



Diamond-shaped versus side-to-side anastomotic duodenoduodenostomy in laparoscopic management of annular pancreas in children: a single-center retrospective comparative study

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Background: Annular pancreas is a rare congenital disorder that requires surgical management once diagnosed. Diamond-shaped and side-to-side duodenoduodenostomy are both popular worldwide nowadays in the surgical management of annular pancreas. Here we present our experience with laparoscopic management of annular pancreas in the last 5 years and compare the clinical results of the diamond-shaped versus side-to-side anastomotic techniques.

Methods: Fifty-two patients diagnosed with annular pancreas who underwent duodenoduodenostomy at our medical center between January 2016 and April 2021 were included in the study. Forty-four patients underwent laparoscopic diamond-shaped duodenoduodenostomy (DS group) and eight underwent laparoscopic side-to-side duodenoduodenostomy (STS group). Clinical data, including surgical indices and early outcomes after surgery, with at least 19 months of follow-up, were collected and analyzed.

Results: Of the 52 patients, 61.5% were prenatally diagnosed, and vomiting was the most common clinical manifestation after birth. The operative time and bleeding volume were 187.5 [interquartile range (IQR), 150–228] min and 2 (IQR, 2–5) mL in the DS group, compared to 175 (IQR, 155–270) min and 2 (IQR, 2–4.25) mL in the STS group ($P=0.89$ and 0.32 respectively). The mean time from surgery to initial oral feeding and full oral feeding was 6 (IQR, 4–10) and 12 (IQR, 10–15) days in the DS group, compared to 8 (IQR, 4.75–11.25) and 14.5 (IQR, 13–16.75) days in the STS group ($P=0.61$ and 0.46 respectively). The mean hospital stay was 16 (IQR, 14–19) and 20 (IQR, 17.75–26) days in the DS and STS groups respectively ($P=0.13$). No severe complications such as anastomotic leakage, anastomotic stenosis, reoperation or unsuspected rehospitalization were noted in either group. Feeding intolerance was revealed in six cases in the DS group and two cases in the STS group, and there was no significant difference between the two groups ($P=0.50$).

Conclusions: Both laparoscopic diamond-shaped and side-to-side techniques showed good clinical results in treating annular pancreas. The surgical technique, trans-anastomotic tube and early feeding are not likely to increase the risk of postoperative feeding intolerance.

Keywords: Annular pancreas; laparoscopy; duodenoduodenostomy; diamond-shaped anastomosis; pediatrics

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Introduction

Annular pancreas is a rare congenital abnormality that occurs in one in 20,000 births (1). A radiological series study on adults showed nearly 60% of adult cases without symptoms and revealed a higher prevalence than previously estimated (2). Annular pancreas causes extrinsic duodenal obstruction and based on its congenital anatomical abnormality, bypass surgery is considered to preserve the anatomy of annular pancreas and has been popular for decades (2). Surgical indications include duodenal obstruction, acute or recurrent pancreatitis, cystic lesions in the pancreas, obstructive jaundice and pancreatic mass (2).

Laparoscopic duodenoduodenostomy was first described in 2001 (3) and has been shown to have faster recovery, a shorter hospital stay, lower complication risks and better postoperative cosmesis than open procedures (4,5). Kimura *et al.* (6) introduced a diamond-shaped duodenoduodenostomy anastomotic technique for treating duodenal atresia or stenosis in 1977. They believed that this technique could create a larger stoma and reduce anastomotic complications. In 1990, Kimura *et al.* (7) provided evidence of the advantages of this technique, with a long-term result for congenital duodenal obstruction, showing earlier recovery of gastrointestinal function and avoidance of complications. Based on this convincing

long-term result, the diamond-shaped anastomotic technique seems to be the gold standard for congenital duodenal obstruction (8). However, Li *et al.* (9) compared the diamond-shaped and side-to-side techniques in their retrospective case study in 2021 and found that side-to-side duodenoduodenostomy was conducive to restoring intestinal function postoperatively, with no complications during mid-term follow-up.

As evidence from clinical results of diamond-shaped versus side-to-side anastomotic techniques has been debatable, we compared the clinical outcomes of neonates with annular pancreas undergoing these two techniques. We present this article in accordance with the STROBE reporting checklist (available at <https://tp.amegroups.com/article/view/10.21037/tp-23-156/rc>).

Methods

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the ethics committee of Guangzhou Women and Children's Medical Center (GWCMC) [Approval No. (2023)061A01] and individual consent for this retrospective analysis was waived. Medical records of all patients who underwent laparoscopic duodenoduodenostomy at our center diagnosed with annular pancreas from January 2016 to April 2021 were reviewed. The exclusion criteria included the presence of other gastrointestinal anomalies (malrotation, imperforate anus, esophageal atresia, intestinal atresia, intestinal ectopic pancreas, and Meckel's diverticulum). All operations were performed by senior surgeons in our surgical team with more than ten years of clinical experience. The selection of a diamond-shaped or side-to-side duodenoduodenostomy was discussed by the surgical team, and the final decision was made by the chief surgeon. The laparoscopic procedure was performed in the standard procedures as previously described (6,9). The same set of conventional 5-mm 30° laparoscope and straight 3-mm laparoscopic instruments were used in all procedures.

We collected data on the patient's sex, age, body weight at surgery, associated anomalies, clinical manifestations, operative technique, operative time, blood loss during surgery, and intra- and postoperative complications. In

Highlight box

Key findings

- Good clinical results with no severe complications in both laparoscopic diamond-shape and side-to-side duodenoduodenostomy. Diamond-shape technique, trans-anastomotic tube and early enteral feeding showed no benefits on feeding tolerance.

What is known and what is new?

- Debating evidences on clinical results have been shown in diamond-shape versus side-to-side anastomotic technique.
- In our study, both techniques showed good results with no severe complications.

What is the implication, and what should change now?

- The selection of surgical technique should be decided by the surgeon's experience as well as the anatomy of duodenum. Be cautious to leave a trans-anastomotic tube.

addition, early outcomes after surgery (time to start initial oral feeding, time to full oral feeding, and postoperative hospital stay) and follow-up results (complications, reoperation/rehospitalization, and disease-related death) were collected and analyzed. Follow-up was scheduled every 3–6 months through an outpatient visit or phone call. Further evaluations such as abdominal plain radiography, ultrasonic examination, or upper gastrointestinal contrast, were considered in patients with complication-related symptoms.

After the surgery, a nasogastric tube (NGT) for decompression was routinely reserved in all patients, but a trans-anastomotic tube was inserted according to the age at surgery and the surgeon's experience. When the age at surgery was more than three months and the trans-anastomotic tube might lead to obvious discomfort, we were not to leave a trans-anastomotic tube postoperatively. Except for premature cases, cases being mechanically ventilated, or cases with other contraindications for early feeding (10), feeding would start within 24 h after surgery, at the rate of 1 mL/kg/h and increased by 1 mL/kg after every two feeds if adequately tolerated. Feeding intolerance was defined as marked abdominal distention, repeated vomiting >3 episodes daily, or bloody stools (11). In this case, feeding was discontinued to maintain nil per os (NPO) and gastrointestinal decompression was reintroduced until symptoms resolved. The NGT would be removed until the daily drain was less than 15 mL/kg and lasted for more than 3 days. Full feeds were considered established if the patient tolerated 80% of the maintenance fluid volume requirement as a liquid diet (12).

Statistical analysis

Continuous data are presented as medians with 25% and 75% interquartile ranges (IQRs), as the data were non-normally distributed. Categorical variables were compared using the Pearson chi-squared test, and continuous variables were compared using the Student's *t*-test. Logistic regression was used to identify the factors related to feeding intolerance. All statistical tests were two-sided. Statistical significance was set at $P < 0.05$. Data analysis was performed using the Statistical Software for the Social Sciences, SPSS Advanced Statistics 26 (IBM Software Group, USA).

Results

Sixty-one patients diagnosed with annular pancreas

underwent laparoscopic duodenoduodenostomy between January 1, 2016 and April 1, 2021 (*Figure 1*). Finally, 52 cases were included, with 26 males and 26 females, at a median age and body weight at surgery of 3 (IQR, 2–9) days and 2.76 (IQR, 2.24–3.09) kg respectively. According to medical records, 44 and eight patients underwent diamond-shaped (DS group) and side-to-side duodenoduodenostomy (STS group). There were no significant differences in the patient's sex, age, weight at surgery, and number of premature births between the two groups (*Table 1*). In 61.5% of our cases, intestinal obstruction was suspected prenatally, and the diagnosis was confirmed to be annular pancreas postoperatively. Bilious vomiting was present in 30.8% of our patients, making it the most common clinical manifestation after birth. Abdominal distension or vomiting with distension was found in two cases separately. Associated malformations, including cardiovascular defects, trisomy 21, urological defects and polydactyly were found in 19.2%, 1.9%, 7.7%, and 1.9% of cases, respectively (*Table 2*).

The operative time and bleeding volume were 187.5 (IQR, 150–228) min and 2 (IQR, 2–5) mL in the DS group, compared to 175 (IQR, 155–270) min and 2 (IQR, 2–4.25) mL in the STS group. The difference in mean operative time and bleeding volume between the two groups was not statistically significant ($P = 0.89$ and 0.32 respectively) (*Table 1*). Because of intermittent vomiting after meals, two cases in the DS group underwent upper gastrointestinal contrast 6 months after the surgery and confirmed no stenosis at the anastomotic site. In both cases, symptoms were relieved with conservative treatment within 3 weeks. Until the latest follow-up, no severe complications, such as anastomotic leakage and anastomotic stenosis, were observed in either group during a follow-up period ranging from 19 to 85 months (*Table 2*). Pneumonia with or without pleural effusion occurred postoperatively in two and one patients, respectively, in DS and STS group; fortunately, all three patients recovered after 1-week of conservative treatment. A neonatal patient in the DS group developed melena, which was alleviated within three days with successful conservative treatment. Other postoperative complications, including urinary tract infection, epididymitis and gastrointestinal bleeding, were presented in one DS case, respectively (*Table 2*). Five cases in the DS group and one in the STS group presented with complications, and there were no statistically significant differences between the two groups in the distribution of postoperative complications ($P = 0.93$).

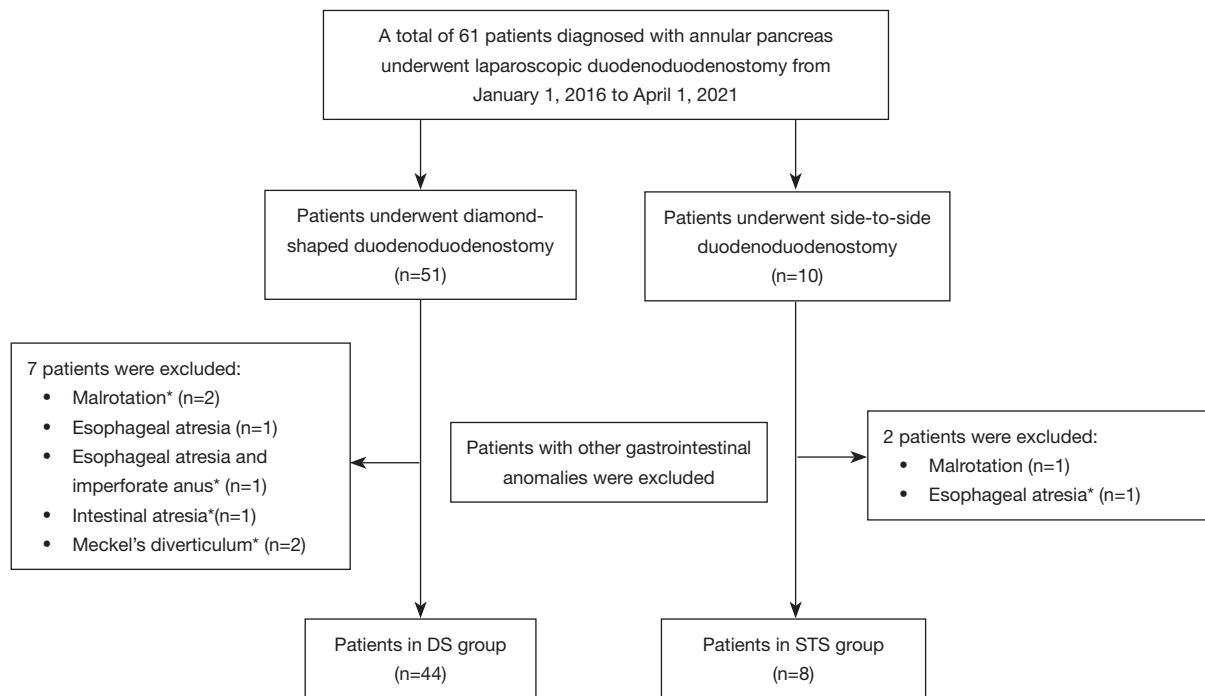


Figure 1 Flow diagram of identified patients: included, and excluded. *, cases excluded for gastrointestinal anomalies were complicated by trisomy 21. Four cases complicated with trisomy 21 were found in the DS group (complicated with malrotation, esophageal atresia and imperforate anus, intestinal atresia, and Meckel's diverticulum for each case, all excluded) and two cases complicated with trisomy 21 were found in the STS group (complicated with esophageal atresia in one case, excluded). The distribution of trisomy 21 in both groups was not statistically significant ($P=0.25$). DS group, diamond-shaped duodenoduodenostomy; STS group, side-to-side duodenoduodenostomy.

Table 1 Baseline data and outcomes of diamond-shaped and side-to-side duodenoduodenostomy in annular pancreas

Variables	Diamond-shape (n=44)	Side-to-side (n=8)	P
Sex (male), n	23	3	0.70
Age at operation (days)	3 [2–9.75]	3 [2.25–8.25]	0.45
Body weight (kg)	2.76 [2.26–3.07]	2.65 [2.16–3.31]	0.53
Operative time (min)	187.5 [150–228]	175 [155–270]	0.89
Operative bleeding volume (mL)	2 [2–5]	2 [2–4.25]	0.32
Postoperative complications	5 (11.4)	1 (12.5)	0.93
Mortality	0	0	–
Time from the surgery to initial oral feeding (days)	6 [4–10]	8 [4.75–11.25]	0.61
Time from the surgery to full oral feeding (days)	12 [10–15]	14.5 [13–16.75]	0.46
Hospital stays (days)	16 [14–19]	20 [17.75–26]	0.13
Reoperation/unsuspected rehospitalization	0	0	–
Follow-up (months)	54 [34–68]	39.5 [38.25–62.5]	0.54

Continuous data were presented as median [interquartile range], and the other data were presented as numbers and percentages.

Table 2 Clinical manifestations, comorbidities, and complications in diamond-shaped and side-to-side duodenoduodenostomy in annular pancreas

Variables	Diamond-shape (n=44)	Side-to-side (n=8)	Total (n=52)
Clinical manifestation, n (%)			
Prenatal diagnosis	26 (59.1)	6 (75.0)	32 (61.5)
Vomiting	14 (31.8)	2 (25.0)	16 (30.8)
Abdominal distension	2 (4.5)	0 (0)	2 (3.8)
Vomiting with distension	2 (4.5)	0 (0)	2 (3.8)
Premature, n (%)	5 (11.4)	1 (12.5)	6 (11.5)
Comorbidities, n (%)			
Cardiovascular defect	8 (18.2)	2 (25.0)	10 (19.2)
Trisomy 21	0 (0)	1 (12.5)	1 (1.9)
Urological defect	3 (6.8)	1 (12.5)	4 (7.7)
Polydactylia	1 (2.3)	0 (0)	1 (1.9)
Postoperative complications, n (%)			
Major complications*	0	0	0
Pneumonia/effusion	2 (4.5)	1 (12.5)	3 (5.8)
Urinary tract infection	1 (2.3)	0 (0)	1 (1.9)
Epididymitis	1 (2.3)	0 (0)	1 (1.9)
Gastrointestinal bleeding	1 (2.3)	0 (0)	1 (1.9)
Wound infection/dehiscence	0 (0)	0 (0)	0 (0)

*, major complications included anastomotic leak, anastomotic stenosis or obstruction.

(Table 2). No mortality related to annular pancreas, reoperation or unsuspected rehospitalization was observed in our study (Table 2).

The time from surgery to initial oral feeding and full oral feeding was 6 (IQR, 4–10) and 12 (IQR, 10–15) days in the DS group, compared to 8 (IQR, 4.75–11.25) and 14.5 (IQR, 13–16.75) days in the STS group (Table 1). The difference in time between surgery to initial and full oral feeding between two groups was not statistically significant ($P=0.61$ and 0.46 , respectively) (Table 1). The hospital stay was 16 (IQR, 14–19) and 20 (IQR, 17.75–26) days in the DS and STS groups, respectively, and there were no significant differences between the two groups ($P=0.13$) (Table 1).

Feeding intolerance was revealed in 6 (13.6%) of DS group and 2 (25%) of STS group and there was no significant difference between the two groups ($P=0.50$). Our patients underwent decompression with the NGT after surgery, and 69.2% of them underwent a trans-anastomotic tube via the transnasal approach (TA). Data showed that 6 (16.7%) patients in the TA group and 2 (12.5%) in the

NGT group experienced feeding intolerance, and there was no significant difference in feeding intolerance between the two groups ($P=0.71$). Early enteral nutrition within 48 h postoperatively through the TA tube was initiated in 11 patients, of whom 2 (18.2%) patients experienced feeding intolerance. Whether early enteral nutrition was initiated within 48 h postoperatively showed no significant difference in feeding intolerance ($P=0.64$) (Table 3).

Discussion

Annular pancreas originates from failed or abnormal migration/rotation of the ventral pancreatic bud and is usually diagnosed during infancy as a manifestation of upper gastrointestinal tract obstruction characterized by vomiting or distention (13). Along with the systematic application of prenatal ultrasound diagnosis in congenital duodenal obstruction, an increasing number of early diagnoses of annular pancreas can be made before birth, and better preparation for surgery is needed to reduce the risk of

Table 3 Feeding intolerance in the treatment of annular pancreas

Variables	Feeding intolerance	Without feeding intolerance	Total	P
Number of cases	8/52 (15.4)	44/52 (84.6)	52 (100.0)	
Surgical technique				0.50
Diamond-shaped DD	6/44 (13.6)	38/44 (86.4)	44/52 (84.6)	
Side-to-Side DD	2/8 (25.0)	6/8 (75.0)	8/52 (15.4)	
Intestinal decompression after surgery				0.71
Trans-anastomotic tube with NGT decompression	6/36 (16.7)	30/36 (83.3)	36/52 (69.2)	
NGT decompression only	2/16 (12.5)	14/16 (87.5)	16/52 (30.8)	
Early enteral nutrition through Trans-anastomotic tube	2/11 (18.2)	9/11 (81.8)	11/52 (21.2)	0.64

Logistic regression showed that the surgical technique, trans-anastomotic tube and early feeding did not increase the risk of feeding intolerance postoperatively ($P > 0.05$). The data were presented as numbers and percentages. DD, duodenoduodenostomy; NGT, nasogastric tube.

metabolic disorders and intestinal failure (14). In adults, acute/recurrent pancreatitis or peptic ulcers may be the most common manifestation of annular pancreas (13). Once symptoms are diagnosed, surgical treatment is indicated (2). Shunting procedures, mainly gastrojejunostomy, duodenojejunostomy and duodenoduodenostomy, are considered to preserve the anatomy of annular pancreas and to avoid severe complications such as pancreatic fistula and fatal peritonitis after complete or partial resection of the pancreatic ring (15). Among these shunting procedures, duodenoduodenostomy, with the shortest possible bypass and soundest physiologic basis, is thought to eliminate the risk of blind loops and is considered the most popular surgical approach for annular pancreas in children, especially in the neonatal period (15).

Although no consensus has been reached on whether open or laparoscopic surgery is the standard approach for annular pancreas (4,5,16), our center prioritizes laparoscopic surgery if there are no contraindications. A recent systematic review showed no statistically significant differences in terms of operation time, time to initial or full enteral feeding, and hospital stay between laparoscopic and open surgery. Further, laparoscopic surgery showed a higher overall incidence of anastomotic complications than open surgery. However, the authors ascribed the unskillful technique to this result, as their study included the first attempts at laparoscopic surgeries and confirmed the safety of laparoscopic surgery (16). In addition, better postoperative cosmesis (4,5) and fewer non-anastomotic complications (16) make laparoscopic surgery popular

among pediatric surgeons and our patients' parents.

Feuchtwanger (15) reported the first case series of annular pancreas treated with side-to-side duodenoduodenostomy. This mid-term report with at least 30 months' follow-up showed good results with no complications such as blind loop syndrome, leakage, or stenosis in the four cases included. Kimura introduced the diamond-shaped anastomotic technique in 1977 (6) and demonstrated the efficacy of this technique with a long-term result of the earlier recovery of gastrointestinal function and avoidance of complications in 1990 (7). The diamond-shaped technique appears to be more popular among pediatric surgeons (8,17). They believed that this technique would create a larger stoma and avoid complications related to a blind loop caused by poorly drained duodenal distension above the obstructive site.

However, clinical evidence from comparative studies between side-to-side and diamond-shaped techniques has yielded conflicting results. Ruangtrakool *et al.* (17) found no statistically significant difference between the two types of anastomoses in the duration of total parenteral nutrition (TPN), ability to be fed early, full feeding, or hospital stay. They also revealed a trend toward higher morbidity and mortality rates with the diamond-shaped technique. Recently, Li *et al.* (9) reported a shorter operative time, earlier feeding, and discharge with no side-to-side complications over diamond-shaped duodenoduodenostomy in their retrospective case study conducted in 2021, and considered the side-to-side technique to be beneficial to

postoperative recovery of intestinal function. Our data showed similar results for early oral feeding, surgical time and blood loss, full oral feeding, feeding intolerance, and risks of complications compared with the STS technique. Although evidence from the clinical results of DS versus STS anastomotic techniques has so far been debatable, both techniques showed excellent outcomes such as fast recovery, low risk of complications, and low mortality in short- to mid-term follow-up (9,18-20). The only long-term follow-up in pediatric patients was reported by Kimura *et al.* (7), which confirmed no blind loop, megaduodenum formation or anastomotic malfunction in 19 of 44 patients in a barium study. In our opinion, it would be too hasty to draw any conclusions on this matter for the following reasons: first, long-term follow-up from the baby into adulthood is needed to investigate late complications including megaduodenum, loop syndrome, duodenogastric reflux, gastritis, and gastroesophageal reflux in both techniques. In addition, comparative studies with higher levels of evidence would provide more instructions for clinical selection.

In clinical practice, technique selection is determined by the surgeon according to certain factors, such as anatomy and surgeon experience. Li *et al.* (9) shared their experiences in surgical technique selection according to the position of the annular pancreas and the diameter of the distal duodenum, which we partially agreed with. When the obstructive site was relatively high, with a relatively free distal duodenum, a simple anastomosis could be chosen. In addition, according to previous reports and our experiences, an incision of 1.0–1.5 cm was thought to avoid postoperative anastomotic stenosis (9). When the diameter of the distal duodenum is relatively small for a transverse incision, a longitudinal incision for a diamond-shaped anastomosis should be considered for a larger stoma. In this case, diamond-shaped anastomosis would be easier to apply in most cases because most of the distal duodenum is relatively small for a transverse incision, which makes the DS technique widely accepted by surgeons worldwide.

Recovery of gastrointestinal function after surgery and the initiation of feeding is another significant but controversial problem, especially after enhanced recovery after surgery (ERAS). It has been widely accepted for decades that patients undergoing surgeries involving intestinal resection and anastomosis were kept “nil by mouth” for gastrointestinal decompression until the gastrointestinal function was recovered (10). As a result, patients were fed when the gastric fluid became clear (5), which was thought to be the clinical evidence for the recovery of gastrointestinal function.

However, in recent years, early enteral feeding in the early postoperative period, from neonates to adults, has been shown to be well tolerated and may shorten the time to overall recovery and reduce postoperative complications (11,12).

Postoperative intestinal recovery was reflected in our study by the average time from surgery to initial and full oral feeding, as well as feeding intolerance. Intolerance in postoperative feeding consisted of abdominal distention, vomiting, re-insertion of the NGT and repeated NPO (11,21,22). In our study, the time of initial oral feeding, full oral feeding and feeding intolerance were found to have no statistically significant difference between the two groups. However, a study by Weber found earlier initiation of feeding in the DS group (23). Better recovery of GI function for the DS technique could not be concluded, as suggested by Kimura *et al.* (7). In contrast, Li *et al.* (9) found that the STS technique was beneficial to the postoperative recovery of intestinal function during mid-term follow-up. These conflicting results suggest that more clinical trials with higher levels of evidence are required to determine this difference.

NGT decompression was routinely performed in all patients in our study, as recommended for duodenal surgery (10). When the gastric fluid became clear, we started to feed the patients and remove the NGT in previous clinical practice. Retaining a postoperative trans-anastomotic tube was considered a part of duodenoduodenostomy procedures used as a stent and for enteral feeding (5,7). However, some surgeons prefer not to use trans-anastomotic tubes as reported (5,8,9,18); the same observation was made in our study. Son *et al.* (5) reported no anastomotic complications in the laparoscopic group without a trans-anastomotic tube. However, in the open surgery group with a trans-anastomotic stent, a leak was reported in one case and anastomotic stenosis or obstruction was reported in two cases. Our data showed no anastomotic complications in both cases with or without a trans-anastomotic tube, which was consistent with other reports showing good clinical results with few complications (5,8,9,18). A trans-anastomotic tube also provides a way for early enteral feeding with the scientific basis that it elicits propulsive activity, stimulates gastrointestinal hormones (10,24), and improves proximal hypomotility situation, which may eventually reduce hospital stay and time to full feeds (10,12,25). However, conflicting results were found on the function recovery promoted by early enteral feeding (11,26,27). Our study showed that neither early enteral feeding nor a trans-anastomotic tube had a beneficial effect

on feeding tolerance. Our result was consistent with the study of congenital duodenal obstruction in which a trans-anastomotic tube was found to make early feeding possible, but showed no benefits on the onset of full feeding, duration of TPN and hospital stay (17). Ruangtrakool *et al.* explained that trans-anastomotic tubes could only provide part of the nutritional requirement and should be supplied by TPN, and trans-anastomotic tubes would not be able to promote duodenal peristalsis and early gastrointestinal function recovery (17). Consequently, in the case of satisfactory anastomosis by the surgeon, we were no longer recommended to leave a trans-anastomotic tube, especially for order patients in our clinical practice, as order patients would feel insufferably uncomfortable leaving such a tube through the nasal cavity.

Our study excluded some cases complicated by Down syndrome or other severe gastrointestinal malformations, which had worse clinical results and severe complications, and may have led to data bias in our study. However, we excluded these cases strictly for statistical comparisons. Although our study represents a retrospective series from one center and is not randomized, both techniques showed good clinical results without severe complications. Our study represents a mid-term comparative study of the surgical treatment of annular pancreas, but the mid-term follow-up was far beyond adequate. In pediatric patients, follow-up until adulthood, even in the elderly, is necessary, and we will continue monitoring and reviewing our case cohort.

Conclusions

Our study has revealed several clinical findings and experiences based on our data and statistical analyses. Similar results in early feeding, full oral feeding, feeding intolerance, and risks of complications were revealed for both techniques. Both laparoscopic diamond-shaped and side-to-side techniques showed good clinical results in the treatment of annular pancreas. Trans-anastomotic tubes and early enteral feeding did not improve feeding tolerance. The surgical technique should be selected based on the surgeon's experience, as well as the anatomy of duodenum.

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Footnote

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Data Sharing Statement: Available at <https://tp.amegroups.com/article/view/10.21037/tp-23-156/dss>

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Conflicts of Interest: All the authors have completed the ICMJE uniform disclosure form (available at <https://tp.amegroups.com/article/view/10.21037/tp-23-156/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the ethics committee of Guangzhou Women and Children's Medical Center (GWCMC) [Approval No. (2023)061A01] and individual consent for this retrospective analysis was waived.

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