for study protocol from ethical committee at Lahore Medical and Dental College (FD/2676/24) patients presenting in OPD of Oral & Maxillofacial Surgery Department were included in the study. All patients underwent a standardized clinical protocol beginning with a comprehensive clinical examination and the collection of demographic data, including age and gender, via a brief questionnaire. ORIF was performed under general anesthesia with nasal intubation in all cases that met the inclusion criteria for maxillary and mandibular fractures. For intraoral surgical access, local anesthesia was administered in the vestibular region, and the fracture sites were exposed through intraoral incisions. Eyelets were placed on the teeth to facilitate MMF, and stainless-steel tie wires were threaded through the eyelets to achieve proper occlusion. Fracture stabilization was accomplished using titanium miniplates, and a layered closure was performed using 3-0 vicryl sutures. Patients with disordered occlusion underwent four weeks of MMF under local anesthesia, which was administered at the time of appliance placement. During these four weeks, patients were scheduled for regular follow-up visits (typically once per week) to monitor healing and ensure appliance stability; additional local anesthesia was administered only if required. Medications were provided, and detailed postoperative instructions were given. After the MMF was removed and tie wires taken out, patients continued follow-up for at least one week, during which they were assessed both clinically and radiographically for any signs of surgical malocclusion. Since the patient was unable to chew following MMF, a blended diet and medicine syrups were recommended. Clinical assessment for occlusion was one of the patient follow-up measures.

After entering data in SPSS version 25.0, analysis was done. As descriptive analysis, frequencies and percentages were calculated for gender, fracture site and MMF. Mean and standard deviation was calculated for age and duration of fracture. Chi-square test was applied for assessment post-operative MMF after ORIF. Effect modifiers such as age, gender, fracture stie, fracture duration was controlled by stratification.

Results

A total of 382 patients that met the study criteria were included in study. Of the total patients, 240 (62.8%) were men and 142 were women. Mean age of the patients was 30.34±9.40 years with minimum age of 12 and maximum age 58 years. Mean age in males was 31.50±9.60 years and 28.37±8.72 years. Maxillary fractures were found in 180 (47.1%); Para symphyseal in 172 (45.3%); and angle in 29(7.6%) of all fractures

Table 1: Basic Demographic and Clinical Features

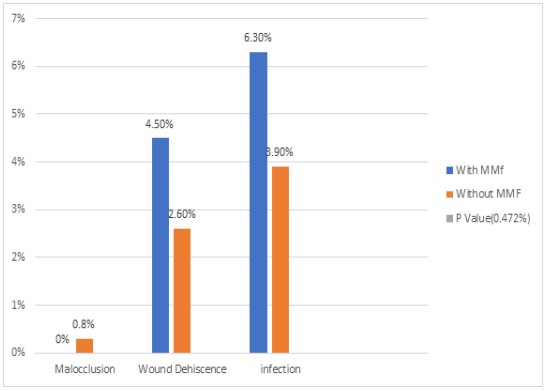
		Frequency	Percentage
Gender	Male	240	62.8
	Female	142	37.2
Maxillary	Lefort (1/2/3)	180	47.1
Mandibular	Para-symphyseal	172	45.3
	Angle	29	7.6
Total		382	100.0

The overall frequency of postoperative MMF was 206 cases (53.9%). Among the 206 patients who underwent ORIF, MMF was performed in 93 patients (51.7%) with maxillary fractures (LeFort I/II/III). In cases of mandibular fractures, postoperative MMF was applied in 58.4% of para-symphyseal fractures, compared to 41.6% in patients who did not require MMF. For angle fractures, MMF was performed in 41.4% of patients, while 58.6% did not undergo MMF (Table 2).

Table 2: Location of Fracture according to Post Operative MMF status

	MMF		P value
	Yes n=206 (%)	No n=176 (%)	
Maxillary (Lefort I/II/III)	93 (51.7)	87 (48.3)	
Mandibular Para-symphyseal	101 (58.4)	72 (41.6)	0.166
Angle	12 (41.4)	17 (58.6)	

Among the complications studied, wound dehiscence occurred in 4.5% of patients with MMF and 2.6% of those without MMF. The incidence of infection was 6.3% in the MMF group compared to 3.9% in the non-MMF group. Malocclusion was observed in 0% of patients with MMF and 0.8% of those without MMF, as detailed in Graph 1 below.



Comparison of Complications of Patient with MMF And Without MMF

Discussion

This study investigated the frequency and outcomes of postoperative MMF following open reduction and internal fixation in patients with maxillary and mandibular fractures. In case of displaced maxillary and mandibular fractures open reduction and internal fixation is done but due to semi rigid fixation of miniplates there is some movement when patient bite and occlusal forces generate that leads to malocclusion. To overcome this issue maxillomandibular fixation play vital role in stabilizing occlusion and potential healing. Among 382 patients, more than half (53.9%) required MMF to restore premorbid occlusion (Table 1).The findings revealed that MMF was associated with a lower rate of postoperative malocclusion and only a slight increase in minor complications such as wound dehiscence and infection. These results suggest that postoperative MMF can be a beneficial adjunct to ORIF in ensuring optimal occlusal alignment and improving overall treatment outcomes in maxillofacial trauma cases.

The prevalence of maxillofacial injuries is rising as a result of increased socioeconomic activity and reliance on road transportation. The maxillofacial region comprises both soft and hard tissues, extending from the mandible inferiorly to the frontal bone superiorly.[12,13] Facial trauma results in damage to the face's soft tissues, teeth, and skeletal components.[9] Many surgeons prefer postoperative MMF for varying periods of time depending upon the type of fractures. Prior to the development of inflexible titanium plating methods, bone fragments were internally fixed via interosseous wire fixation.[14,15] Considering the high incidence of infection and malunion following surgery, which is most likely caused by the interosseous wires inadequate stiffness of interosseous wires, MMF played a critical role in enhancing stabilization and ensuring the success of the repair.[16] This study's goal was to ascertain how frequently post-operative MMF is used to address malocclusion following ORIF repair of maxillary and mandibular fractures using titanium miniplates.

To evaluate the postoperative efficacy of MMF after ORIF, Saman et al. in 2014 carried out research in USA, in which a total of 224 (54.24%) among 413 patients had MMF to restore premorbid occlusion.[10] In another literature review of Maxillary Lefort-I fracture with Zygomaticomaxillary Complex, it was noted that the patient had anterior crossbite at the first follow-up visit after 15 days after ORIF Post op MMF was completed and the patient was placed on guiding elastics.[11] Rigid MMF was performed using 26-gauge stainless steel wire to guide the patient into proper occlusion. After a month, the maxillary segment was immobile and the appropriate occlusion was preserved.[11]

Most surgeons put patients in postoperative MMF while repairing mandibular fractures in order to preserve the restored occlusion and prevent occlusal pressures from interfering with the repair, this study was conducted in minneisotta USA.[17]However, there are dangers and issues associated with postoperative MMF.[18] This study investigates the utility and safety of continuing postoperative MMF in patients who have undergone ORIF for symphyseal, parasymphyseal, or angle fractures. The fractured region location was maxillary fracture in 180 (47.1%) and in mandibular, parasymphyseal in 172 (45.3%); and angle in 29 (7.6%) of all fractures.

Of the complications studied, wound dehiscence was found in 4.5% with MMF and 2.6% without MMF, infection was 6.3% versus 3.9%, Malocclusion 0% and 0.8% in the group with and without postoperative MMF respectively.(Graph 1). Our findings align with a prior retrospective study conducted by Valentino and Marentette, which similarly reported no significant difference in complication rates between patients who underwent postoperative MMF and those who did not.[19]

A recent retrospective study conducted by Kumar et al. examined the outcomes of patients who underwent postoperative treatment with MMF compared to those who did not. The findings indicated that there was no statistically significant difference between the two groups.[20] The drawbacks of postoperative MMF are numerous.[21] It is important to address potential drawbacks related to patient discomfort, gingival trauma, weight loss, and oral hygiene during the course of treatment. Furthermore, TMJ ankylosis may become more common if TMJ mobility is delayed. Osteopenia and variations in local venous pH can also lead to complications with bone repair. Additionally, the masseter and temporalis may weaken and atrophy as a result of prolonged fixation.[18]

Limitations

This study is limited by its single-center design and relatively small sample size. The study did not include long-term follow-up beyond the immediate postoperative period, limiting insight into the durability of occlusal outcomes and late complications.

Conclusion

The findings of this study support the use of post-operative MMF after ORIF of patients with malocclusion in maxillary and mandibular fractures. This treatment modality should be considered a standard of care for these patients, as it offers a safe, effective, and reliable means of achieving optimal occlusal outcomes and improving patient satisfaction.

Authors' Contributions: M.S.: literature review, data acquisition and analysis; A.S.: supervision and final approval of the version to be published; F.C.: topic selection and literature review; A.H.: conception and design of the study; M.N.: conception and design of the study; M.S.: drafting and critical revision of the manuscript.

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Journal of University College of Medicine & Dentistry

Original Article

Sociodemographic Risk Factors and Patterns of Medicolegal Injuries in a Tertiary Care Hospital: A Cross-Sectional Public Health Analysis

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Abstract

Objective: To identify sociodemographic and injury-related risk factors associated with medicolegal cases reported at a tertiary care hospital in Lahore, Pakistan, and to explore their implications for preventive public health strategies.

Methodology: This cross-sectional study was conducted from June to December 2024 at the Services Institute of Medical Sciences, Lahore. Data from 370 medicolegal cases were extracted using non-probability consecutive sampling from the institutional medico-legal register. A structured questionnaire collected demographic characteristics and injury-related variables. Data were analyzed using SPSS v29, with chi-square tests used to assess associations between employment status and injury characteristics. A p-value <0.05 was considered statistically significant.

Results: Among the 370 cases, the majority were male (68.1%), under 45 years of age (81.1%), from urban areas (93.8%), and worked as unskilled labourers (44.9%). Intentional injuries comprised 72.7% of cases, with physical assault being the most common mode (75.4%) and the head and neck the most frequently affected site (53.5%). Employment status was significantly associated with the nature of injury: employed individuals experienced more accidental injuries (29.3%), while unemployed individuals had a higher prevalence of intentional injuries (86%).

Conclusion: Medicolegal injuries disproportionately affect younger males and unskilled workers, with intentional physical assaults being the predominant cause. A public health approach emphasizing injury surveillance, occupational health interventions, and violence prevention strategies is essential to mitigate the burden of such injuries.

Keywords: Medicolegal injuries, Physical assault, Risk factors, public health, Sociodemographic patterns

Introduction

World Health Organization states that injuries are a leading cause of death and disability, with unintentional injuries accounting for over 4.4 million deaths annually globally.[1] Among the injuries road traffic accidents are most common resulting in morbidity, mortality and disability.[2] Other Intentional injuries include interpersonal violence and self-inflicted harm are also public health problem contributing significantly in global burden of disease. The associated factors of injuries can be classified into demographic risk factors, behavioral risk factors, environmental risk factors and cultural risk factors. In demographic risk factors male gender and children are more prone to injuries. Behavioral risk factors include alcohol and drug abuse. Environmental risk factors include poor road conditions, workplace hazards and unsafe housing. Certain cultural practices like using unsafe fireworks in festivities and celebratory gunfire also increase the risk.[3,4]

A medicolegal case is any accident or illness case in which there is some criminality. Globally, medicolegal injuries are a major public health concern, especially in low- and middle-income nations where healthcare systems frequently face the combined challenges of trauma and scarce resources. Increased morbidity, mortality, and socioeconomic expenses are just a few of the far-reaching effects that these injuries which are frequently caused by violence, accidents, or self-harm have on people, families, and societies. Because these cases frequently necessitate legal inquiry and documentation, the medicolegal implications add even another level of complexity, placing further demands on the legal system and healthcare practitioners.[5,6]

Pakistan faces significant burden of injuries as there is ongoing rapid urbanization, unemployment, socioeconomic disparities and lack of implementation of rules.[7-9] The etiology of medicolegal injuries is multifactorial. In order to assess the burden of medico-legal cases, determine their risk, and prevent future avoidable casualties, these cases must be reported. In order to develop and implement preventive measures for medicolegal cases understanding risk factors are important. The determinants of medicolegal cases are complex and might include environmental factors like occupational risks, road safety measures, and levels of violence in the

community, as well as demographic aspects like age, gender, and socioeconomic position.[10-13]

From a public health perspective, addressing medicolegal injuries requires a multifaceted approach. Preventive measures, such as stricter enforcement of traffic laws, public awareness campaigns on violence prevention, and the implementation of occupational safety standards, are critical. Even while the impact of medicolegal injuries on public health is becoming more widely acknowledged, there is still a dearth of data in many contexts, especially in our regions where occupational injuries, interpersonal violence, and traffic accidents are common.[14,15] The purpose of this study is to determine the risk variables for medicolegal injuries. By adopting a public health lens, the study seeks to uncover patterns and determinants of injuries that can inform prevention strategies and reduce the burden on both individuals and healthcare systems.

Methodology

This cross-sectional study was carried out from June to December 2024 through secondary data analysis of medicolegal cases, after obtaining clearance from the Ethical Review Board of the Services Institute of Medical Sciences, Lahore (IRB/2024/1408/SIMS). The inclusion criteria comprised all medicolegal cases involving individuals aged above 18 years, as recorded in the medicolegal register of the Department of Forensic Medicine. Cases with incomplete records were excluded. Additionally, data related to sexual abuse was excluded due to the highly sensitive nature of the information, which required strict confidentiality measures. Even anonymized data could pose a risk of identification in small sample sizes, potentially compromising privacy. The calculated sample size was 370, based on a 95% confidence interval, a 5% margin of error, and an anticipated prevalence of physical violence in medicolegal cases estimated at 40%.[16]

Data was obtained from the medico-legal register through complete enumeration, covering the period from May to December 2023. Data extraction form was used to extract the data from register. The first part of the data extraction form consisted of demographic details. The second part consisted of factors like Mode of Injury, Cause of Injury, Location of Injury, Mechanism of Injury and Time to come to healthcare facility after injury. In this study; mode of injury was categorized into Physical Assault (including both blunt trauma, penetrating trauma and falls), Road traffic accident, Firearm Injury or Burn Injury. The cause of injury was categorized into accidental, intentional, and self-inflicted. Accidental injuries result from unplanned events like falls or traffic accidents. Intentional injuries were harm caused by others and self-inflicted injuries were harm done by themselves. Location of injuries were classified as: head and neck, thoracic, abdominal, back, upper limb (arms), and lower limb (legs). The mechanism of injury was classified as blunt, sharp, firearm, thermal or chemical burns.

To ensure confidentiality and privacy, name and other identifiers were not recorded. The data was entered and analyzed using the statistical package for the social sciences version 29. Qualitative variables were computed in the form of frequencies and percentages. Chi square is used to find association between injury-related variables with employment status. P value less than 0.05 was taken as significant.

Results

A total of 370 cases were included in the study. The socio-demographic profile of study respondents is shown in Table 1. Most of the cases were aged less than 45 years 300 (81.1%), were from urban sector 347(93.8%), were males 252 (68.1%) and were unskilled workers 166(44.9%). Injury related factors are shown in table 2. The majority of the medicolegal cases were intentional 269 (72.7%) and the major mode of injury was physical assault 279 (75.4%). Out of the respondents' head and neck was the most frequent site of injury 198 (53.5%).

Table 1: Sociodemographic Profile of Study Participants

Variable	Category	Frequency (n)	Percentage (%)
Age	Less than 45 years	300	81.1
	Equal or greater than 45	70	18.9
Place of residence	Urban	347	93.8
	Rural	23	6.2
Gender	Male	252	68.1
	Female	118	31.9
Occupation	Skilled Workers	97	26.2
	Unskilled Workers	166	44.9
	Unemployed	107	28.9

Table 2: Injury related Characteristics of Study Participants

Variable	Category	Frequency (n)	Percentage (%)
Cause of Injury	Accidental	90	24.3
	Intentional	269	72.7
	Self-inflicted	11	3.0
Mode of Injury	Physical Assault	279	75.4
	Road traffic accident	62	16.8
	Firearm Injury	19	5.1
	Others (including burn injuries)	10	2.7
Location of Injury	Head & Neck	198	53.5
	Thoracic	12	3.2
	Abdominal	11	3.0
	Back	10	2.7
	Upper Limb(Arms)	92	24.9
	Lower Limb(Legs)	47	12.7
Mechanism of Injury	Blunt	306	82.7
	Sharp	25	6.8
	Firearm	19	5.1
	Thermal or chemical burn	18	4.9
	Others	2	0.5
Time to Reach Healthcare after Injury	Within 06 hours	226	61.1
	06-12 hours	84	22.7
	12-24 hours	52	14.1
	24-48 hours	1	0.3
	More than 48 hours	7	1.9

The location of injury is shown in Figure 1. Most common site of injury in medicolegal cases was head and neck (198 ,53.51%).

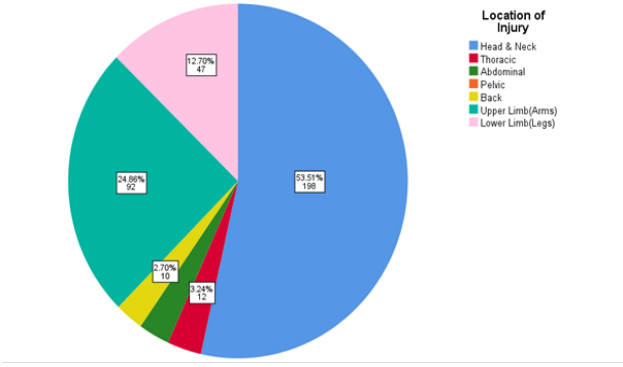

Figure 1: Location of Injury in Medicolegal Cases (n=370)

Chi-square test was applied to compare employment status (Employed including Skilled and Unskilled workers and unemployed) with injury characteristics in the respondents. It shows that employed individuals (both skilled and unskilled workers) and unemployed individuals have similar distributions for most injury types, with no significant differences in mode of injury, location of injury, or mechanism of injury (p-values > 0.05). However, cause of injury significantly differs, with accidental injuries being more common among employed individuals (p = 0.001), while intentional injuries are more prevalent among the unemployed. The duration to reach a healthcare facility shows no significant difference between the groups.

Table 3: Bivariate analysis of Injury-related Variables with Employment Status

Variable	Employed n (%)	Unemployed n (%)	p-value
Mode of Injury			
Physical Assault	194 (73.8)	85 (79.4)	0.299
Firearm Injury	12 (4.6%)	7 (6.5)	
RTA	50 (19)	12 (11.2)	
Others	7 (2.7)	3 (2.8)	
Location of Injury			
Head & Neck	144 (54.8)	54 (50.5)	0.225
Thoracic	11 (4.2)	1 (0.9)	
Abdominal	6 (2.3)	5 (4.7)	
Back	6 (2.3)	4 (3.7)	
Upper Limb	67 (25.5)	25 (23.4)	
Lower Limb	29 (11.0)	18 (16.8)	
Cause of Injury			
Accidental	77 (29.3)	13 (12.1)	0.001
Intentional	177 (67.3)	92 (86.0)	
Self-inflicted	9 (3.4)	2 (1.9)	
Mechanism of Injury			
Blunt	215 (81.7)	91 (85.0)	0.053
Sharp	20 (7.6)	5 (4.7)	
Firearm	12 (4.6)	7 (6.5)	
Thermal/ Chemical Burn	16 (6.1)	2 (1.9)	
Others	0 (0)	2 (1.9)	
Duration to Reach Health Care Facility			
Within 24 hrs	258 (98.1)	104 (97.2)	0.588
After 24 hrs	5 (1.9)	3 (2.8)	

Discussion

This study highlights the associated factors of medicolegal injuries coming to a tertiary care hospital of Lahore. These injuries have a significant implication on health of individual, family and legal systems. The findings from this article show the sociodemographic and environmental risk factors contributing in medicolegal injury which can serve as a foundation for developing preventive strategies.

The findings revealed that individuals below 45 years of age (81.1%) and males (68.1%) were disproportionately affected, consistent with global trends where younger males are more engaged in high-risk activities and occupations. These groups often bear the brunt of occupational hazards, interpersonal violence, and road traffic accidents. Supporting this, a previous study in emergency departments reported males as more frequent victims of injuries.[17] This highlights the necessity of gender- and age-specific interventions, such as workplace safety protocols and awareness campaigns targeting risky behaviors.

Employment emerged as a critical factor influencing injury patterns. While unskilled workers comprised the largest occupational group affected (44.9%), employed individuals were more likely to experience accidental injuries (29.3%, Table 3). A study done in medicolegal department at Sri Lanka has shown that most of the patients presenting are unskilled workers.[18] This suggests exposure to hazardous work environments, underscoring the urgent need for implementing occupational safety regulations. By contrast, unemployed individuals demonstrated a significantly higher prevalence of intentional injuries (86%), reflecting the psychosocial stress and potential involvement in interpersonal conflicts often linked to unemployment. This finding resonates with existing research, which associates unemployment with heightened risks of violence and mental health challenges.[19] A study in France has shown that road traffic accidents while commuting to workplace are showing a rising trend and are a cause of concern.[20]

The mode of injury predominantly involved physical assault (75.4%), followed by road traffic accidents (16.8%, Table 2). This aligns with studies from similar contexts, where physical assault reflects societal issues such as interpersonal violence, substance abuse, and inadequate conflict resolution mechanisms.[21] The location of injuries showed a predominant involvement of the head and neck (53.5%, Figure 1), which can be attributed to the vulnerability of these regions during physical assaults or accidents. A study from Nepal corroborates these findings, reporting that head and neck injuries are common in physical assaults due to punches, kicks, and blunt objects.[22]

The findings of this study can be generalized to populations with similar socio-economic and healthcare contexts, particularly in low- and middle-income countries. The overrepresentation of younger males and unskilled workers among victims aligns with global trends, highlighting universal risk factors such as occupational hazards, interpersonal violence, and risky behaviors. A multifaceted approach is required for preventing medicolegal injuries which can include community-based initiatives, prevention of drug addiction and substance abuse. Strict enforcement of rules and regulations should be done

for injury mitigation. Additionally, establishing robust injury surveillance systems is vital to monitor trends of medicolegal injuries. Collectively these measures can reduce the burden of medicolegal injuries. The strengths of this study are that it is a comprehensive analysis of medicolegal cases, providing insights into the socio-demographic and injury-related characteristics of individuals seeking health care. Additionally, the exclusion of highly sensitive cases, such as sexual abuse, demonstrates ethical consideration and ensures data privacy.

Limitations

However, the study also has limitations that must be acknowledged. The reliance on secondary data from medico-legal registers may introduce reporting bias. Furthermore, the exclusion of sexual abuse cases, while ethical, limits the comprehensiveness of the analysis. Finally, certain variables, such as socio-economic status and underlying health conditions, were not explored in detail, which could have provided additional context to the findings.

Conclusion

This study demonstrates the significant demographic and injury-related factors associated with medicolegal cases. Younger males, particularly those engaged in unskilled labor, were disproportionately affected. The most common causes, including intentional injuries via physical assault and blunt trauma to the head and neck, highlight critical areas for intervention.

Recommendations

First of all, stronger enforcement of occupational safety regulations is needed, especially for unskilled workers who are most at risk of accidental injuries. Providing safety training and protective equipment can help reduce workplace hazards. Secondly, community-based violence prevention programs should target unemployed individuals, focusing on conflict resolution, mental health support, and education to reduce interpersonal violence. Lastly, enhancing injury surveillance systems is crucial for better tracking of medicolegal injuries, enabling evidence-based strategies to prevent and mitigate injuries more effectively.

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Original Article

Frequency of Postoperative Maxillomandibular Fixation Following Open Reduction and Internal Fixation in Maxillofacial Fractures

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Abstract

Objective: To determine the frequency of postoperative maxillomandibular fixation (MMF) required after open reduction and internal fixation (ORIF) for restoring premorbid occlusion in patients with maxillary and mandibular fractures.

Methodology: This cross-sectional analytical study was conducted in Department of Oral & Maxillofacial Surgery, Ghurki Trust Teaching Hospital, Lahore. Patients aged 12 to 60 years of either gender presenting with maxillary or mandibular fractures were included in the study. ORIF procedure was performed under General Anesthesia with nasal intubation in all cases of maxillary and mandibular fractures under inclusive criteria. Then patients were followed-up in OPD for 2 weeks and evaluated for postoperative malocclusion, and MMF was done for 4 weeks under local anesthesia to restore premorbid occlusion

Results: A total of 382 patients that met the study criteria were included in this study. Out of these, 240 (62.8%) were men and 142 were women. Mean age of the patients was 30.34±9.40 years. The maxilla was the site of fracture in 180 cases (47.1%), while among mandibular fractures, the parasymphyseal region was involved in 172 cases (45.3%) and the angle in 29 cases (7.6%). The overall frequency of postoperative MMF was 53.9%. Among the complications observed, wound dehiscence occurred in 4.5% of cases with MMF and 2.6% without it; infection rates were 6.3% with MMF and 3.9% without. Malocclusion was reported in 0% of cases with MMF compared to 0.8% without MMF.

Conclusion: The findings of this study support the use of post-operative MMF after ORIF of patients with malocclusion in maxillary and mandibular fractures. This treatment modality may offer a safe, effective, and reliable means of achieving optimal occlusal outcomes and improving patient satisfaction; however, further controlled studies are needed to establish its role in standard care.

Keywords: Maxillomandibular Fixation, Maxillofacial Fractures. Open Reduction Internal Fixation.

Introduction

Mandibular fractures are among the most frequent face wounds that necessitate surgical treatment.[1] Maxillofacial trauma accounts for approximately 15% to 58% of all injuries globally.[2] About 38% of all maxillofacial fractures are mandibular fractures.[3] Because of the teeth, mandibular fractures are treated differently from those involving long bones.[3] The procedure, which can be either closed or open reduction and internal fixation (ORIF), is often carried out in a hospital environment by oral and maxillofacial surgeons or other pertinent surgical specialities.[4] In general, ORIF is regarded as a safe and successful technique. However, a number of perioperative complications might arise, including bleeding, surgical site infection, non-union of the osseous segments, bone necrosis, soft tissue damage, malocclusion, abscess, hardware exposure, temporomandibular joint abnormalities, and inferior alveolar nerve injury.[5]

For many years, MMF has been utilized to treat mandibular fractures in order to maximize surgical results in terms of normal anatomical shape, occlusion, function, and aesthetics.[6] The majority of surgeons who repair mandibular fractures put their patients in postoperative MMF to guarantee that the restored occlusion is maintained and that occlusal pressures do not interfere with the restoration. Arch bars, eyelet wiring, self-drilling MMF screws, cast metal splints, and self-tapping MMF screws are some methods for achieving MMF.[7] Following maxillofacial fracture surgery, a number of problems may arise. These usually consist of issues with the teeth, soft tissues, temporomandibular joints, nonunion, malunion, malocclusions, facial asymmetry, nerve damage, osteonecrosis, and infection.[8, 9]

The purpose of this study is to determine the frequency of post-operative MMF to correct malocclusion after treating maxillary and mandibular fractures by open reduction and internal fixation using titanium miniplates. Results of this study will guide to modulate treatment plan for future surgical procedures, there by decreasing overall patient morbidity.

Methodology

This cross-sectional analytical study was conducted in the Department of Oral & Maxillofacial Surgery, Ghurki Trust Teaching Hospital, Lahore in 6 months duration.A total of 382 patients, aged 12-60 years of either gender who presented with displaced, unfavorable fractures on clinical and radiographic examinations of Maxilla or Mandible, were included in study. Sample size calculated by WHO calculator at 95% confidence level, anticipated proportion of MMF as 54.24% at 5% margin of error.[10] Edentulous patients, condylar fractures, dentoalveolar fractures, infected fractures, pathological fractures, gunshot injuries and medically unfit for surgery were excluded. After taking approval for study protocol from ethical committee at Lahore Medical and Dental College (FD/2676/24) patients presenting in OPD of Oral & Maxillofacial Surgery Department were included in the study. All patients underwent a standardized clinical protocol beginning with a comprehensive clinical examination and the collection of demographic data, including age and gender, via a brief questionnaire. ORIF was performed under general anesthesia with nasal intubation in all cases that met the inclusion criteria for maxillary and mandibular fractures. For intraoral surgical access, local anesthesia was administered in the vestibular region, and the fracture sites were exposed through intraoral incisions. Eyelets were placed on the teeth to facilitate MMF, and stainless-steel tie wires were threaded through the eyelets to achieve proper occlusion. Fracture stabilization was accomplished using titanium miniplates, and a layered closure was performed using 3-0 vicryl sutures. Patients with disordered occlusion underwent four weeks of MMF under local anesthesia, which was administered at the time of appliance placement. During these four weeks, patients were scheduled for regular follow-up visits (typically once per week) to monitor healing and ensure appliance stability; additional local anesthesia was administered only if required. Medications were provided, and detailed postoperative instructions were given. After the MMF was removed and tie wires taken out, patients continued follow-up for at least one week, during which they were assessed both clinically and radiographically for any signs of surgical malocclusion. Since the patient was unable to chew following MMF, a blended diet and medicine syrups were recommended. Clinical assessment for occlusion was one of the patient follow-up measures.

After entering data in SPSS version 25.0, analysis was done. As descriptive analysis, frequencies and percentages were calculated for gender, fracture site and MMF. Mean and standard deviation was calculated for age and duration of fracture. Chi-square test was applied for assessment post-operative MMF after ORIF. Effect modifiers such as age, gender, fracture stie, fracture duration was controlled by stratification.

Results

A total of 382 patients that met the study criteria were included in study. Of the total patients, 240 (62.8%) were men and 142 were women. Mean age of the patients was 30.34±9.40 years with minimum age of 12 and maximum age 58 years. Mean age in males was 31.50±9.60 years and 28.37±8.72 years. Maxillary fractures were found in 180 (47.1%); Para symphyseal in 172 (45.3%); and angle in 29(7.6%) of all fractures

Table 1: Basic Demographic and Clinical Features

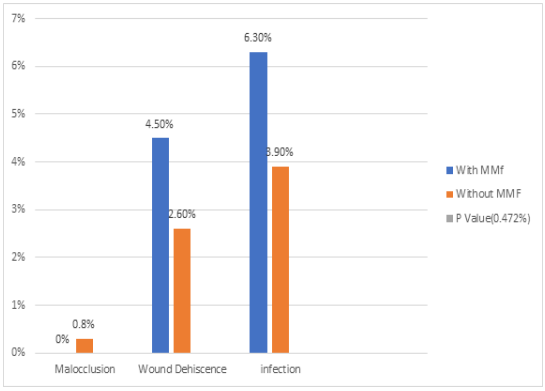
		Frequency	Percentage
Gender	Male	240	62.8
	Female	142	37.2
Maxillary	Lefort (1/2/3)	180	47.1
Mandibular	Para-symphyseal	172	45.3
	Angle	29	7.6
Total		382	100.0

The overall frequency of postoperative MMF was 206 cases (53.9%). Among the 206 patients who underwent ORIF, MMF was performed in 93 patients (51.7%) with maxillary fractures (LeFort I/II/III). In cases of mandibular fractures, postoperative MMF was applied in 58.4% of para-symphyseal fractures, compared to 41.6% in patients who did not require MMF. For angle fractures, MMF was performed in 41.4% of patients, while 58.6% did not undergo MMF (Table 2).

Table 2: Location of Fracture according to Post Operative MMF status

	MMF		P value
	Yes n=206 (%)	No n=176 (%)	
Maxillary (Lefort I/II/III)	93 (51.7)	87 (48.3)	
Mandibular Para-symphyseal	101 (58.4)	72 (41.6)	0.166
Angle	12 (41.4)	17 (58.6)	

Among the complications studied, wound dehiscence occurred in 4.5% of patients with MMF and 2.6% of those without MMF. The incidence of infection was 6.3% in the MMF group compared to 3.9% in the non-MMF group. Malocclusion was observed in 0% of patients with MMF and 0.8% of those without MMF, as detailed in Graph 1 below.



Comparison of Complications of Patient with MMF And Without MMF

Discussion

This study investigated the frequency and outcomes of postoperative MMF following open reduction and internal fixation in patients with maxillary and mandibular fractures. In case of displaced maxillary and mandibular fractures open reduction and internal fixation is done but due to semi rigid fixation of miniplates there is some movement when patient bite and occlusal forces generate that leads to malocclusion. To overcome this issue maxillomandibular fixation play vital role in stabilizing occlusion and potential healing. Among 382 patients, more than half (53.9%) required MMF to restore premorbid occlusion (Table 1).The findings revealed that MMF was associated with a lower rate of postoperative malocclusion and only a slight increase in minor complications such as wound dehiscence and infection. These results suggest that postoperative MMF can be a beneficial adjunct to ORIF in ensuring optimal occlusal alignment and improving overall treatment outcomes in maxillofacial trauma cases.

The prevalence of maxillofacial injuries is rising as a result of increased socioeconomic activity and reliance on road transportation. The maxillofacial region comprises both soft and hard tissues, extending from the mandible inferiorly to the frontal bone superiorly.[12,13] Facial trauma results in damage to the face's soft tissues, teeth, and skeletal components.[9] Many surgeons prefer postoperative MMF for varying periods of time depending upon the type of fractures. Prior to the development of inflexible titanium plating methods, bone fragments were internally fixed via interosseous wire fixation.[14,15] Considering the high incidence of infection and malunion following surgery, which is most likely caused by the interosseous wires inadequate stiffness of interosseous wires, MMF played a critical role in enhancing stabilization and ensuring the success of the repair.[16] This study's goal was to ascertain how frequently post-operative MMF is used to address malocclusion following ORIF repair of maxillary and mandibular fractures using titanium miniplates.

To evaluate the postoperative efficacy of MMF after ORIF, Saman et al. in 2014 carried out research in USA, in which a total of 224 (54.24%) among 413 patients had MMF to restore premorbid occlusion.[10] In another literature review of Maxillary Lefort-I fracture with Zygomaticomaxillary Complex, it was noted that the patient had anterior crossbite at the first follow-up visit after 15 days after ORIF Post op MMF was completed and the patient was placed on guiding elastics.[11] Rigid MMF was performed using 26-gauge stainless steel wire to guide the patient into proper occlusion. After a month, the maxillary segment was immobile and the appropriate occlusion was preserved.[11]

Most surgeons put patients in postoperative MMF while repairing mandibular fractures in order to preserve the restored occlusion and prevent occlusal pressures from interfering with the repair, this study was conducted in minneisotta USA.[17]However, there are dangers and issues associated with postoperative MMF.[18] This study investigates the utility and safety of continuing postoperative MMF in patients who have undergone ORIF for symphyseal, parasymphyseal, or angle fractures. The fractured region location was maxillary fracture in 180 (47.1%) and in mandibular, parasymphyseal in 172 (45.3%); and angle in 29 (7.6%) of all fractures.

Of the complications studied, wound dehiscence was found in 4.5% with MMF and 2.6% without MMF, infection was 6.3% versus 3.9%, Malocclusion 0% and 0.8% in the group with and without postoperative MMF respectively.(Graph 1). Our findings align with a prior retrospective study conducted by Valentino and Marentette, which similarly reported no significant difference in complication rates between patients who underwent postoperative MMF and those who did not.[19]

A recent retrospective study conducted by Kumar et al. examined the outcomes of patients who underwent postoperative treatment with MMF compared to those who did not. The findings indicated that there was no statistically significant difference between the two groups.[20] The drawbacks of postoperative MMF are numerous.[21] It is important to address potential drawbacks related to patient discomfort, gingival trauma, weight loss, and oral hygiene during the course of treatment. Furthermore, TMJ ankylosis may become more common if TMJ mobility is delayed. Osteopenia and variations in local venous pH can also lead to complications with bone repair. Additionally, the masseter and temporalis may weaken and atrophy as a result of prolonged fixation.[18]

Limitations

This study is limited by its single-center design and relatively small sample size. The study did not include long-term follow-up beyond the immediate postoperative period, limiting insight into the durability of occlusal outcomes and late complications.

Conclusion

The findings of this study support the use of post-operative MMF after ORIF of patients with malocclusion in maxillary and mandibular fractures. This treatment modality should be considered a standard of care for these patients, as it offers a safe, effective, and reliable means of achieving optimal occlusal outcomes and improving patient satisfaction.

Authors' Contributions: M.S.: literature review, data acquisition and analysis; A.S.: supervision and final approval of the version to be published; F.C.: topic selection and literature review; A.H.: conception and design of the study; M.N.: conception and design of the study; M.S.: drafting and critical revision of the manuscript.

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Review Article

High-dose versus Standard-dose Daunorubicin in Induction Chemotherapy for Acute Myeloid Leukemia: A Meta-Analysis

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Abstract

Objective: This systematic review and meta-analysis aimed to compare the efficacy and safety of high-dose versus standard-dose daunorubicin in induction therapy for adult acute myeloid leukemia (AML), focusing on complete remission (CR), overall survival (OS), and event-free survival (EFS).

Methodology: PubMed (Medline), Scopus, Science Direct, and Google Scholar were comprehensively and systematically explored for literature published in English, published from inception till January 30, 2025. Eligible studies included RCTs and retrospective cohorts comparing high-dose (>60 mg/m²/day) versus standard-dose (45–60 mg/m²/day) daunorubicin in adult AML patients, reporting at least one of the following outcomes: CR, OS, or EFS. Ten studies met eligibility criteria. Pooled risk ratios (RRs) and 95% confidence intervals (CIs) were calculated using random-effects models. Subgroup analyses were performed based on standard-dose levels (45 vs. 60 mg/m²). Heterogeneity and sensitivity analyses were also conducted.

Results: CR rates were numerically higher in the high-dose group but did not reach statistical significance (RR = 1.07; 95% CI: 0.94–1.22; P = 0.32). High-dose daunorubicin significantly improved 1-year OS (RR = 1.14; 95% CI: 1.06–1.23; P = 0.0002) and 5-year OS (RR = 1.32; 95% CI: 1.07–1.63; P = 0.01), especially when compared to the 45 mg/m² dose. While 1-year EFS showed no significant difference, pooled long-term EFS favored the high-dose group (RR = 1.26; 95% CI: 1.01–1.57; P = 0.04). Toxicity profiles were comparable between groups.

Conclusion: High-dose daunorubicin improves OS and long-term EFS in adult AML patients, particularly when compared to a standard dose of 45 mg/m², without increasing serious toxicity. It may be preferred in induction regimens where survival benefit is prioritized.

Keywords: Acute Myeloid Leukemia, Daunorubicin, Induction Chemotherapy, Meta-analysis, Overall Survival, Event-Free Survival, Complete Remission.

Introduction

Acute myeloid leukemia (AML) is a cancer of the blood and bone marrow characterized by the uncontrolled proliferation of immature myeloid precursor cells.[1] Despite advancements in understanding its pathophysiology, treatment regimens have largely remained unchanged over the past four decades.[1,2] The standard induction chemotherapy protocol commonly known as the "3+7" regimen that combines pyrimidine analogue cytarabine 100–200 mg/m²/day for 7 days with an anthracycline dose of 45–60 mg/m²/day for 3 days of (daunorubicin or idarubicin). This is followed by a consolidation phase with high-dose cytarabine in most cases.[3] One exception to this approach is acute promyelocytic leukemia (APML), which requires alternate agents such as all-trans retinoic acid (ATRA) or arsenic trioxide.[4,5]

However, even with standard treatment, clinical outcomes in AML remain suboptimal, with complete remission (CR) rates ranging from 50% to 80% in non-APML cases.[6, 7] and 5-year overall survival (OS) ranging between 13% and 40%.[8,9] Though the addition of targeted therapies and dose adjustments have shown some improvements, the prognosis for many AML subtypes remains poor.[10,11]

While intensified cytarabine dosing has demonstrated improvements in disease-free survival (DFS) in some trials, it has also been associated with increased toxicity.[12] Recently, interest has shifted toward evaluating the potential benefit of intensifying daunorubicin dosage. Several randomized controlled trials (RCTs) and observational studies have evaluated the effects of escalated daunorubicin dose of 90 mg/m²/day during induction therapy. But findings are inconsistent, and no definitive consensus has been established about the benefits of higher doses regarding remission or survival.[13, 14]

In light of this uncertainty, we carried out a meta-analysis of existing literature to analyze the clinical outcomes of high-dose (90 mg/m²) versus standard-dose (45 or 60 mg/m²) daunorubicin in

induction chemotherapy for AML. We aimed to evaluate differences in CR rates, OS, and event free survival (EFS) to inform clinical practice and contribute to treatment optimization strategies.

Methodology

This meta-analysis was performed to evaluate whether high-dose daunorubicin (>60 mg/m²/day) improves treatment outcomes compared to standard-dose (45 or 60 mg/m²/day) in induction phase in adults diagnosed with AML. The study was registered with PROSPERO (Registration No: CRD42019137595).

Literature Search Strategy

Four electronic databases, including PubMed (Medline), Scopus, Science Direct, and Google Scholar were comprehensively and systematically explored for literature published in English from inception till January 30, 2025. The search terms were combined using Boolean operators and included the following: "high-dose daunorubicin AND AML", "anthracycline dose intensification AND acute myeloid leukemia", "90 mg daunorubicin in AML", and "high-dose anthracycline in AML". To ensure sensitivity, manual search for relevant articles was also carried out. Two independent authors scrutinized all titles and abstracts for eligibility and evaluated the full text of potentially relevant articles. Disagreements were resolved by a third author. Study selection adhered to the PRISMA guidelines,[15] and a flow diagram was generated to illustrate the inclusion process (Figure 1).

Eligibility Criteria

Studies were included if they (1) were published in English; (2) included adult patients (≥18 years) confirmed as AML patients (excluding acute promyelocytic leukemia); (3) compared high dose daunorubicin (>60 mg/m²/day, typically 90 mg/m²/day) with standard dose daunorubicin (45 or 60 mg/m²/day) as part of the 3+7 induction regimen; (4) were full-text articles with original data, and (5) reported at least one of the following outcomes: CR, OS, or EFS. The types of study designs included were randomized controlled trials as well as and retrospective cohorts. The studies excluded were reviews, meta-analyses, editorials, conference abstracts, book chapters, non-comparative studies, or studies lacking the outcomes of interest.

Data Extraction and Outcomes

Data extraction was independently carried out by two authors using a standardized data collection form. Extracted data included: study title, first author, publication year, study design and setting, sample size, patient demographics, daunorubicin dosing schedule in high- and standard-dose arms, chemotherapy details, and outcome data. The primary outcome was CR, including CR with incomplete hematologic recovery (CRi). Secondary outcomes included OS at 1 year and 5 years, and EFS at 1 year and 2/5 years. Discrepancies during data extraction were resolved by discussion or arbitration by a third author.

Definitions were based on the International Working Group criteria for AML. Complete remission (CR) was defined as <5% blasts in the bone marrow, neutrophils >1.0×10⁹/L, and platelets >100×10⁹/L in peripheral blood, with no extramedullary disease. CRi referred to CR with incomplete recovery of peripheral counts. OS was defined as the time from diagnosis to death from any cause. EFS was considered a surrogate for disease-free survival (DFS) or relapse-free survival (RFS) and defined as the time from CR to relapse, progression, or death. CR rates used in the meta-analysis included both CR and CRi, given that some studies grouped them together in reporting. Toxicity data were not uniformly reported across studies and therefore were not included in the meta-analysis outcomes.[3]

Quality Assessment

Risk of bias in the included studies was assessed using the Cochrane Risk of Bias 2.0 tool, which assesses bias across several aspects that includes: randomization process, divergence from planned interventions, missing outcome data, measurement of outcomes, and selection of the reported results. Risk of bias was rated three ways that is low, high or some concerns. Two authors conducted the assessment independently, and any disagreements were decided through consensus. Heterogeneity was assessed using the Chi-square (χ^2) test and quantified with the I^2 statistic. Heterogeneity was interpreted as low (<25%), moderate (25–50%), or substantial (>50%). Sensitivity analyses were performed by removing one study at a time to assess the robustness of the pooled results.

Data Synthesis and Statistical Analysis

Statistical analyses were performed using Review Manager (RevMan) version 5.3. Risk ratios (RR) with 95% confidence intervals (CI) were used for dichotomous outcomes. A random-effects model was employed due to the anticipated clinical and methodological heterogeneity among studies. A p-value <0.05 was considered statistically significant.

Subgroup analyses were conducted based on standard-dose daunorubicin (45 mg/m² vs. 60 mg/m²) to determine whether outcome differences were influenced by the comparator dose. Forest plots were generated for all primary and secondary outcomes. Funnel plots to assess publication bias were not constructed due to the limited number of studies per outcome, consistent with Cochrane guidelines.[16]

Results

Study Selection

The initial database and manual searches yielded 2,036 records. After removing 188 duplicates, 1,848 records remained. Title and abstract screening excluded 1,710 irrelevant records (non-comparative, non-English, or review-type publications). Full-text assessment of 137 articles resulted in 128 exclusions due to failure to meet eligibility criteria. Ultimately, ten studies (published between 2009 and 2023) were analyzed in this meta-analysis (Figure 1).

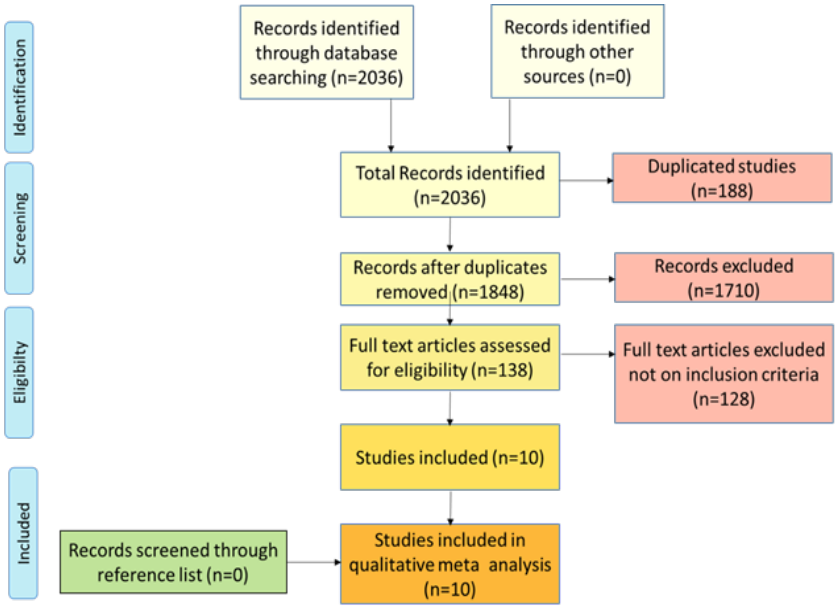

Figure 1: Characteristics of Included Studies

A total of 3,433 adult AML patients were enrolled across the nine studies, with 1,681 receiving high-dose daunorubicin and 1,752 receiving standard doses. Five studies were randomized controlled trials and four were retrospective cohorts. The high-dose regimen typically included 90 mg/m²/day of daunorubicin for three days, except in one study where 80 mg/m² was used (included only in sensitivity analysis). Standard-dose regimens used either 45 mg/m² (in four studies), 60 mg/m² (in four studies), or both (in one study).

CR data were available from eight studies (one was excluded from CR comparison due to universal CR in both groups). OS at 1 and 5 years was reported in seven studies; EFS was variably reported at 1, 2, or 5 years.

Meta-analysis showed that although the CR rate was numerically higher with high-dose daunorubicin, but could not reach statistical significance. Notably, 1-year and 5-year OS were significantly improved with escalated dose, particularly patients previously treated with the 45

Table 1: Summary of Studies Comparing High- vs. Standard-Dose Daunorubicin in AML

Study	Study Design	Sample Size (n)	Group Size (High vs. Standard, n)	Daunorubicin (High vs. Standard, mg/m²/day)	CR Rate (High vs. Standard, %)	5-Year OS (High vs. Standard, %)
Fernandez et al. (2009)[13]	Randomized	582	289 / 293	90 / 45	70.6 vs 57.3	38 vs 23
Prebet et al. (2014)[17]	Retrospective	86	29 / 57	90 / 60	100.0 vs 100.0	92 vs 82
Burnett et al. (2015)[18]	Randomized	1206	604 / 602	90 / 60	81.0 vs 84.0	59 vs 60
Löwenberg et al. (2009)[19]	Randomized	813	402 / 411	90 / 45	51.7 vs 34.8	13 vs 13.5
Lee et al. (2011)[20]	Randomized	383	194 / 189	90 / 45	82.5 vs 72.0	47 vs 36
Reagan et al. (2015)[21]	Retrospective	128	48 / 80	90 / 60	79.2 vs 61.3	NR
Choi et al. (2018)[28]	Retrospective	95	44 / 51	90 / 45	77.3 vs 56.9	50 vs 25
Portugal et al. (2017)[23]	Retrospective	26	12 / 14	90 / 45–60	66.7 vs 64.3	56 vs 34
Vaezi et al. (2017)[24]	Randomized	114	59 / 55	80 / 60	66.7 vs 75.9	58 vs 56
Röllig et al. (2025)[25]	Randomized	864	432 / 432	90 / 60	44 vs 48	65 vs 58 (3 years OS)

Note: CR: Complete Remission. OS: Overall Survival, defined as the time from diagnosis or treatment initiation to death from any cause. NR: Not Reported.

mg/m² standard dose. EFS at 1 year showed no significant difference, while long-term EFS (2–5 years) demonstrated a modest but statistically significant benefit favoring high-dose daunorubicin.

Heterogeneity across studies varied. CR rate analysis showed high heterogeneity (I^2 = 81%), with greater inconsistency in the 45 mg subgroup. In contrast, 1-year OS showed moderate overall heterogeneity (I^2 = 55%) but none within the 45 mg subgroup. Substantial heterogeneity was observed for 5-year OS and mixed patterns were found across EFS outcomes.

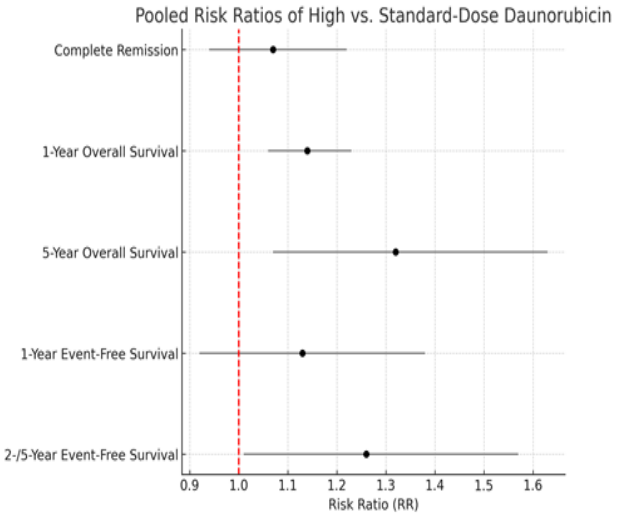

Figure 2: Pooled Risk Ratios with 95% CIs comparing High- vs. Standard-Dose Daunorubicin across major outcomes (CR, OS, EFS).

Discussion

This meta-analysis synthesized data from ten studies comparing high dose with standard dose daunorubicin in adult AML patients. There was no significant difference in CR rates on pooled analysis, although a numerically higher proportion of patients achieved CR in the high dose group (Table-1). In contrast, high dose daunorubicin significantly improved 1-year OS, with the survival benefit being more pronounced in the subgroup receiving a standard dose of 45 mg than in the 60 mg group (Figure 2). This advantage persisted at 5 years, particularly in the 45 mg subgroup (Figure-2). EFS, a composite measure of time to relapse, progression, or death, showed no significant difference at 1 year (Figure-2). However, high-dose daunorubicin demonstrated a modest long-term benefit in pooled 2-/5-year EFS, although subgroup analysis did not reach significance (Figure 2).

Ara-C combined with an anthracycline most commonly daunorubicin or idarubicin has formed the backbone of AML induction therapy for nearly four decades.[25,26] The classic "7 + 3" regimen delivers complete remission rates of about 60-80 % in younger adults, yet long-term overall survival rarely surpasses 40-45%, and results are even poorer in older or adverse-risk patients.[26] These limitations have fuelled investigations into dose-intensification strategies. Over the past two decades, multiple trials have escalated cytarabine exposure, demonstrating meaningful event-free-survival gains increased toxicity.[27,28] Thereafter the idea of high dose anthracycline intensification gained attention.[25] Several studies comparing high-dose daunorubicin (90 mg m^{-2}) with standard doses (45-60 mg m^{-2}) report deeper early blast clearance and improved overall survival,[13,17] providing the mechanistic and clinical rationale for the present meta-analysis of high- versus standard-dose daunorubicin.

We carried out a meta-analysis that included both randomized controlled trials and retrospective studies comparing 90 mg/m² daunorubicin to standard-dose regimens (45 mg or 60 mg). Subgroup analysis was conducted for both standard doses in our study. All studies reported CR, OS, and EFS or its surrogates (RFS, DFS). Although high-dose daunorubicin yielded higher CR numerically, it was not statistically significant. However, high dose daunorubicin showed a clear survival advantage in both short- and long-term OS, particularly when compared to the 45 mg standard-dose subgroup in the studies included. The 1-year OS was better for the high dose group in both combined and subgroup analyses, with a stronger effect in the 45 mg group. This benefit persisted at 5 years in the overall analysis and in the 45 mg subgroup, but was not significant in the 60 mg subgroup. EFS, while not improved at 1 year (Figure 2), showed a significant advantage at 2/5 years in the overall analysis (Figure 2), though subgroup comparisons were non-significant. Comparisons with meta-analyses of high-dose cytarabine suggest that while it may not significantly improve CR or OS, it does improve EFS.[27]

Heterogeneity in our analysis varied across outcomes and subgroups, with zero heterogeneity in the 45 mg subgroup for 1-year OS and moderate to substantial heterogeneity in others. This variation may affect the interpretability of pooled estimates. More robust and elaborative clinical trials are required to define the optimal dose and regimen for AML induction therapy.Several included studies reported better CR rates with high-dose daunorubicin, particularly in those receiving 45 mg as the comparator. Löwenberg et al. (2019) observed improved CR even in patients over 60,[19] while Fernandez et al. (2009) did not find such benefit in those above 50.[13] Cytogenetic profiles also influenced outcomes. Escalated daunorubicin dose provided no benefit in patients with unfavorable cytogenetic markers such as FLT3-ITD or MLL-PTD mutations and MDR1 gene overexpression. Patients with the FLT3-ITD mutation were also found to have a lower median survival.[13] Burnett et al. (2015) found benefit only in patients with favorable cytogenetics.[18]

AML mostly (75%) present in age range of 60 years of or above. But even intensive chemotherapy high dose daunorubicin administration treatment, CR rates fall between 40-55% only but an improved median DFS 6-12 months in these patients older than 60 yesrs.[29] Two large scale studies has documented that dose intensification can improve survival and reduce mortality in elderly patients of AML.[30, 31]

Toxicity profiles were generally comparable between high- and standard-dose groups across most studies. However, Löwenberg et al. and Portugal et al. reported higher infection rates and gastrointestinal toxicity in the high-dose group.[19,23] Burnett et al. also reported more severe gastrointestinal side effects during the first induction cycle in the high-dose group.[18]

Overall, this meta-analysis supports the use of high-dose daunorubicin in selected patient populations, especially

where improved OS is a priority, although the associated toxicities and patient-specific factors such as age and cytogenetic profile must be carefully considered.

Limitations

Variations in study design, outcome definitions, and patient characteristics may influence the consistency of pooled results. The inclusion of retrospective studies introduces a risk of bias. Additionally, limited reporting on toxicity outcomes prevents a comprehensive safety assessment.

Conclusion

By administering high dose daunorubicin in induction therapy, a greater number of patients achieved complete remission although statistical significance level was not achieved. High dose daunorubicin improves event free survival and overall survival, both at 1 and 5 years especially when compared to 45 mg dose. This improvement shows a low toxicity of high dose daunorubicin and must be recommended for maintaining quality of life and long term survival of AML patients.

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Authors' Contribution: KB: Conception or design of the work; acquisition, analysis, and interpretation of the data; drafting and critical revision; NM: Acquisition, analysis, and interpretation of the data; drafting and critical revision; HTS: Acquisition, analysis, and interpretation of the data; drafting and critical revision.

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Journal of University College of Medicine & Dentistry

Case Series

Unusual Clinical Presentations and Diagnostic Challenges of Pediatric Ewing's Sarcoma: A Case Series from a Tertiary Oncology Center

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Abstract

We present a case series of three pediatric patients diagnosed with Ewing's sarcoma at distinct anatomical sites—the scalp with intracranial extension, the forearm involving bone, and the lumbar region with metastatic spread. Each patient underwent a detailed clinical assessment, radiological imaging, histopathology, and immunohistochemistry for diagnosis. Treatment comprised a multidisciplinary approach including surgical resection, chemotherapy, and radiotherapy. Our findings highlight the diverse clinical manifestations, diagnostic challenges, and the critical role of early detection and individualized treatment strategies in optimizing outcomes for Ewing's sarcoma patients.

Keywords: Ewing's sarcoma, pediatric bone tumor, intracranial extension, metastasis, histopathology, immunohistochemistry, case series.

Introduction

Ewing's sarcoma, first described by James Ewing in 1921, is an aggressive bone and surrounding soft tissue malignancy predominantly affecting children and young adults.[1] It is the second most prevalent pediatric bone cancer, after osteosarcoma, with a survival rate of about 30-40%, depending on the metastatic status and tumor location at diagnosis.[2] Although the precise cellular origin of Ewing's Sarcoma is still unclear, it is generally believed to arise from mesenchymal or progenitor stem cells.[3]

Ewing's sarcoma is the second most common primary bone tumor in pediatric cancer patients and accounts for approximately 4% of pediatric malignancies.[4] The most commonly affected bones are the long bones of the extremities and pelvis, while the vertebrae are affected in < 5% of cases. Patients often present with non-specific symptoms, such as muscle aches, low back pain, and vague paresthesia, leading to diagnostic and treatment delays. Neurological symptoms can develop as a result of spinal cord compression in advanced cases.[5] Early identification and a multimodal treatment strategy including chemotherapy, radiotherapy, and surgery are essential for favorable survival outcomes.[6]

Diagnosing Ewing's Sarcoma remains challenging because of its overlapping histological features with other small round cell tumors. Histopathology usually shows small, round, blue cells with CD-99 antigen expression.[7,8] However, CD-99 is not exclusive to Ewing's sarcoma, as it is also expressed in other primitive neuroectodermal tumors. Imaging modalities such as MRI and CT help to assess lesion extent but are not diagnostic. Delayed symptom onset often results into late recognition of the disease.[9] This case series indicates the diagnostic challenges and the importance of a comprehensive treatment approach.

Methodology

This case series includes three pediatric patients diagnosed with Ewing's sarcoma at the Department of Pediatric Oncology, The Children's Hospital, Pakistan Institute of Medical Sciences (PIMS), Islamabad, who presented in May 2024, August 2024, and November 2024, respectively. Patients presented to us with progressively enlarging swellings in various anatomical locations. Each underwent detailed clinical assessment, radiological imaging, histopathological evaluation, and immunohistochemistry to confirm the diagnosis of Ewing's sarcoma. All three cases were presented at the Punjab Tumor Board Meeting held at the Agha Khan University Karachi, where individualized treatment strategies were formulated. Additional imaging studies included computed tomography (CT) scans and bone marrow biopsies. Surgical resection was undertaken in two cases, while the third patient was advised for surgery. This case series study follows the Preferred Reporting of Case Series in Surgery (PROCESS) 2023 criteria, ensuring adherence to methodological and ethical standards and guidelines.

Case Presentation

Case-I: Scalp Swelling with Intracranial Extension

An 11-year-old boy presented with a three-month history of a progressively enlarging scalp swelling, accompanied by low-grade fever and clinical pallor. MRI revealed an aggressive lesion in the occipital region with both extracranial and intracranial extension, causing compression of the cerebellum. Histopathological examination and immunohistochemistry confirmed the diagnosis of Ewing's sarcoma, with tumor cells showing strong positivity for CD-99, synaptophysin, and P-53. The case was reviewed in a multidisciplinary Punjab Tumor Board meeting, where a consensus-based treatment plan was formulated (Figure 1).

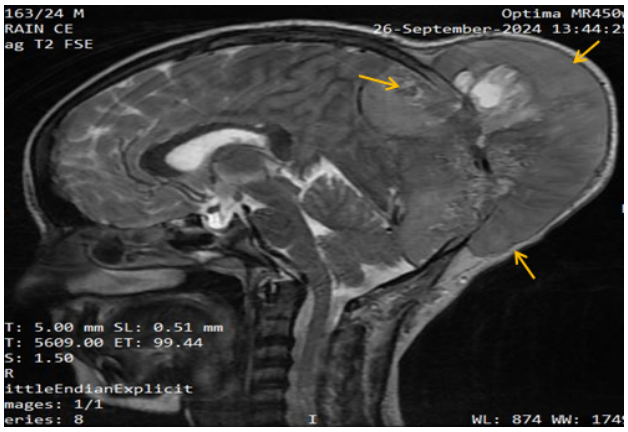

Figure 1: MRI of the brain shows an abnormal signal intensity mass lesion centered over the occipital region, producing a significant bulge in the overlying skin. The lesion causes erosion of the underlying occipital bone with intracranial extension into the posterior parietal and occipital regions, exerting extrinsic compression on the superior surface of the cerebellum.

Case-II: Forearm Swelling with Bone Involvement

A 10-year-old girl presented with a progressively enlarging swelling over the right forearm, developing gradually over the course of one year. MRI revealed a large, heterogeneously enhancing lesion involving the mid-shaft of the radius, with evidence of necrosis and surrounding soft tissue infiltration. Histopathological examination demonstrated sheets of small round blue cells, and immunohistochemistry was positive for NKX2.2, CD99, and focal synaptophysin, consistent with a diagnosis of Ewing's sarcoma. Surgical resection was carried out, involving removal of the proximal two-thirds of the radius. The estimated histologic treatment response was approximately 50%. The patient was subsequently scheduled to receive radiotherapy for local disease control (Figure 2).

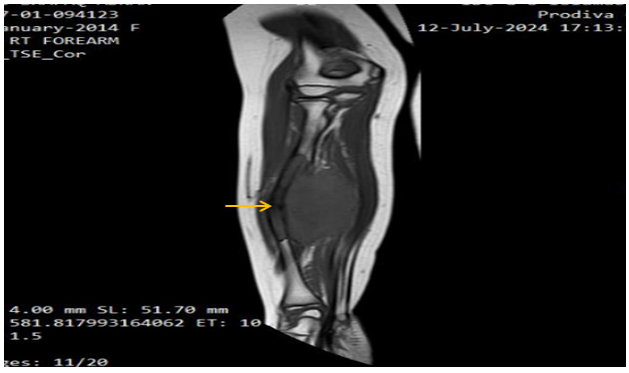

Figure 2: MRI of the right forearm showing a large, heterogeneously enhancing lesion with inner necrosis in the anteromedial cortex of the mid-shaft radius, bowing deformity, and a large soft tissue component

Case-III: Lumbar Swelling with Hematuria

A 3-year-old boy presented with a one-month history of a left-sided lumbar swelling, accompanied by an episode of hematuria. Imaging studies revealed a large, heterogeneous mass arising from the left kidney and extending across the midline. Histopathological examination showed a population of round to spindle-shaped tumor cells with pleomorphic nuclei. Immunohistochemical analysis confirmed the diagnosis of a BCOR-mutated Ewing-like sarcoma. Surgical excision revealed a well-defined, lobulated mass with tumor-free margins. The pathological assessment indicated a complete treatment response, with 100% tumor necrosis (Figure 3).

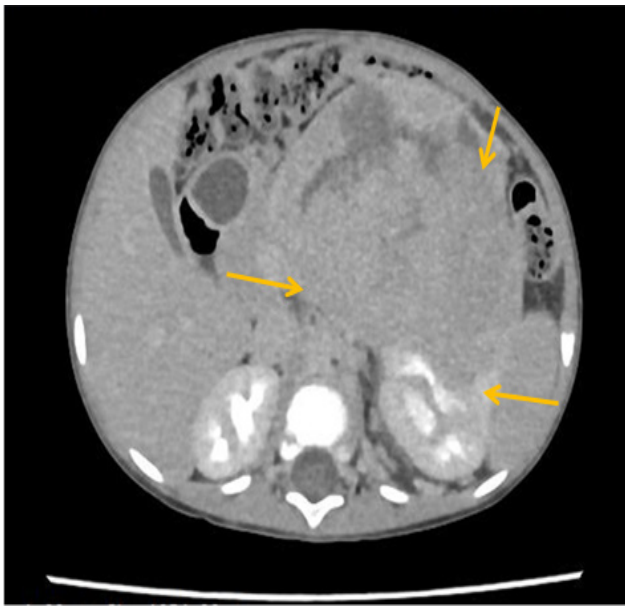

Figure 3: MRI of the abdomen reveals a large, heterogeneously enhancing mass measuring 9 × 7 × 8 cm arising from the left kidney. The mass contains necrotic areas and extends across the midline.

Discussion

Ewing's sarcoma poses a significant challenge in pediatric oncology due to its aggressive nature, diverse clinical presentations, and diagnostic complexity.[10] This case series highlights the distinct anatomical manifestations of Ewing's sarcoma and emphasizes the necessity for increased clinical suspicion, especially when faced with atypical or persistent symptoms in children and adolescents. Standard multimodal treatment protocols comprising chemotherapy, surgery, and radiotherapy were employed across all three cases; however, the varied tumor responses and progression patterns exposed the limitations of a uniform treatment strategy. Diagnosis in each case required the integration of histology, immunohistochemistry, and advanced molecular diagnostic tools, which remain inconsistently accessible in many regions of Pakistan. While CD99 is widely used as an initial marker, the growing utility of newer markers such as NKX2.2 and BCOR gene mutations[11] as reported in our third case, reflects a shift towards more precise, molecularly guided diagnosis and management.

This case series offers valuable insights into the multifaceted challenges of diagnosing and managing Ewing's sarcoma in low- and middle-income countries (LMICs) like Pakistan.

The first case's intracranial extension was exceedingly rare and difficult to diagnose due to its non-specific symptoms and the need for early neuroimaging. This observation aligns with findings from Altaf et al. (2023), who reported that late-stage cranial Ewing's sarcoma is mostly misdiagnosed due to limited awareness and access to neuroimaging. Both cases were marked by delayed neuroimaging, low clinical suspicion at the primary care level, and limited access to specialized services, resulting in diagnosis and treatment delays.[12] Similarly, Ahmed et al. (2019) examined that in peripheral hospitals across Pakistan, initial symptoms such as persistent headaches or localized swelling are often misattributed to benign causes, further delaying oncologic evaluation.[13]

In the second case, involving the forearm, surgical decisions were guided by the need to preserve limb function while ensuring oncologic control. Early multidisciplinary collaboration enabled limb-sparing surgery an outcome supported by Shah et al. (2019), who emphasize the importance of tumor board discussions and preoperative chemotherapy as key factors in achieving limb preservation.[14] Consistent with findings by Raza et al. (2021) at Aga Khan University Hospital, late-stage presentations frequently limit options for limb-sparing procedures, often necessitating amputation.[15] However, in our case, the successful preservation of the limb was significantly influenced by the early involvement of a multidisciplinary team and access to musculoskeletal imaging highlighting that timely collaboration can improve outcomes even in resource-limited settings.

The third case involved a renal Ewing-like sarcoma—an uncommon entity often misdiagnosed without molecular confirmation. Qureshi et al. (2019) and Ali et al. (2020) similarly reported primary renal and adrenal Ewing-like sarcomas in Karachi and Quetta, respectively—both presenting with vague abdominal symptoms and requiring comprehensive diagnostic workups.[16,17] Our case highlights the diagnostic ambiguity surrounding Ewing-like variants and underscores the critical role of molecular testing, including BCOR mutation analysis, in distinguishing them from classical forms. As Kamal et al. (2022) noted, BCOR-altered sarcomas may exhibit distinct responses to conventional chemotherapy and could require alternative or intensified treatment protocols.[18]

Across all three cases, delayed presentation emerged as a consistent challenge, echoing findings by Khan et al. (2020) and Farooq et al. (2017), who reported that over 60% of pediatric sarcomas in Lahore and Multan were diagnosed at advanced stages (III or IV).[19, 20] Contributing factors included poor health-seeking behavior, misdiagnosis at the primary care level, and inadequate access to neuroimaging and biopsy services in peripheral hospitals. To enhance early detection, awareness campaigns targeting primary healthcare providers, coupled with structured diagnostic algorithms for persistent pain or masses, are essential. Moreover, facilitating timely referrals to specialized oncology centers equipped with diagnostic imaging and multidisciplinary teams must become a policy priority.

This case series highlights the pivotal role of multidisciplinary collaboration and access to advanced diagnostics in the management of pediatric Ewing's sarcoma. The involvement of the Punjab Tumor Board was instrumental in recommending individualized treatment strategies for each patient, integrating the expertise of oncologists, radiologists, surgeons, and pathologists. As these cases illustrate, a coordinated, patient-centered approach can help overcome systemic limitations and improve survival outcomes. Moving forward, investment in regional diagnostic infrastructure particularly molecular pathology laboratories and institutionalizing multidisciplinary tumor boards nationwide could significantly increase the standard of care for pediatric sarcoma patients in Pakistan.

Conclusion

Ewing's sarcoma remains a challenging malignancy due to its various clinical presentations, diagnostic complexity, and aggressive nature of a disease. A detailed and comprehensive examination using histology, imaging, and molecular markers is essential. The findings emphasized for enhanced diagnostic access, multidisciplinary care, and, clinician awareness especially in resource-limited healthcare settings. Provision of imaging capabilities (e.g., PET scans, whole-body MRI) could improve staging and treatment planning in low income countries like Pakistan.

Authors' Contributions

RM led the manuscript drafting and literature review and contributed to case presentation development and analysis of diagnostic challenges. JJ assisted in assembling imaging data. NY reviewed, revised, and approved the final manuscript.

Conflict of Interest: The authors have no conflicts of interest.

Footnote: An informed consent was taken from the patients for the purpose of these case reports, without revealing their identity.

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Journal of University College of Medicine & Dentistry

Short Communication

Evolving Journal Policies for Ethical Use of Generative AI in Scientific Publishing

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Abstract

The rapid integration of generative artificial intelligence (AI) tools like ChatGPT into academic writing has created an ethical grey zone for authors, reviewers, and editors. While these tools can enhance clarity and language, their unchecked use raises serious concerns about authorship, accountability, plagiarism, and data fabrication. Yet, the editorial community remains divided: Should AI-assisted writing be treated as ghost authorship? Can reviewers ethically use AI for peer review summaries? Do journals require disclosure only when AI is used by authors, or also when used during editorial workflows? Amid these unresolved tensions, leading medical journals and editorial bodies such as COPE and WAME are introducing policies that vary widely in clarity and enforcement. Some allow AI for grammar correction; others prohibit its use entirely in data interpretation. However, most journals lack consistent language on how to declare, limit, or audit AI use — leaving authors confused and reviewers unregulated. This short communication explores the gaps in current journal policies on AI use and calls for unified, transparent guidelines that balance innovation with integrity. We advocate for a three-tiered declaration system: (1) AI-assisted writing, (2) AI-generated content, and (3) AI use in peer review and editorial decision-making. As medical education and public health researchers increasingly turn to AI for manuscript preparation, the editorial community must act quickly to avoid reputational risks and uphold trust in the publishing process.

Introduction

In an era where the credibility of academic publishing is under constant scrutiny, robust publication policies and a vigilant editorial board are more than administrative necessities. They are the backbone of trust, transparency, and scholarly integrity.[1] When thoughtfully crafted, these policies ensure consistent editorial decision-making, uphold manuscript quality, and reinforce the reputation of journals in a competitive and rapidly evolving academic landscape.[2] Beyond setting procedural standards, clear and inclusive policies help editors make timely, fair decisions and guide authors and reviewers through ethical and professional expectations. Transparency, inclusivity, and alignment with global editorial frameworks—such as those from the Committee on Publication Ethics (COPE) and the World Association of Medical Editors (WAME)—are now essential hallmarks of responsible publishing.[2] To be effective, these policies must be communicated clearly, implemented with stakeholder input, and supported by proper training and timely dissemination across platforms, including journal websites. As scientific publishing enters the age of generative artificial intelligence (AI), traditional policy frameworks face new pressures. Tools like ChatGPT and other large language models (LLMs) are reshaping how manuscripts are written, reviewed, and even evaluated.[3] While these technologies promise to streamline editorial workflows and enhance linguistic quality, they also raise complex ethical questions around authorship, accountability, data integrity, and transparency. Recognizing this dual-edged potential, several leading journals and publishing boards have introduced AI-specific guidelines to govern how such technologies may be ethically integrated into the publication process. These evolving policies aim to strike a balance between innovation and integrity by emphasizing human oversight, transparency in AI usage, and strict adherence to ethical standards.[4]

Most policies now require that any use of AI be clearly disclosed in the methods section of a manuscript, particularly when used for language editing or summarization. They also apply broadly, not just to textual content, but to audiovisual materials, data representations, peer review reports, and other scholarly outputs.[5] Authors are reminded that AI may improve readability but cannot replace critical academic tasks such as data interpretation or scientific reasoning. Human responsibility remains non-negotiable. As AI becomes increasingly embedded in the research ecosystem, journal policies must evolve accordingly—not only to prevent misuse but to guide its ethical adoption in ways that protect scientific rigor and uphold academic trust.

Main Text

Implementing AI Policy in Manuscript Submission and Editorial Workflow

As generative AI becomes increasingly integrated into the scholarly publishing process, journals must adopt clear, enforceable procedures to operationalize their AI policies. The following sections outline essential components that ensure ethical implementation—from author disclosure and editorial oversight to enforcement mechanisms. These practices aim to preserve the integrity of the publication process while embracing the responsible use of emerging technologies.

Table 1: Key Components of Effective AI Integration Policies in Scholarly Journals[6,7]

Category	Key Components	Rationale
Generative AI Integrtion	Disclosure of AI use Limit AI use to language and readability enhancements	Preserves authorship integrity Prevents AI misuse in scientific content creation
Scope of AI Policies	Applies to all submission types and formats	Ensures consistency and fairness across all content types
Author Rsponsibities	Human supervision of AI-generated content Prohibit AI in data analysis or scientific interpretation	Maintains accuracy, eliminates bias, and upholds scientific rigor
Citation & Supplemtary Data	Mandatory citation of AI tools used Upload full AI output as supplementary file	Promotes transparency, reproducibility, and traceability of AI involvement
Reviewer & Editor Guidelines	Prohibit use of AI in peer review or editorial decision-making	Safeguards confidentiality and preserves independent human judgment
Compliance & Cosquenes	Require ethical AI use by authors and editors Non-compliance may result in manuscript rejection or retraction	Reinforces accountability and ensures adherence to journal policy
Ongoing Policy Etion	Periodic review and updating of AI policies to reflect advancements	Keeps editorial standards current and aligned with ethical and technological developments

Ethical Use and Disclosure of Generative AI

If generative AI tools are employed in drafting a manuscript, authors must disclose their use clearly and cite the specific software.[7] Transparency enhances trust among authors, reviewers, editors, and readers, and ensures compliance with software terms of use. As per global editorial consensus, generative AI cannot be listed as an author.[8]Authors are required to follow standardized software citation templates, detailing in the methods section how, when, and to what extent AI tools were used. Additionally, the complete AI-generated content must be submitted as supplementary material.

Editorial and Reviewer Responsibilities

Editors and reviewers bear a critical responsibility in assessing the appropriate use of AI. They must verify the accuracy of AI-generated content while upholding the confidentiality and integrity of the peer-review process. Editors are strictly prohibited from entering any submitted manuscript content or peer-review reports into AI tools like ChatGPT. Similarly, reviewers are not permitted to generate review content using such platforms.[9] These measures are essential to preserve editorial independence and prevent data breaches.

Policy Enforcement and the Path Forward

To ensure compliance, journals must enforce these AI-related policies through clear author guidelines and transparent editorial decisions. Any misuse or undisclosed use of AI may result in editorial action, including rejection or retraction.[10] While AI offers advantages in areas such as language support and plagiarism detection, it must not replace human judgment. Ongoing dialogue, periodic policy updates, and global standardization will be vital to manage the evolving role of AI in scientific publishing while safeguarding scholarly integrity.

Conclusion

The rise of generative AI in academic publishing demands urgent policy adaptation that balances innovation with scholarly integrity. Journals must lead this change by developing transparent, enforceable, and ethically grounded AI policies. Clear disclosure protocols, human accountability, and standardized guidelines across editorial processes are essential to mitigate risks of misinformation, authorship dilution, and data misrepresentation. As AI technologies evolve, so too must our publication frameworks—rooted not only in efficiency but in trust. Future collaborations among global editorial bodies will be crucial to ensuring these technologies uplift, rather than undermine, the foundations of scientific communication.

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- All authors participated in the work in a substantive way and are prepared to take public responsibility for it.
- All authors have seen and approved the manuscript as submitted.
- E-mail and postal addresses of all authors have been entered below in the form correctly.
- The manuscript has not been published and is not being submitted or considered for publication elsewhere.

Date								

Place of study	

Author Sequence	**Name**	**Email ID**	**Signature**	**Author's contribution**
1st				
2nd				
3rd				
4th				
5th				
6th				

Corresponding Author