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COMPLICATIONS ASSOCIATED WITH STENTS IN BILIARY STRUCTURES

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ABSTRACT

Objective: To determine the frequency of complications associated with biliary stents and to compare these complications between patients with stents in situ for less than two years and those with stents for two years or more.
Study Design and Duration of Study: Cross-sectional study. Department of Medicine, Shaukat Khanum Memorial Cancer Hospital and Research Centre, Lahore, over a period of six months after approval from the College of Physicians and Surgeons Pakistan (CPSP).
Method: Participants were selected using a non-probability sequential sampling method. The patients' ages ranged from 18 to 80 and they had a history of choledocholithiasis or biliary endoprosthesis implantation. Patients who had stents placed for less than two years or more than two years were split into two categories. We used a standardized proforma to gather information about the participants' demographics and any stent-related problems, including as jaundice, cholangitis, pancreatitis, internal migration, or CBD stones. We used SPSS version 20 to examine the data. The complication rates between the groups were compared using a chi-square test, with a p-value of $\leq$0.05 being deemed statistically significant.
Results: Out of 275 patients, 140 (50.9%) had stents in situ for less than two years, while 135 (49.1%) had stents for two years or more. The mean age was 55.4 ± 13.0 years, with male predominance (54.5%). Cholangitis was the most common complication (96.4%), followed by CBD stones (94.5%), jaundice (29.8%), internal migration (15.3%), and pancreatitis (5.1%). Comparison between groups showed no statistically significant difference in the frequency of jaundice ($p = 0.561$), cholangitis ($p = 0.089$), pancreatitis ($p = 0.548$), internal migration ($p = 0.842$), or CBD stones ($p = 0.372$).
Conclusion: Biliary stent-related complications are highly prevalent, particularly cholangitis and persistent CBD stones. However, no significant difference was observed between short-term and long-term stent placement. Regular monitoring and timely stent management are essential to minimize complications.

KEYWORDS: Biliary stent, cholangitis, choledocholithiasis, ERCP, pancreatitis, stent migration

1.INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is a complex procedure utilized to investigate and manage various pancreatic–biliary disorders, most commonly for extracting common bile duct (CBD) stones. ERCP entails multiple risks and can lead to major complications[1-3]. Despite improved ERCP techniques, endoscopic removal of biliary stones is occasionally impossible, especially when large or impacted stones are present, or when the distal common bile duct is constricted at the same time (CBD). Potential surgical candidates include patients who did not improve after endoscopic bile drainage repair. One potential treatment option for people who are elderly or have a high risk of surgery is endoscopic biliary endoprosthesis implantation [4, 5].
Tubular biliary stents made of metal or plastic are implanted into the bile ducts to restore patency when the bile ducts become narrowed due to malignancy, benign strictures, or stones 6. Biliary stents are associated with an increased risk of infection, pancreatitis, and bleeding in the early stages of the procedure, and with stent malfunction and, less often, cholecystitis, duodenal perforation, and hemorrhage in the later stages [5, 7]. Prolonged biliary stenting has less established benefit than its shorter-term counterpart. Multiple trials have shown that high-risk elderly patients with irreversible CBD stones may find relief using long-term biliary endoprostheses [8]. After three to six months, biliary stent replacement or removal was suggested due to long-term problems such cholangitis, stent migration, or blockage that were detected in these studies [9].
Biliary endoprostheses play a dual role in managing endoscopically irretrievable common bile duct (CBD) stones[10]. They provide immediate biliary drainage, helping to treat and prevent cholangitis, and allow for elective treatment when the patient is more stable. In elderly or high-risk patients, they may serve as a long-term solution[11, 12]. Although prone to occlusion within 3–5 months, endoprostheses help prevent stone impaction and maintain biliary flow.
Sohn SH et al conducted a study on complications associated with biliary stents were compared between patients with stents in place for 1–2 years and those with stents for more than 2 years. Jaundice was observed in 13 patients (34.2%), with a slightly higher frequency in the 1–2 years group (39.3%) compared to the over 2 years group (20.0%), though this difference was not statistically significant ($p = 0.441$). Cholangitis was the most common complication overall, occurring in 36 patients (94.7%), including 92.9% of the 1–2 years group and 100% of the over 2 years group ($p = 1.000$). Pancreatitis was seen in only 2 patients (5.3%), one from each group, showing no significant difference ($p = 0.462$). Internal migration

of the stent occurred in 5 patients (13.2%), slightly more frequent in the over 2 years group (20.0%) than in the 1–2 years group (10.7%) (p = 0.592). The presence of common bile duct (CBD) stones was identified in 35 patients (92.1%), with 89.3% in the 1–2 years group and 100% in the over 2 years group (p = 0.552)[13].

This study aims to evaluate the complications associated with biliary endoprostheses in both the short and long term. Patients who present for endoscopic retrograde cholangiopancreatography (ERCP) after prior biliary stent placement will be enrolled. Complications will be assessed in relation to the duration since the stent insertion, allowing for a comparison between patients with stents in place for less than two years and those with stents for more than two years. This study seeks to provide local evidence regarding the time-related risk of complications, which may help guide the timing of follow-up and stent replacement strategies.

2.METHODOLOGY

2.1Design of the Study

This cross-sectional study was performed at the Department of Medicine at Shaukat Khanum Memorial Cancer Hospital and Research Centre, Lahore from 13 February 2026 to 13 May 2026.

2.2 Sample

A non-probability successive sampling strategy was used to enroll 275 patients in total. Using the World Health Organization's sample size calculator, we estimated a 5.3% expected pancreatitis percentage, a 95% confidence level, and a 2.65% margin of error. The research comprised male and female patients with a diagnosis of choledocholithiasis and a history of biliary endoprosthesis insertion. Patients' ages ranged from 18 to 80 years. People who were either admitted to the hospital or were on follow-up in the outpatient department were the only ones taken into account. Exclusion criteria for ERCP included the following: active systemic infections unrelated to biliary stents, coagulopathy, bleeding disorders that prevent ERCP, pancreatitis unrelated to biliary stent placement, and previous biliary surgery that significantly altered anatomy (like the Whipple procedure). The research also did not include patients who had stents removed after surgery.

2.3 Procedure

After obtaining approval from the institutional ethical review committee, informed consent was taken from all participants. Demographic data including age and gender, along with clinical details such as duration of symptoms and diagnosis, were recorded using a structured proforma. Patients were categorized into two groups based on the duration of biliary stent placement: Group A included patients with stents in situ for less than two years, while Group B comprised patients with stents in place for two years or more. Each patient was assessed at presentation for stent-related complications, including jaundice, cholangitis, pancreatitis, internal migration of the stent, and the presence of common bile duct (CBD) stones. These findings were documented systematically.

2.4 Statistical Analysis

All acquired data were input and analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0. Mean ± standard deviation was used to describe quantitative data like age and length of stent installation, while frequencies and percentages were used to portray qualitative variables like gender, type of stent, and complications. The occurrence of complications was compared between the two groups using the chi-square test. After stratification, we used chi-square testing to account for potential confounding factors such age, gender, and stent type. Statistical significance was determined by a p-value of less than or equal to 0.05. Throughout the trial, we took every precaution to ensure that patient information remained confidential.

3. RESULTS

There were 275 patients in all, with 140 (50.9%) in the group of less than 2 years and 135 (49.1%) in the group of 2 years or more. The study population had an average age of 55.4 ± 13.0 years, and there was a similar distribution throughout the different categories. Fifty-4.5 percent of the patients were men. The use of plastic stents was higher than that of metallic stents (55.3% vs. 44.7%). A longer stent implantation duration was anticipated in the group with a duration of two years or more, according to the research design. After CBD stone persistence (94.5% of cases), cholangiolithitis (96.4% of cases) emerged as the most common consequence. Jaundice was observed in 29.8% of patients, while internal migration and pancreatitis were less frequent, occurring in 15.3% and 5.1% of cases, respectively. On comparative analysis, cholangitis was slightly more frequent in the ≥2 years group, whereas jaundice showed a marginally higher frequency in the <2 years group. Other complications demonstrated no substantial variation between groups.

Table 1: Demographic Characteristics of Patients (n = 275)

Variable	Group <2 years (n=140)	Group ≥2 years (n=135)	Total (n=275)	p-value
Age (years)	54.8 ± 13.2	56.1 ± 12.7	55.4 ± 13.0	0.412
Gender				0.689
Male	78 (55.7%)	72 (53.3%)	150 (54.5%)	
Female	62 (44.3%)	63 (46.7%)	125 (45.5%)	

Table 1 presents the demographic profile of the study population. A total of 275 patients were included, with a nearly equal distribution between the two groups (<2 years: 50.9%, ≥2 years: 49.1%). The mean age of patients was comparable between both groups (54.8 ± 13.2 vs 56.1 ± 12.7 years), showing no statistically significant difference (p = 0.412). Gender distribution was also similar, with males slightly predominating overall (54.5%), but without significant intergroup

variation (p = 0.689). These findings indicate that both groups were well-matched in baseline demographic characteristics.

Table 2: Clinical Characteristics

Variable	Group <2 years (n=140)	Group ≥2 years (n=135)	Total	p-value
Stent Type				0.273
Plastic	82 (58.6%)	70 (51.9%)	152 (55.3%)	
Metal	58 (41.4%)	65 (48.1%)	123 (44.7%)	

Table 2 shows the distribution of stent types among the study groups. Plastic stents were slightly more frequently used overall (55.3%) compared to metallic stents (44.7%). However, no statistically significant difference was observed between the groups (<2 years vs ≥2 years) regarding stent type (p = 0.273). This indicates that stent selection was not influenced by duration group classification and was comparable across both cohorts.

Table 3: Frequency of Complications

Complication	Yes (n)	No (n)	Percentage (%)
Jaundice	82	193	29.8%
Cholangitis	265	10	96.4%
Pancreatitis	14	261	5.1%
Internal Migration	42	233	15.3%
CBD Stones	260	15	94.5%

Table 3 summarizes the overall frequency of complications associated with biliary stents. Cholangitis was the most common complication, observed in 96.4% of patients, followed by persistent CBD stones (94.5%). Jaundice occurred in 29.8% of cases, while internal migration was noted in 15.3% of patients. Pancreatitis was the least frequent complication (5.1%). These findings highlight those infectious complications, particularly cholangitis, are the predominant adverse outcome in patients with biliary stents.

Table 4: Comparison of Jaundice Between Groups

Group	Yes	No	Total	% Yes	p-value
<2 years	44	96	140	31.4%	0.561
≥2 years	38	97	135	28.1%	

Table 4 compares the frequency of jaundice between the two duration groups. Jaundice was observed in 31.4% of patients in the <2 years group and 28.1% in the ≥2 years group. Although slightly higher in the shorter-duration group, this difference was not statistically significant (p = 0.561). This suggests that duration of stent placement has no significant impact on the development of jaundice.

Table 5: Comparison of Cholangitis Between Groups

Group	Yes	No	Total	% Yes	p-value
<2 years	132	8	140	94.3%	0.089
≥2 years	133	2	135	98.5%	

Table 5 demonstrates a very high incidence of cholangitis in both groups, with 94.3% in the <2 years group and 98.5% in the ≥2 years group. Although a marginally higher frequency was observed in patients with longer stent duration, the difference did not reach statistical significance (p = 0.089). However, the near-significant trend suggests a possible increase in infectious complications with prolonged stent duration
.

Table 6: Comparison of Pancreatitis Between Groups

Group	Yes	No	Total	% Yes	p-value

<2 years	6	134	140	4.3%	0.548
≥2 years	8	127	135	5.9%	

Table 6 shows that pancreatitis occurred in a small proportion of patients, with 4.3% in the <2 years group and 5.9% in the ≥2 years group. The difference between groups was not statistically significant (p = 0.548), indicating that stent duration does not significantly influence the risk of pancreatitis in this cohort.

Table 7: Comparison of Internal Migration Between Groups

Group	Yes	No	Total	% Yes	p-value
<2 years	22	118	140	15.7%	
≥2 years	20	115	135	14.8%	0.842

Table 7 presents the frequency of internal stent migration. Migration was observed in 15.7% of patients in the <2 years group and 14.8% in the ≥2 years group. The difference was minimal and statistically insignificant (p = 0.842). This indicates that stent migration occurs independently of stent duration and shows no meaningful variation between groups.

Table 8: Comparison of CBD Stones Between Groups

Group	Yes	No	Total	% Yes	p-value
<2 years	134	6	140	95.7%	0.372
≥2 years	126	9	135	93.3%	

Table 8 shows the persistence of CBD stones in both groups. A very high frequency was observed in both the <2 years group (95.7%) and ≥2 years group (93.3%), with no statistically significant difference (p = 0.372). This finding suggests that biliary stenting remains largely a palliative intervention, with persistent stone burden regardless of duration

DISCUSSION

The present study evaluated the frequency and pattern of complications associated with biliary stents and compared outcomes between patients with stents in situ for less than two years and those with longer durations. The findings demonstrate that complications are highly prevalent in both groups, with no statistically significant differences in most outcomes. However, certain trends observed in this study are consistent with previously published literature and provide valuable insight into the clinical behavior of long-term biliary stenting. Cholangitis emerged as the most frequent complication in our cohort, affecting 96.4% of patients overall, with a slightly higher frequency in the ≥2 years group (98.5% vs 94.3%). Although the difference was not statistically significant (p = 0.089), the observed trend suggests that prolonged stent placement may increase susceptibility to infection. This finding aligns with the study by Sohn SH et al., who reported cholangitis in 94.7% of patients with long-term biliary stents, including 100% of those with stents retained for more than two years[13]. The high incidence of cholangitis can be attributed to bacterial colonization, biofilm formation, and progressive stent occlusion, all of which impair bile drainage and predispose to infection. Similarly, Sbeit W et al. reported that long-term indwelling biliary stents are strongly associated with recurrent cholangitis due to clogging and microbial proliferation within the stent lumen[14]. Jaundice was the second most common complication, observed in 29.8% of patients, with a slightly higher frequency in the <2 years group (31.4% vs 28.1%). The lack of a statistically significant difference (p = 0.561) suggests that jaundice may be more closely related to the underlying disease process rather than stent duration. Sohn SH et al. also reported jaundice in 34.2% of patients, with a similar pattern of higher occurrence in the shorter-duration group, supporting the findings of the present study[13]. This may be explained by the fact that jaundice often reflects incomplete biliary drainage or early stent dysfunction rather than long-term complications. Pancreatitis was observed in only 5.1% of patients in this study, with no significant difference between groups (p = 0.548). This low frequency is consistent with existing literature, which identifies pancreatitis as primarily a post-procedural complication related to endoscopic retrograde cholangiopancreatography (ERCP) rather than a consequence of prolonged stent placement. Boicean A et al. emphasized that post-ERCP pancreatitis is influenced by procedural and patient-related factors rather than stent duration, which explains the comparable rates across both groups in this study1. Internal migration of the stent was observed in 15.3% of patients, with similar frequencies in both groups (15.7% vs 14.8%; p = 0.842). This finding contrasts slightly with previous studies that have reported higher migration rates with prolonged stent retention. For instance, Sohn SH et al. reported internal migration in 13.2% of patients, with a higher tendency in those with stents retained for more than two years [13]. Although our study did not demonstrate a statistically significant difference, the comparable rates across both groups suggest that factors such as stent type, size, and placement technique may play a more important role than duration alone.

The persistence of common bile duct (CBD) stones was notably high in both groups (94.5% overall), with no significant difference between short- and long-term stenting ($p = 0.372$). This finding reinforces the concept that biliary stenting often serves as a palliative or bridging intervention rather than a definitive treatment for choledocholithiasis. Similar observations have been reported by Tringali A et al., who highlighted that stenting facilitates bile drainage and reduces immediate complications but does not consistently result in complete stone clearance[7]. Additionally, Meng K et al. emphasized that while temporary stenting may aid in stone fragmentation and subsequent removal, long-term retention is associated with persistent stone burden and recurrent complications4. Another important observation from this study is the lack of statistically significant differences in complication rates between the two groups. This suggests that while prolonged stent placement may be associated with a gradual increase in risk, the overall complication profile remains relatively consistent over time. This finding is supported by Hormati A et al., who reported that although long-term stenting is associated with complications such as occlusion and infection, the incidence does not always differ significantly when compared across different durations, particularly in high-risk patient populations[9].

Limitations

This study has certain limitations that should be acknowledged. Being a cross-sectional study, it does not establish causality between stent duration and complications. Additionally, factors such as stent diameter, number of stents, and procedural variations were not analyzed in detail, which may influence complication rates. Despite these limitations, the study provides valuable local data and highlights the need for structured follow-up protocols in patients undergoing biliary stenting.

5 CONCLUSION

Biliary stent-related complications are common, with cholangitis and persistent CBD stones being the most frequently observed adverse outcomes. The frequency of jaundice, pancreatitis, internal migration, and CBD stones did not differ significantly between patients with stents in place for less than two years and those with longer durations. These findings suggest that complication risk remains substantial regardless of stent duration. Therefore, regular follow-up, timely stent replacement, and appropriate clinical monitoring are essential to minimize morbidity and improve patient outcomes.

5.1Implications

The clinical implications of these findings are significant. Given the high frequency of complications, particularly cholangitis, regular follow-up and timely stent replacement are essential to minimize adverse outcomes. Current recommendations suggest that biliary stents should ideally be replaced or removed within 3–6 months to prevent occlusion and infection[15, 16]. However, in elderly or high-risk patients who are not suitable candidates for definitive interventions, long-term stenting remains a viable option despite its associated risks[17].

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