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Outcomes and Complications of Early Cholecystectomy versus Conservative Management in Diabetic Patients with Asymptomatic Gallstones

Waseem Ullah, Muhammad Daud, Aahan Attaullah, Faseeh Muhammad, Fazal Ahmad, Muneeb Ur Rehman

Abstract

Objective: To compare gallstone-related complication rates, emergency cholecystectomy conversions, morbidity, mortality, hospital stay duration, and 30-day readmissions between early laparoscopic cholecystectomy and conservative management in diabetic patients with asymptomatic gallstones.

Study design and setting: This was a prospective, comparative cohort study in which participants were recruited from the Department of General Surgery, Lady Reading Hospital, Peshawar, between January 2024 and December 2024. Those meeting inclusion criteria were allocated to either early laparoscopic cholecystectomy or conservative management groups, and outcomes were assessed at 3, 6, and 12 months.

Methodology: A total of 170 diabetic patients with ultrasound-confirmed asymptomatic gallstones were allocated equally into early cholecystectomy and conservative management group. The primary outcomes included gallstone-related complications, emergency cholecystectomy, and 30-day readmissions. Secondary outcomes included length of hospital stay and morbidity rates.

Results: The early cholecystectomy group showed significantly lower rates of complications (7.1% vs. 18.8%; $p = 0.02$) and emergency cholecystectomy (0% vs. 10.6%; $p = 0.001$) compared to the conservative group. Readmissions were also reduced in the early surgery group (2.4% vs. 8.2%; $p = 0.04$), and the mean hospital stay was shorter (2.5 ± 1.1 vs. 5.2 ± 1.8 days; $p < 0.001$). No mortality was observed in either group.

Conclusions: This study suggests that early cholecystectomy in diabetic patients with asymptomatic gallstones significantly lowers the risk of complications and healthcare utilization compared to conservative management, supporting the adoption of early elective surgery in high-risk populations.

Keywords: Cholecystectomy, Laparoscopic; Diabetes Mellitus; Gallbladder Calculi; Gallstones; Pancreatitis, Biliary

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INTRODUCTION

Diabetes mellitus is a well-recognized risk factor for gallstone formation and is associated with an increased risk of gallstone-related complications, even in asymptomatic cases.[1] Cholelithiasis affects approximately 20% of the global population, but diabetic patients exhibit a disproportionately higher prevalence and complication rate, attributed to impaired biliary motility, autonomic neuropathy, and dysregulated lipid metabolism.[1,2,6,7]

Many people with diabetes develop gallstones without any pain or warning signs. This makes it difficult for doctors to decide between watchful waiting and early surgery. If stones are left alone, they can suddenly cause infections, blocked bile ducts, or pancreatitis. These conditions affect diabetic patients more often than others. Surgery, however, brings its own costs and small operative risks. A balanced plan is to monitor the gallbladder with regular ultrasound, keep blood glucose well controlled, and discuss patient goals clearly. When new symptoms appear or overall risk rises, timely laparoscopic removal can prevent severe complications and protect long-term health.

The relationship between metabolic disorders and gallbladder function is increasingly being acknowledged in clinical research. Gallstone disease displays significant geographical variation, with a rising incidence being observed in South Asia, including India, where lifestyle changes and metabolic syndromes are on the rise.[3,8] Virk et al. note the lack of consensus among surgeons in India regarding the appropriate management of asymptomatic gallstones, highlighting variability in clinical decision-making and calling for standardized guidelines.[3]

This growing disparity in clinical approaches reflects a broader uncertainty regarding treatment thresholds in asymptomatic populations. Although up to 80% of gallstone carriers remain asymptomatic, diabetic patients face an elevated risk of progression to serious complications such as acute cholecystitis, choledocholithiasis, and gallstone pancreatitis.[1,2,4] These complications not only increase morbidity and mortality but also result in substantial healthcare utilization and cost burdens.[1,6] Kousgaard et al. reported a high short-term complication risk in symptomatic uncomplicated gallstone disease, suggesting that early surgical intervention may be beneficial in selected populations.[5] Thangaraj et al. similarly reported a prevalence of asymptomatic gallstones discovered during routine ultrasonography suggests the potential for silent disease progression.[2]

Clinical vigilance is therefore crucial in populations known to be at higher risk of disease progression, such as diabetics. The standard of care for symptomatic gallstone disease is laparoscopic cholecystectomy, which offers definitive treatment with low morbidity.[3,7,10] However, the management of asymptomatic gallstones, particularly in diabetic patients, remains contentious. While conservative management is generally accepted for asymptomatic gallstones in non-diabetic populations due to a low annual complication risk (1-4%),[3,5] diabetic patients are frequently considered a "high-risk" group, potentially warranting a more proactive surgical approach.[3]

Deciding between surgery and observation often requires weighing patient comorbidities, age, and long-term health outcomes. Conservative management could be viable for certain low-risk patients but emphasized considering individual risk profiles.[5] Cirocchi et al. reviewed management strategies in high-risk patients, noting the importance of tailored surgical approaches based on patient-specific risks and clinical presentation.[10]

As evidence accumulates, it becomes increasingly important to revise current clinical frameworks to better align with patient needs. New evidence obtained from prospective cohorts shows that uncomplicated symptomatic Gall Stone Disease carries a short-term risk, with up to 81% of patients developing complications within two years if left untreated.[4] Diabetics, due to their vascular fragility and immuno-compromised state, may be more susceptible to adverse outcomes.[1,2,4,9] Accordingly, Mencarini et al.[8] highlight the need beyond recognizing this heightened risk, clinicians must adopt individualized diagnostic and therapeutic strategies to optimize acute cholecystitis management in high-risk groups.

In spite of these issues, there are no firm recommendations in the present guidelines, such as those of the Society of American Gastrointestinal and Endoscopic Surgeons, on early cholecystectomy in asymptomatic diabetic patients.[3,7] The absence of consensus highlights an important gap in literature and is a source of variation in clinical practice.[3]

Addressing this gap through high-quality comparative research may help establish uniform protocols. Thus, the primary objective of this study was to determine whether the risk of natural disease progression in asymptomatic diabetic patients (progression to acute cholecystitis, pancreatitis, or cholangitis) outweighs the perioperative morbidity associated with elective laparoscopic cholecystectomy. This remains a controversial topic because surgical intervention carries inherent risks, such as bile duct injury or anesthesia-related events, which must be carefully weighed against the natural progression of cholelithiasis. In diabetic populations, this balance is particularly delicate due to their unique physiological vulnerabilities.

METHODOLOGY

This prospective, comparative cohort study was conducted in the Department of General Surgery, Lady Reading Hospital from 1st January 2024 to 29th December 2024 after the approval from the Institutional Review Board, Lady Reading Hospital, Peshawar (IRB Ref: No. 389/LRH/ MTI). The sample size was calculated through WHO sample size calculator. Using a 95% confidence level and 70% power, and assuming a 20% complication rate in the conservative management group and a 10% complication rate in the early cholecystectomy group, the calculated minimum sample size was 154 participants (77 in each group). To compensate for potential dropouts, the final sample size was increased to approximately 170 participants. Adult patients (=18 years) with a confirmed diagnosis of Type 1 or Type 2 diabetes mellitus and ultrasound-confirmed asymptomatic gallstones were included. To ensure a fair comparison between the “natural history” and “surgical risk,” all perioperative complications in Group A were recorded as “gallstone-related complications” for statistical parity. Only patients without prior history of gallstone-related complications and those who were fit for surgery (ASA I-III) were enrolled. Patients presenting with symptomatic gallstone disease, previous cholecystectomy, severe comorbid conditions contraindicating surgery, or pregnancy were excluded. Written informed consent was obtained from all participants. Group A included patients who underwent elective early laparoscopic cholecystectomy within four weeks of diagnosis.

Group B included patients who received conservative management with observation and symptomatic treatment as required. Participants were followed at 3 months, 6 months, and 12 months to assess for gallstone-related complications throughout the given period. The primary outcome was the incidence of gallstone-related complications, including acute cholecystitis, pancreatitis, cholangitis, and the need for emergency cholecystectomy. Secondary outcomes included morbidity and mortality rates, conversion from conservative management to emergency surgery, length of hospital stay, readmission rates, and healthcare costs. Patient demographics, clinical parameters (e.g., HbA1c, BMI, lipid profile), ultrasound findings, management strategy, and clinical outcomes were recorded using a structured data collection sheet. Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean ± standard deviation and compared using Student's t-test or Mann-Whitney U test, depending on normality. Categorical variables were presented as frequencies and percentages and compared using the Chi-square test or Fisher's exact test. A p-value of <0.05 was considered statistically significant.

RESULT

A total of 170 diabetic patients with ultrasound-confirmed asymptomatic gallstones were enrolled in the study and allocated equally into two groups: 85 patients underwent early laparoscopic cholecystectomy (Group A), and 85 patients were managed conservatively (Group B). The mean age of patients was 57.4 ± 9.8 years in Group A and 58.1 ± 10.2 years in Group B, with no statistically significant difference ($p = 0.56$). The majority of patients in both groups were female, accounting for 61.2% in Group A and 64.7% in Group B ($p = 0.48$). Baseline clinical characteristics, including mean body mass index (BMI), glycosylated hemoglobin (HbA1c), and prevalence of comorbidities such as hypertension, dyslipidemia, and ischemic heart disease, were comparable between the two groups without statistically significant differences (Table 1).

During the one-year follow-up period, gallstone-related complications occurred in 6 out of 85 patients (7.1%) in Group A (early cholecystectomy) and 16 out of 85 patients (18.8%) in Group B (conservative management), showing a statistically significant difference ($p = 0.02$). Among the complications, the most common was acute cholecystitis, followed by gallstone pancreatitis and cholangitis, all of which were more frequent in the conservative group. Additionally, 9 patients (10.6%) in Group B required emergency cholecystectomy due to the onset of complications, compared to none in Group A ($p = 0.001$). No mortality was reported in either group during the study period.

Patients in the conservative management group (Group B) had a significantly longer mean hospital stay compared to those in the early cholecystectomy group (Group A**)** **(**5.2 ± 1.8 days vs. 2.5 ± 1.1 days; $p < 0.001$**).** The 30-day readmission rate was also higher in Group B, with 7 patients (8.2%) requiring readmission compared to 2 patients (2.4%) in Group A ($p = 0.04$). The overall morbidity rate was 14.1% in Group B and 4.7% in Group A ($p = 0.03$), primarily related to gallstone-related complications and postoperative issues. No mortality was recorded in either group during the one-year follow-up period. In Group A, the complications (7.1%) were primarily minor postoperative wound infections and transient ileus, whereas in Group B, the complications (18.8%) were systemic and severe, including gallstone pancreatitis and acute cholangitis.

When evaluating the types of gallstone-related complications, acute cholecystitis was the most common in both groups, occurring in 4 patients (4.7%) in Group A and 10 patients (11.8%) in Group B ($p = 0.05$). Gallstone pancreatitis occurred in 1 patient (1.2%) in Group A and 4 patients (4.7%) in Group B ($p = 0.17$). Cholangitis was observed in 1 patient (1.2%) in Group A compared to 2 patients (2.4%) in Group B ($p = 0.56$). The overall complication rate remained significantly higher in the conservative management group ($p = 0.02$), supporting the benefit of early elective surgery in diabetic patients with asymptomatic gallstones. Figure 1 shows a comparison of clinical outcomes between patients who underwent early cholecystectomy (Group A) and those who were managed conservatively (Group B). The complication rate was significantly higher in Group B (18.8%) compared to Group A (7.1%). Emergency cholecystectomy was performed in 10.6% of conservatively managed patients, while no such cases were reported in the early surgery group. Similarly, the 30-day readmission rate was greater in Group B (8.2%) than in Group A (2.4%).

Figure 2 illustrates the distribution of complication types in the conservative management group, with acute cholecystitis being the most frequent complication, followed by gallstone pancreatitis and cholangitis. Figure 3 shows cumulative incidence of gallstone-related complications at 3, 6, and 12 months. The conservative management group consistently showed a higher complication rate compared to the early cholecystectomy group.

DISCUSSION

Diabetic patients with asymptomatic gallstones face a higher risk of developing severe gallstone-related complications; however, the recommended management approach for this population remains a topic of ongoing debate. Our findings demonstrate that early cholecystectomy significantly reduces complication rates, emergency surgical interventions, and healthcare resource utilization compared to conservative management, supporting the role of timely surgical intervention in this high-risk group. The increased risk of complications in diabetics with asymptomatic gallstones has been widely discussed in the literature. Gupta et al.[1]

Table 1: Baseline Characteristics of Study Participants

Variable	Early Cholecystectomy (n = 85)	Conservative Management (n = 85)	p-value
Age (years), mean ± SD	57.4 ± 9.8	58.1 ± 10.2	0.56
Sex, n (%)	Female: 52 (61.2%) Male: 33 (38.8%)	Female: 55 (64.7%) Male: 30 (35.3%)	0.48
BMI (kg/m²), mean ± SD	29.5 ± 3.2	29.7 ± 3.4	0.62
HbA1c (%), mean ± SD	7.8 ± 0.4	7.9 ± 0.5	0.44
Hypertension, n (%)	Yes: 45 (52.9%) No: 40 (47.1%)	Yes: 46 (54.1%) No: 39 (45.9%)	0.87
Dyslipidemia, n (%)	Yes: 53 (62.4%) No: 32 (37.6%)	Yes: 51 (60%) No: 34 (40%)	0.73
Ischemic Heart Disease, n (%)	Yes: 15 (17.6%) No: 70 (82.4%)	Yes: 14 (16.5%) No: 71 (83.5%)	0.82

Notes: BMI = Body Mass Index; HbA1c = Glycosylated Hemoglobin; SD = Standard Deviation

Table 2: Comparison of Clinical Outcomes

Outcome	Early Cholecystectomy (n = 85)	Conservative Management (n = 85)	p-value
Gallstone-related complications, n (%)	6 (7.1%)	16 (18.8%)	0.02
Emergency cholecystectomy, n (%)	0 (0%)	9 (10.6%)	0.001
Morbidity, n (%)	4 (4.7%)	12 (14.1%)	0.03
Mortality, n (%)	0 (0%)	0 (0%)	-
Mean hospital stay (days)	2.5 ± 1.1	5.2 ± 1.8	<0.001
Readmission within 30 days, n (%)	2 (2.4%)	7 (8.2%)	0.04

$p < 0.05$ considered significant

Figure 1: Bar chart comparing complication rates, emergency surgeries, and readmissions between groups

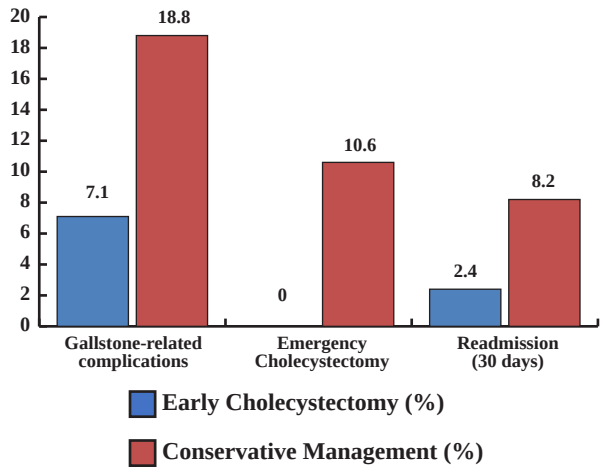
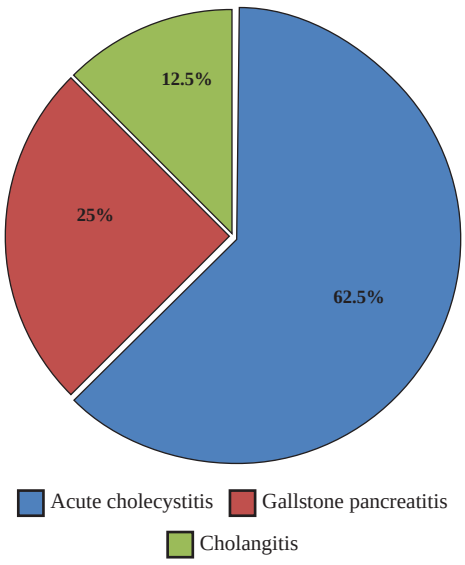
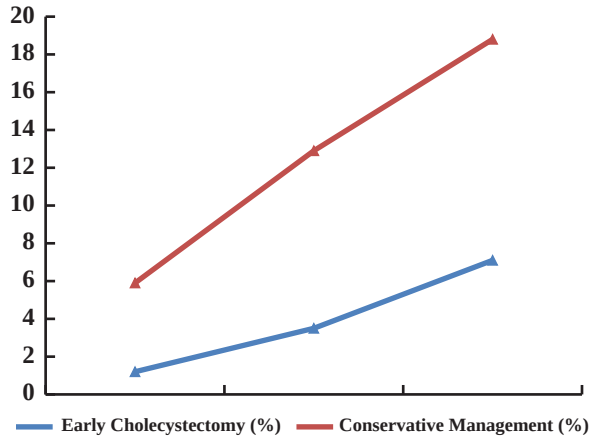


Figure 2: Pie chart showing distribution of complication types in the conservative management group



highlighted that gallstone disease in diabetics is associated with higher morbidity due to autonomic neuropathy and immune dysfunction, increasing the likelihood of progression to symptomatic disease. Our study supports this by showing that diabetic patients managed conservatively experienced a nearly three-fold higher complication rate compared to those who underwent early surgery. These findings highlight

Figure 3: Early cholecystectomy = surgery within 4 weeks; conservative management = observation without surgery; $p < 0.05$ considered significant.



the need to re-evaluate standard management strategies in diabetic populations, particularly those traditionally deemed safe to observe. However, recent European guidelines on bile duct stone management continue to reflect variations in practice patterns.[19] The prevalence of asymptomatic gallstones is substantial, particularly in high-risk populations. Thangaraj et al.[2] found a significant association between diabetes, obesity, and asymptomatic gallstones in a cross-sectional study. This underscores the importance of routine screening and consideration of long-term outcomes even in patients without symptoms. While asymptomatic gallstones are often left untreated, emerging evidence including that from Virk et al.[3] suggests early intervention may prevent complications, especially in diabetics where disease progression may be silent but severe. However, practice variations continue to exist across regions, often due to a lack of unified guidelines and differing perceptions of surgical risk.

Our findings also correlate with recent cohort studies that observed short-term complications in conservatively managed patients. Kousgaard et al.[4] reported that even uncomplicated symptomatic gallstones have a high risk of complications within one year, echoing our result of an 18.8% complication rate in the conservative group. The C-GALL trial similarly noted that laparoscopic cholecystectomy reduces recurrent symptoms and complications compared to non-surgical management, reinforcing the value of surgical intervention in carefully selected patients.[5] The significantly lower incidence of emergency cholecystectomy in the early surgery group supports the hypothesis that proactive intervention can prevent escalation of disease. Emergency surgical interventions in diabetic patients often present with higher perioperative risks due to underlying comorbidities and delayed clinical presentation. By reducing the need for urgent procedures, early surgery not only improves patient outcomes but also allows for better surgical planning, including optimization of glycemic control and perioperative risk mitigation.

Unexpectedly, our study recorded no mortality in either group during the one-year follow-up. This contrasts with literature reporting small but notable mortality rates in diabetic populations undergoing conservative management.[6] This discrepancy may be attributed to strict inclusion criteria, close monitoring, and early escalation of care in deteriorating patients within our study cohort. The structured follow-up schedule (3, 6, and 12 months) likely played a role in timely identification of complications and may serve as a model for surveillance in conservative approaches. Our results are also consistent with a meta-analysis by Cirocchi et al.[10], which demonstrated that early cholecystectomy lowers mortality and readmission rates compared to percutaneous drainage or delayed surgery in high-risk patients. The strong correlation between our data and those findings supports the external validity of our results. Furthermore, the conservative group's elevated emergency cholecystectomy rate mirrors findings from Nogueiro et al.[11] and Sneineh et al.[16], who observed late complications necessitating urgent surgery post-bariatric procedures. The literature also highlights key predictors for recurrent cholecystitis in non-surgical management, particularly among elderly patients with comorbidities. Some studies report recurrence rates ranging from 30% to 40%, most occurring within the first year. This suggest the rationale for considering early surgery in diabetic patients, who frequently present with overlapping risk factors such as age, dyslipidemia, and cardiovascular disease.[12,17] In terms of surgical approach, laparoscopic cholecystectomy remains superior to open surgery, as highlighted by Mannam et al.[13] due to its association with lower morbidity, shorter operative time, and reduced length of hospital stay. The preference for laparoscopic intervention in our study is based on both safety and efficiency. Additionally, in patients with complex bile duct stones, advances such as single-operator cholangioscopy and ERCP offer minimally invasive alternatives and reduce the need for more extensive surgery.[20] The shorter hospital stay in the early surgery group (2.5 ± 1.1 days vs. 5.2 ± 1.8 days; $p < 0.001$) is clinically relevant, reflecting smoother perioperative recovery and fewer complication-related admissions. Readmission rates were also significantly lower in this group. From a health economics perspective, these differences translate into meaningful cost savings. In resource-limited settings, strategies that reduce readmissions and emergency procedures are not only clinically sound but financially advantageous.

A central point of controversy in modern surgery is whether we should interfere with the natural history of a silent disease. Critics argue that surgical complications can be more debilitating than the stones themselves. However, our data suggests that in the diabetic subset, the "natural history" is frequently aggressive. While surgical risks exist, they were predominantly minor (Clavien-Dindo Grade I-II) in our

cohort, whereas the complications in the conservative group often required emergency intervention and longer stabilization. New emerging findings suggest that diabetic autonomic neuropathy may mask the early "warning" symptoms of biliary colic, leading to a late and more dangerous presentation of complications. This supports the shift toward elective surgery before the patient enters a high-risk emergency state. Although no statistically significant difference in baseline demographics was found between the two groups, the conservative group exhibited a higher morbidity rate, emphasizing the limitations of observational management in this population. Complications such as acute cholecystitis, gallstone pancreatitis, and cholangitis were more common in Group B. These conditions can evolve rapidly in diabetics due to impaired immune responses, making early elective surgery a safer option.

The increased rate of emergency cholecystectomy observed in the conservative group (10.6%) reflects the unpredictability of disease progression in diabetics. Emergency surgeries often occur in suboptimal conditions and are associated with greater risk of bile duct injury, longer recovery, and increased patient distress. Therefore, the timing of surgery plays a critical role not only in clinical outcomes but also in the overall surgical experience for the patient.

Additionally, our findings contribute to the growing recognition of the rising burden of gallstone-related complications in diabetic and general populations, as emphasized by Peery et al.[18] This burden extends beyond individual outcomes and impacts hospital admissions, costs, and care delivery efficiency. Li et al.[14] noted an increasing trend of choledocholithiasis and cholangitis, particularly in urban healthcare settings. Similarly, the RELAPSTONE study by Velamazán et al.[15] highlighted relapse rates up to 20% within six months of delayed surgery, supporting the rationale for early intervention in at-risk groups. Our findings are consistent with this broader body of evidence and contribute region-specific data to inform clinical decision-making. Importantly, the data support a nuanced approach to management. While early surgery appears favorable, it is essential to consider patient-specific factors including surgical fitness, comorbidity burden, and personal preference. Individualized care remains a cornerstone of high-quality management. For low-risk patients, particularly those with contraindications to surgery or limited access to surgical care, structured conservative management with close monitoring may still be appropriate. These considerations underpin our decision to standardize laparoscopic procedures in the early cholecystectomy group. These results support the view that tailored management strategies, guided by clinical risk profiles and regular follow-up, can help reduce adverse outcomes. Clinicians should assess both short-term surgical risks and long-term complication potential when making decisions in asymptomatic diabetic patients.

While this study provides valuable insights, certain limitations must be acknowledged. First, as a single-center study with a one-year follow-up, it may not capture very late surgical complications or the lifelong natural history of gallstones. Second, the study did not utilize a randomized controlled trial (RCT) design, which may introduce selection bias. Finally, while we categorized minor surgical issues as complications, a more granular quality-of-life (QoL) assessment would provide a more holistic view of the "surgery vs. observation" trade-off.

CONCLUSION

In conclusion, this study supports early cholecystectomy as a safer and more effective approach compared to conservative management for diabetic patients with asymptomatic gallstones. Our findings reinforce current guidelines advocating for early surgical intervention in high-risk populations, with significant implications for reducing morbidity, emergency surgery, and healthcare resource utilization. Future multicenter randomized trials with longer follow-up periods are recommended to further validate the benefits of early cholecystectomy in diabetic patients with asymptomatic gallstones. Research focusing on cost-effectiveness analysis and patient-reported outcomes could also offer deeper insights.

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Waseem Ullah: data collection, initial draft writing
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Aahan Attaullah: data collection and literature review
Faseeh Muhammad: statistical analysis and tables
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