Original Article

Effect of Right-to-Left (Isoperistaltic Anastomosis) or Left-to-Right (Antiperistaltic Anastomosis) Gastrojejunostomy Technique on the Delayed Gastric Emptying After the Whipple Surgery

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ABSTRACT

Objectives: Delayed Gastric Emptying (DGE) after the Whipple surgery is a common problem. This study aimed to compare the efficacy of Right to Left (R-to-L) (isoperistaltic anastomosis) gastrojejunostomy versus Left to Right (L-to-R) (antiperistaltic anastomosis) in DGE after the Whipple surgery.

Methods: In this clinical trial, 60 patients referred to Golestan and Arvand Hospital in Ahvaz City, Iran, who needed Pancreaticoduodenectomy (PD) or the Whipple procedure were recruited in our study and divided into two groups. The first group underwent gastrojejunostomy with isoperistaltic as R-to-L anastomosis and the second group antiperistaltic as L-to-R anastomosis. The two groups were compared one month after surgery for DGE severity, NPO (Nothing by mouth) duration, hospital stay duration, TPN (total parenteral nutrition) requirement, and re-hospitalization requirement.

Results: DGE intensity in R-to-L decreased significantly compared to L-to-R (intensity: 5 [16.7%] vs 13 [43.5%]; P<0.001). In particular, the intensity difference was as follows: grade A=10%, grade B=6.7%, grade C=0%, versus grade A=20%, grade B=13.3%, grade C=10% (P<0.001). NPO duration and hospital stay in R-to-L were significantly lower than L-to-R (NPO: 3.1 vs 4.7, P=0.028; hospital stay: 4.3 vs. 7.8; P=003). The re-hospitalization rate in R-to-L was lower than in the other group (1 [3%] vs 8 [26.7%]; P<0.001). None of the R-to-L patients required TPN, but 16.7% of the L-to-R group required TPN, a significant difference (P<0.001).

Discussion: R-to-L gastrojejunostomy significantly reduces the delay in gastric emptying after the Whipple operation for a periampullary tumor.

Keywords: Gastrojejunostomy, Gastrointestinal motility, Gastric emptying, Gastroileal bypass, Pancreatic cancer, Pancreaticoduodenectomy

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1. Background

Delayed Gastric Emptying (DGE) is seen in 20% to 40% of patients after Pancreaticoduodenectomy (PD) and affects their quality of life immediately after operation [1, 2]. DGE not only causes the patient's discomfort and malnutrition [3, 4] but can also lead to prolonged hospital stay and postoperative pneumonia, which increases the risk of postoperative death in PD procedure [5]. According to Lermite et al., the exact etiology of DGE after PD is unclear, but its risk factors include diabetes mellitus, malnutrition, perigastric vagal nerve disorders, and antro-duodenal ischemia, decreased motilin plasma concentration, dysrhythmia caused by pericardial inflammation, invasive lymphadenectomy, and pancreatic fibrosis [4].

DGE is a complex process caused by various factors responsible for gastric motility, such as myogenic muscle cells, hormonal factors, and the autonomic nervous system. DGE often occurs after procedures that destroy organs responsible for the movement of the stomach and its emptying or neuromuscular/muscular ischemia. To prevent DGE, the most important way is to develop and generalize surgical techniques to reduce the factors causing DGE during pancreaticoduodenectomy [6-11]. There are several surgical procedures associated with DGE, including resection type classical Whipple vs Pylorus-Preserving (PPPD), gastric drainage reconstruction, antecolic or retrocolic, Right-to-Left (R-to-L) or Left-to-Right (L-to-R) gastrojejunostomy, in addition to the enteroentrostomy of Braun (Braun vs No Braun). However, the most effective way to minimize the incidence of DGE after PD is still being debated [12-14]. In this study, we investigate if DGE is affected by the type of anastomosis in the stomach: R-to-L (isoperistaltic anastomosis) and L-to-R (antiperistaltic anastomosis).

2. Materials and Methods

After obtaining permission from the Ethics Committee of Ahvaz Jundishapur University (IR.AJUMS.REC.1398.110) and the plan's approval, this research was started as a clinical trial study (IRCT2019090506043492N1), controlled and randomized by random numbers. In this clinical trial, we recruited 60 patients who were referred to Golestan and Arvand Hospital in Ahvaz City and needed PD resectable because of a periampullary tumor. With personal consent, they entered the study and were divided into two groups. All patients underwent classic Whipple resect, and after resection, the first group underwent gastrojejunostomy with R-to-L anastomosis as isoperistaltic and the second group underwent gastrojejunostomy with L-to-R anastomosis as antiperistaltic. One surgeon did the presentation in this study. Data on age and sex of the patients, DGE grade (Table 1), length of hospital stay, CA 19-9, and wound infection (according to the attached questionnaire) were collected and analyzed with SPSS software version 22.

3. Results

According to the results, 35 (58.3%) of our 60 patients were male, and 25 (41.7%) were female. The Mean±SD ages of the patients were 58.93±15.35 years in the operative group with R-to-L anastomosis and 59.34±13.21 years in the group with L-to-R anastomosis (Table 2). Patients in the two groups were compared for DGE severity, NPO (nothing per mouth) duration, hospital stay, need for TPN (total parenteral nutrition), and re-hospitalization. According to the results, the frequency of DGE in the R-to-L gastrojejunostomy group was 5 (16.7%), and for the L-to-R gastrojejunostomy group was 13 (43.5%), and there was a significant difference between the two groups in terms of DGE grade, and it has been less common in patients with R-to-L gastrojejunostomy reconstruction (Table 3).

The Mean±SD period of NPO duration in the R-to-L gastrojejunostomy group was 3.1±1.712 days, and for the L-to-R gastrojejunostomy group was 4.7±2.501 days. There was a significant difference between the two groups regarding the NPO duration variable, and there is less prevalence among patients with R-to-L gastrojejunostomy (Table 3).

The Mean±SD duration of hospital stay for the R-to-L and L-to-R gastrojejunostomy groups were 4.3±2.3 and

Table 1. Consensus definition of delayed gastric emptying (DGE)

DGE Grade	NGT Required	Unable to Tolerate Solid Oral Intake by POD	Vomiting/Gastric Distension	Use of Prokinetics
A	4–7 days or reinsertion > POD 3	7	±	±
B	8–14 days or reinsertion > POD 7	14	+	+
C	> 14 days or reinsertion > POD 14	21	+	+

Abbreviation: DGE, delayed gastric emptying; POD, postoperative day; NGT, nasogastric tube.

Table 2. The demographic information of the patients in the studied groups

Variables	Variables	Mean±SD/No. (%)
Age (y)	Right to Left	58.93±15.35
	Left to Right	59.34±13.21
Sex	Male	35(58.3)
	Female	25(41.7)

Table 3. Comparing the patients' monitored variables in both studied groups (n= 30)

Variables	Mean±SD/No. (%)		P
	Right to Left	Left to Right	
DGE grade	5 (16.7%)	13 (43.5%)	<0.001
Duration of NPO, d	3.1 ±1.712	4.7 ±2.501	0.028
Length of hospital stay, d	4.3 ± 2.30	7.8 ± 0.712	0.003
Re-hospitalization	1 (3%)	8 (26.7 %)	<0.001
Needed for TPN)	-	5 (16.7 %)	<0.001

Abbreviation: DGE, delayed gastric emptying; NPO, nothing per mouth; TPN, total parenteral nutrition.

7.8±0.712 days, respectively. There is a significant difference between the two groups regarding the length of hospital stay, and this time is shorter for patients with R-to-L gastrojejunostomy (Table 3).

The frequency of re-hospitalization in the R-to-L gastrojejunostomy group was 1 (3%), and for the L-to-R gastrojejunostomy group was 8 (26.7%), and there is a significant difference between the two groups; there is less prevalence among patients with R-to-L gastrojejunostomy, due to less common DGE at this group. DGE grading, refer to Table 1, is grouped into 3 grades (Table 1).

The percentage of TPN required in patients in the L-to-R gastrojejunostomy group was 5 (16.7%), while none of the patients in the R-to-L gastrojejunostomy group required TPN. Also, there was a significant difference between the two groups, and no TPN was needed in R-to-L gastrojejunostomy (Table 3).

After the surgery, a surgical drain and NG tube were inserted. On the first day, if NG drainage was under 500 mL, the NG tube was removed, and feeding with a liquid diet was started on the second day.

4. Discussion

Delayed gastric emptying is one of the most common complications after the Whipple surgery. Many theories have been proposed, including disruption of the pyloric sphincter, antral and duodenal ischemia, secondary gastrojejunostomy, abdominal complications, pancreatic inflammation associated with leakage from the site of anastomoses, and ileus to explain the causes of delayed gastric emptying [10, 11].

Although no studies have been conducted to investigate these two types of techniques on previous variables, some studies have examined the impact of other possible factors on DGE.

Reconstruction of the gastrointestinal tract after surgery can be done in three ways: Billroth I, Billroth II, and Roux-en-Y. D'Amato et al. compared these three methods and stated that the Roux-en-Y method had better results, including a decrease in the percentage of esophageal reflux, chronic superficial gastritis, gastroesophageal reflux, and delayed gastric emptying [15].

Hanna et al. in Florida examined the effect of PD surgical techniques on delayed gastric emptying. Their results showed that the prevalence of DGE in the anticolic method was lower than in the retrocolic gastrojejunostomy (P<0.001). Also, this decrease in subtotal stomach preserving PD is more pronounced than pylorus-preserving PD. In their findings, they stated that in PD, surgical techniques that use the regeneration pathway and PD while maintaining gastric subtotal are associated with a lower risk of DGE [1].

The Noorani et al. study showed that DGE is often seen after various surgeries that go to the pancreas, and this complication has a complex pathogenesis that is seen even after removal of the pancreatic tail [16].

Glowka et al. studied the effects of bowel reconstruction techniques on DGE in 168 patients in Germany between 2004 and 2015. In their study, two classical PD methods were compared with Pancreatic Gastrostomy (PG) with either Billroth reconstruction. In their findings, they cited high age and retrocolic reconstruction as risk factors for developing DGE and generally concluded that the occurrence of DGE could not be affected by the type of regeneration [17].

The results of a Nickfarjam et al. showed that using Braun enteroentrostomy in DGE was effective in reconstruction after classic pancreaticoduodenectomy. They considered the Braun enteroentrostomy method an independent factor associated with DGE reduction [18].

DGE has been extensively studied as one of the most common complications of the Whipple surgery, but no exact cause has been identified.

Torres et al. believed that Roux-en-Y gastrojejunostomy anastomosis with lesser curvature could cause continuous emptying of food through an anastomotic stoma and effectively modulate delayed gastric emptying after surgery [19].

Comparing anesthesia with billroth II and Roux-en-y, Murakami et al. concluded that using billroth II reduced DGE after the Whipple surgery [20].

Wenming Wu et al. showed that pylorus removal does not significantly reduce the incidence of DGE. Furthermore, subtotal stomach-preserving pancreaticoduodenectomy or pylorus-resecting pancreaticoduodenectomy does not affect DGE either [21].

According to Hanna et al. [1], approximately 30%-65% of postoperative DGE causes stomach pain due to premature satiety. Nausea and vomiting following upper gastrointestinal surgery, mechanical obstruction at the site of the anastomosis, or distal intestinal part may cause a condition that stomach cannot be discharged normally and continuously. DGE is not fatal after surgery but often leads to a longer hospital stay, increased medical costs, and a more significant reduction in patients' quality of life.

This study aimed to investigate the effect of gastrojejunostomy anastomosis of the stomach (from R-to-L or L-to-R) on the rate of DGE in patients undergoing the Whipple surgery. Based on the results, the R-to-L technique in gastrojejunostomy could significantly reduce the rate of DGE, the amount of vomiting, the length of hospital stay, the duration of surgery, and the likelihood of re-hospitalization.

Due to the differences in the techniques studied, it is difficult to compare the present results with the above studies. In the present study, the rate of DGE and NPO time in the surgical group with the R-to-L gastrojejunostomy technique was significantly reduced compared to the L-to-R gastrojejunostomy group. DGE was observed in 16.7% of patients that underwent R-to-L gastrojejunostomy. However, this complication was observed in 43.5% of patients in the other group, and the difference between them was significant ($P<0.001$). The need for further studies in this area, over a longer time with larger sample size, is recommended due to the study's novelty and the necessity for more accurate results.

5. Conclusion

To minimize the complications during and after surgery in patients undergoing the Whipple surgery and also to increase their quality of life, it is necessary to study and compare different methods and introduce a method with fewer complications. This study showed that the R-to-L gastrojejunostomy technique is a good option for preventing surgery complications, especially delayed gastric emptying. Reducing this complication can result in decreasing the length of hospital stay and hospital costs, which in turn can increase patients' quality of life. The results of this study showed that DGE after PD in the Whipple surgery in R-to-L was significantly less than in the L-to-R method ($P<0.001$).

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Jundishapor University of Medical Science.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declare no conflict of interest.

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