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EDITORIAL

GLP-1 RECEPTOR AGONISTS FOR OBESITY: MIRACLE THERAPY OR EMERGING MISUSE?

Farooq Ahmed

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INTRODUCTION

Obesity is now recognized as one of the most pressing health problems of the 21st century. It contributes substantially to the rising burden of non-communicable diseases, including type 2 diabetes, cardiovascular disease, and several forms of cancer. Despite persistent public health campaigns promoting diet and exercise, long-term, population-level weight reduction has remained difficult to achieve.

In this setting, glucagon-like peptide-1 (GLP-1) receptor agonists—particularly Semaglutide and Liraglutide, have been welcomed as a major advance in the management of obesity. Initially developed for the treatment of type 2 diabetes, these agents have demonstrated impressive weight-reducing effects in clinical trials. [1]

However, the rapid growth in their use has also raised important concerns. Increasing demand, off-label prescribing, high costs in many settings, and uncertainty about long-term safety all prompt a critical question: are GLP-1 receptor agonists a genuine therapeutic breakthrough, or are we witnessing the early stages of misuse? This question becomes even more complex in low- and middle-income countries such as Pakistan, where patterns of access, affordability, and regulation differ substantially from those in high-income nations.

The Promise: A Shift in How We Treat Obesity

GLP-1 receptor agonists mimic the action of endogenous incretin hormones. They enhance glucose-dependent insulin secretion, slow gastric emptying, and promote a sense of fullness. In large clinical trials, these mechanisms have translated into meaningful weight reduction.

The STEP programme, for example, showed that once-weekly Semaglutide can produce an average loss of around 15% of initial body weight—results that were previously seen mainly after bariatric surgery. [2] Beyond weight loss, GLP-1 receptor agonists provide broader metabolic benefits, including improved glycaemic control, reduced cardiovascular risk, and possible renal protection. For individuals with obesity-related complications, these drugs are therefore much more than cosmetic interventions; they can be life-changing.

Another important effect of these therapies is conceptual. Their success supports the view of obesity as a chronic, relapsing disease with biological underpinnings, rather than a simple failure of willpower. This shift in perspective can reduce stigma and encourage a more compassionate and structured medical approach to treatment. In this sense, GLP-1 receptor agonists appear to represent a genuine “miracle” of modern pharmacology.

The Pakistani Context: Access, Affordability, and New Risks

Global discussions about GLP-1 receptor agonists often stress the high cost of branded products such as Ozempic. In Pakistan, the situation is more nuanced. Over recent years, the local pharmaceutical market has introduced less expensive synthetic and biosimilar GLP-1 formulations, which have widened access to these drugs.

At first sight, this seems like a highly positive development. More affordable products can help overcome one of the main barriers to evidence-based obesity and diabetes treatment. Yet this same expansion in access has created new challenges.

First, regulatory oversight of biosimilars and compounded preparations remains variable. Unlike originator products that undergo extensive Phase II and III trials, some locally manufactured or imported alternatives may lack robust long-term safety and efficacy data. Questions about bioequivalence, dose consistency, and the full spectrum of adverse effects remain only partially answered.

Second, lower cost has encouraged a rise in over-the-counter purchasing and self-medication. In many urban centres, GLP-1 injections are increasingly sought as a quick route to weight loss, often without appropriate

clinical assessment or follow-up. In a system where prescription regulations may not always be strictly enforced, this trend is worrying.

Third, the promotion of GLP-1 receptor agonists by private clinics and aesthetic or wellness practices has helped normalize their use for essentially cosmetic purposes. In the absence of clear national guidelines, prescribing habits can vary widely across practitioners, increasing the likelihood of irrational use.

Thus, while improved affordability has expanded one dimension of access, it has simultaneously exposed gaps in regulation, ethics, and clinical governance that demand urgent attention.

Key Concerns: Misuse, Overmedicalization, and Inequity

1. Off-Label and Cosmetic Use

One of the most visible trends globally—and now in Pakistan—is the use of GLP-1 receptor agonists by individuals who do not meet criteria for clinical obesity. Social media promotion, celebrity endorsements, and strong cultural pressures around body image have all contributed to driving demand. This pattern raises clear ethical concerns about prescribing for essentially cosmetic reasons and about the medicalization of normal variations in body weight and shape. [3]

2. Clinical Prioritization and Resource Use

Globally, there have been reports of supply shortages. In Pakistan, outright shortages might be less common, but misallocation of available stock is a concern. People with genuine metabolic needs may experience interrupted treatment, while others access these medications for marginal or non-medical reasons. Without clear prioritization policies, these situations can directly result in poorer outcomes for high-risk patients.

3. Cost and Hidden Inequalities

Even when lower-priced alternatives are available, they remain unaffordable for many households. For a significant portion of the population, regular GLP-1 therapy still represents a considerable financial burden.

At the same time, people who can afford even moderately priced preparations may use them for non-essential weight loss. This creates a subtle but important inequity, in which limited resources are disproportionately used by those with the least medical need. [4]

4. Safety, Quality, and Monitoring

The expanding market for biosimilars and compounded products naturally raises concerns around quality assurance. Without effective pharmacovigilance systems, adverse events may be under-recognized and under-reported. Known side effects—including gastrointestinal symptoms, pancreatitis, gallbladder disease, and possible longer-term risks—require careful monitoring over time. In a fragmented healthcare system, where patients may move between providers or obtain drugs from multiple pharmacies, such monitoring is difficult to sustain.

5. Reinforcing a “Quick Fix” Mentality

Perhaps the most far-reaching concern is cultural rather than purely clinical. GLP-1 receptor agonists are sometimes perceived as an easy alternative to sustained changes in diet and physical activity. [5] In a country already facing increasing sedentary lifestyles, aggressive marketing of energy-dense foods, and limited urban spaces for exercise, this perception risks weakening public health messages about prevention. If pharmacotherapy is seen as the main or only solution, long-term efforts to promote healthier environments and behaviours may lose momentum.

Balancing Innovation with Responsibility

The availability of more affordable GLP-1 therapies in Pakistan represents both a major opportunity and a complex challenge. To realize their benefits while limiting harm, a coordinated, multi-level response is required.

Key elements could include:

1. National prescribing guidelines that align with international standards but are adapted to local realities, including criteria for initiation, continuation, and discontinuation of therapy.

2. Stronger regulatory oversight of biosimilar and imported products, with clear requirements for demonstrating quality, safety, and comparability to reference drugs.

3. Public education campaigns that emphasize obesity as a chronic disease and clarify that medicines are intended to complement, not replace, lifestyle measures.

4. Training and support for healthcare professionals to encourage rational prescribing, appropriate patient selection, and regular follow-up.

5. Robust pharmacovigilance systems capable of capturing and analysing adverse events, including collaboration between regulators, professional bodies, and academic institutions.

Professional associations—particularly those representing endocrinologists, diabetologists, general practitioners, and providers of aesthetic medicine also play an important role. They can help define ethical boundaries for cosmetic use, promote evidence-based practice, and advocate for patients who depend on these medicines for their metabolic health.

CONCLUSION

GLP-1 receptor agonists have reshaped the therapeutic landscape of obesity, offering new hope to many patients who have struggled with conventional strategies. Their capacity to promote substantial weight loss and improve cardiometabolic outcomes makes them one of the most significant pharmacological developments of recent years.

In Pakistan, the emergence of cheaper synthetic and biosimilar formulations has added another dimension to this story. Wider access is undeniably valuable, yet it is accompanied by heightened risks of misuse, variable product quality, and uneven regulation.

The central challenge is not to portray GLP-1 receptor agonists as either miracle cures or dangerous missteps, but to acknowledge them as powerful tools that require careful stewardship. Thoughtful integration into clinical practice—guided by evidence, ethics, and strong regulatory frameworks—will determine whether these agents ultimately fulfil their promise or become another example of how rapid innovation can outpace responsible use.

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ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF MAGNETIC RESONANCE IMAGING IN ANTERIOR CRUCIATE LIGAMENT TEAR, TAKING ARTHROSCOPY AS GOLD STANDARD

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ABSTRACT

Objective: To determine the diagnostic accuracy of Magnetic Resonance Imaging (MRI) in detecting anterior cruciate ligament (ACL) tears, using arthroscopy as the gold standard.

Material And Methods: We conducted this cross-sectional validation study in the Orthopedics Department at Khyber Teaching Hospital, Peshawar. A total of 296 patients were enrolled. All participants underwent knee MRI and were compared with arthroscopic findings, which served as the reference standard. Diagnostic parameters and overall accuracy were calculated. Statistical analysis was performed using SPSS 25.

Results: Of the 296 patients, MRI detected ACL tears in 172 (58.1%) cases, while arthroscopy confirmed tears in 197 (66.6%) cases. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of MRI were 70.1%, 65.7%, 80.1%, and 52.4%, respectively, with an overall diagnostic accuracy of 68%. A statistically significant association was observed between MRI and arthroscopy findings ($p < 0.01$). The ROC curve demonstrated fair discriminative ability of MRI.

Conclusion: MRI exhibits moderate diagnostic accuracy in detecting ACL tears, with a reliable predictive value when results are positive. However, its limited sensitivity and specificity in this context highlight the need for cautious interpretation, especially in MRI-negative cases. Arthroscopy remains the definitive diagnostic tool, particularly for ambiguous or complex injuries.

Keywords: Anterior Cruciate Ligament Injuries, Magnetic Resonance Imaging, Arthroscopy

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The knee is a hinge joint, connecting the tibia and femur. Its stability mainly relies on the surrounding ligaments. Of the eleven ligaments that support the joint, the anterior cruciate ligament (ACL) is especially important for preventing the tibia from moving forward relative to the femur. [1] The knee undergoes significant mechanical stress during daily activities, with sports-related injuries being a leading cause. The ACL is the most commonly torn ligament in the body, accounting for about 28.9% of all ligament injuries. Because of its close location, ACL tears are often accompanied by injuries to the medial and lateral collateral ligaments. [2]

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Magnetic Resonance Imaging (MRI) and arthroscopy have significantly improved the diagnosis of knee conditions. MRI is often preferred for its non-invasive approach and high sensitivity in detecting meniscal injuries; however, its effectiveness in identifying ACL tears is still debated. [3] MRI provides superior soft tissue contrast and multi-planar capabilities, making it especially useful for examining the complex anatomy of the knee. Reported MRI sensitivities include 87.8% for ACL tears, 93.5% for medial meniscal tears, and 77.7% for lateral meniscal tears. [4]

MRI not only visualizes all intra-articular ligaments but also detects certain extra-articular structures that may be missed during arthroscopy. Arthroscopy, on the other hand, is a minimally invasive procedure usually done as a day case and remains the gold standard for diagnosing intra-articular ligament injuries. [5] However, emerging evidence shows that a reliable MRI can help reduce unnecessary diagnostic arthroscopies. [6] Shakir et al. reported that MRI had a sensitivity of 66.7%, specificity of 75.9%, positive predictive value (PPV) of 81.1%, negative predictive value (NPV) of 59.4%, and an overall diagnostic accuracy of 70.3% in detecting ACL tears. [7]

In our clinical setting, patients with suspected ligamentous knee injuries routinely undergo MRI, followed by arthroscopy when indicated. Despite the widespread use of MRI, no recent local study has evaluated its diagnostic accuracy specifically for ACL injuries. This study was therefore designed to determine the accuracy of MRI in detecting ACL tears, using arthroscopy as the gold standard. The findings aim to support orthopedic surgeons in counseling patients more effectively and may help reduce the need for invasive diagnostic procedures when MRI findings are sufficiently reliable.

MATERIALS AND METHODS

A cross-sectional validation study was conducted in the Department of Orthopaedics at Khyber Teaching Hospital, Peshawar, over a six-month period from November 2024 to May 2025, after obtaining ethical approval. The sample size was determined using Buderer's formula, considering an expected prevalence of ACL tear at 28.9%, MRI sensitivity of 66.7%, and specificity of 75.9%, with a 10% margin of error and a 95% confidence interval. This resulted in a required sample size of 296 participants. [7]

Patients aged between 18 and 60 years, of either gender, and clinically suspected of having a partial or complete ACL tear were enrolled through a non-probability consecutive sampling method. Exclusion criteria included previous surgical procedures on the affected knee, contraindications to MRI or arthroscopy, dislocated knees, or fractures involving the femoral condyle or tibial plateau.

After obtaining informed written consent, participants were recruited from the orthopedic outpatient clinic. Demographic and clinical variables, including age, gender, BMI, laterality, duration of symptoms, socioeconomic status, education level, occupation, and place of residence, were recorded on a structured form. Clinical assessment was performed by a senior orthopedic surgeon.

All participants underwent MRI using a 1.5 Tesla Magnetom Harmony scanner (SIEMENS, Munich, Germany) with a dedicated knee coil. Sequences included T1, T2, STIR, PD, and PD with fat suppression, captured in axial, sagittal, and coronal planes. For optimal ACL visualization, sagittal images were taken with the knee flexed at 15° in a supine position. MRI scans were interpreted by a senior radiologist with over five years of post-fellowship experience. An ACL tear on MRI was defined using standard criteria. A complete tear was diagnosed based on complete fiber discontinuity, non-visualization, or abnormal laxity of the ligament, often accompanied by secondary signs. A partial tear was defined as increased intraligamentous signal with partial fiber disruption but preserved continuity. A normal ACL appeared as a continuous, low-signal, well-oriented ligament. All patients underwent diagnostic arthroscopy, performed by a sports fellowship-trained orthopedic surgeon under general or spinal anesthesia. The radiologist was blinded to the clinical examination findings, and the orthopedic surgeon was blinded to the MRI report until after the arthroscopy was completed.

Data were collected and entered by the principal investigator. Statistical analysis was performed using IBM SPSS version 25. Descriptive statistics were presented as means and standard deviations for continuous variables and as frequencies and percentages for categorical variables. A 2×2 contingency table was used to calculate the sensitivity, specificity, PPV, NPV, and overall diagnostic accuracy of MRI compared to arthroscopy. 95% confidence intervals (CIs) were reported for all these indices. McNemar's test was used to compare correlated proportions, and receiver operating characteristic (ROC) curves were plotted to evaluate overall diagnostic performance. A p-value less than 0.05 was considered statistically significant. The Standards for Reporting of Diagnostic Accuracy Studies (STARD) 2015 Protocols were followed in reporting this study. [8]

RESULTS

A total of 296 patients were enrolled in the study. Most of them were male (80.7%), with a mean age of 31 ± 4.92 years. Baseline demographic and clinical characteristics of the study population are presented in Table 1. The study's patient flowchart is given in Figure 1.

ACL tears were identified on MRI in 172 patients (58.1%), while 124 (41.9%) showed no tear. Arthroscopy, used as the reference standard, confirmed ACL tears in 197 patients (66.6%) and ruled out tears in 99 (33.4%). A cross-tabulation of MRI findings against arthroscopy is presented in Table 2. The overall diagnostic metrics, along with their confidence intervals and statistical significance, are presented in Table 3.

The likelihood ratio analysis showed a positive likelihood ratio (LR+) of 2.04 and a negative likelihood ratio (LR−) of 0.45, indicating that a positive MRI moderately increases the probability of an ACL tear, while a negative MRI reduces the probability but does not reliably exclude the diagnosis.

The ROC curve revealed an area under the curve (AUC) of 67.9% (95% CI: 61.3%–74.4%) for the ACL tear on MRI (Figure 2).

S Subgroup analysis revealed better MRI performance in complete versus partial ACL tears. For complete tears, sensitivity, specificity, PPV, NPV, and diagnostic accuracy were 82.4%, 72.1%, 88.6%, 62.3%, and 78.9%, respectively, while for partial tears, these values were lower at 58.7%, 60.4%, 66.2%, 52.8%, and 59.5%. Similarly, MRI showed higher diagnostic performance in early presentations (<6 weeks), with sensitivity, specificity, PPV, NPV, and accuracy of 85.2%, 76.8%, 89.5%, 70.4%, and 82.1%,

compared to 62.7%, 60.3%, 73.4%, 47.6%, and 61.5% in late presentations (>6 weeks).

Table No 1: Baseline demographic and clinical characteristics of the study population (n=296).

Characteristics		N (%), mean ± SD
Enrolled cases		296 (100%)
Gender	Male	239 (80.7%)
	Female	57 (19.3%)
Age (years)		31 ± 4.92
Weight (kgs)		73 ± 6.89
Height (meters)		1.7 ± 1.01
BMI (kg/m²)		24.1 ± 3.34
Duration of symptoms (months)		12 ± 2.47
Age groups (years)	20–25	106 (35.8%)
	26-30	101 (34.1%)
	31-35	54 (18.2%)
	36-40	31 (10.5%)
	>40	4 (1.3%)
Injury Type	RTA	165 (55.7%)
	Fall form height	74(25%)
	Sports related	57 (19.3%)
Residence	Rural	188(63.5%)
	Urban	108 (36.5%)
Socioeconomic group	Lower-income group	100(33.8%)
	Middle-income group	104 (35.1%)
	Higher-income group	92 (31.1%)

Table No 2: Comparison of MRI and arthroscopic findings in detecting ACL tears

	ACL Tear on Arthroscopy		χ^2 (P-value)
ACL Tear on MRI	+	-	6.72 (<0.01)
+	138 (46.6%)	34 (11.4%)	
-	59 (19.9%)	65 (21.9%)	

Table No 3: Diagnostic performance of MRI in identifying ACL tears using arthroscopy as the reference standard

MRI	ACL Tear (95% CI)	χ^2
(p-value)	70.1% (63.4%, 76.2%)	460.8 (<0.01)
Specificity	65.7 % (56%, 74.5%)	189.3 (<0.01)
PPV	80.1% (73.9%, 85.7%)	698.1 (<0.01)
NPV	52.4% (43.6%, 61.1%)	136.6 (<0.01)
Diagnostic Accuracy	68%	

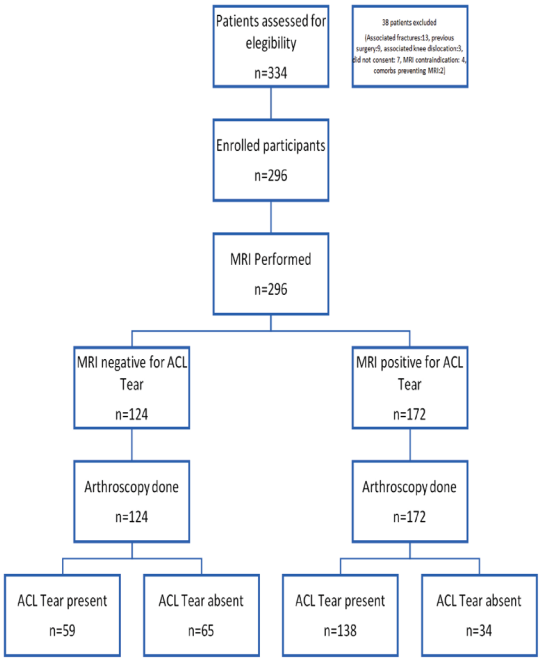

Fig 1:Patient flow diagram throughout the study

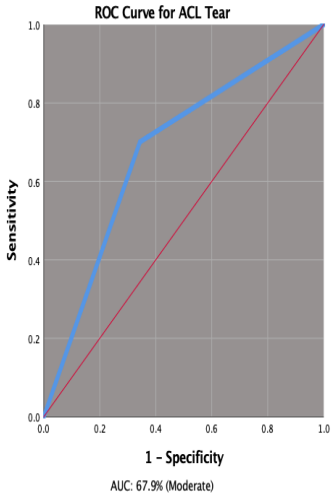

Fig 2: ROC curve for MRI in detecting ACL tears

DISCUSSION

In this study of 296 patients, MRI showed a sensitivity of 70.1% and a specificity of 65.7% for detecting ACL tears compared to arthroscopy, with an overall accuracy of 68%. This matches findings from a similar cross-sectional study of a local cohort, which reported comparable sensitivity (66.7%), specificity (75.9%), PPV (81.1%), and accuracy (70.3%) of MRI in diagnosing ACL injuries.[7]

However, our sensitivity is significantly lower than what has been reported in several international studies. For example, a prospective Chinese study of 78 patients found an MRI sensitivity of 95.45% and a specificity of

91.67% (accuracy of 94.87%) for diagnosing ACL injury.[9] A meta-analysis of 21 studies published between 2006 and 2016 pooled sensitivity and specificity at 87% and 90%, respectively (AUC = 0.93). [10] Similarly, high performance (> 90% sensitivity) was reported by a Pakistani cohort from Lahore (93.3% sensitivity, 85.7% specificity, accuracy 91.9%) and a military hospital study (93.2% sensitivity, 76.3% specificity, accuracy 90%). [11, 12]

Our lower sensitivity and specificity may be due to several factors. The use of a 1.5 T MRI scanner, which offers diagnostic accuracy comparable to 3 T for ACL injuries according to meta-analyses, [is one such factor.] Inclusion of partial tears, which are inherently more difficult to detect because they may resemble mucinous degeneration, exhibit normal or subtle signal changes, or present with ambiguous imaging features, likely reduced overall performance. This is supported by our subgroup analysis, in which complete tears showed higher diagnostic accuracy (78.9%) than partial tears (59.5%), aligning with the literature that indicates significant challenges in identifying nuanced or incomplete ligament disruptions. [13, 14]. Additionally, the timing of imaging affects accuracy: delayed MRIs may allow edema to resolve and scar tissue to form, obscuring ligament abnormalities, which has been shown to impact detection and agreement in related knee ligament pathology. [15] Finally, interpreter experience plays a role, as specialist musculoskeletal radiologists generally achieve higher diagnostic performance than general readers, and differences in expertise may have contributed to the moderate accuracy observed in our cohort, since radiologist experience influences accuracy. [16] Taken together, the combination of subtle partial tears, timing of imaging, and non-specialist interpretation likely explains our lower diagnostic performance compared to studies reporting higher accuracy under optimized conditions.

Conversely, several studies highlight that MRI's diagnostic accuracy may surpass that of manual examination in complex or partial injuries, although results vary depending on the reader's expertise. Navali et al. and Kostov et al. reported clinical tests (Lachman, anterior drawer) that, in some cases, matched or exceeded MRI accuracy when performed by experienced examiners. [17, 18] In other settings, MRI proved to be more sensitive, especially for complex injuries. [9, 19]

A related study evaluating the diagnostic performance of clinical tests for meniscal pathology concluded that clinical examination and MRI should be used together to enhance diagnostic accuracy. [20] These qualitative reports support the idea that MRI may both overcall and undercall tears in ambiguous cases, particularly if imaging is performed early when swelling is present, or if interpretation lacks specialized expertise.

Beyond diagnostic performance, AI integration is rapidly advancing ACL imaging. Deep learning models, especially convolutional neural networks, have demonstrated high accuracy in detecting ACL tears on MRI, often approaching or exceeding clinician performance, with pooled sensitivity and specificity reported around 87–91% in systematic analyses. [21]

Specific AI-assisted approaches have achieved near-perfect diagnostic accuracy in some studies, outperforming less-experienced readers. [22] Certain multicenter validations show strong generalizability across scanners and populations. [23] Machine learning models using multi-sequence radiomics have reported high AUCs with robust performance in both training and validation cohorts. [24] Together, these findings suggest that AI-enhanced imaging can improve diagnostic accuracy and streamline workflow efficiency.

Advanced quantitative MRI techniques, including 3D isotropic imaging, T2 mapping, diffusion tensor imaging, and super-resolution protocols, improve microstructural visualization of the ACL, enhancing the detection of subtle and partial tears. Although ACL-specific evidence remains limited, promising results from accelerated 3T deep learning–based imaging indicate strong future potential. [25] Diagnostic accuracy varies globally due to factors such as radiologist expertise, scanner variability, and injury chronicity; however, AI-assisted tools can help standardize interpretations and close this gap. These advances may also boost cost-effectiveness by reducing scan times and unnecessary arthroscopies, especially in resource-limited settings. [26, 27] Clinically, this supports an integrated diagnostic approach combining patient history, physical examination, and AI-enhanced MRI, with arthroscopy reserved for discordant cases pending further large-scale validation.

This study has several limitations. Including both complete and partial ACL tears, especially partial tears, likely reduced diagnostic accuracy, as shown in our subgroup analysis (complete tears 78.9% vs. partial tears 59.5%). Only one non-specialist radiologist interpreted the scans, which could have caused reader variability. Although all patients had arthroscopy, the single-center design might limit how well the results apply to other clinical settings. Also, differences in the timing of MRI after injury could have affected sensitivity, as delayed imaging may hide subtle ligament abnormalities.

Our PPV of 80.1% indicates that MRI-positive findings remain fairly predictive of ACL tears confirmed by arthroscopy in our setting. The lower NPV (52.4%) warns against ruling out ACL injury based solely on MRI-negative results. These findings reinforce that, while MRI provides useful non-invasive diagnostics, it should be interpreted alongside clinical examination and surgeon judgment, especially in cases of uncertain or partial tears. In such situations, arthroscopy is still essential for a definitive diagnosis.

CONCLUSION

MRI showed moderate diagnostic accuracy for ACL tears in our group, with an overall accuracy of 68%. While a positive MRI reliably confirms an ACL tear, the low negative predictive value (52.4%) indicates that a negative MRI cannot confidently rule out the injury. Therefore, clinical judgment should guide decisions, and arthroscopy remains the definitive standard, especially for partial or unclear injuries. MRI acts as a useful, non-invasive screening method, but negative results should not replace thorough clinical examination.

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Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Ali W	✓	✓	×	×	✓	×
Shah SDA	✓	×	✓	✓	✓	×
Khan L	✓	✓	×	×	×	✓
Ali A	✓	×	✓	✓	✓	×
Raza MM	✓	✓	×	×	×	✓
Khan Z	✓	×	✓	✓	✓	×
Ullah S	✓	×	✓	✓	✓	×
Hassan RE	✓	✓	×	×	×	✓

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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ORIGINAL ARTICLE

EFFICACY AND SAFETY OF SUBLINGUAL MISOPROSTOL IN REDUCING INTRAOPERATIVE BLOOD LOSS DURING ABDOMINAL MYOMECTOMY

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ABSTRACT

Objective: To compare the effectiveness and safety of 400 mg of sublingual and per rectal Misoprostol when given 1 hour prior to abdominal Myomectomy in reducing intraoperative blood loss.

Material and Methods: A quasi-experimental study involving women with uterine leiomyoma was conducted at Khyber Teaching Hospital, Peshawar, Pakistan, including patients who underwent abdominal myomectomy. Participants were enrolled after providing informed consent and were randomly assigned to either group 1, which received 400 mg of misoprostol rectally, or group II, which received 400 mg of misoprostol sublingually one hour before surgery. A total of 48 participants were enrolled. The primary outcome measures were intraoperative blood loss and the difference between preoperative and postoperative hemoglobin levels; secondary measures included postoperative febrile morbidity, gastrointestinal complaints, and other side effects. All data were stored and analyzed using SPSS 20. A p-value of <0.05 was considered statistically significant.

Results: The mean age of patients in the per rectal group 1 was 32.6 (± 4.8) years, and in the sublingual group 2 it was 33.8 (± 4.5) years. The mean parity in group 1 was 1.8 (1.3), while in group 2 it was 1.3 (1.2). The mean uterine size in group 1 was 17.6 (2.3) cm, and in the per rectal group 15.8 (2.2) cm. Blood loss during the myomectomy procedure was 342.8 (154.6) ml in group 1 and 386.5 (118.3) ml in the sublingual group. Complications of misoprostol were very rare and minor, such as nausea and uterine cramps.

Conclusion: Sublingual misoprostol is an effective and safe agent for reducing blood loss during abdominal myomectomy. When compared with the use of the same dose of per rectal misoprostol given 1 hour before surgery, it did not show a significant difference; however, the ease of administration via the sublingual route is favored and acceptable to women in the Asian community.

Keywords: Sublingual Misoprostol, Intraoperative Blood Loss, Myomectomy

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INTRODUCTION

Uterine myomas are the most common tumors that develop from the smooth muscles of the myometrium and occur in about 20-40% of women of reproductive age. These tumors are estrogen-dependent and are mostly asymptomatic but become symptomatic in 20-50% of cases, presenting with menorrhagia, chronic pelvic pain, and urinary or bowel symptoms. [1, 2] The severity of symptoms depends on the size, number, and location of the tumors. The standard treatment for fibroids is hysterectomy for women who have completed their families, and myomectomy for those who wish to conceive. Bleeding is a common complication of the myomectomy procedure, with 20% of patients requiring a transfusion. Various methods are used to reduce bleeding, including GnRh agonist use before surgery, intraoperative vasopressin, intravenous oxytocin, intramyometrial bupivacaine with epinephrine, tourniquet application, and pre-operative uterine artery embolization. [3, 4]

Misoprostol, a PGE1 analogue, is used not only for managing miscarriages, inducing labor, and preventing and treating primary postpartum hemorrhage but also has gained significance in myomectomy. It enhances myometrial contractions, which helps reduce blood flow through the uterine arteries. Misoprostol decreases bleeding through two mechanisms. [5] First, it increases myometrial contractions because prostaglandins affect vascular structures supplied by both the uterine artery and

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utero-ovarian anastomoses, causing vascular contraction and lower blood flow. The second mechanism involves the direct vasoconstrictive effect of misoprostol on uterine arteries.

MATERIALS AND METHODS

This study was conducted in the Gynecology and Obstetrics unit of Khyber Teaching Hospital from 1st September 2021 to 31st August 2023. It is a quasi-experimental study in which patients who attended the outpatient clinic for treatment of symptomatic myomas and met the inclusion criteria were included.

Inclusion criteria included patients aged 20-40 years, all fibroids classified as intramural or subserosal by ultrasound, and a uterine size smaller than 24 weeks of gestation on bimanual examination. Exclusion criteria consisted of patients with a history of previous pelvic surgery, laparotomy, or C-section, a history of endometriosis, allergy to misoprostol, cardiac or pulmonary diseases, bleeding or coagulation disorders, Hemoglobin levels below 10 gm, chronic endocrine or metabolic diseases like diabetes, and a BMI greater than 30.

The goal of my study was to assess the effect of a single sublingual dose of misoprostol 400 mg given 1 hour preoperatively and to compare it with the same dose given rectally on the amount of bleeding during abdominal myomectomy. Primary outcome measures included the amount of intraoperative blood loss, the difference between pre-op and post-op hemoglobin levels, and the need for intraoperative or post-op blood transfusions. Secondary measures included postoperative febrile morbidity, other side effects, and complications of surgery. Efficacy was evaluated based on decreased blood loss during myomectomy surgery, postoperative hemoglobin levels at 6 and 24 hours, and the necessity for intraoperative and postoperative blood transfusions. Safety was assessed by monitoring side effects associated with sublingual misoprostol, such as fever, chills, vomiting, diarrhea, or vaginal bleeding immediately prior to surgery.

All patients were counseled about the study. Written informed consent was obtained after explaining the possible consequences. A detailed history was taken from all women, and they underwent a clinical examination to rule out general medical disorders. Abdominal and vaginal examinations were conducted. Abdominal and pelvic ultrasounds were performed to assess the number, location of fibroids, and the largest fibroid diameter. Preoperative full blood count and coagulation profile tests were conducted for all women. Surgery was performed by the same surgical team to eliminate any bias related to surgical skill. The myomectomy procedure involved enucleating all myomas and clamping large blood vessels; no other interventions, such as tourniquets or ligation, were used. Intraoperative blood loss was measured by collecting and weighing surgical sponges before and after surgery, then converting the weight to blood volume, considering 1 gram of blood as equivalent to 1 mL. Blood loss was further estimated by measuring the amount of blood collected in a suction bottle at the end of surgery and the blood in the kidney trays when blood-soaked packs were squeezed into them. The blood on the surgical drapes and the pooled blood beneath the patient and on the floor were also noted. The volume of irrigation fluid was subtracted from the final blood loss volume. Vital data during the operation, including duration of surgery and the time from opening of the peritoneum to closure, were recorded. Hemoglobin levels were measured at 6 hours and 24 hours postoperatively, and any intraoperative or postoperative blood transfusions were documented. The number and size of fibroids were recorded after surgery. Any postoperative side effects, such as febrile episodes, shivering, or diarrhea within 24 hours post-surgery, were also documented.

All data were stored and analyzed using SPSS 20. Descriptive statistics were calculated for quantitative variables such as age, parity, mean fibroid size, and mean Hb concentration. Frequencies and percentages were calculated for categorical variables like efficacy and side-effect frequency. Efficacy in both groups was stratified by age, parity, fibroid size, pre- and post-surgery Hb concentration, and blood loss during surgery. A post-stratification chi-square test was used to compare the efficacy of the two groups, with a p-value < 0.05 considered significant. All results are presented in tables and graphs.

RESULTS

In the study, 24 women were randomized to receive 400 mg of rectal misoprostol, and 24 women were given sublingual 400 mg misoprostol 1 hour before myomectomy.

The baseline demographic characteristics, including age, parity, preoperative and postoperative hemoglobin, and uterine size, are shown in Table 1.

In one case, the procedure resulted in a hysterectomy. She was para 3 with fibroids in the broad ligament and posterior uterine wall. Despite performing internal iliac ligation, the bleeding persisted, leading to a total abdominal hysterectomy as a last resort.

DISCUSSION

Ahmad Abbas compared the efficacy of 400 micrograms of sublingual and rectal misoprostol administered one hour before abdominal myomectomy. He found that the mean blood loss in the rectal group was 247.44 ± 106.04 ml, compared to 256.17 ± 116.27 ml in the sublingual group ($P = 0.06$). No significant differences were observed between the two groups in the change in hemoglobin levels and hematocrit values pre- and postoperatively

Table No 1: Baseline Demographic and Intraoperative Blood Loss Comparison.

Treatment Group Statistics					
Variables	Rectal Mean (SD) Group 1	Sublingual Mean (SD) Group 2	t (df=46)	P value	Effect Side Hedges Correction
Age	33.8 (4.5)	32.6 (4.8)	0.87	0.391	0.25
Parity	1.3 (1.2)	1.8 (1.3)	-1.16	0.254	-0.33
Uterine size in Cm	15.8 (2.2)	17.6 (2.8)	-2.37	0.022	-0.69
Pre op Hb (g%)	11.7 (0.6)	12 (0.4)	-2.22	0.032	-0.63
Blood loss during surgery	342.8 (154.6)	386.5 (118.3)	-1.10	0.277	-0.31
Post op Hb (g%)	10.8 (0.3)	11 (0.2)	-2.67	0.010	-0.76
No of Fibroids	1.8 (1)	2.5 (1.3)	-2.39	0.021	-0.68
Hb difference	0.9 (0.6)	1 (0.5)	-0.79	0.436	-0.22

Table No 2: Side Effects, Complications, frequency of blood transfusions in Both Groups

Side Effects of Misoprostol	Side Effects of Misoprostol	Group 2 (Sublingual N-24)
Uterine bleeding	**-**	-
Uterine cramps	-	1
Nausea	-	1
Vomiting	-	-
Diarrhea	-	-
Shivering	-	-
Complications and frequency of blood transfusions		
Intraoperative blood transfusions		
1 Transfusion	9	4
> 1 Transfusion	7	5
Post-operative blood transfusions	3	2
Procedure ending in hysterectomy	1	-

($P < 0.05$). Similarly, there were no differences in patients' demographics, duration of surgery ($P = 0.9$), or need for transfusion ($P = 0.08$). Both groups showed similar results regarding the occurrence of adverse effects ($P = 0.97$). Fever and chills were the most common adverse effects, indicating that both rectal and sublingual misoprostol 400 mcg are equally effective in reducing blood loss during abdominal myomectomy. [6] In our study, the mean blood loss was 342 ± 154 mL in the rectal group and 386 ± 118 mL in the sublingual group ($P = 0.27$).

In another study, Ahmad Abbas compared two different doses of Misoprostol. He administered 200 and 400 mcg of sublingual misoprostol and observed that the estimated blood loss was significantly lower in the misoprostol 400 mcg group (373.3 ± 55.6 vs 560 ± 105.2 ml, $P < 0.001$). Moreover, the reduction in hemoglobin level was significantly less in the misoprostol 400 mcg group (0.8 ± 0.18 vs 1.7 ± 0.38 gm/dL, $P < 0.001$). The operative duration was significantly shorter in the misoprostol 400 mcg group (91.3 ± 5.7 vs 111.2 ± 6.3 minutes, $P < 0.001$. [7] In our study, post-op hemoglobin 24 hours after surgery was 11 (0.2) gm% in the sublingual group and 10.8(0.3) gm% in the per rectal group, with a p-value of 0.10.

Lima Wetherell conducted a double-blind RCT pilot study in Melbourne, Australia, and compared sublingual misoprostol 400 mg with placebo preoperatively. Intraoperative blood loss in the misoprostol group was 306 ml ± 281 ml, compared to 325 ml ± in the placebo group ($P = 0.83$). Fibroid volume was a consistent predictor of intraoperative blood loss. For each ml increase in fibroid volume, there was an associated increase in blood loss by 0.25ml (95% CI: 0.07-0.46). [8] In our study, the mean uterine size was 17.6 (2.8) cm in the sublingual group and 15.8 (2.2) cm in the per rectal group, p value 0.022.

The most popular method for reducing hemorrhage in myomectomy is the use of GnRH analogues. However, myoma growth recurs after treatment is stopped. Osteoporosis also occurs with long-term use of GnRH analogues. Therefore, its use is limited to decreasing intraoperative blood loss. Additionally, GnRH analogues are expensive, and their hemorrhage-reducing effect takes

time to manifest, whereas misoprostol is given an hour before surgery and significantly decreases intraoperative blood loss. [9, 10]

In comparison between misoprostol and vasopressin, cost and safety concerns are present. Side effects have been reported to arise from the use of local vasopressin. Temporary increase in blood pressure during local vasopressin injection, bleeding at the injection site, and intravascular infiltration by mistake can lead to pulmonary edema or myocardial infarction. [10, 11]

The mechanical vascular occlusion technique known as a tourniquet or uterine artery embolization has also gained popularity in recent years. These methods all require additional intervention or a separate procedure. The challenges of accessing the uterine arteries in large, laterally positioned myomas, such as broad ligament myomas, and the difficulty of placing tourniquets are disadvantages. Julian conducted a systematic review and meta-analysis of 2016 patients to identify non-hormonal interventions, perioperative interventions, and devices to reduce blood loss during surgery for uterine leiomyomas. She found that perioperative use of misoprostol was associated with a lower postoperative hemoglobin drop (0.39 versus 0.59 gm%, $p<0.1$). [12,13]

The route of misoprostol administration affects the onset, duration of action, the effects achieved, and the severity of side effects. The oral and sublingual routes produce the quickest and strongest uterotonic effects compared to vaginal and rectal routes, but they also come with more side effects. [14-16]

The onset of action for oral, sublingual, and vaginal routes occurs within 30 minutes, while the rectal route takes longer at 100 minutes. The sublingual route reaches the highest peak plasma concentration and systemic bioavailability, whereas vaginal and rectal routes provide more sustained plasma levels. All routes have an action duration of at least 2 hours, which is sufficient for an uncomplicated open myomectomy. El Maraghay compared 400 mg of sublingual misoprostol with a placebo 60 minutes prior to myomectomy. Postoperative blood loss, hemoglobin levels, and hospitalization time were reduced (252.5 ± 170.5 ml, 10.8 ± 1.02 g/dl, and 1.8 ± 0.4 days, respectively) ($P = 0.003$, 0.032, and 0.004, respectively). [17]

Asma Hunain and Mohammad Khalaf observed changes in the vascularity and perfusion of fibroids by studying Doppler blood flow patterns. The study included 82 patients, with 41 in each group.

Women were randomly assigned to group A, which received 400 mg of misoprostol rectally, and group B, which received the medication sublingually one hour before surgery. The vascularization of the fibroid and surrounding myometrium was visualized using color Doppler. There was no statistically significant difference in RI, PI, or systolic-diastolic ratios at different times of assessment between the two groups. Misoprostol significantly reduces the vascularity and perfusion of fibroids, regardless of whether it was administered rectally or sublingually one hour prior to the procedure. R1 was 0.90 ± 0.11 in the rectal group versus 0.85 ± 0.19 in the sublingual group ($P = 0.07$) at 20 and 40 minutes after intake. [18]

Sabry found that, with the use of 400 mg Misoprostol transrectally one hour prior to surgery, intraoperative blood loss was significantly lower than with placebo, at 460.8 ± 155 ml versus 815.4 ± 187.7 ml, $P < 0.00001$. The duration of the operation was also significantly shorter: 70.84 ± 11.3 minutes versus 87.6 ± 21.2 minutes, $P < 0.001$. Postoperative hemoglobin levels showed a significant difference (10.6 ± 0.96 versus 9.76 ± 0.78). The decrease in hemoglobin percentage was significantly lower in the misoprostol group compared to the other group (1.16 ± 0.5 g/dl versus 1.7 ± 0.5 g/dl, $P = 0.005$). [19]

The dosage and route of administration of misoprostol vary across published studies. Some researchers found no statistical difference in mean blood loss or postoperative hemoglobin levels after surgery.

This may be due to the smaller sample sizes in these studies. Although the direct impact of sublingual misoprostol has not been widely studied, [20-22] a study by Mansoureh involved 64 patients undergoing abdominal myomectomy who were randomized into two groups: one receiving 200 mg of sublingual misoprostol 30 minutes before surgery, and the other receiving a placebo. The mean age, BMI, and baseline hemoglobin levels showed no significant differences; however, hemoglobin levels 6 hours after surgery were significantly higher in the misoprostol group (Hb 9.8 ± 0.8 versus 9.1 ± 0.9, $P = 0.003$). [23, 24]

Ivanzzo found no significant differences between groups in site or number of myomas, but there was a notable difference in myoma size. The mean fibroid size in the misoprostol group was 33.8 ± 15.2 cm compared to 24 ± 13.6 cm in the control group, $P = 0.042$. Postoperative Hb was 10.8 g ± 1.02 g/dL in the misoprostol group versus 9.9 ± 1.3 g/dL in the other group. Blood loss in the two groups was 336 ± 160.9 ml, respectively, $P = 0.077$. [25] The use of misoprostol during cervical myomectomy may not provide the same benefits as its ability to decrease cervical resistance, but further studies are needed.

We had four patients with cervical and intramural fibroids, not isolated cervical fibroids. In these cases, bleeding was significantly reduced with misoprostol. However, in one patient with multiple intramural and cervical fibroids, the procedure resulted in hysterectomy due to intractable bleeding.

CONCLUSION

Sublingual misoprostol is an effective and safe option for reducing blood loss during abdominal myomectomy. When compared with the same dose of per rectal misoprostol given 1 hour before surgery, blood loss during the procedure and the change in HB were similar. P values of 0.277 and 0.436, respectively, showed no significant difference; however, the ease of administration via the sublingual route is preferred and acceptable to women in the Asian community.

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Mazhar T	✓	✓	×	×	✓	×
Ghayur MS	✓	×	✓	✓	✓	×
Adil Z	✓	✓	×	×	×	✓
Haris A	✓	×	✓	✓	✓	×

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ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF SONOURETHROGRAPHY IN THE DIAGNOSIS OF ANTERIOR URETHRAL STRICTURE TAKING RETROGRADE URETHROGRAM AS A REFERENCE STANDARD

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ABSTRACT

Objective: To determine the Diagnostic accuracy of sonourethrography (SUG) in the diagnosis of anterior urethral stricture, taking retrograde urethrogram (RUG) as a reference standard

Materials and Methods: This cross-sectional study was performed at the Radiology Department of the Combined Military Hospital (CMH) in Peshawar, Pakistan, from November 3, 2022, to May 3, 2023. A total of 104 clinically suspected cases of anterior urethral stricture were included. Male patients aged 15–65 years presenting with lower urinary tract symptoms for at least one week were enrolled. Patients with posterior urethral strictures, allergies to contrast media, or severe perineal conditions were excluded. SUG was conducted using a Toshiba Xario 200 Doppler scanner, with RUG serving as the gold standard for confirmation. Diagnostic accuracy metrics, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy, were calculated using SPSS version 25.

Results: The average age of participants was 37.80 ± 9.245 years. SUG identified strictures in 32 patients, with 71.8% located in the bulbar urethra and 28.1% in the penile urethra. Severity assessment showed 65.6% of strictures as mild, 28.1% as moderate, and 6.25% as severe. Average stricture lengths were 2.1 ± 0.31 mm on SUG and 2.8 ± 0.46 mm on RUG. SUG demonstrated a sensitivity of 97%, specificity of 96%, PPV of 91.2%, NPV of 98.6%, and a diagnostic accuracy of 96.1%.

Conclusion: Sonourethrography is a dependable diagnostic tool for anterior urethral strictures, showing excellent sensitivity and specificity. Its superior ability to evaluate stricture length and severity makes it a crucial modality for clinical practice.

Keywords: Sonourethrography, Retrograde urethrography, Diagnostic accuracy

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INTRODUCTION

Urethral strictures, a common cause of bladder outflow obstruction, are important urological conditions that cause significant physical and psychological burdens. This condition is marked by narrowing of the urethral lumen due to fibrosis and scarring, often leading to obstructive voiding symptoms such as difficult micturation, decreased urinary flow, and pain during urination. [1, 2] The causes of urethral strictures vary by region, with Lichen sclerosis being the main cause in developed countries and trauma being the leading cause in developing nations. [3, 4] In the past, infections like sexually transmitted diseases were the main causes of urethral strictures, but recent studies show that trauma, including blunt injuries and iatrogenic causes, now make up most of the etiological spectrum. Pelvic fractures and incorrect instrumentation, such as improper Foley catheter use, are often involved, especially in male patients whose longer urethra makes them more prone to these injuries. Urethral strictures mainly affect older men, with the prevalence increasing after age 55. [4, 5]

The impact of urethral strictures on quality of life can be significant, as patients often face considerable distress and discomfort from their symptoms. This condition's complexity demands accurate diagnosis and effective treatment to alleviate symptoms and prevent long-term complications. Traditional imaging methods, including retrograde urethrography (RUG) and voiding cystourethrography (VCUG), have long been the standard for diagnosing urethral strictures. While RUG is highly sensitive in detecting strictures, it has notable limitations, such as static two-dimensional imaging, underestimating stricture length, and radiation exposure. [6] The accuracy of RUG can also be influenced by patient positioning and the degree of penile stretching, making it less reliable for assessing complex or periurethral pathologies. [7] Furthermore, RGU

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provides limited information on spongiofibrosis—a critical factor in surgical planning—and carries risks like contrast extravasation and infection. [8, 9]

To address these limitations, sonourethrography (SUG) has become a superior imaging method, providing dynamic, high-resolution, three-dimensional images without the risks of radiation exposure. [1, 3] Introduced by McAninch et al. in 1988, SUG has transformed the evaluation of anterior urethral strictures by offering detailed views of the urethral lumen, periurethral fibrosis, and stricture length. [3, 8] Compared to RGU, SUG not only improves diagnostic accuracy but also greatly enhances preoperative planning by identifying key features such as spongiofibrosis and related conditions, including diverticula, fistulae, and polyps. [6, 7]

The benefits of SUG go beyond just diagnosis. This method is non-invasive, affordable, and especially suitable for children and older adults because of its safety. [10] Studies consistently show that SUG measures stricture length more accurately than RGU, which helps in planning better surgeries and lowers the chance of relapse. [4, 11] However, it is important to remember that SUG has limitations in assessing posterior urethral strictures, where RGU is still the preferred choice. [2, 6] Even with its increased use, SUG presents some challenges. It requires skilled radiologists and special equipment, like high-frequency transducers, for the best imaging results. Also, interpreting SUG results needs a systematic approach and experience to ensure accurate diagnosis, especially in complicated cases. [11]

Given the evolving landscape of diagnostic imaging for urethral strictures, this study aims to reevaluate the diagnostic accuracy of sonourethrography compared to retrograde urethrography. By assessing the strengths and limitations of these modalities, this research seeks to add to the growing evidence supporting the integration of advanced imaging techniques into routine clinical practice. With the potential to enhance patient outcomes and quality of life, further investigation into the role of SUG in diagnosing urethral strictures is justified.

MATERIALS AND METHODS

This cross-sectional study was carried out at the Department of Radiology in the Combined Military Hospital in Peshawar, Pakistan, from November 3, 2022, to May 3, 2023. The study included 104 clinically suspected cases of anterior urethral stricture. The sample size was determined using an expected sensitivity of 81.6%, specificity of 91.6%, prevalence of 26.28%, and an absolute precision of 15%. Non-probability consecutive sampling was used to ensure that all eligible patients were included.

The inclusion criteria for this study were male patients aged 15–65 years with lower urinary tract symptoms lasting at least 1 week and clinically suspected of having an anterior urethral stricture. Patients with allergies to contrast material, posterior urethral stricture, Fournier's gangrene, or watering-can perineum were excluded. After obtaining ethical approval, patients meeting the inclusion criteria were recruited from the outpatient department (OPD) or emergency room (ER). Study details were explained to each patient, and informed consent was obtained to ensure participants fully understood the study's purpose and procedures.

Demographic data, including age, occupational and residential status, and symptom duration, were recorded for each patient. A documented history of diabetes mellitus and hypertension was also noted, as these comorbidities might influence the development or severity of urethral strictures. Patients underwent sonourethrography (SUG) using a Toshiba Xario 200 Doppler scanner with a 7.5 MHz linear probe. Strict aseptic techniques were followed, and local anesthesia was applied with 2% lignocaine jelly to reduce discomfort during the procedure. A 12 Fr catheter was inserted, inflated, and used to infuse saline for imaging. Both transverse and longitudinal scans were performed, with a transperineal approach to provide clear visualization of the bulbous urethra.

The diagnosis of anterior urethral stricture via SUG was confirmed using a retrograde urethrogram (RUG), performed with Foley's catheter and Urografin 76% contrast media, followed by single-spot imaging. Findings from both methods were recorded and compared to evaluate the diagnostic accuracy of SUG. SPSS version 25 was used for data analysis. Quantitative variables such as age, BMI, and symptom duration were assessed for normality using the Shapiro-Wilk test and reported as means with standard deviations and medians with interquartile ranges.

The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of SUG were calculated using RUG as the gold standard. Effect modifiers were stratified, and diagnostic metrics were recalculated after stratification to address potential confounding variables.

RESULTS

In this study, patients' ages ranged from 15 to 65 years. The average age was 37.80 ± 9.245 years. Comparisons of ultrasonography findings from sonourethrography with retrograde urethrography, based on the location of the stricture, are shown in Table 2. A total of 32 patients had strictures on SUG, of whom 23 had a stricture in the bulbar urethra, while 9 had a stricture in the penile urethra.

Distribution of urethral stricture severity on SUG is given in Table 3. Out of 32 cases diagnosed as urethral strictures, 21 were mild, 9 were moderate, and 2 were severe.

Mean stricture length was calculated as 2.1 ± 0.31 mm on SUG, while 2.8 ± 0.46 mm on RUG. The comparison of SUG with RUG for anterior urethral stricture is shown in Table 4. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of SUG for detecting anterior urethral stricture were 97%, 96%, 91.2%, 98.6%, and 96.1%, respectively.

Table No 1: Mean ± SD of patients according to age, weight, and BMI

Demographics And Baseline Characteristics	MEAN ± STD. DEVIATION
Patient Age (Years)	37.80 ± 9.245
Patient Weight (Kg)	65.22 ± 7.101
BMI (Kg/m2)	21.40 ± 3.1042

Table No 2: Stricture category on SUG

Category	Frequency (n)	Percent (%)
Bulbar	23	71.8
Penile	09	28.1
Total	32	100 %

Table No 3: SUG outcome of anterior urethral strictures according to severity

SUG Outcome	Frequency(n)	Percent
(%)	23	71.8
Mild	21	65.6
Moderate	09	28.1
Severe	02	6.25
Total	32	100 %

Table No 4: Comparison of SUG and RUG for diagnosing anterior urethral stricture

SUG outcome	RUG Outcome		Total
	Positive	Negative	
Positive	31 (TP)*	1 (FP)**	32
Negative	3 (FN)***	69 (TN)****	74
Total	34	70	104

*TP = True positive, **FP = False positive, ***FN = False negative, ****TN = True Negative

DISCUSSION

The present study aimed to determine the diagnostic accuracy of sonourethrography (SUG) in identifying anterior urethral strictures, with retrograde urethrography (RUG) serving as the reference standard. Our findings revealed that SUG diagnosed urethral strictures in 30.8% of patients, while RUG identified strictures in 32.7% of cases. These results are slightly higher than those reported by Hassan et al., where SUG identified strictures in 23.5% and RUG in 24.5% of cases. Shahsavari et al. also reported similar findings. [4,11,12] This variation might stem from differences in patient demographics or imaging techniques used in the studies. However, the close agreement between SUG and RUG detection rates in both studies highlights the reliability of these diagnostic modalities.

When analyzing the location of urethral strictures, SUG in our study identified 71.8% of strictures in the bulbar urethra and 28.1% in the penile urethra. These findings closely match Hassan et al., who reported 66.66% of strictures in the bulbar urethra and 33.33% in the penile urethra.[4]

The predominance of bulbar strictures seen in both studies reflects a consistent trend across patient groups. These results are also similar to those of Alam et al., who documented that bulbomembranous strictures were the most common.[13] The consistency in stricture location across studies suggests that SUG and RUG are both effective in detecting strictures in different parts of the urethra.

Severity grading of strictures in our study showed that SUG identified 65.6% of strictures as mild, 28.1% as moderate, and 6.25% as severe. In comparison, Hassan et al. reported mild, moderate, and severe cases as 14, 9, and 1, respectively. [4]

While the distribution of mild and moderate strictures is similar, our study recorded a slightly higher percentage of severe strictures. These results are also similar to those of Hatgonkar et al. [14.] This variation may reflect differences in grading criteria or patient characteristics. However, both studies highlight SUG's ability to detect a full range of stricture severities, including severe cases that RUG may underreport.

Stricture length is a key parameter for management planning. In our study, the average stricture length was 2.1 ± 0.31 mm on SUG and 2.8 ± 0.46 mm on RUG. Hassan et al., however, reported mean lengths of 4.60 ± 4.26 mm for SUG and 1.83 ± 0.34 mm for RUG. Although the absolute lengths differ, both studies consistently show that SUG measures longer stricture lengths compared to RUG. This difference highlights SUG's improved ability to offer detailed anatomical assessments of strictures, as also shown by Akpayak et al.'s findings. [15]

Miszewski et al. documented that in 81% of cases, the estimated length of the stricture by SUG matched intraoperative findings. [16] Variations in reported lengths may result from differences in study populations or imaging techniques.

The diagnostic performance of SUG in our study was impressive, with sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of 97%, 96%, 91.2%, 98.6%, and 96.1%, respectively. These metrics align with those reported by Hassan et al., who found sensitivity and specificity

of 96% and 100%, respectively. [4] Additionally, Hassan et al. cited ranges of sensitivity (75-100%) and specificity (72-97%) from other studies, which match our findings. [4, 17] Ravikumar et al. also support these results, reporting 100% sensitivity, specificity, PPV, and NPV for SUG. [18] While our study slightly falls short of perfect values, it confirms the role of SUG as a highly accurate diagnostic tool. Janan et al. noted that sonourethrography is more effective than RUG in evaluating various causes of ureteric obstruction. [19]

Our study supports the growing evidence that SUG is a reliable and accurate tool for evaluating anterior urethral strictures. In addition to its high sensitivity and specificity, SUG has advantages over RUG, such as better visualization of periurethral structures and stricture lengths. These benefits are important for customizing management options like urethral dilation, urethrotomy, or reconstructive surgery. Furthermore, SUG's non-invasive nature and absence of ionizing radiation improve its usefulness and patient acceptance.

A limitation of our study was that it could not assess posterior urethral strictures due to the limitations of SUG, whereas RUG can be used to evaluate both anterior and posterior urethral strictures. Future studies may compare the diagnostic accuracy of SUG and RUG across different types of urethral strictures and explore the potential applications of SUG.

CONCLUSION

Sonourethrography (SUG) is a highly accurate diagnostic tool for evaluating anterior urethral strictures, excelling in measuring stricture length, grading severity comprehensively, and providing high diagnostic precision.

These qualities make SUG a valuable resource in clinical practice, offering a reliable, non-invasive method for diagnosing and managing urethral strictures. Future research should seek to validate these findings across different populations and explore potential technological improvements to further boost its diagnostic abilities.

By incorporating SUG into routine clinical workflows, healthcare providers can improve the assessment and treatment of anterior urethral strictures, ultimately leading to better patient outcomes. The use of SUG can simplify diagnostic procedures, decrease reliance on invasive tests, and support more effective treatment planning, thereby improving the overall quality of care for patients with urethral strictures.

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Yadain SH	✓	✓	×	×	✓	×
Nisar U	✓	×	✓	✓	✓	×
Bukhari SARS	✓	✓	×	×	×	✓
Sultana SM	✓	×	✓	✓	✓	×
Ihsan HR	✓	✓	×	×	×	✓
Tahir F	✓	×	✓	✓	✓	×

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

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ORIGINAL ARTICLE

COMPARISON OF MINI-PERCUTANEOUS CYSTOLITHOTRIPSY AND TRANSURETHRAL CYSTOLITHOTRIPSY IN CHILDREN WITH BLADDER STONE

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ABSTRACT

Objective: This study aims to compare mini-percutaneous cystolithotripsy and transurethral cystolithotripsy in children with bladder stones at our hospital.

Materials and Methods: A total of 84 patients were divided equally (42 in each group) into two groups (A and B) based on self-selection of stone size, and the type of management was decided by the researcher after clinical examination. Mini-percutaneous cystolithotripsy was performed on patients in Group A utilizing a mini-nephroscope and a 15 Fr access sheath. 4.5/6 Fr or 6/7.5 Fr pediatric ureteroscopes were used to treat transurethral cystolithotripsy in patients in Group B. A Holmium YAG laser was used to break apart the stone.

Results: Patients in group A had an average age of 8.38 ± 3.48 months, while those in group B were 8.30 ± 3.23 months old. Of the 84 patients, 49 (58.33%) were male and 35 (41.67%) were female, with a male-to-female ratio of 1.4:1. In my study, the mean operative time for group A (mini-percutaneous cystolithotripsy) was 31.43 ± 5.43 minutes, and for group B (transurethral cystolithotripsy), it was 39.52 ± 7.31 minutes, with a p-value of 0.0001.

Conclusion: PCCL allows for easier fragmentation, quicker extraction of larger bladder stone fragments, fewer urethral complications, and reduced operative time.

Keywords: Urinary bladder calculi, Lithotripsy, Operative time.

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INTRODUCTION

Although bladder stones are not commonly found in young people, they pose specific challenges for diagnosis and treatment. [1] Although bladder stones are more frequently seen in adults, children can also develop these crystalline formations. In the evolving field of therapeutic options, two notable procedures have gained recognition for their effectiveness in treating bladder stones in children: mini-percutaneous cystolithotripsy. [2-4]

Mini-percutaneous cystolithotripsy is a less invasive method for removing bladder stones. This technique involves making a small incision in the lower abdomen and inserting a narrow-diameter nephroscope. [5] This enables direct visualization and feeling of the stones in the bladder. After examination, the stones are broken up using laser or ultrasonic energy, and the fragments are then removed by vacuum. [6]

A surgical technique called transurethral cystolithotripsy removes the need for external incisions by entering the bladder through the urethra. A cystoscope is inserted into the bladder via the urethra to perform this surgery. [7] The cystoscope is equipped with a lithotripsy tool, such as a laser or pneumatic lithotripter, which breaks the stones into smaller pieces. These smaller fragments can be expelled through urination or removed using a cystoscope. [8] For larger stones, mini-percutaneous cystolithotripsy is typically the best option because it provides rapid and direct access to the stone. [9] A less invasive approach suitable for small stones or when protecting the urethra is crucial is transurethral cystolithotripsy. [10] According to a study, children with bladder stones required an average of 33.5±8.42 minutes for mini-percutaneous cystolithotripsy and 38.2±6.76 minutes for transurethral cystolithotripsy. [11]

Given the limited local literature on the subject, the aim of this study is to compare transurethral and mini-percutaneous cystolithotripsy in children with bladder stones at our hospital. This comparison is expected to evolve as

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technological and surgical advances continue, offering more sophisticated and tailored methods to address the specific challenges of bladder stones in children.

MATERIALS AND METHODS

The study included 84 patients (42 in each group) who presented to the Department of Urology, Khyber Teaching Hospital, Peshawar (from January 2025 to August 2025). The Sample size calculation is performed by the WHO sample size calculator with the help of the following assumptions: mean operative time in mini-percutaneous cystolithotripsy (33.5+8.42 min) in children with bladder stones, mean operative time in transurethral cystolithotripsy (38.2+6.76 min) in children with bladder stones, confidence level of 95%, and power of 80%. The determined sample size is 84 (42 in each group). [11] After obtaining approval from the hospital's ethics committee, research was initiated. The patients' guardians were given a brief explanation of the study's purpose and benefits, and reassured that there would be no risks associated with participating. Written informed consent was obtained from each patient's guardians.

Patients aged 1 to 12 months with urinary bladder stones (presenting with dark-colored or cloudy urine, hematuria, and dysuria) were included. Diagnosis was confirmed through ultrasound examination showing bright echoes within the bladder lumen and a shadow posteriorly. Patients with bladder dysfunction, outlet obstruction, or neurological defects were excluded.

A total of 84 patients were equally divided into two groups (42 each) (A and B) based on self-selection of stone size, and the researcher decided the management type after clinical examination.

Mini-percutaneous cystolithotripsy was performed on patients in Group A using a mini-nephroscope and a 15 Fr access sheath. After filling the bladder with saline, the first puncture was guided by ultrasound. A screw dilator was used for single-step dilation, and a 15 Fr access sheath was inserted into the bladder. The stone was fragmented with a mini-nephroscope, and the pieces were removed using the "vacuum-cleaner effect." Post-surgery, steri-strips were applied to dress the puncture site without sutures. No suprapubic catheter was inserted. All patients had a 6 or 8 Fr plain or Foley's urethral catheter placed for 24-hour drainage. For transurethral cystolithotripsy in Group B, 4.5/6 Fr or 6/7.5 Fr pediatric ureteroscopes were used. A Holmium YAG laser was employed to break the stones. The mean operative time was calculated as the period from the start to the end of the procedure, in minutes, for both groups.

IBM-SPSS v.27 software was used to analyze the data. Mean ± SD or Median (IQR) were determined for numerical variables. Frequencies and percentages were calculated for categorical data. Operational times for both groups were compared using the Mann-Whitney U test or the Independent Samples T-test, with a p-value of <0.05 considered significant.

RESULTS

The mean age was 8.87 ± 3.31 months. Patients in group A averaged 8.38 ± 3.48 months, while those in group B averaged 8.30 ± 3.23 months. Among 84 patients, 49 (58.33%) were male, and 35 (41.67%) were female, resulting in a male-to-female ratio of 1.4:1. The average stone size in group A was 8.90 ± 4.36 mm, compared to 8.88 ± 5.42 mm in group B. The mean hospital stay was 2.57 ± 1.11 days in group A and 2.61 ± 1.14 days in group B. Table 1 shows the distribution of various variables across both groups.

In my study, the mean operative time in group A (mini-percutaneous cystolithotripsy) was 31.43 ± 5.43 minutes, and in group B (transurethral cystolithotripsy) was 39.52 ± 7.31 minutes, with a p-value of 0.0001 (Table 2). Stratification of operative time based on age, gender, length of hospitalization, stone size, mother's education level, mother's employment status, socioeconomic status,

Table No 1: Distribution of different variables (n=84).

Variable	Group A (n = 42)	Group B (n = 42)
Age (months)		
1–6	18 (42.9%)	16 (38.1%)
7–12	24 (57.1%)	26 (61.9%)
Gender		
Male	23 (54.8%)	26 (61.9%)
Female	19 (45.2%)	16 (38.1%)
Stone size (mm)		
≤10	28 (66.7%)	27 (64.3%)
>10	14 (33.3%)	15 (35.7%)
Length of hospitalization (days)		
≤2	25 (59.5%)	29 (69.0%)
>2	17 (40.5%)	13 (31.0%)
Residence		
Rural	24 (57.1%)	26 (61.9%)
Urban	18 (42.9%)	16 (38.1%)
Socioeconomic status (SES)		
Poor	15 (35.7%)	16 (38.1%)
Middle	16 (38.1%)	13 (31.0%)
Upper	11 (26.2%)	13 (31.0%)
Mother's education		
Uneducated	23 (54.8%)	25 (59.5%)
Educated	19 (45.2%)	17 (40.5%)
Mother's occupation		
Unemployed	31 (73.8%)	33 (78.6%)
Employed	11 (26.2%)	9 (21.4%)

Table No 2: Comparison of mean operative time (n=84).

Variable	Group A (n = 42) Mean ± SD	Group B (n = 42) Mean ± SD	p-value
Operative time (minutes)	31.43 ± 5.43	39.52 ± 7.31	0.0001

Table No 3: Distribution of operative time based on age, gender, length of hospital stay, stone size, mother's education level, mother's occupation, socioeconomic status, and residence.

Variable	Group A (n = 42) Mean ± SD	Group B (n = 42) Mean ± SD	p-value
Age (months)			
1–6	32.78 ± 4.78	39.65 ± 6.95	0.0001
7–12	30.46 ± 5.71	40.21 ± 7.68	0.0001
Gender			
Male	31.89 ± 5.30	40.78 ± 6.78	0.0001
Female	32.68 ± 4.92	39.59 ± 7.43	0.0001
Stone size (mm)			
≤10	29.83 ± 6.12	38.56 ± 6.75	0.0001
>10	33.09 ± 4.68	40.34 ± 7.13	0.0001
Length of hospitalization (days)			
≤2	30.28 ± 6.19	37.32 ± 6.72	0.0001
>2	34.62 ± 5.36	41.17 ± 7.39	0.0001
Residence			
Rural	32.44 ± 5.60	39.89 ± 6.73	0.0001
Urban	31.26 ± 4.78	39.25 ± 7.09	0.0001
Socioeconomic status (SES)			
Poor	31.68 ± 4.79	38.43 ± 7.32	0.0001
Middle	32.58 ± 5.24	38.56 ± 6.75	0.0001
Upper	32.49 ± 5.76	40.34 ± 7.13	0.0001
Mother's education			
Uneducated	31.89 ± 5.56	39.59 ± 7.43	0.0001
Educated	31.22 ± 4.97	38.56 ± 6.75	0.0001
Mother's occupation			
Unemployed	32.25 ± 5.78	40.34 ± 7.13	0.0001
Employed	31.15 ± 5.52	37.32 ± 6.72	0.0001

and residence is shown in Table 3.

DISCUSSION

According to the current study, PCCL is faster and safer than TUCL, has a shorter operative time, and is associated with fewer urethral complications. The goal of all endoscopic procedures is to remove all stones as quickly as possible, with the fewest complications and a shorter hospital stay.

Aron M et al. claim that PCCL has lower morbidity than open cystolithotomy and fewer problems than TUCL. [12] Some studies suggest that in terms of safety and stone-free rate, PCCL is faster than TUCL and is not less effective. [13, 14] According to Tzortzis V et al., PCCL can be performed safely and efficiently under local anesthesia. It may also be useful when extended urethral instrumentation is not recommended. [15] According to Torricelli FC et al., bladder stones 2-4 cm in size respond equally well to percutaneous or transurethral approaches. [16]

In the current study, a mini-nephroscope and a 15 Fr access sheath were utilized. The stone was subsequently broken up and extracted. Demirel F et al. conducted a similar study.[17]

For this, Akmal M et al.[18] used a percutaneous procedure guided by ultrasound, with gradual dilation using dilators followed by an Amplatz sheath. In this work, we employed a percutaneous approach under direct cystoscopic guidance, followed by repeated dilatation and placement of an Amplatz sheath. The PCCL technique in this study had a significantly shorter mean operative time than the TUCL treatment. Similar results were reported by several other authors. [19-21]

The need for additional stone fragmentation to remove the stone in the TUCL group may have contributed to the lengthy surgical procedure due to the smaller lumen, decreased vision, and the potential for bladder mucosal damage. Lastly, the postoperative stay was considerably shorter in the TUCL group, whereas it was longer in the PCCL group due to suprapubic catheter placement.

The results mentioned above were statistically significant. Similar findings were reported by Karkee RJ et al., who found that the mean length of hospital stay for the TUCL group was 1.9±0.8 days, while the mean length of stay for the PCCL group was 2.7±0.9 days. [22] The results indicated that the operative time for PCCL was significantly shorter than that for TUCL in male children.

Additionally, this conclusion was corroborated by the complication incidence findings for the two surgical procedures, which indicated a higher incidence of urine retention following TUCL than PCCL. The study by Yağmur et al., which included preschool-aged children with bladder stones undergoing PCCL and TUCL, reported mean operative times of 41.1 ± 9.9 minutes and 39.0 ± 12.3 minutes for the PCCL and TUCL groups, respectively, which differ from our results. [23]

Another study by Shahat et al. indicated that children under 14 years old with a median stone size of 10 mm had shorter surgery times for PCCL. [24] Although there was no noticeable difference in the length of hospitalization between the two groups, we observed that patients treated with PCCL had a longer catheter retention period than those treated with TUCL.

By comparing the effectiveness of TUCL and PCCL

in children, this study offers important insights; however, it is essential to recognize the limitations inherent in our research. First, information bias could have resulted from the study's quasi-experimental design. Second, our small sample size may have affected the statistical power of the findings. This limitation might have introduced bias into our research, restricting how broadly the results can be generalized.

CONCLUSION

In PCCL, the wider lumen of the Amplantz sheath and the use of a nephroscope allow for easier fragmentation, better visibility, faster removal of even larger bladder stone fragments, fewer urethral-related complications, and a shorter operative time. Because of this, it appears to be a superior treatment for bladder stones compared to TUCL.

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Ullah I	✓	✓	×	×	✓	×
Ahmad T	✓	×	✓	✓	✓	×
Ali M	✓	✓	×	×	×	✓
Muhammad S	✓	×	✓	✓	✓	×
Ali S	✓	✓	×	×	×	✓
Ullah E	✓	×	✓	✓	✓	×

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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ORIGINAL ARTICLE

COMPARISON OF STONE-FREE RATES FOLLOWING EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY (ESWL) AND RETROGRADE INTRARENAL SURGERY (RIRS) FOR RENAL PELVIC STONES MEASURING 1–2 CM

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ABSTRACT

Objective: This study aimed to determine the effectiveness of extracorporeal Shock Wave Lithotripsy and retrograde Intrarenal Surgery on obtaining stone-free status for renal pelvic stones measuring 1-2 cm in diameter.

Material & Methods: This quasi-experimental study was conducted at the Department of Urology, Khyber Teaching Hospital, Peshawar, where a total of 60 patients with renal pelvic stones measuring 1–2 cm were randomly assigned to two equal groups: ESWL (n = 30) and RIRS (n = 30). Stone clearance was assessed on the 7th postoperative day using ultrasound and X-ray KUB.

Results: The mean age of participants in Group A (ESWL) increased to 41 years (SD = 10.67), while the mean in Group B (RIRS) increased to 42 years (SD = 9.09). For Group A (ESWL), the sample included 20 males and 10 females, representing 67% and 33%, respectively. For Group B (RIRS), 21 participants were males, and 9 were females, accounting for 70% and 30%, respectively. The Chi-square test results indicate no statistically significant difference between the two groups regarding gender ratio (p = 0.7813). The data indicated that the patients with renal pelvic stones of 1–2 cm were more likely to be stone-free after retrograde intrarenal surgery (RIRS) than after extracorporeal shock wave lithotripsy (ESWL). In the RIRS group, 73% were stone-free, while only 33% were stone-free in the ESWL group (p = 0.0019).

Conclusion: The study finds that RIRS is more effective than ESWL for managing 1-2cm renal pelvic stones. RIRS achieves higher stone-free rates, especially when anatomical difficulties and challenges associated with ESWL are common, and it can precisely locate stones and utilize advanced laser treatment features.

Keywords: stone-free rate, renal pelvic stones, urolithiasis, retrograde Intrarenal surgery, extracorporeal Shock Wave lithotripsy.

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INTRODUCTION

Urolithiasis, also known as kidney stones, is a common medical condition affecting thousands of people worldwide. Research indicates that up to 50% of sufferers experience a recurrence of stones within five years. [1, 2] Those struggling with kidney stones often endure symptoms such as severe pain, hematuria, urinary tract infections, reduced kidney function, and, in severe cases, kidney failure. In developing countries, the prevalence of urolithiasis is estimated to range from 10% to 15%, but only 1–2% of symptomatic patients seek treatment at medical facilities. [3] As the number of cases continues to rise, there is an urgent need for effective and accessible treatment options.

Several techniques are used to treat kidney stones, including extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), and retrograde intrarenal surgery (RIRS). ESWL, a non-invasive procedure, is popular because it is easy to perform, doesn't require surgery, and is available in most healthcare settings. [4, 5] However, ESWL has limitations. For instance, it is less effective in overweight patients, has difficulty with radiolucent stones (which aren't visible on X-rays), and may cause headaches in those with urinary tract infections. Conversely, RIRS, a minimally invasive technique, has shown excellent outcomes for stones measuring 1–2 cm, with higher stone-free rates and fewer follow-up procedures compared to ESWL. [6-8] Despite these advantages, ESWL remains the first-line treatment for renal pel-

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vic stones smaller than 2 cm, as recommended by the 2012 European Association of Urology (EAU) guidelines. In clinical practice, choosing between ESWL and RIRS for 1–2 cm renal pelvic stones often depends on factors such as resource availability and the healthcare professional's preference. However, there is a lack of robust randomized controlled trials comparing the two approaches, creating a gap in the evidence.

This study aims to address this gap by directly comparing the effectiveness of ESWL and RIRS in reaching a stone-free status for renal pelvic stones measuring 1–2 cm. We hypothesize that RIRS will be more effective than ESWL in achieving stone-free rates for this stone size.

MATERIALS AND METHODS

This quasi-experimental study was conducted at the Department of Urology, Khyber Teaching Hospital, Peshawar, from June 7, 2023, to January 6, 2024. Sixty patients with renal pelvic stones measuring 1-2 cm were enrolled in the study.

The sampling process was regulated by clearly defined inclusion and exclusion criteria, which ensured the homogeneity and validity of the results. Ethical approval from Khyber Medical College was obtained, and all participants provided written informed consent before enrollment. The following criteria were used to select participants:

1. Patients aged between 18 and 60 years.
2. A single renal pelvic stone measuring 1–2 cm, confirmed by ultrasound and non-contrast CT KUB.
3. Renal Function: Normal RFT, defined as serum creatinine < 1.2 mg/dL or eGFR > 60 mL/min/1.73 m^2.
4. No prior surgical interventions for urolithiasis.
5. Consent: Willingness and ability to provide written informed consent.
6. Patients were excluded from the study if they met any of the following conditions:
7. Stone Size: Larger than 2cm with multiple stones.
8. Radiolucent Stones: Stones not detectable on imaging.
9. Pregnancy: Pregnant women were excluded.
10. Infections: Active urinary tract infection (defined as a positive urine culture with > 10^5 CFU/mL). These patients were excluded until completion of antibiotic therapy and confirmation of sterile urine.
11. Comorbidities: Uncontrolled comorbidities, such as:
12. Uncontrolled diabetes mellitus (HbA1c > 8%).
13. Uncontrolled hypertension (BP > 160/100 mmHg).
14. Coagulopathies: Patients with coagulopathies or those on anticoagulant therapy that could not be temporarily discontinued.
15. Anatomical Abnormalities: Any anatomical abnormalities of the urinary tract that could complicate the procedure.

Patients were consecutively recruited from the urology outpatient clinic at Khyber Teaching Hospital. Diagnosis of renal pelvic stones was confirmed using ultrasound and non-contrast CT KUB. All eligible individuals were contacted, and those willing to participate in the study signed informed consent forms.

The patients were allocated into two equal groups of 30 patients each based on the planned treatment modality. Group A consisted of patients who underwent extracorporeal shock wave lithotripsy under local anesthesia. Group B consisted of patients who underwent retrograde intrarenal surgery with flexible ureteroscopy under general anesthesia.

TREATMENT PROTOCOLS

The ESWL Protocol: The treatment was done in either the supine or the lateral position, following its own routine methodology. Pain relief (analgesia) was provided as needed.

• The RIRS Protocol: During flexible ureteroscopy, the patient was positioned in lithotomy. The patient was relaxed and secure while general anesthesia was administered, enabling laser lithotripsy to break the stones.

Postoperative stone clearance was assessed on day 7 by ultrasound and X-ray KUB. Any leftover fragments were noted.

OUTCOME MEASURES

The main deliverable was the stone-free rate, defined as the primary outcome: the absence of stones on the imaging scan. The secondary outcomes include: 1. Complications: Any unfavorable results from the procedure. 2. Pain Levels: The degree of pain experienced by patients after surgery. 3. Recovery Time: The period during which the patient is fully functional and able to perform regular activities.

DATA ANALYSIS

We used SPSS version 25 software to conduct the analysis. Percentages described categorical data, while

continuous variables were summarized as means with standard deviations. Chi-square tests were applied for categorical variables, and t-tests were used for continuous variables. We considered results statistically significant at $p < 0.05$.

RESULTS

The mean age of participants in Group A (ESWL) increased to 41 years (SD = 10.67), while the mean in Group B (RIRS) increased to 42 years (SD = 9.09). The data indicated that the patients with renal pelvic stones of 1–2 cm were more likely to be stone-free after retrograde intrarenal surgery (RIRS) than after extracorporeal shock wave lithotripsy (ESWL). In the RIRS group, 73% were stone-free, while only 33% were stone-free in the ESWL group ($p = 0.0019$).

An independent samples t-test revealed no statistically significant difference between the two groups ($p = 0.6974$). Thus, age was relatively constant in the two groups, eliminating the potential risk of age confounding the results (Table 1).

For Group A (ESWL), the sample included 20 males and 10 females, representing 67% and 33%, respectively. For Group B (RIRS), 21 participants were males, and 9 were females, accounting for 70% and 30%, respectively. The Chi-square test results indicate no statistically significant difference between the two groups regarding gender ratio ($p = 0.7813$). see table 2 for details.

Group A had an average pelvic stone duration of 1 year, with a standard deviation of 1.31, while Group B had an average duration of 1 year, with a standard deviation of 1.37. An independent samples t-test comparing the two groups' mean and standard deviation showed no statistically significant difference (Table 3). This indicates that the stone's chronicity was similarly represented in both treatment groups. ($p=1.000$).

In ESWL (Group A), the mean stone size was 1.3cm (SD ± 0.57), while in RIRS (Group B), the mean stone size was 1.5cm (SD ± 0.61). An independent samples t-test showed that the mean stone sizes in both groups are not significantly different ($p=0.1946$). Both groups exhibited a similar distribution of stone sizes, indicating no bias toward a specific size in either treatment (Table 4).

Overall, Group A (ESWL) had 33% of patients who were stone-free (table 5), while Group B (RIRS) had 73%. A Chi-square test showed that the difference in stone-free rates between the two groups was statistically significant ($p=0.0019$).

This suggests that RIRS is more effective than ESWL in achieving stone-free status for renal pelvic stones, considering the study's limitations.

When the stone-free rate is broken down by age, a gap appears between the two age groups. For the 20-to-30-year age range, there is no significant difference ($p = 0.0618$). However, in the 31 to 50-year age group, there is a statistically significant difference ($p = 0.0134$), showing that the RIRS group is more successful in achieving a stone-free status. This finding should be noted in the data analysis (Table 6).

In the stone-free rate analysis, stratifying by sex revealed significant differences (Table 7). In men, there was a significant difference in achieving stone-free status between the two groups ($p = 0.0346$), indicating that RIRS produces better outcomes in this subgroup. In female patients, a difference in stone-free status was also observed ($p=0.0372$), suggesting better outcomes with RIRS.

In the two groups analyzed, the rate of being stone-free varied significantly at the 1cm stone threshold ($p = 0.0096$). For 2 cm stones, the difference was not significant ($p=0.0858$); however, the RIRS group appeared to have better outcomes (Table 8). This suggests that RIRS is more effective for smaller stones (1 cm), whereas both techniques are comparable in terms of free status for larger stones.

Table No 1: Age Distribution of Study Groups:

Age Range	Group A (ESWL) n (%)	Group B (RIRS) n (%)
20-30 Years	11 (37%)	12 (40%)
31-50 Years	19 (63%)	18 (60%)
Total	30 (100%)	30 (100%)
Mean ± SD (years)	41 ± 10.67	42 ± 9.09 (P-Value: 0.6974)

Table No 2: Gender Distribution of Study Groups:

Gender	Group A (ESWL) n (%)	Group B (RIRS) n (%)
Male	20 (67%)	21 (70%)
Female	10 (33%)	9 (30%)
Total	30 (100%)	30 (100%)

Table No 3: Duration of Pelvic Stone:

Duration of Pelvic Stone	Group A (ESWL) n (%)	Group B (RIRS) n (%)	Mean ± SD (years)
≤ 1 Year	13 (43%)	14 (47%)	1 ± 1.31
> 1 Year	17 (57%)	16 (53%)	1 ± 1.37
Total	30 (100%)	30 (100%)	

Table No 4: Stone Size Distribution:

Stone Size	Group A (ESWL) n (%)	Group B (RIRS) n (%)	Mean ± SD (cm)
1 cm	21 (70%)	22 (73%)	1.3 ± 0.57
2 cm	9 (30%)	8 (27%)	1.5 ± 0.61
Total	30 (100%)	30 (100%)	

Table No 5: Overall, Stone-Free Rate:

Stone-Free	Group A (ESWL) n (%)	Group B (RIRS) n (%)
Yes	10 (33%)	22 (73%)
No	20 (67%)	8 (27%)
Total	30 (100%)	30 (100%)

Table No 6: Stone-Free Rate Stratified by Age Distribution:

Age Range	Stone-Free	Group A (ESWL) n	Group B (RIRS) n	P-value
20-30 Years	Yes	4	9	0.0618
	No	7	3	
	Total	11	12	
31-50 Years	Yes	6	13	0.0134
	No	13	5	
	Total	19	18	

Table No 7: Stone-Free Rate Stratified by Gender:

Gender	Stone-Free	Group A (ESWL) n	Group B (RIRS) n	P-value
Male	Yes	7	15	0.0346
	No	13	6	
	Total	20	21	
Female	Yes	3	7	0.0372
	No	7	2	
	Total	10	9	

Table No 8: Stone-Free Rate Stratified by Stone Size:

Stone Size	Stone-Free	Group A (ESWL) n	Group B (RIRS) n	P-value
1 cm	Yes	7	16	p = 0.0096
	No	14	6	
	Total	21	22	
2 cm	Yes	3	6	p = 0.0858
	No	6	2	
	Total	9	8	

DISCUSSION

This research emphasizes the superiority of RIRS over ESWL in achieving a stone-free state in patients with pelvic stones measuring 1-2 cm. Although ESWL is a non-invasive procedure accessible to almost all patients, its effectiveness is often limited by stone size, as well as the patient's anatomy and radiological features. [4, 5] Conversely, RIRS, while not completely minimally invasive, can precisely target the stone using a laser, resulting in a high stone removal rate. [7, 8] The results of this study support previous research demonstrating RIRS's advantages over ESWL in providing better outcomes for patients with similarly sized stones (8, 9). For example, Resorlu et al. (2013) reported high stone-free rates for medium-sized kidney stones, highlighting the clinical effectiveness of RIRS. [3] Additionally, laser lithotripsy during RIRS effectively breaks down stones, decreases the need for additional procedures, and improves patient outcomes. [7, 9] The primary benefit of RIRS is its ability to overcome certain physical limitations that can hinder the success of ESWL.

For example, patients with kidney stones or hydronephrosis located at the lower pole of the kidneys tend to be very challenging to treat with limb shock wave lithotripsy and stone manipulation using ESWL. [4, 5] In these cases, RIRS achieves more complete stone clearance and a lower likelihood of leaving fragments behind. [7, 8] However, this study has limitations that warrant attention. The main characteristics of this study are its relatively small sample size and the short follow-up period. Future research should focus on long-term follow-up with larger patient populations.

CONCLUSION

The study concludes that RIRS is more effective than ESWL for managing 1-2 cm renal pelvic stones. RIRS shows higher stone-free rates, especially when anatomical difficulties and challenges typical of ESWL are present. It also offers the ability to accurately locate stones and utilizes advanced laser features.

Healthcare professionals should include specifics about the individual patient, such as stone characteristics, its location, and the patient's anatomy, when developing the operative plan. While RIRS remains the most appropriate approach for treating 1-2 cm stones, especially when resources and expertise are readily available, ESWL may also be useful in certain cases.

Further research is required to explore the supporting outcomes of RIRS, such as long-term impacts, cost-effective options, and patient experiences, to fully validate these benefits of the RIRS procedure. There should also be an effort to expand the use of RIRS across different patients and healthcare systems to facilitate access to advanced treatment options.

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Rehman IU	✓	✓	×	×	✓	×
Ullah H	✓	×	✓	✓	✓	×
Ali M	✓	✓	×	×	×	✓
Sabir M	✓	×	✓	✓	✓	×
Iqbal MA	✓	✓	×	×	×	✓
Shah SAB	✓	×	✓	✓	✓	×

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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This study was approved by the Institutional Ethical Review Board of Khyber Teaching Hospital, Peshawar, Pakistan Vide No. 43/DME/KTH, Dated: 16/01/2025

SENSORINEURAL HEARING IMPAIRMENT (SNHI) IN PATIENTS WITH TYPE 2 DIABETES MELLITUS: A CROSS-SECTIONAL STUDY AT A TERTIARY CARE HOSPITAL IN PAKISTAN

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ABSTRACT

OBJECTIVE: To assess the prevalence of sensorineural impairment in patients with type 2 diabetes and to explore the relationship between hearing loss and variables such as age, gender, HbA1C, and duration of diabetes.

MATERIALS AND METHODS: This cross-sectional study was conducted from April to August 2025 and included patients with type 2 diabetes mellitus. Data were collected using the Hearing Handicap Inventory for Adults (HHIA) to screen for diabetes among individuals with hearing impairment. A non-probability convenience sampling method was used. Pure-tone audiometry (PTA) was employed to assess hearing. SPSS Statistics version 20 was used for data analysis. The chi-square test was used to assess associations, with results presented as frequencies and percentages.

RESULTS: The study included 195 patients with Type 2 Diabetes mellitus aged 25-65 years. Of these, 7.7% were found to have sensorineural hearing loss, which primarily affects higher frequencies (2-4 kHz) and is usually mild to moderate. Additionally, it was found that sensorineural hearing impairment was significantly ($p<0.005$) associated with diabetes duration, hypertension, poor glycemic control, and chronic kidney disease.

CONCLUSION: In this study, SNHI was found in only a small portion of diabetic patients. HHIA responses showed that most participants faced minimal hearing-related issues, while a significant link was observed between SNI and the duration of diabetes, poor blood sugar control, hypertension, and chronic kidney disease.

KEYWORDS: Pure Tone Audiometry, Sensorineural Hearing Impairment, and Diabetes Mellitus

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INTRODUCTION

There is limited awareness of hearing loss as a comorbid condition associated with type 2 Diabetes. [1] The prevalence of diabetes mellitus is rising at a startling rate. The World Health Organisation (WHO) estimates that the global prevalence was approximately 537 million in 2021 and could rise to 783 million by the end of 2045. [2, 3] About 35% to 60% of people with diabetes have auditory deficits, and chronic hyperglycemia can cause sensorineural hearing loss (SNHL), which is an independent risk factor for the onset of hearing impairment (HI). [4]

According to data from the European Centre for Disease Prevention and Control (ECDC), the World Health Organization (WHO) estimates that 20.3% of people worldwide experience SNHI. People with type 2 diabetes mellitus (T2DM) have a 30% higher prevalence of SNHI than those without the disease. [5, 6] Additionally, according to the American Diabetes Association, SNHI is twice as common in patients with T2DM compared to non-diabetic patients. A Canadian meta-analysis found that the prevalence of SNHI among patients with T2DM ranges from 44% to 69.7%. [8] According to a local study conducted in India, 76.8% of diabetic patients have sensorineural hearing loss (SNHL). [9]

While little is known about SNHI in Pakistan, a study from Southern Punjab found that 46.1% of T2DM patients had the condition, and another study from Lahore with a sample of 325 people found that 36.6% (n=119) had hearing loss across all frequencies, with 30.8% experiencing mild to severe hearing loss at high frequencies. [10, 11]

Therefore, the current study aims to assess the prevalence of sensorineural hearing loss and its association with hypertension, poor glycemic control, and chronic kidney disease among patients with T2DM in our region.

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Understanding the extent of hearing loss in this group could raise awareness of the importance of regular auditory screening in diabetic patients and encourage earlier interventions to prevent the progression of hearing decline.

MATERIAL AND METHODS

A descriptive cross-sectional study was carried out at Khyber Teaching Hospital in Peshawar, Pakistan, from April to August 2025. A sample size of 195 was determined using the WHO sample size calculator, with 95% confidence, a 0.05 margin of error, and a prevalence of 21% from a prior study. [12] A total of 195 diabetic patients aged 25 years and older were recruited from both outpatient and inpatient departments. A non-probability convenience sampling method was used. Data was collected using the Hearing Handicap Inventory for Adults (HHIA) along with an audiometric assessment. [13] The questionnaire was initially piloted to assess its reliability, resulting in a Cronbach's alpha of 0.82. Data collection commenced after approval from the Institutional Research and Ethics Board (IREB) at Khyber Teaching Hospital.

Sensorineural hearing loss was assessed using pure-tone audiometry. The Hearing Handicap Inventory for Adults (HHIA) served as a screening tool to identify early hearing impairment and to evaluate the social and emotional impacts of hearing loss in adult patients with type 2 diabetes mellitus. [14] HHIA responses were scored on a three-point scale (Yes = 4, Sometimes = 2, No = 0). Total scores ranged from 0 to 100, with higher scores indicating a greater perceived hearing handicap. Patients aged 25 to 65 with known T2DM were included in the study, while those with congenital hearing impairments, a history of ototoxic drug use, or acute or chronic ear infections were excluded. Data were analyzed using SPSS software version 20. The prevalence of SNHI was calculated, and its association with variables such as age, diabetes duration, and HbA1c was assessed using the chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 195 T2 DM patients participated in this cross-sectional study. The participants' average age was 52.25 years (SD = 6.682). Most participants (120; 61.5%) were from rural areas, while 75 (38.5%) were from urban areas. The largest group had no formal education (66.2%; n = 129), followed by those with primary education (16.4%; n = 32), secondary education (10.3%; n = 20), and diploma or higher (7.2%; n = 14). According to 91.3% of participants, there was no noise at their workplace. Six percent reported frequently hearing loud noises.

HHIA responses indicated that most participants experienced minimal hearing-related difficulties, with only a small proportion reporting problems in conversational or noisy environments. Audiometric evaluation showed that 92.3% of participants had normal hearing, while 7.7% had sensorineural hearing impairment (SNHI), mostly bilateral (5.6%). SNHI was identified in 7.2% of right ears and 6.2% of left ears across tested frequencies. Most affected ears experienced mild to moderate hearing loss, with only a small number having severe or profound loss. On chi-square analysis, duration of type 2 diabetes mellitus ($p = 0.006$), poor glycemic control ($p = 0.021$), occupation in a noisy environment ($p = 0.028$), hypertension ($p = 0.014$), and chronic kidney disease ($p = 0.003$) showed a statistically significant association ($p < 0.05$). In contrast, gender ($p = 0.703$), age ($p = 0.738$), residence ($p = 0.526$), education level ($p = 0.853$), occupation ($p = 0.700$), family history of hearing impairment ($p = 0.694$), and heart disease ($p = 0.921$) were not significantly associated ($p > 0.05$).

DISCUSSION

The current study examined the frequency and correlates of sensorineural hearing impairment (SNHI) in patients with type 2 diabetes mellitus (T2DM). It found a general prevalence of 7.7%, with 2.1% having unilateral and 5.6% bilateral SNHI. Compared to various regional and international studies, this prevalence is notably lower. Studies in Eastern and Southern India have shown that diabetic populations tend to have much higher rates of SNHI. In India, research by Mishra et al. and Vybhavi et al. reported prevalence rates of 90.2% and 70.76%, respectively, with significant associations to age, duration of diabetes, and HbA1c levels. [15, 16] Meanwhile, Shafiepour et al. in Iran found a prevalence of 71.3%, linked to age and blood pressure. [17] Esubalew et al. in Ethiopia reported a prevalence of 50.49%, associated with age, hypertension, and hyperlipidemia. [13] In our study, no link with age was observed, but a significant association with hypertension was identified.

Higher prevalence rates have also been observed in Pakistani data. Manzoor et al. reported a 36. 6% prevalence, mainly at higher frequencies, while Asghar et al. reported 74. 7% SNHL, with most cases being mild to moderate. [11, 18] These findings are inconsistent with our study. However, Uddin et al. found that individuals with poor glycemic control had higher rates of hearing loss, aligning with our results. [19] Several methodological and demographic factors may explain the lower frequency observed here. First, thresholds >25 dB at 0. 5–4 kHz were used to define hearing impairment, possibly missing subclinical high-frequency losses. Second, unlike many studies with older participants, the average age in our sample was lower (mean age of 52.25 years). Third, studies reporting higher prevalence often included patients with long- standing diabetes, but only one- third of participants had diabetes for over ten years. Despite the lower overall prevalence, notable correlations emerged: patients with chronic kidney disease (CKD) ($p = 0. 003$), poor glycemic control (HbA 1 c> 7. 7.1%, $p = 0. 021$), noisy occupational exposure ($p = 0. 028$), hypertension ($p = 0. 014$), and longer diabetes duration ($p = 0. 006$) were more likely to have hearing impairment. These findings support the existing literature linking cumulative microvascular and neural damage in diabetes to auditory dysfunction (Gioacchini et al., 2021). [20] A multicenter study from Ethiopia suggested

that CKD and hypertension share microangiopathic pathways that may exacerbate cochlear damage, consistent with our findings of a strong association between hearing impairment and both CKD and hypertension. Although occupational noise exposure affected only 8.7% of participants, it likely increased their susceptibility to diabetic cochlear hearing loss. Moreover, early subjective complaints, such as trouble hearing in noisy environments (21. 5%), highlight the importance of routine auditory screening in diabetic patients, as recommended by Asghar et al. [18] Interestingly, SNHI was not significantly associated with age (p = 0. 738) or gender (p = 0. 703), unlike several studies in India by Vybhavi et al. [16] and Iran by Shafiepour et al. [17], where age was a strong predictor. This difference may be due to our smaller age range (32–60 years). Similarly, cardiovascular disease showed no significant correlation (p = 0. 921), contrasting with a study from Southern Punjab by Majid et al., which linked hearing loss to diabetic retinopathy and other vascular complications. This study has some limitations. Since it is cross-sectional, we cannot determine causation. Additionally, because the study was conducted in a hospital setting, its findings might not apply to the broader diabetic population. However, the study emphasizes the importance of including audiometric screening in diabetes care, especially for those with long-term diabetes, poor glycemic control, or co-existing hypertension and chronic kidney disease.

CONCLUSION

In this study, SNHL was found in only a small percentage of patients with diabetes. HHIA responses showed that most participants experienced minor hearing difficulties, while a significant link was identified between SNI and the duration of diabetes, poor glycemic control, hypertension, and chronic kidney disease.

Table No 1: Frequency Distribution of Hearing Handicap Inventory for Adults (HHIA) Responses

Variables	Response	Frequency	Percentage
Do you Frequently asking others to repeat themselves?	Yes	36	18.5%
	No	159	81.5%
Do you have Trouble when conversations involve more than two people?	Yes	42	21.5%
	No	153	78.5%
Do you think that others are mumbling?	Yes	17	8.7
	No	178	91.3
Do you have Problems hearing in noisy places such as busy restaurants?	Yes	42	21.5
	No	153	78.5
Does your hearing problem make it difficult to listen to TV or radio	Yes	12	6.2
	No	183	93.8
Do you avoid telephone conversation due to hearing difficulties?	Yes	8	4.1
	No	187	95.9
Does your hearing problem make you talk to family members less?	Yes	13	6.7
	No	182	93.3
Which statement best describes your ability to hear with your ear (without a hearing aid)?	Good	154	79
	Little trouble	38	19
	A lot of trouble	03	1.5

Table No 2: Frequency of clinical and biochemical characteristics

Variable	Response	Frequency	Percentage
Duration after being diagnosed with Type 2 Diabetes?	5-1 years	69	35.4
	10-6 years	60	30.8
	More than 10 years	66	34
Have you been diagnosed with hypertension?	Yes	94	48.2
	No	101	51.8
History of heart disease?	Yes	44	22.6
	No	151	77.4
History of chronic kidney disease?	Yes	34	17.4
	No	161	82.6
Glycemic control (HbA1c level if available)	Good (HbA1c<%7)	63	32.3
	Poor (HbA1c>%7.1)	132	67.7

Table No 3: Audiometric characteristics

Variable	Response	Frequency	Percentage
SNHI	unilateral	4	2.1
	Bilateral	11	5.6
	Normal hearing	180	92.3
Presence of SNHI at 0.5,1,2, and 4kHz in the Right Ear.	Yes	14	7.2
	No	181	92.8
The Severity of SNHI in the right ear.	Mild(40-26dB)	8	57.1
	Moderate(55-41dB)	4	28.6
	Moderately Severe (70-56dB	0	0.0
	Severe(90-71dB)	1	7.1
	Profound(>90dB)	1	7.1
Presence of SNHI at 0.5,1,2, and 4kHz in the Left Ear.	Yes	12	6.2
	No	183	93.8
The Severity of SNHI in the left ear	Mild(40-26dB)	8	66.7
	Moderate(56-41dB)	3	25.0
	Moderately Severe(70-56dB)	1	8.3
	Severe (90-71dB)	0	0
	Profound (>90dB)	0	0

Table No 4: Association of SNHL with Diabetes Mellitus

Variable	Response	Unilateral SNHL	Bilateral SNHL	Normal hearing	P-value
Duration of T2DM	1-5 years	1.4	0.0	98.6	0.006
	6-10 years	5.0	1.7	93.3	
	11-15 years	0.0	11.8	88.2	
	More than 16 years	3.1	15.6	81.3	
Glycemic control (HbA1c)	Good< 7%	0.0	0.0	100	0.02
	Poor >7%	3.8	7.6	88.6	

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Hassan FU	✓	✓	×	×	✓	×
Huma S	✓	×	✓	✓	✓	×
Afridi FN	✓	✓	×	×	×	✓
Zaib S	✓	×	✓	✓	✓	×
Mustafa A	✓	✓	×	×	×	✓
Huraira A	✓	×	✓	✓	✓	×

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This study was approved by the Institutional Ethical Review Board of Khyber Medical College, Peshawar, Pakistan Vide No. 662/DME/KMC, Dated; 04/01/2024

ORIGINAL ARTICLE

ASSESSING STUDENT ENGAGEMENT IN FORENSIC MEDICINE IN AN INTEGRATED UNDERGRADUATE MEDICAL CURRICULUM: A CROSS-SECTIONAL STUDY AT A MEDICAL COLLEGE IN PAKISTAN

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ABSTRACT

Objective: This study aimed to assess medical students' engagement levels and identify socio-demographic factors associated with participation.

Materials and Methods: A cross-sectional study was performed at a single medical college using self-reported surveys to assess student engagement across different age groups, genders, and academic years. Data were analyzed to determine the prevalence of "Good," "Neutral," and "Poor" engagement levels, with $P < 0.05$ set as the cutoff for statistical significance.

Results: Most students (63.75%) exhibited a neutral level of engagement, while 20% demonstrated high engagement and 16.25% reported low engagement. Significant correlations were found between engagement and demographic variables ($P < 0.05$); notably, high engagement was most common among 21-year-olds (47.7%) and third-year students (59.6%), whereas engagement decreased significantly in older students and those in their fourth year of MBBS. Female students also reported significantly higher "Good" engagement (36.9%) compared to their male counterparts (1.31%).

Conclusion: Engagement levels notably decline as students advance through their medical education and age. Although the study is limited by its single-center, cross-sectional design, these findings highlight the importance of targeted interventions to sustain student motivation in the later stages of medical training.

Keywords: Student engagement, Modular Teaching System, Impact of Assessment Weightage, student motivation

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INTRODUCTION

Globally, teaching methods are continually evolving, encouraging educators to adopt more effective, student-centered approaches that improve students' understanding and retention of complex subjects. [1]

A well-structured curriculum is widely recognized as crucial for achieving optimal learning outcomes; however, efforts to implement broad institutional reforms often overlook deeper, systemic barriers that impede education quality at the subject level. Specifically in the medical field, curriculum design must align with international standards while also addressing local healthcare needs. [2]

Forensic medicine, legal medicine, and forensic pathology are often used interchangeably to refer to a specialized field where detailed medical knowledge intersects with the legal and justice systems.

This intersection is essential for evidence-based legal decisions. More specifically, Clinical Forensic Medicine (CFM) focuses on examining and managing living individuals in legal contexts, such as victims of assault or

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sexual abuse, while forensic pathologists mainly work with deceased individuals to determine the cause and manner of death. [4]

Although CFM is gaining significant prominence and professional recognition worldwide, in countries like India, the crucial medico-legal responsibilities are unfortunately often assigned to undertrained general practitioners, highlighting the urgent need for structured, comprehensive undergraduate training in this discipline. [5]

Health sciences education today requires collaborative learning environments, practical exposure to real-world scenarios, and strong ethical competence, especially as emerging challenges like new infectious diseases and rapidly advancing digital technologies demand multidisciplinary approaches. Importantly, basic forensic training greatly enhances a future doctor's ability to identify abuse, ensure full compliance with legal procedures, and maintain accurate case documentation. Despite its importance, many medical institutions rely mainly on a theoretical, lecture-based pedagogical model, often failing to connect the subject to clinical practice. [6]

In contrast, several countries, such as Germany, Switzerland, Italy, and the UK, incorporate critical medico-legal skills into their undergraduate curricula, including hands-on experience in conducting post-mortem examinations and understanding legal procedures for certifying death. [7] Similarly, in Malaysia, forensic medicine is well-established as a core subject, where autopsy-based teaching actively supports simultaneous learning in anatomy and raises awareness of legal responsibilities. Even when teaching hours are limited, students recognize the high value of forensic medicine, although data often show that their active, voluntary participation remains consistently low. [8]

To improve this, virtual learning platforms offer a promising way to boost engagement, develop ethical decision-making skills, and build professional competence by providing safe, simulated learning environments. Additionally, educational models in countries like Russia focus on developing critical thinking and communication skills through modern blended learning strategies. These include innovative methods such as CLIL (Content and Language Integrated Learning), the flipped classroom model, and project-based learning. [9] Such modern approaches are vital for increasing student engagement and supporting lifelong learning, which are essential for medical professionals.

While integrated medical curricula generally correlate with improvements in student satisfaction and knowledge retention, most research to date has focused on the overall curriculum rather than on engagement within specific subjects. As a result, there remains a significant research gap in fully understanding how student engagement in Forensic Medicine is specifically shaped and influenced within these integrated curricular models. Factors such as the chosen teaching methodology (e.g., problem-based learning, in-depth case discussions, or simulation exercises), institutional assessment practices, and students' perceived clinical relevance of the subject significantly affect their overall engagement. [10]

This study, therefore, aims to examine the key factors among undergraduate medical students, providing targeted, practical insights to improve forensic medicine education within the integrated curriculum.

OBJECTIVES

To assess students' engagement in forensic medicine within an integrated undergraduate medical curriculum and identify factors that influence this engagement.

To determine the association between student engagement and variables such as gender, academic year, and assessment weightage.

MATERIALS AND METHODS

This cross-sectional study was conducted among 3rd- and 4th-year MBBS students at Khyber Medical College, Peshawar. A total of 160 students were selected using an online sample size calculator, based on data from Vidua et al. (2020). Probability random sampling was used to recruit participants. All students in 3rd and 4th year were eligible for inclusion, while those who did not give consent were excluded. [11] Written informed consent was obtained from all participants. Confidentiality was maintained by anonymizing all collected data.

Data were collected using a structured Student Engagement Questionnaire (Annexure II), which assessed participants' engagement and interest in forensic medicine learning activities. The questionnaire had three sections: The first three variables—Student Motivation, Modular Teaching System Feedback, and Impact of Assessment Weightage—are each measured by summing the scores of three dedicated questions.

For each section, the total possible score ranges

from 3 to 15. A high score of 10–15 indicates a positive outcome (high motivation, positive feedback, or strong perceived impact), while a score of 6–9 reflects neutral responses. Scores below 5 signify poor motivation, negative feedback, or a negative perceived impact of assessment weightage, respectively.

Each section included three items, totaling nine questions, all rated on a 5-point Likert scale from "Strongly Disagree" (1) to "Strongly Agree" (5). A demographic section was also included to record age, gender, and academic year. This aggregate score is calculated by summing the responses to all nine questions, yielding a total score of 9 to 45. Overall engagement is categorized into three tiers:

Good Engagement: 35–45

Neutral Engagement: 20–34

Poor Engagement: Below 19

Data analysis was performed using SPSS version 22. Descriptive statistics, including means, standard deviations, frequencies, and percentages, summarized the data. Comparative analyses were conducted with the Chi-square test to examine the relationship between academic year (3rd vs. 4th) and address the study objective. Associations between student engagement and variables such as gender and academic year were also analyzed using the Chi-square test. A p-value of less than 0.05 was deemed statistically significant.

RESULTS

A total of 160 MBBS students participated in the study, with complete data for all variables. The average age of the participants was 21.99 ± 0.99 years. Most students were 21 years old (40.6%), followed by 22 years old (28.1%), indicating that the majority of respondents were in the early stage of their medical education (Table 1).

Regarding gender distribution, 76 (47.5%) participants were male and 84 (52.5%) were female. Overall, 32 students demonstrated high engagement, 102 showed neutral engagement, and 26 showed poor engagement (Figure 1). Figure 2 shows student engagement levels, with 63.75% having a neutral engagement. Higher engagement accounts for 20.00% of students, while 16.25% are categorized as having low engagement.

Table 2 indicates that student engagement is significantly affected by demographic and academic factors, with p-values less than 0.05 across all categories. While the overall population is mostly neutral at 63.75%, higher engagement is significantly more common among younger students, particularly those aged 21 (47.7%), and among female students (36.9%). Conversely, engagement seems to decrease sharply with age and academic progress; 92.8% of 24-year-old students and 24.07% of fourth-year MBBS students report "poor" engagement, compared to 0% in both the 21-year-old and third-year groups. Overall, the findings show significant links among MBBS students between student engagement level and gender, age, and academic year.

Table No 1: Frequency Distribution of Ages in Years

Age in years	Frequency	Percent
21	65	40.6
22	45	28.1
23	36	22.5
24	14	8.8
Total	160	100.0

Table No 2: Association of students' engagement with different variables

variables	Categories	Engagement			P value
		Good	Neutral	Poor	
Age	21 years	31(47.7 %)	34 (52.3 %)	0 (0.00 %)	< 0.05
	22 years	0 (0.00 %)	32 (71.1 %)	13 (28.9 %)	
	23 years	1 (2.77 %)	35 (97.2 %)	0 (0.00 %)	
	24 years	0 (0.00 %)	1 (7.14 %)	13 (92.8 %)	
Gender	Male	1 (1.31 %)	49 (64.4 %)	26 (34.21%)	< 0.05
	Female	31(36.9 %)	53 (63 %)	0 (0.00 %)	
MBBS year	Third year	31 (59.6 %)	21 (40.38 %)	0 (0.00 %)	< 0.05
	Fourth year	1 (0.92 %)	81 (75 %)	26 (24.07 %)	

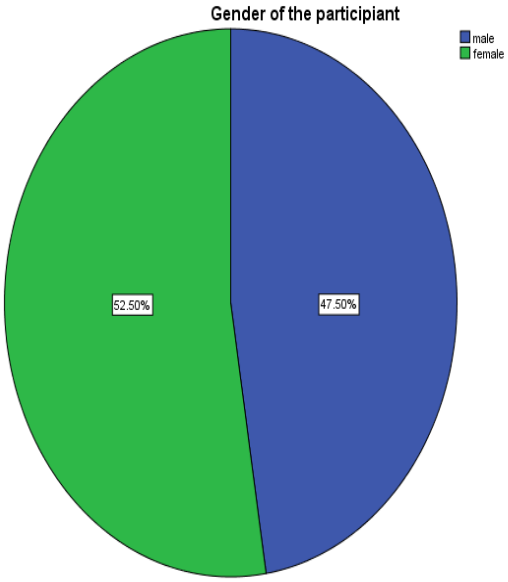

Fig 1: Gender of the participants in percentages

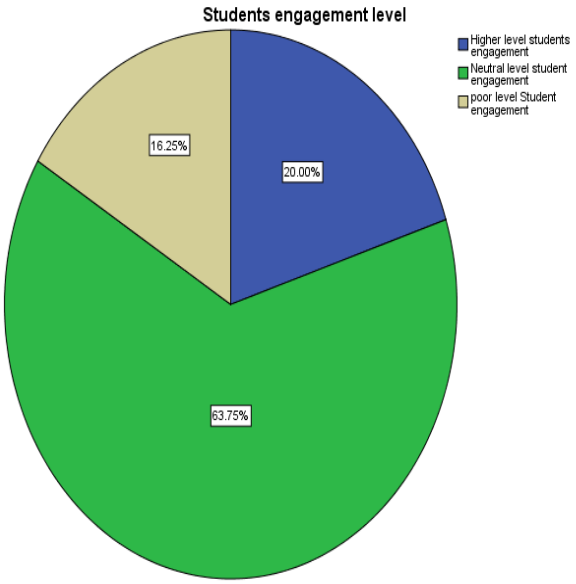

Fig 2: Engagement in the subject of forensic medicine

DISCUSSION

The study evaluated students' engagement in forensic medicine within an integrated undergraduate medical curriculum and identified factors influencing this engagement. It involved 160 MBBS students; only 32 (20%) demonstrated a high level of engagement with Forensic Medicine and Toxicology, while the majority showed neutral engagement (102, 63.8%), and 26 students (16.2%) exhibited poor engagement.

Significant associations were found between engagement and gender, age, and academic year, with higher engagement observed among female students and 3rd-year MBBS students, and lower engagement mainly seen in male and 4th-year MBBS students. In comparison, a survey-based perception study by Raghvendra Kumar Vidua from India, published in July 2022 and including 275 MBBS students, reported highly positive perceptions, with 83.3% finding the subject interesting and 85.9% considering it useful; however, only 14.2% expressed willingness to pursue FMT as a career. [12]

Together, these findings suggest that despite favorable perceptions of FMT, consistent academic engagement remains limited, particularly in senior years, as shown in our study.

In contrast, another study published in the Journal of the Panjab Academy of Forensic Medicine, India, in January 2024, examines the role of student feedback in improving active learning strategies, emphasizing that incorporating learner input can positively affect teaching quality and student engagement. [13] While our study quantitatively measures levels and determinants of engagement, the latter underscores pedagogical responsiveness as a crucial mechanism for enhancing engagement. Together, the two studies indicate that the neutral and poor engagement observed in our findings may be improved through structured student feedback and active learning methods, highlighting the importance of learner-centered teaching reforms in Forensic Medicine.

While our study offers descriptive and associative evidence of engagement patterns within medical education, significant links were found between engagement and gender, age, and academic year, showing that engagement varies among student groups. In comparison, the study published in February 2021 titled "Factors affecting students' learning performance through collaborative learning and engagement," which used Structural Equation Modeling (SEM) to explore causal pathways, showed that social interaction and engagement directly boost collaborative learning, which then significantly improves academic performance.[14] Specifically, peer interaction and social media use were key predictors of collaborative learning, accounting for 26% of its variance, while collaborative learning explained 38% of the variation in academic performance. The SEM-based study provides explanations for how engagement impacts learning outcomes. Together, these findings suggest that the moderate-to-low engagement seen in our group could be improved by enhancing collaborative and socially interactive learning strategies to boost both engagement and academic suc-

cess in Forensic Medicine.

A 2021 study on the Impact of Integrated Modular System on the Basic Science Disciplines highlights the negative structural effects of the IMS, noting that the fragmentation of Forensic Medicine across different modules leads to a decline in its perceived importance, as students tend to prioritize subjects based solely on their assessment weight. [15] In contrast, our engagement study identifies the human element—the "lever"—that can reverse this trend: the power of clinical relevance. While Zaidi's study points out that the modular structure can "break" a subject's identity, our findings likely provide the necessary "fix," suggesting that when content is delivered through clinically-focused strategies, student engagement and perceived value remain high despite the modular framework. Both studies highlight a critical shift in how students view the importance of pre-clinical subjects within an Integrated Modular System (IMS), but they approach the "engagement" problem from different perspectives.

The study's findings are limited by a single-center, cross-sectional design, which cannot be generalized, and by reliance on subjective, self-reported data, which prevents assessment of long-term knowledge retention or behavioral changes over time. These factors restrict the overall applicability of the results. More detailed longitudinal studies are necessary to explore what factors can enhance students' engagement in forensic medicine within an integrated medical curriculum.

CONCLUSION

This study found that only one-fifth of MBBS students demonstrated a high level of academic engagement in Forensic Medicine and Toxicology, while the majority exhibited neutral engagement. Engagement was more common among female students and 3rd-year students. Poor engagement was mainly observed among male students and 4th-year students. Gender, age, and academic year were compared with engagement levels and found to be highly statistically significant. Furthermore, although students generally find the subject interesting and useful, this did not lead to high academic engagement.

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Nadeem F	✓	✓	×	×	✓	×
Hussan J	✓	×	✓	✓	✓	×
Kashif L	✓	✓	×	×	×	✓
Ali A	✓	×	✓	✓	✓	×
Kashif Q	✓	✓	×	×	×	✓
Zafar Q.	✓	×	✓	✓	✓	×

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This study was approved by the Institutional Ethical Review Board of Khyber Medical College, Peshawar, Pakistan Vide No. 854/DME/KMC, Dated 10/09/2025

ORIGINAL ARTICLE

DRUG PRESCRIBING COMPETENCY AMONG FINAL-YEAR DENTAL STUDENTS, HOUSE OFFICERS, AND RESIDENTS AT A PUBLIC SECTOR UNIVERSITY HOSPITAL IN KARACHI, PAKISTAN

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ABSTRACT

OBJECTIVE: To assess drug prescribing competency and compare these competencies across the clinical levels at Sindh Institute of Oral Health Sciences (SIOHS), Jinnah Sindh Medical University (JSMU).

MATERIAL & METHODS: A cross-sectional study was conducted over 4 months involving final-year dental students, house officers, and residents of SIOHS, JSMU. Data were collected using a modified questionnaire and analyzed with IBM SPSS. Descriptive statistics summarized the demographic data. ANOVA was used to compare the means of competency across four domains: Information Gathering, Clinical Decision Making, Communication, and Monitoring/Review. Tukey's Post Hoc test was conducted to identify group-wise differences. A p-value of <0.05 was considered statistically significant.

RESULTS: About 102 participants responded. Most participants reported adequate knowledge of drug dosage, frequency, duration, and route. Residents (50.0–65.38%) and house officers (54.54–61.36%) showed higher prescribing competency than final-year students (9.37–31.25%).

CONCLUSION: When comparing prescribing competency, only the Information Gathering and Clinical Decision-Making domains were significant, with p-values of 0.018 and 0.042, respectively. Tukey's Post Hoc test showed that only the Information Gathering domain was significantly different between final-year students and house officers, with a p-value of .013. Seniors demonstrated greater confidence in prescribing practices than their juniors, likely due to increased clinical exposure.

KEYWORDS: Prescription writing, dental students, clinical competency, drug prescriptions

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INTRODUCTION

A prescription serves as a means of communication between the doctor and pharmacist. [1] Prescribing involves authorizing medications for treatment at their correct dosages and optimal intervals. An essential part of prescribing medications is understanding the drug to be prescribed, its interactions with other drugs, and its potential side effects. [2-4]

Dentists can prescribe medications for various reasons. The most commonly prescribed drug classes in dentistry include antibiotics, analgesics, anti-inflammatories, antifungals, anticonvulsants, and emergency medications. [5] However, antibiotics remain the most frequently prescribed medicines in dental practices. [6]

Knowing the correct drugs, their appropriate dosages, and duration is important for prophylaxis, especially in cases of infective endocarditis, which is a fatal condition commonly associated with bacteremia caused by dental procedures. [7]

Prescribing medication involves applying both theoretical and clinical knowledge. To prescribe drugs accurately, students need a clear understanding of clinical indications, contraindications, and side effects. Therefore, a dental graduate must have a solid understanding of pharmacological therapeutics principles, along with a basic knowledge of the prescribed drug's mechanism of action. [8]

Recently, concerns have increased about the quality and quantity of dental prescriptions. [9] Misuse of medications can cause serious side effects. [10] A recent USA study found that dentists prescribe up to 10% of antibiot-

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ics worldwide, with about 81% of these prescriptions being unnecessary. [9] Poor prescription practices have led to a sharp rise in antimicrobial resistance, which the World Health Organization (WHO) now recognizes as a serious public health threat and a danger to future generations. While antibiotic resistance is a natural response to antibiotics, excessive and inappropriate use of these drugs plays a major role. [11]

During their clinical years, dental students are exposed to a range of clinical conditions and are prescribed medications under supervision. [12] Dental students may make errors in prescriptions. [8, 13] Students and interns undergoing clinical training should be periodically assessed on their drug prescription skills to minimize any errors that may occur during prescription.[14,15,16]

Incomplete and improper prescriptions missing key data about a patient's allergies, overall health, and other co-morbidities can lead to inappropriate medication administration, which may worsen the patient's condition. [4, 17] Errors in prescriptions may even result in medico-legal problems. [18]

Traditional dental curricula teach pharmacology early but fail to connect it to real-world prescribing, promoting rote learning and limiting clinical application. [19, 20] This gap increases the risk of prescription errors. While other clinical skills in dentistry are emphasized, drug-prescribing skills remain overlooked. Existing literature lacks insights into how prescribing competence varies with academic level in clinical settings. To address this, a cross-sectional study was conducted to assess drug-prescribing competency across clinical dental academic levels (i.e., final-year students, house officers, and residents) and compare these competencies at Sindh Institute of Oral Health Sciences (SIOHS), Jinnah Sindh Medical University (JSMU), Karachi. Additionally, it aims to provide empirical insights for educational institutions to help improve their strategies for effective medication use in dental practice.

MATERIALS AND METHODS

A cross-sectional study was conducted at SIOHS, JSMU, over a period of 4 months, from November 2025 to March 2026, after receiving approval from its Institutional Review Board (reference no. JSMU/IRB/2025/1073). Final-year dental students, house officers, and residents of SIOHS, JSMU, aged 18 or above, were approached using non-probability convenience sampling. Students from all religions and socioeconomic backgrounds were included. Only individuals willing to participate and who gave their verbal and written consent were included.

1st- to 3rd-year dental students were excluded from the study due to their limited clinical training and pharmacological knowledge. Postgraduate dental faculty, demonstrators, and lecturers were excluded because of their active involvement in clinical training.

The participants were told that their anonymity would be preserved throughout the study. No personally identifiable information was gathered. Data was always accessible to the main author and co-author.

The total target population at SIOHS, JSMU, was calculated as 138. While maintaining a margin of error of 5% and a confidence level of 95%[17], a sample size of 102 was calculated using the reputable online calculator provided by Open Epi.

A modified structured questionnaire was distributed to collect data from participants after obtaining their consent. The questionnaire comprised of two sections. The first section gathered demographic information about the participants, including age, gender, ethnicity, and academic level. The second section included 14 closed-ended questions related to drug prescribing competency, developed based on the four-stage prescribing model by Coombes et al. (2011), covering Information Gathering, Clinical Decision-Making, Communication, and Monitoring/Review, ensuring a comprehensive assessment of prescribing skills across all clinical levels. [21] In this section, the first five questions used a five-point Likert scale ranging from 'Always' to 'Never,' while the remaining questions were closed-ended. Additionally, the questionnaire was pilot-tested on 10% of the study population to evaluate the clarity, reliability, and validity of the questions. Data from the pilot study were not included in the final analysis.

Data was entered and analyzed using IBM SPSS Statistics (version 27). Descriptive analysis was performed for the demographic data, with continuous variables reported as means and standard deviations (SD), and categorical variables as frequencies and percentages. To compare mean competency scores for each domain (Information Gathering, Clinical Decision Making, Communication, and Monitoring & Review) across three academic levels (Final Year, House Officers, and Residents), an ANOVA test was used. Each competency domain score was calculated by combining responses from multiple related questionnaire items. Tukey's Post Hoc test was conducted after ANOVA to identify group differences. A p-value of <0.05 was considered statistically significant.

RESULT

The questionnaire was completed by 102 participants, with the majority (69.6%) being female, and a mean age of 24.4 years, as shown in Table 1, which displays the key demographic data of the respondents.

Table 2 shows a breakdown of participant responses. Prescribing competency increased with clinical experience, with higher confidence among residents (50.0–65.38%) and house officers (54.54–61.36%) compared to final-year students (9.37–31.25%). Most final-year students (46.87%), house officers (54.54%), and residents (50%) often used the WHO prescribing guidelines when

Table No 1: DEMOGRAPHIC DATA (Frequencies and Percentages)

VARIABLES	FREQUENCIES (%)
Age	
Mean (SD)	24.42 (2.41)
Gender	
Female	71(69.6)
Male	31 (30.4)
Ethnicity	
Urdu	53 (52.0)
Sindhi	37 (36.3)
Punjabi	8 (7.8)
Pathan	4 (3.9)
Position	
Final Year	32 (31.4)
House officer	44 (43.1)
Resident	26 (25.5)

prescribing medications. Most participants reported having adequate knowledge of drug dosage, frequency, duration, and route (≥75% "always/often"). Dental caries (50–54.54%) and pain (42.30–50%) were the most common conditions treated. Paracetamol (36.36–46.87%) and diclofenac (38.63–43.75%) were frequently prescribed, while Augmentin was the most common antibiotic (73.07–100%), and drug interactions were the most frequently reported error (47.72–73.07%). Confidence in explaining prescriptions (96.15–100%) and including essential elements (81.25–88.63%) were high, whereas follow-up (40.6–72.7%) and Adverse Drug Reaction monitoring (56.25–69.23%) were relatively lower.According to Figure 1, only the Information Gathering and Clinical Decision Making domains were significant, with p-values of 0.018 and 0.042, respectively, when comparing drug prescribing competency across academic levels using ANOVA. Tukey's Post Hoc test showed that only the Information Gathering domain was significant between final-year and

Table No 2: DRUG PRESCRIBING COMPETENCY VARIABLES (Frequencies & Percentages)

1. Do you use the WHO prescribing guidelines while writing a prescription?					
	Always	**Often**	**Sometimes**	**Rarely**	**Never**
Final Year	3 (9.37%)	15 (46.87%)	10 (31.25%)	3 (9.37%)	1 (3.12%)
House officer	12 (27.27%)	24 (54.54%)	5 (11.36%)	2 (4.54%)	1 (2.27%)
Resident	8 (30.76%)	13 (50.0%)	3 (11.53%)	2 (7.69%)	0 (0.0%)
2. Are you confident in determining the correct drug dosage for patients?					
	Always	Often	Sometimes	Rarely	Never
Final Year	5 (15.62%)	14 (43.75%)	10 (31.25%)	2 (6.25%)	1 (3.12%)
House officer	17 (38.63%)	21 (47.72%)	5 (11.36%)	1 (2.27%)	0 (0.0%)
Resident	15 (57.69%)	8 (30.76%)	2 (7.69%)	1 (3.84%)	0 (0.0%)
3. Do you know the correct frequency (e.g., once daily, twice daily) for common drug prescriptions?					
	Always	Often	Sometimes	Rarely	Never
Final Year	10 (31.25%)	16 (50.0%)	6 (18.75%)	0(0.0%)	0 (0.0%)
House officer	27 (61.36%)	14 (31.81%)	3 (6.81%)	0 (0.0%)	0(0.0%)
Resident	17 (65.38%)	7 (26.92%)	1 (3.84%)	1 (3.84%)	0 (0.0%)
4. Do you know the correct duration for which the drug should be prescribed?					
	Always	Often	Sometimes	Rarely	Never
Final Year	10 (31.25%)	15 (46.87%)	7 (21.87%)	0 (0.0%)	0 (0.0%)
House officer	27 (61.36%)	15 (34.09%)	2 (4.54%)	0 (0.0%)	0 (0.0%)
Resident	15 (57.69%)	6(23.07%)	3 (11.53%)	1 (3.84%)	1 (3.84%)
4. Do you know the correct route of drug delivery (oral, IV, topical, etc.) for commonly prescribed drugs?					
	Always	Often	Sometimes	Rarely	Never
Final Year	10 (31.25%)	14 (43.75%)	6 (18.75%)	2 (6.25%)	0 (0.0%)
House officer	24 (54.54%)	14 (31.81%)	6 (13.63%)	0 (0.0%)	0 (0.0%)
Resident	11 (42.30%)	11 (42.30%)	3 (11.53%)	1 (3.84%)	0 (0.0%)
5. What are the most common health conditions you treat in dental practice?					
	Dental caries	Dental pain	Tooth sensitivity	Others	None
Final Year	16 (50.0%)	16 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
House officer	24 (54.54%)	19 (43.18%)	0 (0.0%)	1 (2.27%)	0 (0.0%)

Resident	13 (50.0%)	11 (42.30%)	0 (0.0%)	2 (7.69%)	0 (0.0%)
6. What are the most common health conditions you treat in dental practice?					
	Dental caries	Dental pain	Tooth sensitivity	Others	None
Final Year	16 (50.0%)	16 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
House officer	24 (54.54%)	19 (43.18%)	0 (0.0%)	1 (2.27%)	0 (0.0%)
Resident	13 (50.0%)	11 (42.30%)	0 (0.0%)	2 (7.69%)	0 (0.0%)
7. Which non-steroidal anti-inflammatory drug (NSAID) do you prescribe most commonly?					
	Paracetamol	Diclofenac	Aceclofenac	Others	None
Final Year	15 (46.87%)	14 (43.75%)	2 (6.25%)	1 (3.12%)	0 (0.0%)
House officer	16 (36.36%)	17 (38.63%)	0 (0.0%)	10 (22.72%)	1 (2.27%)
Resident	10 (38.46%)	11 (42.30%)	0 (0.0%)	5 (19.23%)	0 (0.0%)
8. Which antibiotic do you most commonly prescribe?					
	Amoxicillin	Augmentin	Metronidazole	Others	None
Final Year	0 (0.0%)	32 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
House officer	9 (20.45%)	34 (77.27%)	1 (2.27%)	0 (0.0%)	0 (0.0%)
Resident	6 (23.07%)	19 (73.07%)	0 (0.0%)	1 (3.84%)	0 (0.0%)
9. What is the most common error you think occurs during prescription?					
	Incorrect dosage	Drug interaction/			
incompatibility	Wrong drug name	Others	None		
Final Year	14 (43.75%)	18 (56.25%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
House officer	14 (31.81%)	21 (47.72%)	3 (6.81%)	2 (4.54%)	4 (9.09%)
Resident	4 (15.38%)	19 (73.07%)	1 (3.84%)	0 (0.0%)	2 (7.69%)
10. What is your primary source of information regarding drug prescription?					
	Textbooks	Professors	Colleagues	Others	None
Final Year	9 (28.12%)	14(43.75%)	6 (18.75%)	3 (9.37%)	0 (0.0%)
House officer	8 (18.18%)	24(54.54%)	2 (4.54%)	7 (15.90%)	3 (6.81%)
Resident	10 (38.46%)	4 (15.38%)	0 (0.0%)	12 (46.15%)	0 (0.0%)
11. Do you feel confident explaining prescription instructions (dose, duration, side effects) to patients?					
	Yes			No	
Final Year	32 (100%)			0 (0.0%)	
House officer	44 (100%)			0 (0.0%)	
Resident	25 (96.15%)			1 (3.84%)	
12. Do you usually include all essential elements (drug name, dose, frequency, duration, route) when writing a prescription?					
	Yes			No	
Final Year	26 (81.25%)			6 (18.75%)	
House officer	39 (88.63%)			5 (11.36%)	
Resident	23 (88.46%)			3(11.53%)	
13. Do you ask patients to return for follow-up after prescribing antibiotics/analgesics?					
	Yes			No	
Final Year	13 (40.6%)			19 (59.4%)	
House officer	32 (72.7%)			12 (27.3%)	
Resident	18 (69.2%)			8 (30.8%)	
14. Do you monitor or inquire about possible adverse drug reactions in your patients?					
	Yes			No	
Final Year	18 (56.25%)			14 (43.75%)	
House officer	27 (61.36%)			17 (38.63%)	
Resident	18 (69.23%)			8 (30.76%)	

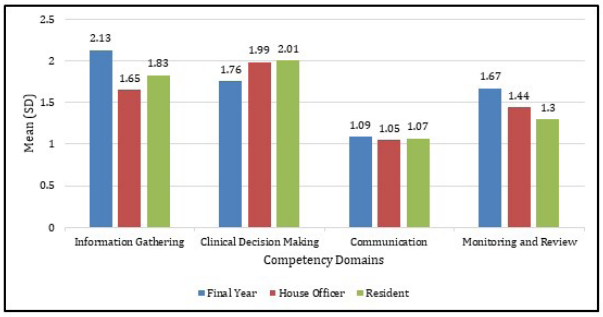

Fig 1: Comparison Of Drug Prescribing Competency Across Academic Levels

house-officer groups, with a p-value of .013.

DISCUSSION

Prescription writing is a skill essential for the effective management of diseases encountered in dentistry. This study examines the drug prescribing skills of final-year dental students, house officers, and residents—three clinical academic levels that differ significantly in their clinical exposure.

The study shows that the majority of final-year students (46.87%), house officers (54.54%), and residents (50%) often use the WHO prescribing guidelines when prescribing medications. These findings align with the papers published by Vijaykumar et al. and Dali et al. [2, 17]

In this study, it was observed that while most residents (57.69%) reported being always confident in determining the correct drug dosage, final-year students (43.75%) and house officers (47.72%) reported that they 'often' felt confident but not always. This indicates that some clinical uncertainty remains among juniors when prescribing medicines. A study from Lahore showed similar results: only 56% of house officers reported being confident in their prescription skills, with 15% admitting they had little confidence in their prescription writing. [4] In another study, although most students answered most questions regarding medication knowledge correctly, about 27% of dental students did not feel confident in prescribing medications safely. Findings suggest that some students still feel uncomfortable prescribing medication even under supervision. [6] While the vast majority of house officers (61.36%) and residents (65.38%) answered that they always knew the correct frequency for commonly prescribed drugs, (50%) of final-year students were more uncertain, responding with 'often' rather than 'always,' showing a gap in their knowledge. This finding aligns with another study, which found that only 66.1% of BDS students felt confident in their knowledge of drug frequency. [8] In this study, most house officers (61.36%) and residents (57.69%) responded that they always know the correct duration for the drug they are prescribing. However, the majority of final-year students (46.87%) leaned towards 'Often,' suggesting they might not be as comfortable prescribing medications as their seniors. In contrast, an Australian study showed that 88% of dental students were confident in the appropriate dosage and timing.

When asked about the most common error encountered during drug prescription, all clinical levels in the study unanimously agreed that 'drug interaction/incompatibility' was the most frequent mistake. Conversely, Ashraf et al. found that failing to inquire about a patient's allergies resulted in incorrect dosages, and another study also reported that not asking about allergies led to wrong dosages. [22, 23] Additionally, one study highlights that approximately 28% of dental students believed the main barrier was 'not knowing the exact drug dose. [2]

In this study, all clinical students preferred Paracetamol and Diclofenac as the most common analgesics, whereas in other studies, most final-year students and house officers considered Ibuprofen to be the most frequently prescribed NSAID. [19] Almost all final-year students, house officers, and interns chose Augmentin as the most common prescribed drug, a view shared by Ashraf et al. [22] All three clinical levels agreed that dental caries was the most common dental condition treated in practice, though in the final years, dental caries and dental pain were treated equally. A study in Rawalpindi contradicts our findings, finding dental pain to be the most encountered condition by dentists. [22]

While most final-year students (43.75%) and house officers (54.54%) in the study consider professors the primary source of information about drug prescriptions, residents prefer textbooks and other methods for obtaining their information. This finding is supported by a study that alarmingly found a significant number of dental students and house officers relied on senior faculty for information. Only about a third of them considered the internet and books their main sources for prescriptions. [4]

A statistically significant difference was observed in the Information Gathering domain across academic levels ($p = 0.018$). Post hoc Tukey's test showed that final-year students scored higher than house officers ($p = 0.013$), while no significant differences were found among the other groups. This indicates that final-year students exhibit stronger theoretical preparation before transitioning into clinical practice. Compared to house officers, lower scores may suggest that increased clinical workload limits systematic information gathering during prescribing. Similarly, a key difference was identified in the Clinical Decision-Making domain ($p = 0.042$), where residents scored higher than their juniors, indicating progressive improvement in clinical reasoning with greater exposure.

This study offers a comprehensive evaluation of prescribing competence across various clinical levels and areas, employing appropriate statistical methods to improve the reliability of the results. However, a cross-sec-

tional design restricts causal conclusions. Self-reported data may lead to response bias, and convenience sampling limits how well the findings can be applied to broader populations. Factors that cannot be measured, such as clinical exposure and supervision, were not taken into account.

CONCLUSION

Drug prescribing competency varied across all clinical academic levels, especially in areas of information gathering and clinical decision-making. Residents and house officers expressed greater confidence in prescribing than final-year dental students, likely due to their increased clinical exposure. These findings emphasize the importance of structured pharmacologic training and supervision during early clinical years to improve rational prescribing and competency among future dental practitioners.

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Shah H	✓	✓	×	×	✓	×
Muqri IA	✓	×	✓	✓	✓	×
Urooj I	✓	✓	×	×	×	✓
Kanwal K	✓	×	✓	✓	✓	×
Ayoub D,	✓	✓	×	×	×	✓
Mubasher A	✓	×	✓	✓	✓	×

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This study was approved by the Ethical Review Board of Jinnah Sindh Medical University Vide No. JSMU/ IRB/2025/1073, Dated: 18/11/2025

ORIGINAL ARTICLE

CORRELATION OF FIB-4 AND CHILD PUGH SCORE IN PATIENTS WITH LIVER CIRRHOSIS

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ABSTRACT

OBJECTIVE: To determine the correlation of the FIB-4 Score with the Child Pugh Score in patients with liver cirrhosis, presenting to Khyber Teaching Hospital, Peshawar, Pakistan

MATERIALS AND METHODS: We conducted this cross-sectional study from October 1, 2023, to December 31, 2024, in the Medical Department of Khyber Teaching Hospital, Peshawar. Patients with liver cirrhosis were enrolled after providing written informed consent. All data, including age, gender, disease duration, BMI, Child-Pugh Score, and FIB-4, were recorded on an approved pro forma.

RESULTS: According to the inclusive criteria, 81 patients were included. The mean age was 49 years, with a standard deviation of 10.91 years. Of these, 65 (80%) were males, and 16 (20%) were females. The mean FIB-4 score was 5.69 ± 0.903, and the mean Child-Pugh score was 9.08 ± 1.014. A statistically significant but modest positive correlation was observed between FIB-4 score and Child-Pugh score ($r = 0.329$, $p = 0.0003$).

CONCLUSION: The FIB-4 score demonstrated a statistically significant yet modest positive correlation with the Child-Pugh score in patients with liver cirrhosis and may serve as an adjunct rather than a surrogate marker.

KEY WORDS: Correlation, FIB-4 Score, Child Pugh Score, Cirrhosis

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INTRODUCTION

Liver cirrhosis results from chronic injury, and healing leads to the formation of nodules and fibrosis, which alter the normal lobular architecture of the liver. Laennec introduced the term cirrhosis, impressed by the brawny color of the liver in this condition.

The essential feature is diffuse parenchymal destruction and replacement by fibrous tissue, disrupting the normal lobular structure of the liver. There is active hepatocyte regeneration while fibrosis progresses. [2-4]

The more common causes of liver cirrhosis are alcoholic liver disease, hepatitis C virus (HCV), and non-alcoholic steatohepatitis (NASH) in the developed world, while in the developing world, HCV and hepatitis B virus (HBV) are the main causes. [5]

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The worldwide prevalence of cirrhosis is unknown; however, it has been estimated to be between 0.15% and 0.27% in the United States. [3] Hyperdynamic circulation, portal hypertension, and related complications are the main causes of mortality and morbidity in patients with liver cirrhosis.[6]

Patients with liver cirrhosis may remain asymptomatic until decompensation occurs. Therefore, physicians must be vigilant for early diagnosis and management. Nonspecific symptoms include easy fatigability, sleep disturbance, and poor appetite [7-11].

The remaining symptoms depend on the underlying causes and complications. For accurate diagnosis, thorough clinical examination followed by ultrasound is essential; it may reveal features suggestive of cirrhosis, but the gold standard remains a liver biopsy [12, 13].

The Child-Pugh-Turcotte (CPT) score has traditionally been used to evaluate the prognosis of patients with cirrhosis, as it correlates with the severity of liver disease. It includes three continuous variables (serum albumin, serum bilirubin, and prothrombin time), while encephalopathy and ascites are categorical variables.

Three distinct groups—A, B, and C—represent increasing severity, determined by these five variables and their respective cut-off values. Points 1, 2, and 3 are assigned to these variables. The total score, obtained by summing these points, ranges from 5 to 15. Patients with scores of 5-6 are classified as Group A, those with scores of 7-9 as Group B, and those with scores of 10-15 as Group C. [14-17]

FIB-4 score is a noninvasive scoring for the assessment of liver fibrosis, particularly in patients with chronic liver diseases like hepatitis B and C, nonalcoholic fatty liver disease, and liver cirrhosis. It comprises four parameters.

1. Age: older age is associated with more advanced disease
2. Platelet Count, thrombocytopenia is associated with advanced disease
3. S. AST; its elevated level indicated advanced disease
4. S. ALT: Elevated level indicates damage to the liver
5. The formula for the calculation of FIB-4 is as follows;

FIB-4= [age (years)×AST (IU/L)] / [PLT (10^9/L) ×ALT1/2 (IU/L)].

A score <1.45 indicates lower risk of fibrosis, an intermediate score of 1.45-3.25 indicates moderate risk, and a score>3.25 indicates advanced fibrosis or cirrhosis. [2]

As several studies have shown a close link between Child-Pugh-Turcotte (CPT) and FIB-4 scores and the development of liver cirrhosis, we conducted this study to evaluate the relationship between FIB-4 score and Child-Pugh-Turcotte (CPT) score in our patients with chronic liver disease or cirrhosis. [4,5]

MATERIALS AND METHODS

This hospital-based cross-sectional observational study was carried out in the Medical Department of Khyber Teaching Hospital, Peshawar, from 1st October 2023 to 31st December 2024. All consecutive patients aged 14 years or older with clinically and radiologically diagnosed cirrhosis presenting to the outpatient department were screened for inclusion. Patients who refused consent, had decompensated cirrhosis, or had hepatocellular carcinoma were excluded.

The lower age limit of 14 years was used because younger patients are managed in the Paediatric Department. The diagnosis of cirrhosis was based on clinical assessment and ultrasound findings obtained in the hospital radiology department. Liver biopsy was not performed in patients with straightforward clinical and radiological evidence of cirrhosis.

For each participant, age, sex, disease duration, body mass index, Child-Pugh score, and FIB-4 score were recorded on a structured pro forma. Laboratory workup included complete blood count, serum albumin, prothrombin time, liver biochemistry, renal function tests, and viral hepatitis screening where indicated. Potential confounding variables, including age, sex, body mass index, and disease duration, were documented and examined in subgroup analyses. No multivariable adjustment was performed because of the limited sample size. Data were analyzed using SPSS version 23.

RESULTS

We included 81 patients; 9 (11%) were in the 18-35 years age group, and 72 (89%) were in the 36-60 years age group. The mean age was 49 years, with a standard deviation of 10.91 years.

Males made up 65(80%) of the patients, while 16(20%) were females. In 9 (11%) patients, the duration of disease was <3 years, whereas in 72 (89%) patients, it was >03 years. Regarding BMI, 64(79%) patients had a BMI ≤30 kg/m^2, and 17(21%) had a BMI >30 kg/m^2. The mean FIB-4 score was 5.69 ± 0.903, and the mean Child Pugh score was 9.08 ± 1.014.

The correlation coefficient r = 0.329 indicates a positive relationship between the FIB-4 score and the Child Pugh score. (Table no 3) Correlations between the Child-Pugh score and the FIB-4 score with respect to age, sex, duration of disease, and body mass index are shown in Tables 4–7.

DISCUSSION

In this study, the mean age of the patients was 49 ± 10.91 years, and males made up 80% of the sample. Most patients had a disease duration of more than 3 years, and 79% had a body mass index of 30 kg/$m^{2\ or\ less}$. The mean FIB-4 score was 5.69 ± 0.903, while the mean

Table No 1: Mean FIB Score was 5.69±0.903

FIB-4 SCORE	FREQUENCY	PERCENTAGE
≤ 5	**33**	41%
> 5	48	59%
Total	81	100%

Mean Child Pugh Score was 9.08± 1.014

Table No 2: CHILD PUGH SCORE

CHILD PUGH SCORE	FREQUENCY	PERCENTAGE
Class A (5 to 6 points)	**28**	35%
Class B (7 to 9 points)	34	%53
Class C (10 to 15 points)	10	%12
Total	81	%100

Mean Child Pugh Score was 9.08± 1.014

Table No 3: CORRELATION OF FIB-4 SCORE WITH CHILD PUGH SCORE (n=81)

FIB-4 SCORE (Mean and SD)	CHILD PUGH SCORE (Mean and SD)	P value SCORE	Pearson correlation
5.69± 0.903	9.08± 1.014	**0.0003**	r = 0.329

Table No 4: CORRELATION OF FIB-4 SCORE WITH CHILD PUGH SCORE W.R.T AGE DISTRIBUTION (n=81)

AGE	FIB-4 SCORE (Mean and SD)	CHILD PUGH SCORE (Mean and SD)	P value	Pearson correlation
18-35 years (n=9)	5.33± 0.707	**1.166 ±9.11**	0.281	r = 0.404
60-36 years (n=72)	5.74± 0.919	**1.166 ±9.11**	0.005	r = 0.330

Table No 5: CORRELATION OF FIB-4 SCORE WITH CHILD PUGH SCORE W.R.T GENDER DISTRIBUTION

GENDER	CHILD PUGH SCORE (Mean and SD)	FIB4- SCORE (Mean and SD)	P value	Pearson correlation
Male (n=65)	0.973 ±5.77	**1.045 ±9.04**	0.188	r = 0.292
Female (n=16)	0.883 ±5.66	**1.011 ±9.10**	0.007	r = 0.348

Table No 6: CORRELATION OF FIB-4 SCORE WITH CHILD PUGH SCORE W.R.T DURATION OF DISEASE

DURATION OF DISEASE	CHILD PUGHSCORE (Mean and SD)	FIB4- SCORE (Mean and SD)	P value	Pearson correlation
≤ 3 years (n=9)	1.054 ±5.89	**0.333 ±8.88**	0.047	r = 0.672
> 3 years (n=72)	0.888 ±5.67	**1.068 ±9.11**	0.004	r = 0.336

Table No 6: CORRELATION OF FIB-4 SCORE WITH CHILD PUGH SCORE W.R.T BMI DISTRIBUTION

BMI	CHILD PUGHSCORE (Mean and SD)	FIB4- SCORE (Mean and SD)	P value	Pearson correlation
≤ 30 Kg/m2 (n=64)	0.913 ±5.73	**0.920 ±9.09**	0.004	r = 0.351
> 30 Kg/m2 (n=17)	0.874 ±5.53	**1.344 ±9.05**	0.258	r = 0.291

Child-Pugh score was 9.08 ± 1.014.

A statistically significant positive correlation was observed between FIB-4 and Child-Pugh scores, but the strength of the relationship was modest, with a correlation coefficient of r = 0.329. This finding suggests that FIB-4 may indicate increasing severity of liver disease, but it should not be considered a direct replacement for Child-Pugh scoring. In our study, only 35% of patients were in Child-Pugh class A, compared to Adeel AB et al., who reported 89.7% in Child-Pugh class A.

This difference may be due to variation in disease severity and patient characteristics between the two populations. Similar findings were reported by Adeel AB et al., who studied 21,116 patients with HCV-related liver cirrhosis over five years to assess hepatic decompensation, hepatocellular carcinoma, and all-cause mortality. [2]

They found that 89.7% of patients were in Child-Pugh class A, 79.9% had a MELD score below 09, and 43.4% had a FIB-4 score below 1.45. At 1, 3, and 5 years, the AUROC for hepatic decompensation was lower for MELD (0.70-0.76) than for FIB-4 (0.84-0.86), with a P value less than 0.001.

At the same intervals, the AUROC for HCC was between 0.61 and 0.68 for Child-Pugh and MELD scores, but 0.81-0.82 for FIB-4 ($P < 0.001$). For all-cause mortality, the AUROC at 3 and 5 years ranged from 0.65 to 0.68. The cut-off scores for identifying individuals at lower risk of complications were: Child-Pugh score below 5; MELD score below 8; FIB-4 less than 3 for hepatic decompensation and HCC; and FIB-4 less than 0.2 for all-cause mortality. They concluded that the FIB-4 score was a better predictor of hepatic decompensation and hepatocellular carcinoma in patients with HCV infection. A FIB-4 score below 3 was associated with a lower risk of liver decompensation and HCC at 1 and 3 years after HCV diagnosis. Hsieh YC et al. also reported a significant correlation between non-invasive fibrosis markers and hepatic venous pressure gradient in cirrhosis, with the ALBI score showing the strongest correlation ($r = 0.307$, $p = 1.4$) and low serum sodium. Zhou P et al. reported that 9.3% (46/495) of patients developed PHLF. The area under the ROC curve for the FIB-4 index in predicting PHLF was higher than that of the Child-Pugh score (0.744 versus 0.621; $P = 0.044$). The optimal cut-off value of the FIB-4 index for predicting PHLF was 4.16. Multivariable analyses showed that the FIB-4 index was an independent predictor of PHLF regardless of the hepatectomy subgroup, while the Child-Pugh Score was only a significant predictor in the minor hepatectomy group. The FIB-4 index of 4.16 not only divided patients into two distinct survival groups ($P = 0.006$), but also classified those with Barcelona Clinical Liver Cancer (BCLC) stages 0 and A into two survival groups ($P = 0.001$ and $P = 0.034$, respectively). [16]

This study has several limitations. It was conducted at a single center and included only 81 patients, which limits generalizability. Male patients were overrepresented, which may have influenced the findings. Patients with decompensated cirrhosis were excluded, so the results may not apply to the full clinical spectrum of cirrhosis. Liver biopsy was not performed, and the diagnosis was based on clinical and radiological assessment. In addition, the cross-sectional design does not allow evaluation of temporal relationships or long-term outcomes.

Despite these limitations, the study has significant strengths. It emphasizes FIB-4 as a simple, non-invasive, and affordable tool that aligns with the Child-Pugh score. By offering local data, it provides practical value for clinicians working in resource-limited settings.

CONCLUSION

Our findings show a positive link between FIB-4 score and Child-Pugh score in patients with liver cirrhosis. This supports using FIB-4 as a practical tool in everyday clinical practice, especially in resource-limited settings where invasive procedures may not be feasible. While larger multicenter studies are needed to confirm these results, our work lays the groundwork for including FIB-4 in the diagnostic and prognostic assessment of cirrhotic patients.

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Ullah N	✓	✓	×	×	✓	×
Shehzad A	✓	×	✓	✓	✓	×
Iqbal MD	✓	✓	×	×	×	✓

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This study was approved by the Institutional Review and Ethics Board of Khyber Teaching Hospital, Peshawar

Vide no. 209/DME/KMC, Dated: 07/03/2025

DRUG-INDUCED ACUTE PANCREATITIS IN A PATIENT WITH ACUTE MYELOID LEUKEMIA COMPLICATED BY DISTAL RENAL TUBULAR ACIDOSIS: A CASE REPORT

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ABSTRACT

Drug-induced pancreatitis (DIP) is a rare but significant complication of chemotherapy. We report an 18-year-old male with high-risk Acute Myeloid Leukemia (AML) who developed acute pancreatitis (AP) after beginning chemotherapy, complicated by refractory hypokalemia and Distal Renal Tubular Acidosis (Type 1 RTA). This case emphasizes the combined risk of chemotherapy and metabolic instability in the development of DIP.

Keywords: Acute Myeloid Leukemia, Drug-Induced Pancreatitis, Distal Renal Tubular Acidosis, Cytarabine, Hypokalemia.

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INTRODUCTION

Acute pancreatitis (AP) involves inflammation, edema, and potential pancreatic necrosis caused by autodigestion. 1,2 Although biliary disease and alcohol are common triggers, DIP is a rare but recognized cause, accounting for 0.1–2% of cases. 3, 4 Chemotherapeutic agents have been frequently linked, although the mechanisms underlying these associations are often unclear. This report examines a case of AP caused by combination chemotherapy in an AML patient with concurrent RTA. 5, 6

CASE PRESENTATION

An 18-year-old male, HCV PCR–positive, presented with severe epigastric pain and hypotension (80/40 mmHg). Initial labs showed a hemoglobin of 3.2 g/dL and circulating blasts. Bone marrow examination confirmed AML with adverse-risk cytogenetics, including monosomy 7 (classified as adverse risk according to ELN criteria).

The patient exhibited severe electrolyte imbalances, including sodium 156 mmol/L and chloride 115 mmol/L. Notably, he had profound, refractory hypokalemia (initial 2.49 mmol/L), which persisted despite aggressive IV supplementation. Urinary evaluation showed failure to acidify urine (pH 6.0) despite hypokalemia, suggesting Distal Renal Tubular Acidosis (Type 1 RTA).

After starting induction chemotherapy with Cytarabine and Daunorubicin, the patient developed clinical and radiological signs of acute pancreatitis. Serum amylase (472 U/L) and lipase (477 U/L) were elevated, and CT imaging showed peripancreatic inflammatory changes

Table No 1: Summary of laboratory findings, highlighting elevated pancreatic enzymes and persistent hypokalemia

Parameters	Result	Normal Range
WBC	5.2 × 10^9/L	4–11 × 10^9/L
Hemoglobin	3.2 g/dL	13–17 g/dL (male)
Platelets	670,000/μL	150,000–450,000/μL
Sodium	156 mmol/L	135–145 mmol/L
Potassium (initial)	2.49 mmol/L	3.5–5.0 mmol/L
Chloride	115 mmol/L	98–106 mmol/L
Magnesium	2.52 mg/dL	1.7–2.2 mg/dL
Creatinine/Urea	Normal	Creatinine 0.6–1.2 mg/dL, Urea 7–20 mg/dL
Amylase	472 U/L	30–110 U/L
Lipase	477 U/L	23–300 U/L
ABG	Normal	pH 7.45–7.35 (no acidosis/alkalosis)
Urinary potassium	Elevated	Low in hypokalemia; <20 mmol/L expected
Chest X-ray	Normal	
CT Abdomen	Pancreatic changes	
Potassium Level	□ 2.7 □ 2.49 □ 2.9 □ 1.9 3.2 mmol/L	5.0–3.5 mmol/L

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(figure 1) consistent with acute pancreatitis. Gallstones, alcohol use, hypertriglyceridemia, and hypercalcemia were ruled out. Chemotherapy was temporarily paused, and the patient was treated conservatively with bowel rest, intravenous fluids, pain relief, and electrolyte correction, leading to gradual clinical and biochemical recovery.

DISCUSSION

DIP is a diagnosis of exclusion. In this case, the temporal relationship between Cytarabine and Daunorubicin suggests a likely contributory role. 7-10 Furthermore, severe hypokalemia from Type 1 RTA may have increased the pancreas's vulnerability to injury by affecting cellular enzyme secretion.

11-14 The RTA itself may result from leukemic organ infiltration or early drug-related toxicity. Unlike typical cases, this patient's early presentation indicates a complex interaction between leukemia-associated organ dysfunction and chemotherapy-induced injury. Management focused on stopping the suspected drugs and aggressively correcting electrolytes, leading to clinical improvement. 12, 13

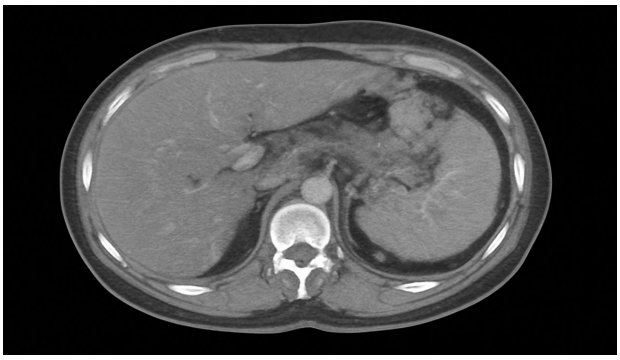

Fig- 1: contrast- enhanced CT abdomen showing peripancreatic inflammatory changes consistent with acute pancreatitis

CONCLUSION

Clinicians should consider monitoring pancreatic enzymes in patients with AML undergoing combination chemotherapy, especially when refractory electrolyte imbalances like RTA are present. Early detection and removal of the offending agent are crucial for recovery.

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AUTHOR'S AGREEMENT

Journal of Medical Sciences (KMC Peshawar pISSN 1997-3438)

Journal_____

ArticleTitle_____

I certify that

A) None of the material in the manuscript has been published previously/currently under consideration for publication elsewhere.

B) The article has not been accepted for publication elsewhere

C) I have not signed any right or interest in the article to any third party

D) I am able/willing to produce the data on which this article is based, should the Editorial Board of the Journal of Medical Sciences request such data.

E) Animal Care Committee/Institutional Review Board approval was granted for this study.

I (including spouse and children), disclose financial interest at the level

a) Nothing to disclose b) Financial interest to the amount of _____

F) I/We confirm to comply fully with the suggestions/critical views of the reviewers/editor, failing which my/our article may be rejected at the sole discretion of the editor. I/we further confirm that if our article is rejected (whihc is the sole discretion of the editor) I/we will have no right to complain against the journal/editor/representative of the journal/printer in any forum including the court of law.

G) I/we suggest the following two overseas reviewers to review our article.

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Name of reviewer	Postal address	Email address & Telephone No.

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Author name	Author signature	Author e-mail address

Note: Author agreement form must be signed by each author (one page for each) and submitted with the article.

Author's Checklist:

1. Eliminate nonstandard abbreviation in the titles
2. Supply full author names (including institutional affiliation and contact informations)
3. Contribution of individual authors
4. Abstract: 250 words, Article word count must be between 2500 - 3500 words excluding references. see details of this section in editorial policy on the website (www.jmedsci.com)
5. Mention references in Vancouver style, accurately cited in the text in numerical order
6. Cite tables in the text in numerical order
7. Cite figures in the text in numerical order
8. Author agreement is signed by all authors.
9. Letter of ethical review of concerned hospital/study place.
10. A processing and publication fee of Rs. 15,000/-(Pakistani) for local authors and $ 250 (US) for international authors has been approved by the competent authority. The fee should be submitted as bank draft/online payment through the account (IBAN) no: PK56NBPA0388004048685170 (Branch code: 0388 / National Bank of Pakistan, University campus branch, Peshawar, Pakistan). See the fee Submission Process in the editorial Policy on the website.

ETHICAL AND EDITORIAL POLICY OF THE JOURNAL OF MEDICAL SCIENCES (JMS) - UPDATED 2024

1. PURPOSE

This document highlights JMS's mission, objectives, and editorial policy regarding the publication process by adhering to the guidelines of COPE (Committee in Publication Ethics) and ICMJE (International Committee of Medical Journals Editors). Each component of the editorial policy is explained in the next sections.

A- MISSION OF JMS

To publish relevant, scientific, and accessible material to help medical students and health professionals in their practice, teaching and learning, and career development

B- OBJECTIVES OF JMS

To publish clinical, epidemiological, public health, educational, translational, and allied sciences research to enable scientists, clinicians, and researchers to learn about developments and innovations in these disciplines

To publish high-quality descriptive and experimental research, review articles, editorials, letters to the Editors, and case reports to enhance the understanding of the scientific community regarding clinical practice and education

To provide a platform for the scientific community to promote their career development through publishing quality research

2- SCOPE

This policy applies to the authors, reviewers, and readers of the JMS inside and outside the institution.

PROCESS / POLICY DESCRIPTION

1. OPEN ACCESS

JMS is an Open-access scholarly literature source that is free of charge and often carries less restrictive copyright and licensing barriers than traditionally published works, for both the users and the authors. However, it complies with well-established peer review processes and tries to maintain high publishing standards.

2. PEER REVIEW PROCESS

The review process of JMS follows a "triage approach". Upon submission of a manuscript, either online or physical, the document undergoes a preliminary open (un-blinded) review by the Editorial team. The document is either accepted for further review, sent for revision back to the authors, or rejected at that time mentioning the reasons for rejection/declining. Further review of JMS follows a blinded approach, where the article is sent to 2 reviewers, local and international who are already registered on the JMS website. During this process, the confidentiality of the authors and reviewers is ensured. The editorial board has the authority to retract an article if a serious violation of credibility or quality of research is found any time before publication, including after acceptance or after the article is published if concerns arise about the integrity of the work. (See also the section on 'Correction and retraction of articles").

3. AUTHORSHIP

According to the ICMJE criteria, authorship is based on 4 criteria; (1) conceptualization and designing, (2) AND, data collection, (3) AND, writing and critical review, (4) AND, taking responsibility for the authenticity and integrity of all the research process. All those designated as authors should meet all these 4 criteria. The co-authors should declare their roles and contributions in the research process explicitly. Those who do not meet all 4 criteria should be ACKNOWLEDGED only. If agreement cannot be reached about who qualifies for authorship, the institution(s) where the work was performed, not the journal editor, should be asked to investigate. The journal editor should seek an explanation and signed statement of the agreement if a corresponding author requests the removal, addition, or changes in the sequence of a co-author after manuscript submission and processing mentioning the approval of all listed authors and the author concerned. The corresponding author is the one individual who takes primary responsibility

for communication with the journal during the manuscript submission, peer review, and publication process. The corresponding author typically ensures that all the journal's administrative requirements, such as providing details of authorship, ethics committee approval, clinical trial registration documentation, and disclosures of relationships and activities, are properly completed and reported. The maximum number of authors for any manuscript must not exceed 6, except in some cases where the rationale must be provided by the corresponding author that will need the approval of a committee comprising the Chief, Executive, and managing editors.

4. SUBMISSION OF MANUSCRIPT

The manuscript should be submitted through the journal`s website, which uses the Online Journal System (OJS) along with the Institution`s Research and Ethics Board (IREB) certificate and other requirements as mentioned during the submission process. The article should have the following format:

4.1: The abstract should be structured with a word count of not more than 250 words. The whole document should be between 2500 and 3500 words (excluding references and appendices) for an original article. The case report and case series should be between 500-1500 words excluding references. A letter to the editor should not be more than 500 words and a review article (including meta-analysis and systematic reviews should be between 3000-5000 words excluding references and other documents. A short communication should be between 1500 to 2500 words excluding references.

4.2: The fonts should be in Calibri, with a size of 12, and spacing of 1.5, with justified margins in the MS Office format.

4.4: No article in any form should contain more than 4 figures and more than 5 tables.

4.6: Copied pictures and tables from other sources will not be entertained unless written approval from the original researcher and publisher is provided and properly captioned with the source.

5. INSTITUTIONAL RESEARCH AND ETHICS BOARD (IREB) CERTIFICATE

Under no circumstances, an article will be processed if approval from the relevant ethical board/committee for Ethical approval is not presented at the time of article submission. The Ethical approval certificate MUST have been availed before the start of the research and must include the participants` consent forms as follows:

a. Baseline data
b. Introduction
c. Purpose of the research
d. Type of research intervention
e. Voluntary participation
f. Information about the trial drug/device/test (if an experimental study)
g. Procedures and protocols
h. Description of the process
i. Side effects and risks
j. Benefits
k. Reimbursements
l. Confidentiality
m. Sharing the results
n. Right to refuse or withdraw from the study
o. Contact person
p. Undertaking of the participant and the researcher

6. CONFLICT OF INTEREST

The authors, peer reviewers, and editors must declare conflicts of interest about the financial aspects, academic competitions, and relationships during the writing, reviewing, and publishing of the manuscripts. This will ensure transparency in the research conduction, writing, and publication. The authors should clearly state the details of sponsors along with their roles and access to data.

7. CONFIDENTIALITY

The editorial board in no way should publicize the work of a researcher in any form unless it is published. They should not publicize the comments and critiques given by reviewers. Similarly, the reviewers are bound to keep the confidentiality of the work of researchers during and after the review. The work of researchers and the critique should never be discussed or exemplified in forums. The confidentiality of the researchers should be maintained in every possible way when the documents are sent for review. However, our review process is open (non-blinded) in the first phase, as per policy of the journal. In this case, the policy is displayed on the journal`s website for the researchers. Reviewers must not retain the manuscript for their per-

sonal use and should destroy paper copies of manuscripts and delete electronic copies after submitting their reviews. If a manuscript is rejected, it should be deleted from the editorial system. If an article is published, the manuscript along with its reviews and other relevant documents should be retained for 3 years and then deleted. The only situation where confidentiality needs to be breached is when a situation of fraud or misconduct is found during the review process or after publication. Still, the authors and sometimes the reviewers, have to be notified.

8. CORRECTION AND RETRACTION OF ARTICLES

The guidelines for correction and retraction of articles are as follows:

8.1: A specific page is allocated in the journal (both electronic and printed) that will be used for news related to corrections in articles published in previous journals.

8.2: The editor should also post a new article version in the journal with details of the changes from the original version and the date(s) on which the changes were made.

8.3: Previous electronic versions will prominently note that there are more recent versions of the article (that will be placed at the end of the abstract). Similarly, the authors or others should cite the more recent version.

8.4: If the error is judged to be unintentional, the underlying science appears valid, and the changed version of the paper survives further review and editorial scrutiny, then retraction with republication of the changed paper, with an explanation, allows full correction of that research paper.

8.5: If a serious violation of credibility or quality of a research paper is found after publication, the article must be retracted after approval of at least 3 editorial board members in consultation with the chief editor. The process will follow the guidelines presented by the Committee on Publication Ethics (COPE).

8.6: The retracted article should be noted on the website and the word “retracted” should be mentioned along with the title of the article.

9. CORRESPONDENCE

Correspondence for submitting an article in JMS will be through a corresponding author. The duties of a corresponding author have already been presented in a previous section. Correspondence regarding debating an article is given high value and a separate page for letters to the editors has been allocated. Derogatory and demeaning letters are screened and letters that promote debates and critique are encouraged to be published. However, correspondence about the articles published in the last 1 year will be included only.

10. THE FEE SUBMISSION PROCESS

A processing and publication fee of Rs. 15,000/-(Pakistani) for local authors and $ 250 (US) for international authors has been approved by the competent authority. The fee should be submitted as bank draft/online payment through the account (IBAN) no: PK56NBPA0388004048685170 (Branch code: 0388 / National Bank of Pakistan, University campus branch, Peshawar, Pakistan) as follows:

1. Article processing fee of 5000/- PKR at the time of submission of the article. This amount will be non-refundable.
2. Article publication fee of 10000/- PKR at the time of acceptance of article after external review. This amount will be refundable if the article is rejected for any reason.
3. For international authors, the amount of 250 US dollars will be accepted after both internal and external review. Researchers belonging to countries other than Pakistan are advised to submit the fee after the whole process of review is completed and the article is accepted for publication.
4. There will be no fee exemption in any circumstances, including members of the editorial board.

11. ROLES OF THE EDITORIAL BOARD, EDITORS, AND MEMBERS

The editorial board of JMS is following the Higher Education Commission (HEC) policy for research journals. The roles of the editorial board for JMS are mentioned below:

11.1: The roles of the Editorial Board are:

11.1.1: To offer expertise in their specialist area

11.1.2: To review submitted manuscripts

11.1.3: To advise on journal policy and scope

11.1.4: To work with the Editor to ensure ongoing development of the journal

11.1.5: To identify topics for special issues of

the journal or recommend a Conference which would promote the journal, which they might also help to organize and/or guest edit

11.1.6: To attract new and established authors and articles

11.1.7: To submit some of their own work for consideration, ensuring that they adhere to Conflict of Interest rules and stating their relationship to the journal. This is very important as the journal cannot be seen to publish only papers from members of the Editorial Board.

11.1.8: It is important that Editorial Boards have a regular communication forum with other boards of similar nature, either face to face in person (depending on their country of origin, funding availability, etc.) or as more journals are doing today, communicating by teleconference, Skype or other web platforms.

11.2: THE PATRON:

The Patron is usually the Dean of the institute, and is overall incharge of the journal, who needs to be kept informed of the decisions taken by the editorial board. The patron is the final authority to approve the decisions and policies of the editorial board.

11.3: THE CHIEF EDITOR:

11.3.1: THE CRITERIA FOR SELECTION OF CHIEF EDITOR ARE:

i. Expertise and experience in the specialist field related to the journal

ii. Publication record of a number of articles and /or books (usually in / related to the specialist field)

iii. Being a reviewer for an international peer reviewed journal

iv. Senior research position with equivalent experience in research and scholarship

v. Enthusiasm to undertake the Editor role

vi. Preferably a diploma, master or doctoral degree in Education and Research

vii. It is not necessary to fulfill all the criteria to become a chief editor.

11.3.2: THE ROLES OF CHIEF EDITOR ARE:

i. The key role of a journal`s chief editor is to promote scholarship in the specialist field associated with the journal, whilst also promoting the journal as the best journal to publish in. For any journal, the editor will need to encourage new and established authors to submit articles and set up a reliable panel of expert reviewers. Editors are also responsible for offering feedback to reviewers when required and ensure that any feedback to authors is constructive.

ii. An editor should also familiarize themselves with the Committee on Publication Ethics (COPE) 'Code of Conduct and Best Practice Guidelines for Journal Editors'.

iii. Depending on how the journal is managed and how it is structured, an Editor may have to make all the decisions regarding which articles to accept or reject for publication.

11.3.3: MANAGING EDITOR:

i. The roles of manging editor are:

ii. To help the chief editor to achieve the above-mentioned goals

iii. To communicate with the authors, reviewers, publishers and other agencies for smooth running of the journal

iv. To regularly evaluate the research work

v. To communicate with funding and regulating agencies (HEC and others) for grants and accreditations.

11.3.4: EXECUTIVE EDITOR:

i. The roles of executive editor are:

ii. To evaluate the research articles presented for publication

iii. To help the editorial board in policy making

iv. The help the editorial board in smooth publishing

v. To communicate with reviewers and collaborate with external agencies for relevant purposes

11.3.5: SECTION EDITORS:

Section editors are allotted different responsibilities. Some of these are mentioned below:

i. Bibliography

ii. Proof-reading

iii. Academic writing reviewing, grammar and spell checking

iv. Dissemination of articles for review

v. Contact with publishers under the supervision of

senior editorial team

vi. Training of future reviewers, young members and other faculty members

vii. others

11.3.6: EDITORIAL ADVISORY BOARD:

Editorial advisory board members consist of national and international senior academicians, researchers, clinicians and others to help the current editorial board in designing, implementing and evaluating policies regarding upgrading the quality of research work. These people also share best practices to help the editorial team to refine their research work.

12. POLICY REGARDING RECRUITMENT AND CONTINUATION OF EDITORIAL BOARD

The policy for recruitment and continuation of the editorial board is based on the guidelines discussed in the previous section. The chief editor, managing editor, and executive editors are recruited by the patron in-Chief. Members are then selected by them from amongst the faculty who have an aptitude for research, and their names are endorsed by the patron. The tenure of the editorial board is decided by the Patron after 3 years whether to continue or recruit a new team or member. The editorial advisory board members are recruited for an indefinite period by the editorial team of JMS.

13. PLAGIARISM POLICY

The journal follows the plagiarism policy of the Higher Education Commission of Pakistan, and for this purpose, a plagiarism standing and review committee has been established under the chairmanship of the Chief Editor of JMS along with 4 members amongst senior faculty. The committee has been given the authority to review research papers and plagiarism complaints related to published work in the journal.

14. CONTACT INFORMATION

The office of managing editor or chief editor should be contacted anytime in working hours or can be contacted through their emails for correspondence.

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