American Journal of Medicine and Medical Sciences 2025, 15(9): 3124-3127
DOI: 10.5923/j.ajmms.20251509.61

Possibilities of Minimally Invasive Technologies in Early Postoperative Complications of the Biliary Tract

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Abstract This article presents the results of diagnosing and treating early postoperative bile duct complications in 92 patients. Following minimally invasive surgical interventions, the number of postoperative complications decreased from 16 (33.3%) to 3 (6.8%), and the average length of hospital stay reduced from 15.8±2.32 days to 8.41±0.32 days. Additionally, postoperative mortality declined from 12.5% to 2.3%. These findings demonstrate the effectiveness of the performed minimally invasive surgical interventions.

Keywords Biliary fistula, Peritonitis, Duct surgeries, Abdominal complications

1. Introduction

The achievements in abdominal surgery over the past decade have not diminished the relevance of issues related to the tactics and strategies for treating patients with early postoperative abdominal complications. This is due to the challenges of timely diagnosis and adequate treatment of abdominal complications in the early postoperative period, their high incidence rate, and mortality that shows no tendency to decrease [1,3,5,8].

Despite all the advancements in modern surgery, operations associated with postoperative abdominal complications are performed late, and sometimes unnecessarily, in a significant number of patients. This is largely because objective criteria that emerge in the early postoperative period often make it difficult to recognize the clinical picture of complications against the background of intensive treatment in intensive care and anesthesiology units, especially after extensive open surgeries [2,4].

Although patients and surgeons often express negative attitudes towards repeated interventions, the role of subjective aspects in the postoperative period is of considerable importance [6,7,8].

Despite significant positive experiences from initial research in this field, many unresolved issues remain. For instance, optimal criteria for diagnosing and selecting treatment methods for early postoperative complications have not been developed, and the immediate and long-term consequences of using minimally invasive technologies have not been fully addressed. Moreover, there is currently a viewpoint questioning the applicability of these methods in clinical practice and the feasibility of using expensive technologies. All these factors underscore the relevance of the issue under study and the necessity of our scientific research.

Purpose of the study: To improve treatment outcomes for early postoperative biliary tract complications through the rational use of minimally invasive diagnostic and treatment methods.

Received: Aug. 28, 2025; Accepted: Sep. 26, 2025; Published: Sep. 29, 2025
Published online at http://journal.sapub.org/ajmms

2. Materials and Methods

The study is based on an analysis of examination and treatment results for 92 patients with early postoperative biliary complications following various bile duct surgeries. These patients were treated at the multidisciplinary clinic of the Center for Professional Development of Medical Workers in Tashkent.

To address research objectives aimed at developing new treatment and diagnostic tactics, considering modern trends in emergency surgery, patients were divided into two groups. Group I (control group - patients from 2010 to 2016) included 48 (52.2%) patients with various complications from biliary tract surgeries, who received standard, generally accepted

treatment approaches. Group II (main group - patients admitted after 2016) included 44 (47.8%) patients, for whom the therapeutic and diagnostic algorithm was based on enhanced recovery program (ERP) principles, with minimally invasive surgical interventions used as the primary surgical treatment methods.

In the main group, women comprised 28 (63.6%) and men 16 (36.4%), while in the control group these figures were 31 (64.6%) and 17 (35.4%) respectively ($\chi 2=0.0089$; $p=0.92$). The ratio of women to men was 2:1, which corresponds to the average statistical data on the incidence of cholelithiasis. The age of patients ranged from 21 to 81 years, with a mean age of 51.2 ± 13.8 years in the main group and 49.7 ± 9.72 years in the control group ($t=0.09$; $df=90$; $p=0.93$). The compared groups were representative in terms of gender and age ($p>0.05$). Statistical analysis of the obtained results was conducted using the STATISTICA 13 software package.

3. Results and Discussion

Forty-eight patients with postoperative biliary peritonitis underwent emergency surgery. These patients constituted the control group. Clinical, laboratory, and instrumental signs of postoperative biliary peritonitis (n=38), hemoperitoneum (n=8), and combined biliary peritonitis and hemoperitoneum (n=2) served as indications for emergency surgery. In this group, postoperative biliary peritonitis developed in 11 patients due to cystic duct stump failure, in 4 patients due to biliodigestive anastomosis failure, in 6 patients due to aberrant bile ducts in the gallbladder bed, and in 17 patients after common bile duct injuries (n=7) and various drainage procedures (Kehr drainage - 7, Pikovsky drainage - 3). In 2 patients, both bleeding and biliary peritonitis were caused by biliodigestive anastomosis failure.

In 8 patients, the causes of bleeding from the biliary tract were hemorrhages from the cystic artery (n=6) and the abdominal wall (2) (Figure 1).

In 9 patients who underwent open surgery for biliary peritonitis, multiple interintestinal abscesses were discovered during the operation. Bacteriological analysis of their contents revealed the presence of infection - St. aureus and E. coli in all cases. In 25 patients, external drainage of the abscess cavity and abdominal drainage were performed using double-lumen drainage tubes with active flow-aspiration lavage.

The probability of eliminating postoperative biliary peritonitis in a single surgical intervention was high in 25% of cases. For postoperative decontamination, we used the method of flow-aspiration fractional abdominal lavage. The severity of peritonitis did not allow for quick results from a single operation, and in 60% of cases, a strategy of planned sanitations was employed to decontaminate the abdominal cavity.

In this group of 48 patients, active surgical tactics were used in 43 cases and active-expectant surgical tactics in 5 cases (Table 1).

Table 1. Active surgical approach for biliary complications following bile duct operations

Nature of operation	n	%
Ligation of the gallbladder duct	7	30,4
Repeated drainage of the common bile duct	5	21,7
Suturing of the biliodigestive anastomosis failure site	1	4,3
Ligation of the gallbladder artery	3	13
Reconstruction of the common bile duct	4	17,4
Sanitation and drainage of the abdominal cavity	23	100

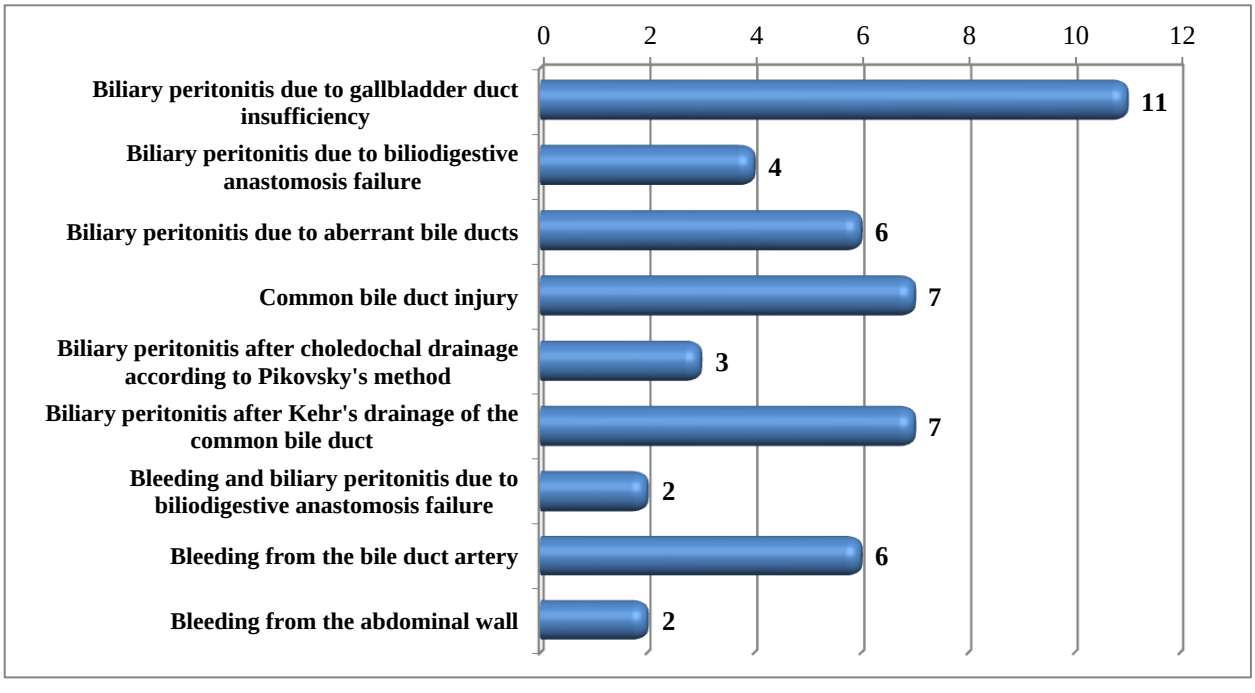

Figure 1. Conditions causing biliary complications

The necessity for external drainage in these patients is due to their severe condition, intoxication associated with the continued influx of bile and small intestine contents. Since a significant concentration of bile in the exudate substantially reduces the likelihood of pathological contents being expelled from the free abdominal cavity, when selecting a drainage method, preference was given to drainage with active aspiration. Separate drainage of the opened interintestinal abscesses was not performed. However, a drain was placed into the pelvic cavity within 24 hours, as bile entering the abdominal cavity caused significant chemical exudation at a rate exceeding the peritoneum's aspiration capabilities.

In the early postoperative period, 6 patients underwent repeated operations on the 2nd, 3rd, 5th, and 6th days after the initial surgery. Indications for relaparotomy were the appearance of peritoneal symptoms in 3 patients, and collapse with a decrease in hemoglobin levels in 2 patients.

During repeated operations, all patients exhibited complete closure of the drainage cavity by necrotic masses and leakage of purulent exudate from the area around the drain into the free abdominal cavity. In 2 patients, on the 3rd-4th day after biliary drainage surgery, a recurrence of bile leakage from the liver wound was observed at the site of percutaneous transhepatic biliary drainage.

After drain removal, external biliary fistulas formed in 3 patients. In 2 of these patients, the fistulas closed spontaneously, and only in one case was it necessary to excise the abscess cavity along with the fistulous tract.

The frequency and nature of postoperative complications in patients of the control group following external laparotomy drainage are presented in Table 2.

Table 2. Complications after laparotomy in the early postoperative period

Nature of complications	n	%
External biliary fistula	12	75
Primary or recurrent erosive bleeding	6	37,5
Renal-hepatic failure	5	31,3
Diffuse peritonitis	4	25
Laparotomy wound infection	7	43,7
Acute gastric and duodenal ulcers	2	12,5
Total	16	100

A total of 6 (12.5%) patients died in the control group. The cause of death for 3 patients was abdominal sepsis. Two patients died from acute cardiovascular failure due to anemia and intoxication, and 1 died from progressive hepatorenal failure.

However, it is impossible to compare the groups based on the operations performed. This is because in the control group, the operations were performed via laparotomy (except for 3 patients who were under active observation), while in the main group, minimally invasive methods were used in all cases. This, in turn, reduced the length of patients' hospital stay (8.41 ± 0.32 days in the main group, 15.8 ± 2.32 days in the control group) by 53% ($t=3.16$; $df=49$; $p=0.003$).

Comparison of postoperative complications showed that in the main group, complications were observed in 3 (6.8%) patients. In the control group, this figure was 16 (33.3%) patients. It is evident that the frequency of postoperative complications in the main group significantly decreased by almost 5 times compared to the control group ($\chi2=9.85$; $p=0.002$).

When comparing mortality rates between groups, it was found that the number of deaths in the main group was 1 (2.3%). In the control group, this figure was 6 (12.5%). Thus, mortality decreased from 12.5% to 2.3% (by 10 percentage points) ($\chi2=3.4$; $p=0.032$).

4. Conclusions

Thus, biliary complications after bile duct surgeries occurred due to cystic duct stump insufficiency, biliodigestive anastomosis failure, presence of aberrant bile ducts in the gallbladder bed, and after various types of extrahepatic duct drainage (according to Kehr, Pikovsky, Vishnevsky) due to common bile duct injuries and Mirizzi syndrome. Bleeding and biliary peritonitis were caused by biliodigestive anastomosis failure, and isolated bleeding from the cystic artery and abdominal wall was also observed. In the control group of 48 patients, active surgical tactics were employed in 43 cases, and active-expectant tactics in 5. This group underwent relaparotomy, cystic duct suturing, repeated common bile duct drainage, suturing of failed biliodigestive anastomosis, cystic artery ligation, reconstructive operations on the common bile duct, and abdominal cavity lavage and drainage. In the main group, minimally invasive methods were used in all cases: relaparoscopy for cystic duct stump failure with repeated clipping, relaparoscopic suturing of common bile duct injuries with Kehr and Vishnevsky drainage, relaparoscopic lavage of the gallbladder bed with coagulation of bile leakage source in aberrant ducts, relaparoscopic repeated drainage of the common bile duct in biliary peritonitis after drainage for Mirizzi syndrome, relaparoscopic lavage and drainage of the abdominal cavity (subhepatic space and pelvis) in limited biliary peritonitis, relaparoscopic hemostasis for bleeding from the gallbladder bed, and percutaneous drainage for limited bile leakage from biliodigestive anastomosis. ERCP with EST was performed in 5 patients after bile leakage through drains ceased.

After minimally invasive surgical interventions, postoperative complications decreased from 16 (33.3%) to 3 (6.8%) ($\chi2=9.85$; $p=0.002$), and the length of hospital stay decreased from 15.8 ± 2.32 to 8.41 ± 0.32 days ($t=3.16$; $df= 49$; $p=0.003$). Postoperative mortality decreased from 12.5% to 2.3% (10%) ($\chi2=3.4$; $p=0.032$). This indicates the feasibility of using the performed minimally invasive surgical interventions.

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