



A Comparative Study between Modified Kakita Pancreaticojejunostomy and Conventional Reconstruction after Pancreaticoduodenectomy: A Retrospective Review

Wanthanachai Rotchomphu MD¹

Wisit Kasetsermwiriya MD^{1*}

¹ Department of Surgery, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand

* Corresponding author, e-mail address : wisit@edu.vajira.ac.th

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Abstract

Background: Advances in surgical techniques and appropriate perioperative management has decreased the mortality rate of pancreaticoduodenectomy less than 5 percent. However, postoperative pancreatic fistula is the most serious and life-threatening condition with the incidence rate at 27% for conventional reconstruction. A newly modified technique in Japan Kakita pancreaticojejunostomy has been reported that it reduces postoperative pancreatic fistula; however there were only few reports of this technique outside Japan. This study aimed to compare rate of pancreatic leakage between the new technique and conventional pancreaticojejunostomy after pancreaticoduodenectomy in Thai patients.

Methods: Data of 25 consecutive patients with periampullary cancer and benign conditions (e.g. chronic pancreatitis) who underwent pancreaticoduodenectomy at Vajira hospital from 2005 to 2015 were reviewed. Postoperative results of fifteen patients who underwent conventional pancreaticojejunostomy (group A) were compared with ten patients who underwent modified Kakita pancreaticojejunostomy (group B). The primary outcome measure was the rate of postoperative pancreatic fistula (POPF) and secondary outcomes included; operative data, postoperative morbidity, mortality and evaluation of the risk factors of pancreatic leakage.

Results: There were no differences in clinicopathological characteristics and postoperative morbidity between two groups. Overall, the leakage rate was 32% (8/25). The pancreatic leakage in group A was 50 % (5/10) while the leakage rate in group B was 20% (3/15), $p=0.194$. Duration of hospital stay in group A was 39 days (17-66 days) and in group B was 28 days (21.5-46.5 days); $p = 0.824$. All of the complications could be managed by conservative measures. Intraoperative blood loss was a risk factor for leakage (1500 ml vs. 750 ml, $p = 0.038$). The leakage caused delayed gastric emptying (3 vs. 0, $p = 0.24$) and prolonged hospital stay (72.5 days vs. 25.5 days, $p < 0.0001$).

Conclusion : This retrospective single-center study showed that duct-to-mucosa anastomosis by modified Kakita technique was a safe procedure.

Keywords : pancreaticoduodenectomy, postoperative pancreatic fistula



การศึกษาเปรียบเทียบภาวะแทรกซ้อนรอยต่อระหว่างการต่อแบบใหม่และแบบดั้งเดิมหลังจากการผ่าตัด Pancreaticoduodenectomy

วรรณชนชัย รอดชมภู พ.บ.¹

วิศิษฐ์ เกษตรเสริมวิริยะ พ.บ.^{1*}

¹ ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์วชิรพยาบาล มหาวิทยาลัยนวมินทราธิราช กรุงเทพมหานคร ประเทศไทย

* ผู้ติดต่อ, อีเมล: wisit@edu.vajira.ac.th

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บทคัดย่อ

วัตถุประสงค์: ด้วยเทคนิคการผ่าตัดและการดูแลผู้ป่วยหลังผ่าตัดที่ดีขึ้นทำให้สามารถลดอัตราการตายของการผ่าตัด pancreaticoduodenectomy จนน้อยกว่าร้อยละ 5 แต่อย่างไรก็ตามการเกิด pancreatic fistula หลังการผ่าตัดยังเป็นภาวะแทรกซ้อนที่อันตรายและเป็นสาเหตุของการเสียชีวิต โดยมีอุบัติการณ์ถึงร้อยละ 27 สำหรับการตัดต่อแบบทั่วไป เทคนิคการผ่าตัดแบบ modified Kakita ได้ถูกพัฒนาสำหรับการต่อ pancreatojejunostomy และพบว่าสามารถลดอัตราการเกิด pancreatic fistula หลังผ่าตัดได้ดีในประเทศญี่ปุ่น แต่อย่างไรก็ตามผลของการผ่าตัดด้วยวิธีนี้นอกประเทศญี่ปุ่นยังมีรายงานจำนวนน้อย การศึกษานี้เพื่อเปรียบเทียบอัตราการเกิด pancreatic leakage ระหว่างการผ่าตัดแบบเทคนิคใหม่เทียบกับวิธีการผ่าตัดแบบเดิมในผู้ป่วยชาวไทยที่ทำการผ่าตัด pancreaticoduodenectomy

วิธีดำเนินการวิจัย: เก็บข้อมูลย้อนหลังของผู้ป่วย 25 รายที่ทำการผ่าตัด pancreaticoduodenectomy เนื่องจาก perampullary cancer และ benign conditions (เช่น ตับอ่อนอักเสบเรื้อรัง) ที่คณะแพทยศาสตร์วชิรพยาบาลระหว่างปี พ.ศ. 2548-2558 ได้รับการรวบรวมและวิเคราะห์ ผลของการผ่าตัดของผู้ป่วย 15 รายได้รับการต่อ pancreatojejunostomy แบบ conventional (group A) ได้นำมาเปรียบเทียบกับผู้ป่วยจำนวน 10 รายที่ทำการผ่าตัดแบบ modified Kakita pancreatojejunostomy (group B) โดยทำการเปรียบเทียบการเกิดการรั่วของรอยต่อ pancreatojejunostomy (postoperative pancreatic fistula: POPF) และผลของการผ่าตัดอื่นๆ เช่น อัตราการเสียชีวิตและการเกิดภาวะแทรกซ้อน รวมถึงปัจจัยที่ทำให้เกิดการรั่วของรอยต่อ

ผลการวิจัย: ลักษณะทางคลินิกและพยาธิวิทยาของผู้ป่วยทั้งสองกลุ่มพบว่าไม่มีความแตกต่างกันอย่างมีนัยสำคัญ อัตราการเกิดภาวะแทรกซ้อนหลังผ่าตัดระหว่างทั้งสองกลุ่มก็พบว่าไม่มีความแตกต่างกัน อัตราการเกิด pancreatic anastomosis leakage ทั้งหมดเท่ากับร้อยละ 32 (8/25) อัตราการเกิด pancreatic leakage ในผู้ป่วยกลุ่ม A เท่ากับร้อยละ 50 (5/10) ในขณะที่อัตราการรั่วในผู้ป่วยกลุ่ม B เท่ากับร้อยละ 20 (3/15), $p = 0.194$ ระยะเวลาในการอยู่โรงพยาบาลเฉลี่ยในผู้ป่วยกลุ่ม A คือ 39 วัน (ค่าพิสัยควอไทล์ 17-66 days) ในขณะที่ค่าเฉลี่ยในกลุ่ม B เท่ากับ 28 วัน (ค่าพิสัยควอไทล์ 21.5-46.5 วัน), $p = 0.824$ ไม่มีผู้ป่วยเสียชีวิตในการศึกษานี้และภาวะแทรกซ้อนทั้งหมดสามารถให้การรักษาด้วยการไม่ผ่าตัดสำเร็จทุกราย พบว่าปริมาณการเสียเลือดขณะผ่าตัดเป็นปัจจัยเสี่ยงของการเกิดการรั่วของรอยต่อ (1500 มล. ต่อ. 750 มล., $p = 0.038$) การรั่วของรอยต่อเป็นสาเหตุของการเกิด delayed gastric emptying (3 ต่อ 0, $p = 0.24$) และทำให้ผู้ป่วยอยู่โรงพยาบาลนานขึ้น (72.5 วัน ต่อ. 25.5 วัน, $p < 0.0001$).

สรุป: การผ่าตัด pancreatojejunostomy anastomosis ด้วยวิธี duct-to-mucosa anastomosis ด้วยวิธี modified Kakita technique นั้นสามารถทำได้อย่างปลอดภัย

คำสำคัญ: การผ่าตัด pancreaticoduodenectomy, การเกิด pancreatic fistula หลังการผ่าตัด

Introduction

Pancreatoduodenectomy (PD) is an established surgical procedure in the treatment of malignant and benign diseases of the pancreas and periampullary region. Mortality after pancreatoduodenectomy has been declining dramatically in centers with experienced surgeons and now reportedly to less than 5% but postoperative morbidity rate remains high at approximately 40%. The most frequent complication was the leakage of the pancreatic-enteric anastomosis¹. Traverso et al. reported the incidence of pancreatic anastomosis leak of 10% with a range from 0% to 18%. Several risk factors for leakage have been reported including soft texture pancreas, small pancreatic duct size, preoperative normal pancreatic exocrine function and surgeon experience. The presence of post-operative pancreatic fistula (POPF) was strongly associated with other complications such as delayed gastric emptying, wound dehiscence, and intraabdominal infection. Thus, a reduction in POPF may lead to decreased morbidity and mortality after PD²⁻³. A variety of techniques have been attempted to lower the leakage rate, for example; end-to-end or end-to-side pancreaticojejunostomy, duct-to-mucosa or dunking anastomosis, pancreaticojejunostomy or pancreaticogastrostomy, internal or external stent, fibrin glue, and pharmacological agents that lower the volume of pancreatic exocrine secretion have been tried, but the leaks rate remains high^{1-4,7-8}.

The new technique of duct to mucosa, end-to-side pancreatojejunostomy was first proposed by Kakita et al. in 1996⁴. Since its introduction, many studies have shown the benefit of post-operative pancreatic anastomosis leakage reduction. Satoi et al. have reported the anastomosis technique reduced incidence of overall postoperative complications such as grade B/C POPF and delayed gastric emptying time after PD^{2,5}.

In Thailand, there has been no study about postoperative complication in modified Kakita method in PD. At our institute, we started performing this technique for pancreatic anastomosis since 2005. This study aimed to compare the rate of pancreatic leakage between a new technique and conventional pancreaticojejunostomy and analyze perioperative risk factors for pancreatic leakage after PD in Thai pancreatic cancer patients.

Methods

A retrospective chart review of 25 consecutive patients with periampullary cancer and benign conditions (e.g. pancreatic head cancer, distal common bile duct cancer, ampullary cancer, duodenal cancer and chronic pancreatitis), who underwent PD at Department of surgery, Vajira hospital, Bangkok was performed. The resections were performed from January 2005 to December 2015. Postoperative results of fifteen patients who underwent conventional pancreaticojejunostomy (group A) were compared with ten patients who underwent modified Kakita pancreaticojejunostomy (group B). The operations were performed by the same surgical team (consists of hepatobiliary and general surgeons who had experience of whipple operation more than 20 cases) and the patients who underwent operation by other surgeon were excluded. Clinical data including preoperative, intraoperative and postoperative data were reviewed. The study was approved by the institutional review board of faculty medicine Vajira hospital, Navamindradhiraj University.

Primary end point of the study was the rate of post-operative pancreatic fistula (POPF). According to the international study group of pancreatic surgery (ISGPS), we defined anastomosis leakage criteria as amylase-rich fluid concentration 3 times of the upper limit of normal serum amylase level

collected from the peripancreatic after postoperative 3th day with a drainage volume over 10 ml per day⁶. Post-operative complications were defined as follows; abdominal abscess was defined as a collection of pus or infected fluid confirmed by ultrasound or computed tomographic, delayed gastric emptying was defined as either the need for nasogastric intubation for 10 or more days or the inability to tolerate regular food on the 14th postoperative day and intra-abdominal infection was defined as radiological findings of fluid collection or microbiological findings of bacteria with infection-induced SIRS. The risk factors for anastomosis leakage were also evaluated⁷⁻¹².

Surgical Techniques

All surgical procedures were performed by experienced surgeon. Data were collected from two groups;

Group A consisted of 15 patients who underwent the conventional method for pancreaticojejunal end-to-side anastomosis in 2 layers with interrupted stitches. Group B consisted of 10 patients.

The details of modified Kakita's pancreaticojejunostomy are as follows, six to eight absorbable interrupted stitches were placed between the pancreatic duct and jejunal mucosa in end-to-side fashion, and an approximation of the jejunal wall and the pancreatic stump with 3 or 4 non-absorbable interrupted penetrating stitches were performed (figure 1). After completion the hepaticojejunostomy and gastrojejunostomy, two closed suction drain were placed near the pancreatic anastomosis and hepaticojejunostomy respectively.

Statistical Analysis

For the statistical analysis, continuous variables were presented as median and interquartile range; they were compared by the Mann-whitney

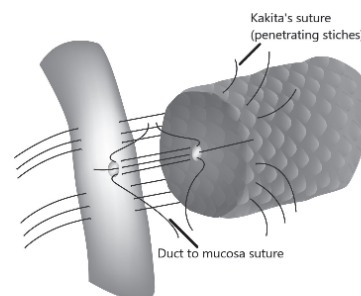
U test. Categorical variables were displayed as percentages or proportion and they were compared by Fisher's exact test. Logistic regression was performed to examine the factors that impact on pancreatic leakage. The significance was accepted at the $P<0.05$ level.

Results

The characteristics and intra-operative data of patients were shown in Table 1. There were no differences in pre and intra-operative variables (such as gender, underlying diseases, operative time and pancreatic duct size) between the conventional pancreaticojejunostomy group (group A) and the modified Kakita method group (group B).

There was no postoperative mortality and postoperative morbidities of two groups were not different (table 2). Overall pancreatic leakage rate was 32% (8/25), the pancreatic leakage in group A was 50 % (5/10) while the leakage rate in group B was 20% (3/15), $p=0.194$.

The incidence of complications such as delayed gastric emptying time, postoperative hemorrhage and intra-abdominal collection were not different between two groups. All complications could be managed by conservative measure (table 3).



Shit. Anand...

Figure 1: shows pancreaticojejunostomy using the modified Kakita method.

Table 1:

Pre and intra-operative data of patients in both groups

Variables	Conventional group (n=10)	Modified Kakita group (n=15)	p-value
Age (range) year	61 (29-80)	61 (44-81)	0.598
Male	4 (40%)	9 (60%)	0.428
Female	6 (60%)	6 (40%)	
Weight (Kg)	69.5 (45-103)	57 (40-82)	0.120
Diabetes mellitus	3 (30%)	3 (20%)	0.653
Hypertension	6 (60%)	9 (60%)	1.000
Chronic kidney disease	1 (10%)	0 (0%)	0.400
Chronic obstructive pulmonary disease	0 (0%)	1 (6.7%)	1.000
Coronary artery disease	2 (2%)	0 (0%)	0.150
Operation time (minutes)	415 (240-600)	360 (180-420)	0.093
Blood loss (ml)	1000 (200-4000)	775 (100-2100)	0.436
Pancreatic duct size (mm)	3.5 (2-4)	4 (2-4)	0.598
Pathology (Adenocarcinoma, %)	80% (8/10)	80%(12/15)	1.000
Albumin (mg/dl)	2.65 (2.0-4.4)	2.5 (2.1-4.0)	0.657

Table 2:

Postoperative outcomes of patients in both groups.

Variables	Conventional group (n = 10)	Modified Kakita group (n = 15)	p-value
Anastomosis leak	5 (50%)	3 (20%)	0.194
Postoperative hemorrhage	1 (10%)	2 (13.3%)	1.000
Delayed gastric emptying	3 (30%)	0 (0%)	0.240
Re-operation	0 (0%)	0 (0%)	1.000
Intraabdominal collection	1 (10%)	1 (6.7%)	1.000
Hospital stay length (day)	39 (17-66)	28 (21.5-46.5)	0.824

Table 3:

Details of patients who has POPF and management.

Sex	Age	Grading of POPF	Anastomosis technique	Management
Male	44	A	Kakita	Conservative
Male	70	A	Conventional	Conservative
Female	61	A	Conventional	Conservative
Male	51	A	Kakita	Conservative
Male	57	A	Conventional	Conservative
Female	56	B	Conventional	Percutaneous drainage
Female	61	A	Conventional	Conservative
Female	61	A	Kakita	Conservative

Hospital stay in group A was 39 days (17-66 days) and in group B was 28 days (21.5-46.5 days, $p=0.824$). Univariate analysis was applied to find the POPF risk factors (table 4).

The intraoperative blood loss was only a risk factor for leakage (1500 ml vs. 750 ml, $p=0.038$). Furthermore, the leakage caused delayed gastric emptying (3 vs. 0, $p=0.24$) and prolonged hospital stay (72.5 days vs. 25.5 days, $p< 0.0001$) (table 5).

Table 4:

Univariate analysis of risk factor for pancreatic fistula

Variables	Pancreatic fistula (n = 8)	No pancreatic fistula (n = 17)	p-value
Age (year)	59 (44-70)	64 (29-81)	0.243
Weight (kg)	64 (51-103)	58 (40-82)	0.350
Albumin (g/l)	2.5 (2.0-4.4)	2.6 (2.0-4.2)	0.907
Operation time (min)	405 (300-600)	360 (180-480)	0.141
Blood loss (ml)	1500 (200-4000)	750 (100-2100)	0.038
Blood transfusion (unit)	3 (0-6)	1 (0-4)	0.033
Pancreatic duct size (mm)	3 (2-4)	4 (2-4)	0.103

Table 5:

Impact of pancreatic leakage

Variables	Pancreatic fistula (n = 8)	No pancreatic fistula (n = 17)	p-value
Delayed gastric emptying time	3 (37.5%)	0	0.024
Hospital stay (day)	72.5	25.5	<0.001

Discussion

In 1996, Kakita et al first described his new method of pancreaticojejunostomy as a simple and reliable technique¹⁻². Later, Satoi et al reported the modified technique of Kakita pancreaticojejunostomy reduced postoperative complications but there were a few reports of application of this technique outside Japan²⁻³. To date, there is still no report of the outcomes of modified Kakita's method in Thailand. Herein we evaluated the results of the technique in our institute. To our knowledge, this study is the first comparative study of post-operative results between conventional technique and modified Kakita's pancreaticojejunostomy after pancreaticoduodenectomy, which was conducted in Thailand. The results of our study show that the POPF of the modified Kakita's group is comparable to those in conventional technique group. Even though the pancreatic leakage rate is not statistically significantly different (20% vs 50%, $p=0.194$) because of the small number of patients, it may have clinical significance. The overall leakage rate of our study is 32% (8/25) which is higher than the results of the other reports that ranged from 10% to 30%^{1-2,8-9,11}. However, almost of the leakages severity were classified in mild form (grade A) and no interventional treatment was needed. The only one patient in conventional group (10%) has grade B POPF that need percutaneous drainage. As a result, modified Kakita pancreaticojejunostomy anastomotic technique may be beneficial for POPF prevention. Generally, the risk factors for pancreatic leakage are a soft pancreas, a small pancreatic duct, and a high pancreatic secretion rate (10-12) however, our study found high volume of intraoperative blood loss, blood transfusion were associated with the anastomosis leakage. The result of anastomosis leakage caused prolong hospital stay and delayed gastric emptying time. There were some limitations

in our study. Firstly, there was a bias due to the nature of retrospective study. Second, the number of population in the study was small which did not reach the power of statistics. As a result, further a large number of patients prospective randomized is required to prove to benefit of the modified Kakita pancreaticojejunostomy anastomosis after pancreatoduodenectomy.

In summary, we concluded that modified Kakita method was a safe procedure with comparable morbidity and mortality with the outcomes of conventional method. Furthermore, intraoperative blood loss and blood transfusion were the risk factors of anastomosis leakage. The prolong hospital stay and delayed gastric emptying time were caused by anastomosis leakage.

Conclusion

This retrospective single-center study showed that duct-to-mucosa anastomosis by modified Kakita technique was a safe procedure.

Disclosure statement

All authors declare that they have no conflict of interest.

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