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Postoperative bile leak after hepato-pancreato-biliary surgery in malignant biliary obstruction: rates, treatments, and outcomes in a high-volume tertiary referral center

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Abstract

Background Biliary leakage is a serious complication of hepato-pancreato-biliary operations, increasing morbidity and mortality, and challenging clinicians.

Objective This study aims to evaluate the incidence of bilioenteric anastomotic leakage, treatment options, and their outcomes at a high-volume tertiary referral center.

Methods A retrospective cohort study was conducted to analyze the outcomes of patients who underwent biliary anastomosis formation between 2016 and 2021. Data from patients with malignant biliary obstruction was analyzed collectively and in two homogenous cohorts: distal malignant (DM) group with distal biliary obstruction undergoing pancreatic head resection, proximal malignant (PM) group with perihilar biliary obstruction undergoing perihilar biliary resection without liver resection.

Results 724 patients were found. After exclusions, 410 remained in the DM and 41 in the PM group. In the DM group the leak rate was 5.6% (23/410). Mortality was 3.9%, in patients with anastomotic failure 26% (6/23) vs no failure 2.6% (10/387) ($p<0.0001$). Leak rate in the ASA III and ASA I-II patients were 52.2% (12/23) vs 48.8% (11/23), ($p=0.597$). Leak rates were higher in the PM group 14,6% (6/41), mortality was 4.9% (2/41). All leaks in the PM group occurred in ASA III patients (6/6). No statistically significant associations were found between leak rates and factors such as patient age, preoperative serum bilirubin levels, preoperative or intraoperative biliary drainage, cholangitis, blood transfusion, postoperative pancreatic fistula, or bile duct dilation in either group. Bile leaks ($n=29$) were treated conservatively ($n=9$) with percutaneous transhepatic drainage ($n=3$) or reoperation with ($n=16$) or without ($n=10$) external biliary drainage. Clinical success rates were slightly higher after reoperation with external drainage.

Conclusion This study identified perihilar resection as a risk factor for biliary leakage and trends indicating higher leak rates among patients with advanced comorbidities (ASA III), elevated preoperative bilirubin levels, non-dilated bile ducts, cholangitis or postoperative pancreatic fistula but these associations did not reach statistical significance,

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likely due to the limited sample size. In the management of anastomotic leakage, conservative and minimally invasive methods are effective; however, most cases required relaparotomy combined with external biliary drainage.

Keywords Anastomotic leakage, Bile duct, Biliary obstruction, Risk factors, External drainage, Biliary drainage

Introduction

Surgeries such as pancreatoduodenectomy, bile duct resection, and surgical palliation are used to reconstruct the biliary tract in cases of malignant obstruction. This surgery usually succeeds, although failure can cause bile leakage or peritonitis. Depending on the type of treatment, 0.4% to 33% of patients experience biliary leakage after a hepaticojejunostomy [1–5].

The success of biliary anastomosis is critically dependent on the vascularity, particularly the hepatic artery. This condition explains the high incidence of biliary complications in patients with hepatic arterial thrombosis (up to 80%) or hepatic artery stenosis (up to 67%) [6]. Advanced surgical methods and postoperative care have reduced hepatobiliary and pancreatic surgery morbidity and death. Bile leakage still causes surgical morbidity by prolonging hospital stays, delaying abdominal drain removal, and requiring invasive diagnostics and treatments.

After a bilioenteric anastomosis, bile leakage can be managed using a variety of techniques. Conservative management is generally the first approach in the clinical practice in patients without biliary peritonitis, although it is not always sufficient [7, 8]. Using computed tomography or ultrasound guidance, the biloma can be percutaneously drained to address biliary leakage. Percutaneous transhepatic drainage can also treat bilioenteric anastomotic failure (PTD). A transhepatic drainage catheter is inserted into bile ducts to reach the bilioenteric anastomosis and drain bile outside. It alleviates symptoms and prevents further complications. To treat uncontrolled anastomosis dehiscence, relaparotomy and resuture may be needed. To prevent bilioenteric anastomosis leakage after biliary reconstruction, external biliary drainage has been examined. External drainage can reduce pressure on the anastomosis by diverting bile [2]. However, there is no evidence on the optimal treatment and prevention of postoperative biliary drainage. Studies examining the effectiveness of various therapy alternatives are lacking. Our study aims to evaluate the failure rate and risks of bilioenteric anastomosis, as well as the available treatments and their outcomes in a high-volume tertiary referral center with extensive expertise in percutaneous transhepatic drainage.

Materials and methods

We designed a retrospective cohort study and performed a data analysis of the results of patients who underwent biliary anastomosis formation for malignant obstruction in our tertiary referral center between 2016 and 2021. We collected data on patient demographics, perioperative clinical and biochemical parameters, preoperative and intraoperative biliary drainage, underlying pathology, surgical procedure resulting in bilioenteric anastomosis, presence of anastomotic failure resulting in bile leakage, additional radiological and surgical interventions, and clinical outcomes.

The study was approved by the Semmelweis University Regional and Institutional Committee of Science and Research Ethics (SE RKEB #25/2023). Patient records were accessed on 13 of March 2023 via the electronic medical system used by Semmelweis University. The records were fully anonymized during the data analysis, and the ethics committee did not require informed consent. The authors had no access to information that could identify individual participants during or after data collection.

Outcomes and definitions

The initial patient cohort comprised a variety of disease etiologies followed by operations detailed in the results section. After exclusions patient data were evaluated collectively, and in order to mitigate inhomogeneity bias, the patients were analyzed in two separate homogeneous cohorts. The two groups were defined as the following:

Distal Malignant (DM) group—patients with distal malignant biliary obstruction undergoing pancreatic head resection.

Perihilar malignant (PM) group—patients with perihilar malignant obstruction undergoing perihilar resection. Liver resection is a major trauma for the patients and can result in complex technically more challenging biliary reconstructions which are hard to evaluate homogenously. Thus, this group only included patients without liver resection.

Surgeon's experience must play a key role in anastomotic leakage; however, in our center advanced HPB surgeries like pancreatic head and perihilar resections are always performed under the supervision of an experienced HPB surgeon. In cases where the operation is done by a younger fellow an experienced HPB surgeon supervise as first assistant in every case.

We measured the technical and clinical outcomes of interventions to stop biliary leakage. Biliary leakage was diagnosed if bile was observed in drain fluid in the post-operative period. The diagnoses were based on clinical evidence. The location of biliary leakage was determined by reviewing data from the subsequent surgical or radiological interventions. Thus, failure of bilioenteric anastomosis was defined if the bile leak was observed through the bilioenteric anastomosis. Other sites of bile leakage (i.e. gastroenteric anastomosis, cystic duct stump, or pancreatic anastomosis) were not included in the analysis of anastomotic failure.

Technical success was defined as a successful intervention that resulted in bile leakage controlled by a percutaneous or transabdominal drain catheter. Our percutaneous transhepatic drainage technique is described in our previous publication [9].

Conservative therapy is defined as the state in which leaking stopped spontaneously and no further action was required.

Clinical success was defined if the bile leakage resolved without the need for additional interventions directly related to anastomotic leakage other than percutaneous intra-abdominal drainage.

Biliary leaks were classified from A to C by the impact of this complication on the clinical management of patients, according to the classification system described by the International Study Group of Liver Surgery (ISGLS) [10].

We examined the relationship between anastomotic failure and various factors, including the ASA (American Society of Anesthesiologists) score, patient age, total bilirubin levels, preoperative cholangitis, preoperative biliary drainage, the presence of preoperative biliary duct dilation, surgical type, intraoperative external biliary drainage, postoperative red blood cell transfusion, and postoperative pancreatic fistula (POPF). Cholangitis was diagnosed based on the presence of systemic inflammation, cholestasis, and biliary dilatation, as outlined in the Tokyo Guidelines for acute cholangitis [11]. Pancreatic fistula (type A, B, C) was defined following the guideline of the International Study Group of Pancreatic Surgery (ISGPS) [12].

Statistical analysis

To summarize our data descriptive statistical tools were used, for continues variables mean and standard deviation, for categorical variables frequencies and percentages were applied. To compare differences between groups Mann–Whitney U-test in case of continues data, Chi-squared test, or Fisher test in case of categorical data were used. A significance level of less than 0.05 was considered statistically significant. To identify independent predictive variables binary logistic regression with stepwise selection was applied. All calculations were implemented using IBM SPSS for Windows (version 28; IBM Corp., Armonk, NY, USA).

Results

The initial cohort comprised 724 patients who underwent bilioenteric anastomosis for various underlying conditions. After excluding benign etiologies, the analysis focused on 451 patients with malignant pathology. These were further stratified into two homogeneous cohorts: the DM group (410 patients) and the PM group (41 patients). (Fig. 1.) Baseline characteristics are presented in Table 1. We also performed data analysis without exclusions on all patient's data which can be found in the supplement material.

The overall mortality rate among all patients was 3.99%, 24% (7/29) in patients with anastomotic failure and 3% (11/422) in patients without anastomotic failure. ($p<0.0001$).

In the DM group, mortality was 3.9%, significantly ($p<0.0001$) higher in patients with anastomotic failure 26% (6/23) vs without failure 2.6% (10/387).

In the PM group, mortality was 4.9% (2/41). 1 death happened with anastomotic failure (16.7%, 1/6) and 1 without (2.9%, 1/35), the difference was not significant.

Anastomotic failure

All patient's leak rate was 6.4% (29/451). Leak rate in the DM group was 5.6% (23/410), in the PM group 14.6% (6/41) which difference was significant $p=0.038$.

ASA score, age, total bilirubin levels, preoperative cholangitis, preoperative biliary drainage, bile duct dilatation, surgery type, intraoperative external biliary drainage, postoperative red blood cell transfusion, and POPF were examined in association of biliary failure and leakage. We found no non-dilated bile ducts in the PM group.

Although the leak rate appeared to be higher in patients with advanced comorbidities (ASA III), the differences across ASA categories were not statistically significant in either group. Biliary leakage had a greater prevalence across all potential risk factors analyzed; however, the differences did not demonstrate any statistically significant connections with leak rates in either group (Table 2).

Multivariate analysis did not find any statistically significant protective or risk factors in relation to anastomosis leakage in either group.

Management of the biliary leakage

Biliary leakage was managed using various approaches depending on the severity.

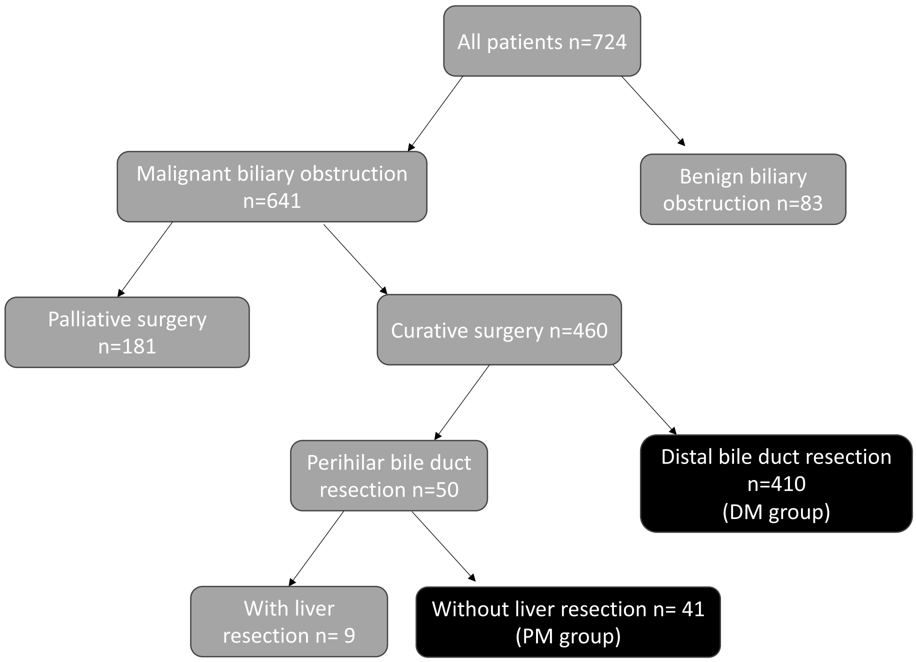

Fig. 1 Patient exclusion flowchart

Table 1 Baseline characteristics

Baseline characteristic	Total	DM	PM
Male sex, *n* (%)	223 (49%)	202 (49%)	26 (63%)
Age in years, mean (SD)	67.6 (11.07)	67 (11)	71 (12)
ASA score *n*, %			
I	3 (0.7%)	3 (0.9%)	0
II	229 (51%)	215 (68%)	14 (34%)
III	219 (49%)	192 (60%)	27 (65%)
IV	0	0	0
Bilirubin, pre-operative µmol/L, mean (SD)	40.77 (74.78)	37.35 (70.5)	74.76 (101.84)
Preoperative endoscopic stent, *n* (%)	229 (50%)	199 (49%)	30 (73%)
Preoperative PTD, *n* (%)	24 (5%)	19 (5%)	5 (12%)
Not present or removed during surgery, n (%)	5 (20%)	5 (26%)	0
Not removed during surgery, n (%)	19 (79%)	14(74%)	5 (100%)
External biliary drainage *n*, (%)	29 (6%)	16 (4%)	13 (31%)
Intraoperative PTD placed during surgery	2 (6%)	0	2 (15%)
PTD placed before surgery and left in place	19 (66%)	14(87%)	5 (38%)
Transjejunal drainage	8 (28%)	2 (13%)	6 (46%)
Disease etiology *n*, (%)			
Pancreatic head cancer	318 (71%)	318 (78%)	0
Periampullary tumor	78 (17%)	78 (19%)	0
Perihilar cholangiocarcinoma (B-C 1–2)	35 (8%)	0	35 (85%)
Distal cholangiocarcinoma	14 (3%)	14 (3%)	0
Gall bladder carcinoma	6 (1%)	0	6 (15%)
Days between anastomosis formation and diagnosis of leakage, mean (SD)	5.3 (4.8)	5.4 (4.99)	5.1 (3)

Table 2 Univariate analysis of factors in association of biliary failure and leakage

Factor examined	number of patients (*n*)	leakage (*n*)	%	*p*
All patients—ASA I-II	232	11	4.74%	
All patients—ASA III	219	18	8.22%	
				0.178
DM group—ASA I-II	218	11	47.8%	
DM group—ASA III	192	12	52.2%	
				0.597
PM group—ASA II	14	0	0.0%	
PM group—ASA III	27	6	100.0%	
				0.079
All patients—Cholangitis	24	3	12.5%	
All patients—No Cholangitis	427	26	6.09%	
				0.194
DM group—Cholangitis	19	1	5.26%	
DM group—No Cholangitis	391	22	5.63%	
				1
PM group—Cholangitis	5	2	40%	
PM group—No Cholangitis	36	4	11.11%	
				0.148
All patients—Preoperative biliary drainage used	253	14	5.53%	
All patients—No preoperative biliary drainage used	198	15	7.58%	
				0.441
DM group—Preoperative biliary drainage used	218	9	4.1%	
DM group—No preoperative biliary drainage used	192	14	7.3%	
				0.165
PM group—Preoperative biliary drainage used	35	5	14.3%	
PM group—No preoperative biliary drainage used	6	1	16.7%	
				> 0.999
DM group—Dilated bile duct	262	12	4.58%	
DM group—Non dilated bile duct	148	11	7.43%	
				0.265
All patients—External biliary drainage used	29	3	10.34%	
All patients—No external biliary drainage used	422	26	6.16%	
				0.42
DM group—External biliary drainage used	16	1	6.3%	
DM group—No external biliary drainage used	394	22	5.6%	
				0.61
PM group—External biliary drainage used	13	2	15.4%	
PM group—No external biliary drainage used	28	4	14.3%	
				> 0.999
All patients—Postoperative red blood cell transfusion	93	10	10.75%	
All patients—No postoperative red blood cell transfusion	358	19	5.31%	
				0.093
DM group—Postoperative red blood cell transfusion	87	8	9.2%	
DM group—No postoperative red blood cell transfusion	323	15	4.64%	
				0.116

Table 2 (continued)

Factor examined	number of patients (*n*)	leakage (*n*)	%	*p*
PM group—Postoperative red blood cell transfusion	6	2	33.33%	
PM group—No postoperative red blood cell transfusion	35	4	11.43%	
				0.206
DM group—Postoperative pancreatic fistula	35	4	11.43%	
DM group—No postoperative pancreatic fistula	375	19	5.07%	
				0.122
Age	mean	St. Dev	-	
All patients without leakage	67.74	10.011		
All patients with leakage	65.52	11.8111		
				0.331
DM group without leakage	67.39	11.088		
DM group with leakage	64.74	12.622		
				0.238
PM group without leakage	71.62	9.33		
PM group with leakage	68.55	7.44		
				0.237
Total bilirubin	mean (µmol/L)	St. Dev	-	
All patients without leakage	38.51	72.24		
All patients with leakage	73.50	101.03		
				0.077
DM group without leakage	36.49	70.17		
DM group with leakage	51.73	77.49		
				0.263
PM group without leakage	60.68	88.93		
PM group with leakage	156.95	129.73		
				0.080

In the DM group the prevalence of biliary leakage was 5.6% (23/410) among the patients, in 7 cases conservative treatment was successfully. A total of 16 patients needed intervention (3.9% 16/410). The failed primary intervention was followed by repeat interventions in 6 cases, for a total of 22 interventions.

In the PM group the prevalence of biliary leakage was 14.6% (6/41) among the patients, in 2 cases conservative treatment was successfully. A total of 4 patients needed intervention (9.7% 4/41). The failed primary intervention was followed by repeat interventions in 3 cases, for a total of 7 interventions.

According to the classification proposed by the International Study Group of Liver Surgery, Grade B leaks received minimally invasive intervention, and Grade C leak underwent relaparotomy [10]. Grade C cases were further divided in two subgroups: laparotomy with (Grade C-2) or without intraoperative biliary drainage (Grade C-1).

The results of all groups and subgroups are detailed in Table 3.

Discussion

Biliary leakage is a serious complication of hepato-pancreato-biliary surgery that alters the postoperative course of patients, increases morbidity and mortality, and challenges clinicians.

This unique study analyses one of the largest single-center patient population comparing leak and treatment outcomes in such patient population.

The rate of bile leakage depended on the type of surgery and disease, with significantly higher leak rate observed in the PM group (14.6%) compared to the DM group (5.6%). This finding highlights the importance of analyzing the data in these groups separately. Previous studies reported biliary leak rates 3–10% following pancreatoduodenectomy and up to 11% after bile

Table 3 Results of interventions used to treat biliary leakage

DM group	Total (*n*)	Technical success (*n*; %)	Clinical success (*n*; %)
Grade B	1	1; 100%	0;0%
PTD	1	1; 100%	0;0%
Grade C	21	16;76.2%	12;57.1%
Grade C-1	10	8;80%	5;50%
Grade C-2	11	8;72.7%	7;63.6%
Laparotomy + PTD	3	2;67%	2;67%
Laparotomy + T-Tube	5	3;60%	2;40%
Laparotomy + Transjejunal drain	3	3;100%	3;100%
PM group			
Grade B	2	1;50%	1;50%
PTD	2	1;50%	1;50%
Grade C	5	4;80%	4;80%
Grade C-1	0		
Grade C-2	5	3;60%	3;60%
Laparotomy + PTD	2	1;50%	1;50%
Laparotomy + T-Tube	1	1;100%	1;100%
Laparotomy + Transjejunal drain	2	1;50%	1;50%
All patients			
Grade B	3	2; 75%	1;25%
Grade C	26	20;78.1%	16;68.6%
Grade C-1	10	8;80%	5;50%
Grade C-2	16	11;66.4%	10;61.8%

duct resection [13, 14, 1]. Olthof et al. reported even higher rates of 32–36% after resection of perihilar carcinoma, but with liver resection [2]. Segmental branches are involved in most perihilar resections, making these branches more vulnerable to leakage due to extensive dissection required. This leads to compromised blood flow, which is known to be essential for the healing of biliary anastomosis [15]. Based on these considerations, we excluded liver resection from our cohort.

Age, prolonged operating time, postoperative pancreatic fistula, small size common bile duct, post-pancreatectomy hemorrhage, low blood albumin, delayed gastric emptying, and sepsis were among the risk factors following pancreatoduodenectomy for the development of biliary leakage, according to previous reports [16]. Jaundice, and thus elevated serum bilirubin level, also increases the risk of morbidity and mortality through several pathophysiologic changes [17]. We showed increased serum bilirubin levels in patients with bile leak in both DM and PM groups; however, the difference was not significant.

Preoperative cholangitis is a well-known consequence of biliary obstruction which maintains a generalized toxic state decreasing healing tendency. The study by Darnell et al. demonstrated that cholangitis is an independent risk factor for mortality after pancreatoduodenectomy but does not influence postoperative morbidity [18]. However, its role as an independent risk factor for biliary leakage remains ambiguous. In the DM group no significant difference in biliary leakage rates was observed between patients with and without cholangitis. In contrast, the PM group showed a higher leakage rate, but due to the small number of cases, this result could not reach statistical significance.

Preoperative biliary drainage may seem advantageous in treating jaundice and cholangitis; however, the data is uneven and debated. Several guidelines advise against preoperative bile duct draining for malignant obstruction unless surgery is delayed or cholangitis is present [19–21]. However, a recent article by Farooqui et al. found fewer post-pancreatoduodenectomy complications and lower mortality in patients receiving biliary drainage prior to surgery [22]. In this study, preoperative biliary drainage was associated with slightly lower anastomotic failure, but it was statistically not significant in either of the cohorts due to low number of leaks.

The ASA score is known as an independent predictor of post-operative medical complications and mortality across procedures [23]. A high ASA score suggests several comorbidities and increased risk of consequences. High ASA scores may diminish immune function, wound healing, and surgical infection risk, which can lead to biliary anastomotic failure. This tendency is visible in both groups, but statistically not significant due to the low number of events.

Postoperative pancreatic fistula can increase mortality and morbidity, but it is not yet verified as an independent risk factor for hepaticojejunostomy [24]. We found higher biliary leakage ratio in patients with POPF although not significantly.

Postoperative red blood cell transfusion may indicate anemia due to blood loss or septic complications and, therefore, could serve as an indicator for biliary leakage risk. Our data revealed an elevated biliary leakage ratio in patient who received transfusions, but the difference could not reach statistical significance. The available publications on this risk factor are mixed with only one study verifying bleeding as significant risk factor of biliary leakage after hepaticojejunostomy [1].

There is insufficient evidence on the role of external biliary drainage in preventing biliary leakage. External drainage promises to reduce bile leakage after bilioenteric anastomosis, but with such a small sample size, our study failed to demonstrate any significant benefit of this technique in pancreatoduodenectomy or perihilar bile duct resection without liver resection. The same results were reported by Olthof et al. who investigated bile leaks after perihilar resection with liver resection [2]. Another aspect of external biliary drainage is utilizing a catheter in the differential diagnosis of postoperative biliary leakage. The direct administration of contrast material through the catheter aids in the clear visualization of anastomotic leakage during fluoroscopic imaging.

Another questionable factor in stopping leakage is anastomotic stent application. Mercado et al. studied intraoperatively placed stents over biliary reconstructions of iatrogenic biliary lesions but found no difference in bile leaks between the stented and non-stented groups [25]. In a study published by Suzuki et al., biliary leakage was observed in 15.2% of patients undergoing hepaticojejunostomy. The presence of a transanastomotic stent and preoperative biliary drainage was associated with the development of clinically significant bile leaks. These findings suggest no benefit from the use of intraoperatively inserted transanastomotic drains [26].

Non-dilated bile duct is a verified risk factor of biliary leakage after pancreatoduodenectomy [24]. Although almost double of the patients developed biliary leakage with non-dilated bile ducts the risk was statistically not significant in our cohort. We could not find such patients in the PM group.

Leak rates also depend on the definition of biliary leakage [10]. There are some classifications based on the amount of bilirubin measured in the drain fluid, but in our study group bilirubin levels were not routinely measured in catheter fluid. Thus, we relied on clinical reports of increased biliary fluid in drain catheters and analyzed intervention reports of leaks. However, the classification of the severity of bile leakage was possible using the ISGLS system.

In our clinical practice, if the patient does not exhibit biliary peritonitis, we attempt to control the leakage conservatively by leaving the intraoperatively placed abdominal drain in place until the leakage spontaneously resolves. In our results the effectiveness of conservative management was clear. If this method is unsuccessful, historically it was followed by surgery. The development of minimal invasive techniques, endoscopy, percutaneous drainage the role of surgery decreased. Percutaneous therapies offer a good option because endoscopic interventions cannot be carried out on an altered anatomical structure, such as that left after a Roux-en-Y hepaticojejunostomy. In high volume centers, percutaneous transhepatic biliary interventions have high technical success rates (94%–100%) regardless of the presence of dilated bile ducts [9, 27, 28]. Our previous data describes the safety and efficacy of this modality with the same patient population [9]. In our center two trained surgeons performed all percutaneous biliary intervention under local anesthesia. The interventions were performed under fluoroscopy without ultrasound guidance. The primary puncture was performed in the 9th–10th intercostal space on the patient's right side. If the right lobe was not accessible the left liver lobe access was indicated, left-side puncture was performed in the subxiphoid space. Seldinger technique was used to insert a sheath to perform a cholangiography to determine the leakage level. Once the sheath crossed the leakage site an 8.5F or 10.2F drain was left behind bridging the leakage. The drain was sutured and fixed to the skin with its original kit. If the postoperative intraabdominal catheter did not drain any more bile it was removed. The patients were sent home with the opened PTD which was removed in ambulatory setting after a final cholangiogram.

This approach is supported by publications by Mansueto et al. who report a long-term success (77%) of patients treated with biliary fistula, and Anglieri et al., who recommend percutaneous treatment of bile leaks as a first-first line therapeutic option to avoid more invasive procedures [13, 29]. In this cohort, percutaneous transhepatic drainage had low patient numbers in the minimally invasive subgroup, which limits the interpretation of the data. It was not possible to conclude whether the minimally invasive approach was superior to alternative procedures.

In cases where excess biliary fluid leads to peritonitis, reoperation cannot be avoided. Several techniques have been described to maximize postoperative success after redo surgery. As for the lack of high quality reoperation techniques, they can only be discussed at a low level of evidence [15]. There are no guidelines to follow when external biliary drainage should be considered in relaparotomy. External biliary drainage has not been shown to be effective in preventing biliary leakage in primary bilioenteric anastomosis. In the DM group clinical success was slightly better when external drainage was used (Grade C-2) to treat biliary leakage in the relaparotomy group. Due to the complexity of managing anastomotic leakage in the perihilar anatomical region, reoperations performed in the PM group consisted of implantation of an external biliary drainage with anastomosis reconstruction. In our practice, the preferred external drainage technique is the intraoperatively placed PTD. Before completing the anterior aspect of the biliary anastomosis, a metallic probe is introduced through the anastomosis into the right intrahepatic bile duct. If entry from the right side is not feasible, access from the left side is recommended. The metallic probe is extracted through the intrahepatic bile duct and passed through the Glisson capsule and the 9th–10th intercostal space on the patient's right side or the subxiphoid space in left sided approach. The previously mentioned 8.5F or 10.2F drain is attached to the metallic probe and subsequently pulled back through the parenchyma, crossing over the anastomosis. With this external catheter, theoretically it's possible to decrease the biliary pressure and diagnose and treat any further leakage.

However, external drainage is not well supported by research, and there are no studies comparing the efficiency of surgical revision surgery and external drainage. Thus, this area needs more exploration.

The main limitation of this study is the retrospective data analysis. This did not allow us to use previously described bile leak definitions; thus, we relied on expert opinion. The methodology did not allow us to select biliary interventions according to the severity and to directly compare results. In addition, the low number leaks and interventions reduce the statistical power of the study. It was also not possible to collect more possible risk factors in association to anastomotic failure. Furthermore, the present study was performed only in a single center.

Conclusion

Failure of postoperative biliary anastomosis is a serious complication of hepato-pancreato-biliary operations that significantly increases mortality. This study provides valuable insights into the incidence and management of this complication in patients undergoing hepatopancreatobiliary surgery at a high-volume tertiary referral center. Our findings suggest that the risk of anastomotic leakage is influenced by the complexity of the surgical procedure, particularly with higher rates observed following perihilar bile duct resections. While in the literature several risk factors of biliary anastomotic leakage are suggested and this study identified trends indicating higher leak rates among patients with advanced comorbidities (ASA III), elevated preoperative bilirubin levels, cholangitis, postoperative red blood cell transfusion, non-dilated bile duct, or postoperative pancreatic fistula, these associations did not reach statistical significance, likely due to the limited sample size. This study also evaluated several interventions for the treatment of biliary anastomotic leakage depending on the severity of the complication. Our data highlight that conservative management is effective in a subset of patients, most cases required more invasive interventions. Most cases required relaparotomy combined with external biliary drainage.

In conclusion this single center study highlights the complexity of management of biliary anastomotic leaks and the patient tailored approach. Future studies with larger cohorts are needed to develop guidelines based on higher level of evidence of managing and preventing biliary anastomotic leaks following hepatopancreatobiliary surgery.

Abbreviations

DM	Distal Malignant
PM	Perihilar Malignant
ASA	American Society of Anesthesiologists
PTD	Percutaneous Transhepatic Drainage
POPF	Postoperative pancreas fistula
ISGLS	International Study Group of Liver Surgery
ISGPS	International Study Group of Pancreatic Surgery

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12893-024-02721-8.

Supplementary Material 1: Table Raw dataset.

Supplementary Material 2: Analysis of all patient data.

Supplementary Material 3: Multivariate analysis.

Supplementary Material 4: Table: surgeon's experience and anastomotic leakage.

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Authors' contributions

BK conceptualized the study, collected, analyzed, and interpreted the patient data and wrote the manuscript. LU and PR collected patient data. NF analyzed patient data and was a major contributor in statistics. ASZ and ÁSZ contributed to the conceptualization of the study, interpretation of the data, revision of the manuscript. All authors read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The study was approved by the Semmelweis University Regional and Institutional Committee of Science and Research Ethics (SE RKEB #25/2023). The informed consent is waived by the mentioned ethics committee considering the retrospective nature of the study.

Consent for publication

Not applicable. The records were fully anonymized during the data analysis, and the ethics committee did not require informed consent. The authors had no access to information that could identify individual participants during or after data collection.

Competing interests

The authors declare no competing interests.

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