Original Article

Interrupted versus continuous sutures in the posterior wall of bilioenteric anastomosis: A retrospective study

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ABSTRACT

Background: Hepaticojejunostomy (HJ) anastomosis is a vital surgical procedure in gastrointestinal surgery that involves the creation of a connection between the bile duct and the jejunum. This study aimed to evaluate the effectiveness of interrupted suturing, compared with continuous suturing of the posterior wall of the anastomosis, regarding primary and secondary outcomes of HJ anastomosis.

Patients and Methods: Sixty patients were allocated to two groups, each group comprising 30 patients where in group A (Interrupted Suture, n=30), 4/0 polydioxanone sutures were used. In group B (continuous Suture, n=30), 4/0 proline sutures were used. In addition, in all cases interrupted sutures 4/0 polydioxanone were used in the anterior wall of anastomosis to decrease postoperative stricture incidence, then all patients were followed up until the end of data analysis (6 months after HJ anastomosis) using a standardized data collection sheet.

Results: The primary postoperative outcomes: Regarding the incidence of leakage, the continuous group (13.3%) had a lower rate of postoperative biliary leak than the interrupted group (16.7%). Regarding the incidence of stricture of anastomosis, two (6.7%) cases had strictures in the interrupted group, whereas there were four (13.8%) strictures in the continuous group. This suggests that the interrupted group had a lower risk of postoperative strictures than the continuous group. Regarding secondary outcomes, the mean number of sutures of the posterior wall was six in the interrupted group, while it was two in the continuous group which means the continuous group was better than the interrupted group as regards cost and time consumed during anastomosis.

Conclusion: Postoperative outcomes in HJ vary with interrupted and continuous suture techniques. The continuous sutures revealed lower postoperative biliary leakage, and had better time and cost-effectiveness, while the interrupted sutures had lower incidence of stricture formation.

Key Words: Biliary leak, continuous sutures, hepaticojejunostomy, interrupted sutures, strictures.

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INTRODUCTION

The biliary tract may need to be reconstructed in severa l clinical situations, including benign or malignant biliary strictures, intraoperative biliary injury, and liver transplantation Keane *et al*.[1]. Reconstruction of the biliary tract is necessary to restore normal bile flow and provide adequate bile drainage Turakulov *et al*.[2] Bile ducts may need to be reconnected, or scar tissue may need to be removed to prevent obstructions. A bile duct anastomosis, conduit surgery, or autotransplantation are all options available for reconstruction Tschuor *et al*.[3].

Hepaticojejunostomy (HJ) anastomosis is a vital surgical procedure in gastrointestinal surgery that involves the creation of a connection between the bile duct and the jejunum Booij *et al*.[4] The choice between the interrupted and continuous suture technique for performing this anastomosis can significantly impact the outcome and complications Eickhoff *et al*.,[5] In the interrupted suture technique, multiple separate sutures are placed through the tissue layers, typically starting at the bile duct and extending into the jejunum. Each suture is tied individually, creating individual knots along the length of the anastomosis Aboulfotoh Mohammed *et al*.[6]. The interrupted versus continuous suture technique is a common debate in biliary reconstruction surgeries. Both methods have advantages and disadvantages, and the choice of technique can vary depending on the patient's condition, the surgeon's preference, and the specific surgical technique used Seifert *et al*.[7]. The interrupted suture technique involves intermittently placing sutures along the length of a suture line. Each suture is placed at an interval and tied securely Gai *et al*.[8]. This technique allows for precise control over tension, which can be crucial in biliary reconstruction surgeries. It also provides visibility of the entire suture line, which can be beneficial in ensuring proper closure and reducing the risk of leakage and strictureSullivan

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et al.[9]. One of the main advantages of the interrupted suture technique is its ease of removal. The sutures can be easily separated and pulled out individually, facilitating remodeling each of these sutures separately. This advantage is particularly relevant in biliary reconstruction surgeries where long-term durability is essential Wu *et al*.[10]. In the same context, continuous sutures technique involves running a suture line continuously along its whole length. Instead of tying individual sutures, a continuous suture is formed by knotting the ends of the suture material together. This technique reduces the total number of sutures required and allows for continuous tension and approximation of tissues. Further, one of the main advantages of continuous suture is that a single thread of suture is looped continuously around the tissue. This eliminates the need for tying knots, which reduces the amount of time needed to do the anastomosis. It seems to be more watertight, thus giving the advantage of decreasing leakage incidence; moreovwe, the use of a single thread of suture can reduce suture material costs Alghoul *et al*.,[11]. However, the continuous suture technique also has its drawbacks. It can be challenging to secure knots in delicate tissues and if excessive force was applied it may lead to tissue ischemia. The continuous suture line may not be as easily visualized or inspected as the interrupted one, increasing the risk of complications such as leaks, strictures, and purse string effect Seifert *et al*.[7].

In addition, interrupted sutures allow for easier identification and management of potential complications during the surgery Navarro *et al*.[12]. Furthermore, interrupted sutures provide better hemostasis, as each suture can be tied tightly around a bleeding vessel to stop bleeding; however, continuous sutures may be more hemostatic if there was oozing of blood from the whole suture line, as in patients with liver cirrhosis or coagulopathy, who have an increased risk of bleeding complications Seifert *et al*.[7].

Therefore, this study aims to compare two methods of suturing, continuous and interrupted, to figure out which of them was more effective in reducing postoperative complications and had better time and cost-effectiveness, in the bile duct posterior wall in HJ anastomosis operation.

PATIENTS AND METHODS:

We conducted a retrospective analysis of the patient database in this study, which included cases with biliary reconstruction at the General Surgery Department, Ain Shams Hospitals. This study included patients with an HJ, a more than 5 mm duct size, ASA 1, 2, 3, and over 18 years old. The study also excluded patients who had previous biliary enteric anastomosis procedures, patients with impaired mental state, patients who did not comply with the study requirements, patients who required emergency surgery, patients who had more than one duct, and patients with biliary stent. Study period was from 1 April 2023 till the end of the November 2023.

Before performing the study on all patients, we received written consent approval from our Surgery Department Protocol Review Board. As part of the ethics approval process, Ain Shams University's Institutional Review Board (IRB) committee reviewed the study and granted ethical approval. All patients who met the inclusion criteria were followed up until the end of data analysis (6 months after HJ anastomosis operation) using a standardized data collection sheet, including their age, gender, and diagnosis. The study included primary endpoints: biliary leaks, anastomotic strictures, bleeding, and need for blood transfusion, and surgical interventions for biliary complications and secondary endpoints: anastomosis time and cost.

To diagnose a biliary leakage, it could be detected intraoperatively or postoperatively, intraoperative: soakness of dry gauze left for 5 min at the anastomotic site, postoperative: one or more of the following criteria must be met: the bile may be drained into intraoperatively placed drains or may be detected by postoperative MRCP, an abdominal collection with percutaneous drainage or well-defined biliary leak from the wound. It was considered that a patient has biliary stricture if clinically manifested as jaundice, itching, alkaline phosphatase elevations, and gamma-glutamyl transferase elevations; MRCP studies demonstrated anastomotic strictures, abdominal U/S showed bile duct dilation.

All patients were allocated to two groups, each group comprising 30 patients where in group A (interrupted suture, n=30): A 4/0 polydioxanone (PDS) sutures were used over the distal end, and an interrupted anastomotic technique was applied (Fig. 1).

Group B (continuous suture, n=30), 4/0 proline sutures were used; for the anastomosis in this group, a double-armed suture was first placed at the 3 o'clock position and tied outside the lumen with the knot. In the next step, the suture was run in opposite directions and secured outside the bile duct lumen at 9 o'clock (Fig. 2) position. With regard to the anterior wall of the bile duct, all 60 patients received interrupted sutures. Sutures were placed in the row of the anastomosis and tied in a way that the knots were inside the lumen of the anastomosis. In the next stage, anterior interrupted sutures were placed and secured on the outside of the bile duct to make the knots visible. Our hypothesis in using proline in continuous sutures of the posterior wall of anastomosis. Proline was used because of its smooth suture, which minimizes tissue injury. It is resistant to bile erosion and does not cause local inflammation. It can also reduce scar formation and anastomotic stricture development which is more common in the continuous suture, in addition, proline stitches have more tensile strength and it is easier to give traction on it which is needed (can maintain its tension during its traction while suturing).

Fig. 1: Interrupted sutures.

Fig. 2: Continuous sutures.

Follow-up

In patients

(1) Daily: The wound must be examined for signs of infection or inflammation and the surgical dressing has to be changed.

All drains have to be checked as regards the amount and color of content.

(a) Every other day: laboratory workup including complete blood count, LFTS, and amylase.

(b) Abdominal U/S: on the 7th day after operation and before discharge.

Outpatients

(a) After 3 months: Laboratory workup: total, direct bilirubin, ALK, phosphatase and gamma-glutamyl transferase

Radiology workup: Abdominal ultrasound

(b) After 6 months: Laboratory workup including total, direct bilirubin, ALK phosphatase and gamma glutamyl transferase

Radiology workup: Magnetic Resonance Cholangiopancreatography.

Sample size calculation

The sample size was calculated using Epi-Info StatCalc using the following assumptions: an odds ratio and power of 80% for 95% confidence levels with 5% alpha errors calculated is equal to 1.115. Epi-Info output resulted in a maximum sample size of 53. Due to this, the sample size was increased to 60 patients to account for any dropout cases during follow-up Noordzij, *et al*.[13].

Statistical analysis

The data analysis was conducted using the Statistical Package for the Social Sciences 12.0 (SPSS Inc., Chicago, IL). The study used Fisher's exact and chi-square tests of proportions, with an alpha level of 0.05 as the threshold for statistical significance. The results are presented as percentages (%), range, or mean±SD.

RESULTS:

Demographic characteristics, comorbidities, and clinical presentation.

Table 1: Demographic characteristics, comorbidities, and clinical presentation

Variables	Interrupted group (Total=30)	Continuous group (Total=30)	*P* value
Age (years)			
Mean±SD	46.1±13.0	45.5±15.6	^0.865
Range	18.0–69.0	21.0–76.0	
Sex (*n*, %)			
Male	17 (56.7)	15 (50.0)	#0.605
Female	13 (43.3)	15 (50.0)	
BMI (kg/m^2)			
Mean±SD	26.8±2.0	27.1±1.9	^0.550
Range	24.1–32.2	23.9–31.8	
Hypertension (*n*, %)	10 (33.3)	11 (36.7)	#0.787
Diabetes mellitus (*n*, %)	12 (40.0)	7 (23.3)	#0.165
Chronic heart diseases (*n*, %)	1 (3.3)	1 (3.3)	§0.999
Chronic liver diseases (*n*, %)	2 (6.7)	3 (10.0)	§0.999
Other chronic diseases (*n*, %)	5 (16.7)	6 (20.0)	#0.739
ASA (*n*, %)			
I	6 (20.0)	7 (23.3)	
II	17 (56.7)	14 (46.7)	#0.734
II	7 (23.3)	9 (30.0)	
Clinical presentation			
Abdominal pain	27 (90.0)	29 (96.7)	§0.612
Anorexia	25 (83.3)	24 (80.0)	#0.739
Dyspepsia	9 (30.0)	14 (46.7)	#0.184
Vomiting	13 (43.3)	12 (40.0)	#0.793
Diarrhea	11 (36.7)	10 (33.3)	#0.787
Jaundice	24 (80.0)	24 (80.0)	#0.999
Itching	14 (46.7)	15 (50.0)	#0.796
Weight loss	18 (60.0)	15 (50.0)	#0.436

Table 1 shows no statistically significant differences between the studied groups regarding age, gender, BMI, comorbidities, and ASA grade as well as clinical presentation.

Preoperative data

Table 2: Preoperative data

Variables	Interrupted group (Total=30) [n (%)]	Continuous group (Total=30) [n (%)]	*P* value
Detailed diagnosis			
CBD stone	3 (10.0)	1 (3.3)	
Bile duct injury	2 (6.7)	5 (16.7)	§0.478
Periampullary (Whipple)	24 (80.0)	22 (73.3)	
Cholangio carcinoma mid-CBD (CBD and CHD resection)	1 (3.3)	2 (6.7)	
Diagnosis			
Benign	5 (16.7)	6 (20.0)	#0.739
Malignant	25 (83.3)	24 (80.0)	
CBD size			
6–10 mm	8 (26.7)	4 (13.3)	
11–20 mm	19 (63.3)	16 (53.3)	#0.069
>20 mm	3 (10.0)	10 (33.3)	
Total bilirubin (mg/dl)			
Mean±SD	6.5±1.3	6.2±1.3	^0.456
Range	1.8–8.2	1.3–7.5	
Direct bilirubin (mg/dl)			
Mean±SD	3.5±0.7	3.4±0.7	^0.424
Range	1.1–4.4	0.9–4.1	
Alkaline phosphatase (U/l)			
Mean±SD	346.0±25.2	349.0±23.0	^0.628
Range	304.0–390.0	292.0–384.0	
Gamma-glutamyl transferase (U/l)			
Mean±SD	249.9±12.3	250.6±10.6	^0.806
Range	215.0–270.0	232.0–262.0	
Amylase (U/l)			
Mean±SD	152.4±4.2	153.3±4.4	^0.400
Range	144.0–161.0	139.0–161.0	
Preoperative drainage			
Non	8 (26.7)	7 (23.3)	
ERCP	16 (53.3)	15 (50.0)	#0.825
PTC	6 (20.0)	8 (26.7)	
Cases with malignancy only	Total=25	Total=24	
CA 19.9 (U/ml)			
Mean±SD	102.9±22.8	100.0±12.9	^0.597
Range	75.0–152.0	80.0–137.0	
CEA (*n*, %)			
Positive	2 (8.0)	3 (12.5)	§0.667
Negative	23 (92.0)	19 (86.4)	

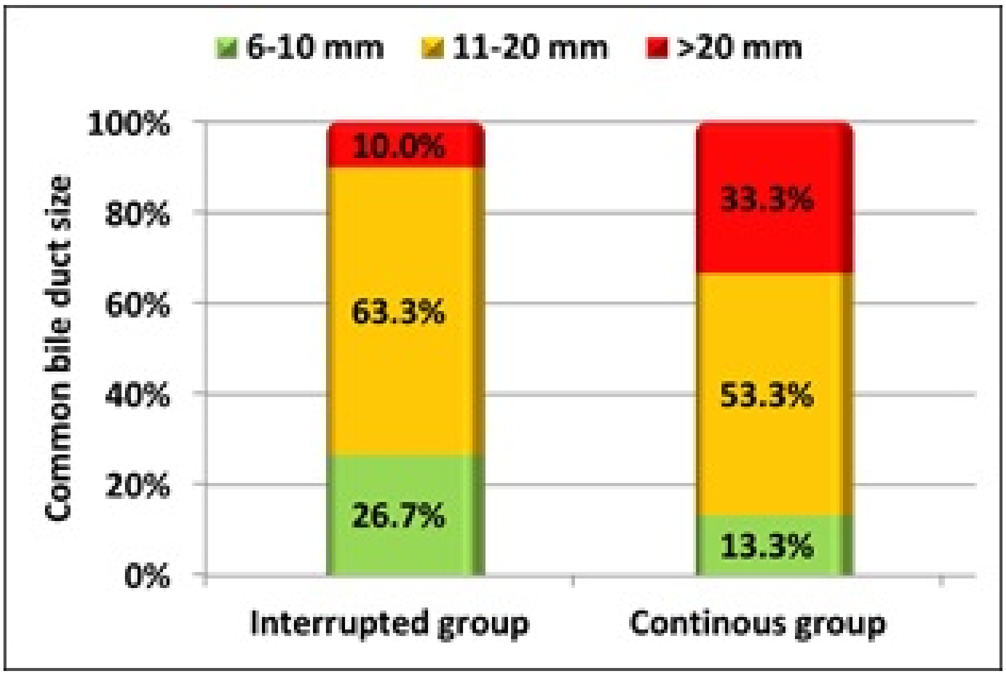

Fig. 3: Common bile duct size.

Table 2 and Fig. 3 show no statistically significant differences between the studied groups regarding pathological diagnosis, CBD size, baseline laboratory data, as well as preoperative biliary drainage.

Intraoperative data

Table 3b: Intraoperative data

Variables	Interrupted group (Total=30)	Continuous group (Total=30)	*P*-value
Number of sutures			
Mean±SD	6.1±0.7	2.0±0.0	^<0.001*
Range	5.0–7.0	2.0–2.0	
Duration of suturing (min			
Mean±SD	17.3±0.9	12.4±0.8	^<0.001*
Range	15.0–19.0	11.0–14.0	
Intraoperative leak (*n*, %)	2 (6.7)	1 (3.3)	§0.999
Blood loss (ml)			
Mean±SD	553.0±112.7	578.1±156.3	^0.478
Range	329.0–769.0	332.0–1118.0	
Blood transfusion			
None	24 (80.0)	23 (76.37)	
1 pack	6 (20.0)	5 (16.7)	§0.638
2 packs	0	2 (6.7)	

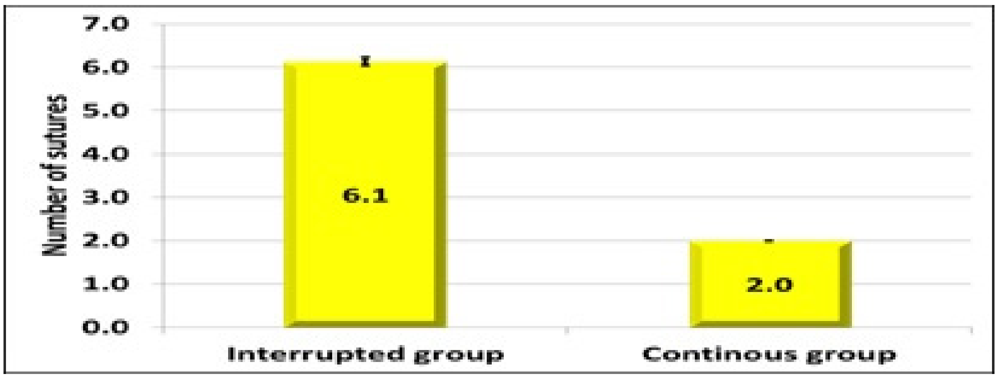

Fig. 4: Number of sutures between the studied groups.

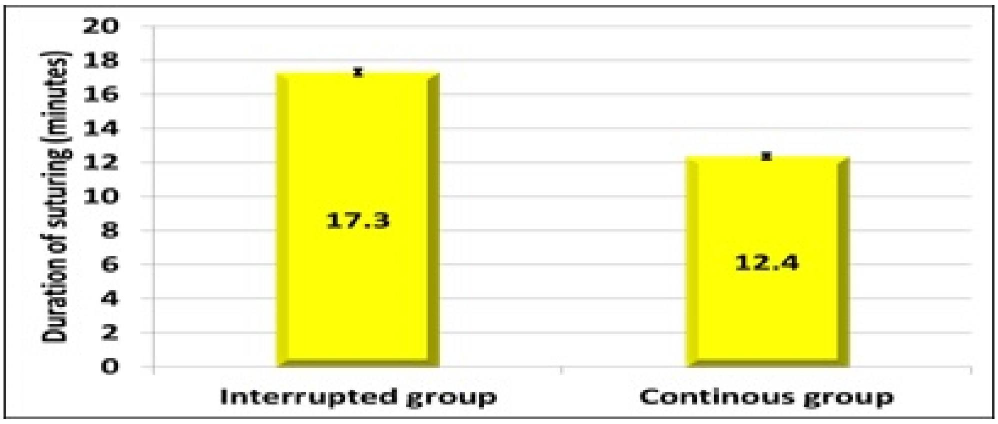

Fig. 5: Duration of suturing between the studied groups.

Table 3 and Figs. 4, 5 show that the number of sutures used in the posterior wall of anastomosis was significantly higher in the interrupted group. The duration of suturing was significantly longer in the interrupted group. Intraoperative leaks were nonsignificantly more frequent in the interrupted group. There were no statistically significant differences between the studied groups regarding blood loss and the need to blood transfusion.

Postoperative data

Table 4: Postoperative data

Variables	Interrupted group (Total=30) [n (%)]	Continuous group (Total=30) [n (%)]	*P*-value
Intensive care unit (ICU) stay			
Mean±SD	3.8±0.9	3.6±0.9	^0.381
Range	0.0–5.0	0.0–4.0	
Ward stay			
Mean±SD	10.5±2.2	10.2±2.3	^0.646
Range	4.0–15.0	3.0–14.0	
Nothing per os (NPO)			
Mean±SD	3.8±0.7	3.7±0.7	^0.719
Range	1.0–5.0	1.0–4.0	
Wound infection	2 (6.7)	3 (10.0	§0.999
Bleeding	3 (10.0)	4 (13.3)	§0.999
	Total=3	Total=4	
Management			
Conservative	3 (100.0)	4 (100.0)	NA
Blood transfusion			
None	2 (66.7)	3 (75.0)	§0.999
1 pack	1 (33.3)	1 (25.0)	

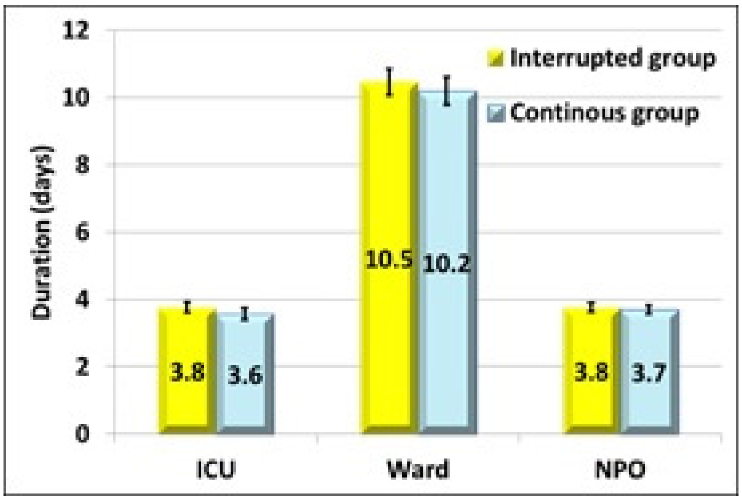

Fig. 6: Durations of ICU, ward stay, and NPO between the studied groups.

Table 4 and Fig. 6 show no statistically significant differences between the studied groups regarding the duration of ICU, ward stay and NPO (days), postoperative wound infection, and postoperative bleeding.

Postoperative outcomes

Table 5: Postoperative outcomes

Status	Interrupted group (Total=30) [n (%)]	Continuous group (Total=30) [n (%)]	*P* value
Postoperative leak	5 (16.7)	4 (13.3%)	§0.999
	Total=5	Total=4	
Maximum drain output (cc/24hr)			
Mean±SD	280.0±201.9	262.5±143.6	^0.888
Range	50.0–500.0	50.0–350.0	
Duration (days)			
Mean±SD	10.2±4.3	12.0±9.0	^0.702
Range	3.0–14.0	5.0–25.0	
Management			
Conservative	3 (60.0)	2 (50.0)	
Percutaneous drainage	1 (20.0)	1 (25.0)	§0.999
Insertion of PTC drain	1 (20.0)	1 (25.0)	
Outcome			
Success	5 (100.0)	3 (750.0)	NA
Postoperative stricture	2 (6.7)	4 (13.3)	§0.671
	Total=2	Total=4	
Time			
Month 3	1 (50.0)	3 (75.0)	§0.999
Month 6	1 (50.0)	1 (25.0)	
Management			
Dilatation by interventional radiology	2 (100.0)	3 (75.0)	§0.999
Redo	0	1 (25.0)	
Outcome			
Success	2 (100.0)	4 (100.0)	NA
Readmission	0	1 (3.3)	§0.999
Mortality	0	1 (3.3)	§0.999

		Total=1	
Time of mortality (days)		28	
Clavien-Dindo score			
1	24 (80.0)	23 (76.7)	§0.999
2	2 (6.7)	2 (6.7)	
3	4 (13.3)	4 (13.3	
5	0	1 (3.3)	

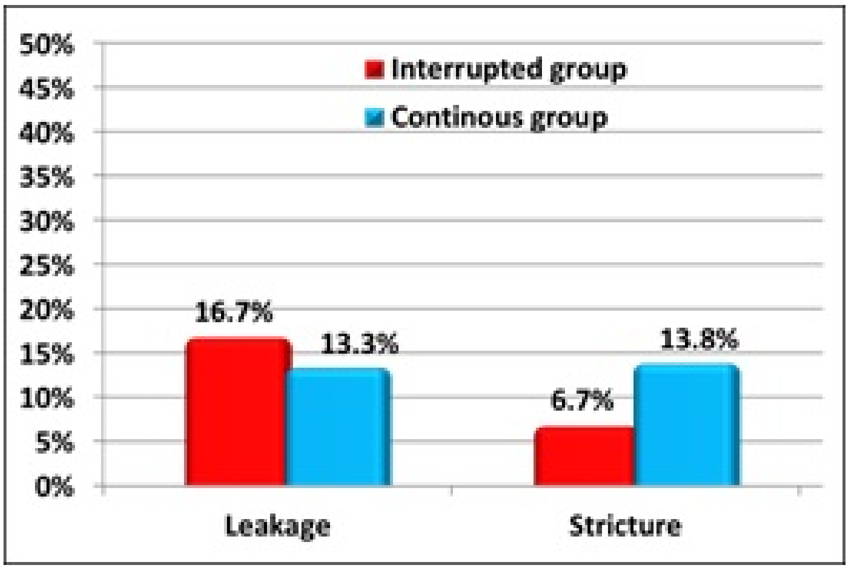

Fig. 7: Postoperative biliary leak and stricture formation between the studied groups.

Table 5 and Fig. 7 show that postoperative biliary leak was nonsignificantly more frequent in the interrupted group. Management was nonsignificantly different between groups. All cases with leaks in either group had successful management.

The postoperative stricture was nonsignificantly less frequent and more delayed in detection in the interrupted group. There were no statistically significant differences between the studied groups regarding management plans. All cases with stricture in either group had final successful management.

There were no statistically significant differences between the studied groups regarding readmission, mortality, and Clavien-Dindo score.

Comparison according to CBD size regarding postoperative stricture in the studied group

Table 6: Comparison according to CBD size regarding postoperative stricture

		CBD size			
Group	Stricture	6–10 mm	11–20 mm	>20 mm	§*P* value
Interrupted group (total=2)	N	8	19	3	
	Stricture	1 (12.5)	1 (5.3)	0	0.607
	No stricture	7 (87.5)	18 (94.7)	3 (100.0)	
Continuous group (total=4)	N	4	15	10	
	Stricture	2 (50.0)	1 (6.7)	1 (10.0)	0.109
	No stricture	2 (50.0)	14 (93.3)	9 (90.0)	

Table 6 shows that stricture was nonsignificantly more frequent in smaller sizes of CBD in the studied groups. In the previous table, in the continuous group the number of cases became 29 instead of 30 because there was one patient readmitted on the 21st day postoperatively with fever and electrolyte disturbance diagnosed as septicemia and died on the 28th day postoperatively; it was too early to detect stricture formation at this time.

Postoperative follow-up

Table 7: Total and direct bilirubin follow-up

Time	Interrupted group (Total=30)	Continuous group (Total=29)	^*P* value (groups)
Total bilirubin (mg/dl)			
At discharge			
Mean±SD	2.9±1.0	3.1±0.9	0.334
Range	1.0–5.0	1.2–4.5	
Month 3			
Mean±SD	2.3±0.7	2.5±0.7	0.174
Range	0.2–3.9	0.7–4.2	
Month 6			
Mean±SD	0.7±0.2	0.8±0.2	0.185
Range	0.4–1.2	0.6–1.4	
¤ *P* value (time)	<0.001*	<0.001*	
Direct bilirubin (mg/dl)			
At discharge			
Mean±SD	1.7±0.5	1.8±0.4	0.488
Range	0.5–2.6	0.6–2.8	
Month 3			
Mean±SD	0.9±0.3	0.8±0.3	0.108
Range	0.1–1.4	0.3–1.1	
Month 6			
Mean±SD	0.4±0.1	0.4±0.1	
Range	0.1–0.7	0.2–0.6	0.131
¤ *P* value (time)	<0.001*	<0.001*	

Table 8: ALK phosphatase and GGT

Time	Interrupted group (Total=30)	Continuous group (Total=29)	^*P* value (groups)
Alkaline phosphatase (U/l)			
At discharge			
Mean±SD	268.5±7.2	269.4±7.3	0.654
Range	251.0–280.0	241.0–277.0	
Month 3			
Mean±SD	187.5±8.8	184.2±9.0	0.165
Range	148.0–211.0	141.0–199.0	
Month-6			
Mean±SD	128.3±7.2	126.8±6.0	0.396
Range	103.0–148.0	109.0–143.0	
¤*P* value (time)	<0.001*	<0.001*	
Gamma-glutamyl transferase (U/l)			
At discharge			
Mean±SD	193.2±2.6	193.5±5.0	0.760
Range	186.0–198.0	171.0–201.0	
Month 3			
Mean±SD	52.7±1.7	51.8±5.0	0.367
Range	49.0–55.0	42.0–72.0	
Month 6			
Mean±SD	38.8±3.3	40.1±2.7	0.105

Range	32.0–45.0	38.0–47.0
¤ *P* value (time)	<0.001*	<0.001*

Tables 7 and 8 show that: there were no statistically significant differences between the studied groups regarding total and direct bilirubin at different follow-up points (preoperative, at discharge, month 3, and month 6). Total and direct bilirubin significantly decreased throughout follow-up times in both study groups. There were no statistically significant differences between the studied groups regarding alkaline phosphatase and gamma-glutamyl transferase at different follow-up points (preoperative, at discharge, month 3, and month 6). Alkaline phosphatase and gamma-glutamyl transferase significantly decreased throughout follow-up times in both studied groups.

DISCUSSION

Hepaticojejunostomy is a surgical procedure to restore bile flow between the liver and intestines Tekant *et al*.[14]. It involves the reconnection of the biliary system, which can be performed using different techniques. Interrupted and continuous sutures are two commonly used suturing methods Bramis *et al*.[15]. The comparison of the interrupted and continuous suture techniques in hepaticojejunostomy surgeries is a subject of debate in the surgical community Pinsak *et al*.[16].

The goal of our study was to evaluate the interrupted sutures versus continuous sutures of the posterior wall of the anastomosis regarding our outcomes which were the primary outcomes (postoperative biliary leakage and incidence of strictures formation) and the secondary outcomes (no of sutures and time of anastomosis) in HJ anastomosis

The results of this study revealed that the leakage rate was lower in the continuous suture group (13.4%) compared with the interrupted suture group (16.7%). This could be explained by the continuous suture technique providing better control over tension, which is crucial in biliary reconstruction surgeries Ando *et al*.[17] It also seems to be watertight, ensuring proper closure and reducing the risk of leakage Celeste *et al*.[18]. However, the interrupted suture technique also provides better visibility of the suture line, making it easier to inspect and remolding each of this sutures separately if needed. Wu *et al*.[10].

Furthermore, postoperative strictures are a common complication in HJ anastomosis Nagakawa *et al*.[12].The results of the present study revealed that the interrupted group had a lower occurrence of strictures (6.7%) than the continuous group (13.8%). This is likely because of the continuous suture technique that involves the continuous tightening of the suture, which may lead to more tension in the anastomosis and is more likely to form strictures than the interrupted suture technique Brewer Gutierrez *et al*.[19]. Therefore, the interrupted suture remains a valuable technique in our study. The results of the Jarlot-Gas study support the findings of the present study, which compared the occurrence of strictures in HJ anastomosis using continuous versus interrupted suture techniques in children. The results revealed that the interrupted suture had a lower stricture incidence (4.7%) than the continuous suture technique (14.3%) Jarlot-Gas *et al*.[20] Another study by Saboo revealed that the incidence of strictures was significantly lower in the interrupted suture group (7.9%) compared with the continuous suture group (20.8%) Saboo *et al*.[21].

In our study a different technique was used, which was a combination of using interrupted sutures in the anterior wall of HJ anastomosis in association with continuous sutures in the posterior wall of anastomosis, The idea behind this was to decrease the incidence of stricture formation (13.8%) instead of using continuous suture technique all over the anastomosis as what happened in the C. Jarlot-Gas's study, The incidence of stricture formation was 14.3% Jarlot-Gas *et al*.[20] and the incidence of stricture formation was 20.8% in the R. Saboo's study Saboo *et al*.[21].

In Germany (2018), a total of 77 of the 102 addressed hospitals (76%) participated in one survey. Brunner said that the use of the continuous suture technique of the posterior wall of anastomosis offers an advantage in time (average of 17.1 min) versus the interrupted suture technique (average of 24.2 min); this time saving had no drawbacks on patient outcomes. Brunner *et al*.[22].

In India, a retrospective cohort analysis was done, in 2021, at the Center of Hepatobiliary Disease, Sanjay. A total of 556 eligible patients (468 patients undergoing interrupted suturing, and 88 undergoing continuous suturing) were analyzed. The two groups were similar in number of sutures, cost, and time. This study concluded that continuous suturing had better time and cost-effectiveness than interrupted suturing). Rajan saxena *et al*.[23].

Tatsuguchi's study showed that the cost and the time required to complete anastomosis was $144.7 and 27 min in the interrupted suture group compared with $11.7 and 16.2 min in the continuous suture group. Tatsuguchi *et al*.[24].

In our study, time and cost saving were better in continuous suture than the previous studies (range of 11–14 min) because of the different techniques used, which offered advantages of interrupted suture technique in the anterior wall of anastomosis in addition to advantages of continuous suture technique in the posterior wall of HJ anastomosis.

Furthermore, in our study, the time for strictures was documented at month 3 in 50% of the interrupted group and 75% of the continuous group and month 6 in 50% of the interrupted group and 25% of the continuous group. This suggests that strictures tend to occur earlier in the continuous group than in the interrupted group. However, the sample size is small, and further studies are needed to confirm this finding.

The operative time showed a statistical difference between the two groups in our study. There was a mean of 17.3±0.9 min (range 15–19 min) in the interrupted sutures group versus 12.4±0.8 min (range 11.0–14.0 min) in the continuous sutures group, which means that time effectiveness was better in the continuous group.

In our study, the number of sutures showed a statistical difference between the two groups. There was a mean of 6.1±0.7 sutures (range 5–7 sutures) in the interrupted group versus 2 sutures in the continuous group, which means that cost-effectiveness was better in the continuous group.

From the fact that the interrupted suture is less likely to cause irritation or infection to the patient could be explained by the fact that interrupted sutures create a more controlled and less traumatic anastomotic suture. Therefore, infections can be reduced and hospital stays lengthened Venkatanarasimha *et al*.[25] However, one of the main advantages of the continuous suture is that a single thread of suture is looped continuously around the tissue. This eliminates the need for tying knots, which reduces the amount of time needed to close the wound. In addition, the use of a single thread of suture can reduce suture material costs. Alghoul *et al*.[11].

This study had several limitations. First, it was a retrospective study, which may introduce biases and confounding factors. Second, the sample size was relatively small, which may limit the generalizability of the results.

Future studies with larger sample sizes, more extended follow-up periods, and standardized surgical techniques are necessary to get more significant statistical results. More studies are required to compare Proline and PDS sutures in HJ operation regarding the advantages and disadvantages of each.

CONCLUSION

Based on the results of this study, it can be concluded that both the interrupted and continuous suture techniques of the posterior wall of the bile duct have differences in the operative and postoperative outcomes of HJ anastomosis. There was a reduction in postoperative stricture formation following the interrupted suture compared with the continuous one. While continuous sutures were associated with less biliary leakage, they were also less costly and time-consuming compared with interrupted sutures. Using interrupted sutures in the anterior wall of HJ anastomosis in association with continuous sutures in the posterior wall of anastomosis reduces the incidence of stricture formation. Ultimately, the choice of suture technique should be made based on the patient's condition, the surgeon's preference, and the specific surgical technique used.

CONFLICT OF INTEREST

There are no conflicts of interest.

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