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Research on the Clinical Value of Different Pancreaticojejunostomy Techniques in Laparoscopic Pancreaticoduodenectomy

Guangsheng Wang[1,2]*

[1] Department of Gastrointestinal Surgery, The First College of Clinical Medical Science, China Three Gorges University, Yichang 443003, Hubei, China

[2] Department of Gastrointestinal Surgery, Yichang Central People's Hospital, Yichang 443003, Hubei, China

**Author to whom correspondence should be addressed.*

Abstract: *Objective:* To observe the clinical application and value of different pancreaticojejunostomy techniques in laparoscopic pancreaticoduodenectomy. *Methods:* Sixty-eight patients who underwent laparoscopic pancreaticoduodenectomy in our hospital from January 2023 to January 2025 were selected. They were divided into two groups of 34 patients each using a random method. One group underwent duct-to-mucosa pancreaticojejunostomy (control group), while the other group underwent modified pancreaticojejunostomy (observation group). Surgical indicators (operation time, pancreaticojejunostomy time, intraoperative blood loss, postoperative hospital stay) were recorded for both groups, and postoperative complications were documented. *Results:* The observation group had significantly shorter operation time, pancreaticojejunostomy time, intraoperative blood loss, and postoperative hospital stay compared to the control group ($P < 0.05$). The incidence of postoperative complications was significantly lower in the observation group than in the control group ($P < 0.05$). However, there was no significant difference in the width of the main pancreatic duct between the two groups ($P > 0.05$). *Conclusion:* In laparoscopic pancreaticoduodenectomy, there are significant differences in perioperative indicators between different pancreatic anastomosis techniques. Among them, the modified pancreaticojejunostomy method can shorten time indicators and reduce the possibility of postoperative complications, making it worthy of clinical selection.

Keywords: Laparoscopic pancreaticoduodenectomy; Duct-to-mucosa pancreaticojejunostomy; Modified pancreaticojejunostomy; Pancreatic fistula; Time indicators; Complications

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1. Introduction

With the continuous development of medical technology, laparoscopic techniques have become increasingly mature,

and their use in the operating room has become more frequent. Due to factors such as accumulated surgical experience, updated laparoscopic equipment, and technological optimization, the scope of clinical application of laparoscopic pancreaticoduodenectomy (LPD) has been expanding. More and more patients with gastrointestinal diseases require this surgical approach for treatment. However, LPD itself is a surgically difficult procedure that involves various precision devices and abdominal organs, which can easily lead to postoperative complications, especially pancreatic fistula. Research indicates that the incidence of pancreatic fistula after LPD ranges from 4.5% to 52.3%. The occurrence of pancreatic fistula can easily lead to secondary abdominal infection and bleeding, which is one of the main factors leading to death in LPD patients. This demonstrates the high risk of this surgical approach. Some scholars believe that selecting a reasonable pancreatic anastomosis method during surgery can effectively prevent complications. However, there is still controversy in clinical practice regarding which anastomosis method is more advantageous. In this study, 68 LPD patients were observed to explore the effectiveness of modified pancreatic anastomosis and duct-to-mucosa pancreaticojejunostomy. Details are as follows.

2. General information and methods

2.1. General information

Sixty-eight patients undergoing laparoscopic pancreatoduodenectomy in our hospital from January 2023 to January 2025 were selected. They were divided into two groups of 34 patients each using a blinded selection method.

In the control group, there were 19 males and 15 females, aged between 43 and 72 years old, with a mean age of (60.32 ± 3.41) years old. Thirteen patients had hypertension, 15 had diabetes, and 4 had heart disease. Symptoms at admission included jaundice in 23 cases, abdominal pain in 14 cases, and fever in 5 cases.

In the observation group, there were 18 males and 16 females, aged between 42 and 73 years old, with a mean age of (60.21 ± 3.48) years old. Fourteen patients had hypertension, 15 had diabetes, and 4 had heart disease. Symptoms at admission included jaundice in 22 cases, abdominal pain in 14 cases, and fever in 6 cases. Basic data analysis between the two groups showed no significant difference ($P > 0.05$).

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) Comprehensive preoperative examination meeting the indications for laparoscopic pancreatoduodenectomy [1]; (2) Whipple procedure and child digestive tract reconstruction performed during surgery; (3) Informed consent and voluntary cooperation from the patient.

Exclusion criteria: (1) Intraoperative exploration revealing tumor metastasis, resulting in incomplete surgery; (2) No Child digestive tract reconstruction performed; (3) Conversion to open surgery during the procedure; (4) Patient disagreement with the study leading to withdrawal.

2.3. Methods

The control group received continuous pancreatic duct-jejunal mucosa anastomosis. Using 4-0 Prolene sutures, continuous sutures were placed between the full thickness of the posterior wall of the pancreas and the posterior wall of the jejunum, 5 cm from the residual end of the jejunum based on examination results. An electrocautery hook was used to make a 0.3 cm incision in the jejunum, and the mucosa was flipped open and disinfected with povidone-iodine.

With 5-0 Prolene sutures, interrupted sutures were placed between the posterior walls of the pancreatic duct and

jejunal mucosa, with approximately 2–3 sutures. A pancreatic duct drainage tube was then inserted, with one end inserted as far as possible into the pancreatic duct and the other end inserted 3–4 cm into the intestinal cavity. Interrupted sutures were then placed between the anterior walls of the pancreatic duct and jejunal mucosa.

Using 4-0 Prolene sutures, continuous sutures were placed between the full thickness of the anterior wall of the pancreas and the anterior wall of the jejunum, ensuring full apposition between the pancreatic stump and the jejunal serosa.

The observation group received modified pancreaticojejunostomy.

(1) A 3-0 Prolene suture was used to place a horizontal, full-thickness suture through the pancreas 0.5–1.0 cm from the inferior margin of the pancreatic stump. The suture was tightened and knotted, leaving a 3 cm tail.

(2) A pancreatic drainage tube similar in diameter to the pancreatic duct and 10–15 cm long was selected. The insertion end had 3–4 side holes and was beveled. It was inserted as far as possible into the pancreatic duct. A 4-0 Vicryl suture was used to pierce through the pancreatic duct at the 12 o'clock position from the superior margin, pass through the pancreatic drainage tube, exit at the 6 o'clock position from the inferior margin, and then tied for fixation. Proper fixation was confirmed by gentle traction on the pancreatic drainage tube without displacement. Another suture was placed around the pancreatic drainage tube, tightened, and knotted.

(3) The corresponding jejunal area for the pancreatic duct was identified, and a small incision was made using an electrocautery hook. The surrounding 2 cm of intestinal wall serosa was cauterized.

(4) Starting 1.5 cm from the pancreatic stump, a 4-0 Prolene suture was used for continuous suturing, entering through the ventral side of the pancreas and exiting through the dorsal side. After exiting, the suture was passed through the serosa of the jejunum 1.5 cm away from the incision horizontally on the dorsal side, entered through the serosa at the edge of the incision, and returned to the pancreas. It entered through the dorsal side and exited through the ventral side 0.5cm from the pancreatic stump, following a longitudinal path relative to the pancreas. After exiting, the suture entered again at the edge of the jejunal incision horizontally and exited 1.5 cm away from the ventral side. The suture was then tightened, knotted, and trimmed.

(5) Depending on the size of the pancreatic stump, 3-4 sutures were placed repeatedly from front to back, wrapping around the pancreatic stump in a "C" shape to ensure full apposition between the pancreatic stump and the jejunal serosa.

2.4. Evaluation indicators

The operation time, intraoperative blood loss, pancreaticojejunal anastomosis time, postoperative hospital stay, and main pancreatic duct width of the two groups of patients were observed and recorded. Postoperative complications, mainly including pancreatic fistula, biliary fistula, and gastric emptying disorders, were observed in both groups. Among them, the diagnosis and grading criteria for pancreatic fistula referred to the relevant standards published by the International Study Group on Pancreatic Surgery in 2016 [2]. Namely, Grade A: biochemical leakage without corresponding clinical symptoms, which can recover spontaneously. Grade B: presence of corresponding clinical symptoms requiring conservative treatment. Grade C: presence of severe symptoms such as infection and intra-abdominal bleeding, requiring prompt transfer to the ICU or surgical treatment.

2.5. Statistical analysis

The data were analyzed using statistical software SPSS 18.0. Measurement data were expressed as mean ± standard deviation (SD) and compared using the *t*-test. Count data were expressed as rates (%) and compared using the chi-

square test. A *P*-value less than 0.05 was considered statistically significant.

3. Results

3.1. Perioperative indicators

The observation group had shorter operation time, pancreaticojejunal anastomosis time, intraoperative blood loss, and postoperative hospital stay compared to the control group, with significant differences ($P < 0.05$). However, there was no difference in the main pancreatic duct width between the two groups ($P > 0.05$). See the **Table 1**.

Table 1. Comparison of perioperative indicators between the two groups

Perioperative indicators	Observation group ($n = 34$)	Control group ($n = 34$)
Operative time (min)	370.21 ± 50.42	400.29 ± 60.58
Pancreaticojejunostomy time (min)	28.47 ± 5.21	43.20 ± 7.62
Intraoperative blood loss (mL)	267.31 ± 102.38	298.31 ± 87.21
Postoperative hospital stay (d)	12.32 ± 3.29	15.62 ± 3.21
Main pancreatic duct diameter (mm)	3.34 ± 0.83	3.62 ± 0.81

3.2. Complications

The incidence of postoperative complications in the observation group was significantly lower than that in the control group ($P < 0.05$). See the **Table 2**.

Table 2. Comparison of postoperative complications between the two groups of patients (*n*,%)

Group	Cases (*n*)	Pancreatic fistula		Bile leakage	Delayed gastric emptying	Total incidence
		Grade A	Grade B			
Control group	34	3 (8.82)	4 (11.76)	2 (5.88)	3 (8.82)	12 (35.29)
Observation group	34	11 (2.94)	2 (5.88)	1 (2.94)	1 (2.94)	5 (14.71)

4. Discussion

The introduction of laparoscopic technology has made clinical diagnosis and treatment more convenient. Especially when used in surgery, it can ensure both safety and accuracy. LPD (laparoscopic pancreaticoduodenectomy) is a commonly used minimally invasive abdominal surgery and one of the most difficult minimally invasive abdominal surgeries clinically recognized [3]. With the deepening of this technology and the accumulation of clinical experience, LPD has basically achieved the same safety level as open pancreaticoduodenectomy. However, due to the large number of abdominal tissues, surgery may stimulate them, resulting in a higher incidence of postoperative complications.

Pancreatic fistula, as one of the most serious complications of LPD, can lead to secondary intra-abdominal hemorrhage, infection, etc., which are also the main causes of death for such patients. Therefore, choosing the appropriate pancreaticojejunostomy technique becomes a top priority. According to clinical statistics, there are currently more than 50 types of pancreaticojejunal anastomosis methods. Common methods include telescoping, binding, penetrating, and Hong's one-stitch method. The telescoping pancreaticojejunostomy is a traditional method

that mainly includes end-to-end anastomosis and end-to-side anastomosis. During its implementation, there is no need to specifically find the pancreatic duct, the operation is simple, and the operation time can be shortened. However, end-to-end anastomosis can easily cause difficulties in telescoping due to the mismatch between the diameter of the pancreatic stump and the jejunum, which may cause the pancreatic stump to be eroded by intestinal fluid, causing a series of complications [4]. For end-to-side anastomosis, there is no need to consider the size of the pancreatic section and the jejunum diameter, but it faces the same problems. This also makes the selectivity of this type of anastomosis method relatively low. With the optimization of medical technology, the clinical application of penetrating pancreatic duct jejunal mucosa anastomosis has increased. This method allows the jejunal mucosa layer to closely adhere to the pancreatic section, optimizing the healing speed. Meanwhile, the jejunal serosa leaves no needle holes, which can reduce the possibility of pancreatic juice extravasation.

However, it is difficult to control the tightness of the binding during the operation. If it is too loose, pancreatic juice may leak out; if it is too tight, it may cause tissue blood supply obstruction. Under the influence of these factors, the incidence of postoperative pancreatic fistula and abdominal infection may also increase. Furthermore, this anastomotic method only anastomoses the main pancreatic duct with the jejunal mucosa, while the accessory pancreatic duct and secondary pancreatic duct are not well treated, resulting in a poor anastomotic effect. The modified pancreaticojejunostomy is a method proposed by combining the advantages of Hong's pancreaticojejunostomy concept and Chen's pancreaticojejunal suturing technique, as well as clinical experience. After forming an artificial fistula between the pancreatic duct, jejunum, and pancreatic juice drainage tube using Hong's pancreaticojejunostomy, a "U"-shaped suture is performed using Chen's method of penetrating the pancreas. The jejunum can fully wrap around the pancreaticojejunal section in a "C" shape, allowing the pancreatic section and jejunal serosa to tightly adhere, which can reduce both the dead space and the leakage of pancreatic juice from the accessory and secondary pancreatic ducts, thereby reducing corrosion of the pancreatic section and jejunal serosa [5]. The entire operation and suture retention are determined based on existing clinical experience, ensuring tightness without affecting normal tissue blood supply.

Additionally, after partial serosal layer burning of the jejunum, it tightly adheres to the pancreatic section, optimizing the speed of adhesion and healing, which naturally results in a shorter postoperative hospital stay. In this study, by observing perioperative indicators in two groups of patients, it can be seen that the modified anastomotic method is simple to operate, has less intraoperative blood loss, achieves better anastomotic effects, and allows for faster postoperative recovery of patients. Meanwhile, although there are differences in the width of the main pancreatic duct between the observation group and the control group, they are not statistically significant. This means that the modified anastomotic method does not have a significant impact on the width of the main pancreatic duct compared to the penetrating method. In terms of the incidence of postoperative complications, the observation group had a lower rate of 14.71% compared to the control group's 35.29%, indicating better safety of the modified anastomotic method. Especially in terms of pancreatic fistula occurrence, both the incidence and grading were advantageous in the observation group. However, it should be noted that the sample size selected for this study is limited, with insufficient prospectiveness. As a new anastomotic method, continuous training and optimization of suturing techniques are still needed.

5. Conclusion

In summary, there are significant differences in perioperative indicators among different pancreatic anastomoses in laparoscopic pancreatoduodenectomy. Among them, the modified pancreaticojejunostomy can shorten time indicators and reduce the possibility of postoperative complications, making it worthy of clinical selection.

Disclosure statement

The author declares no conflict of interest.

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