Retrograde vs Conventional Dissection Technique in Pancreaticoduodenectomy: A Pilot Study

Hai-Yang Zhou, MD; Yi Wang, MD; Jian Zhang, MD; Can-Ping Ruan, MD; Wei-Jun Wang, MD; Yan-Ping Sun, MD; Zhi-Qian Hu, MD

Pancreaticoduodenectomy (PD) is increasingly being performed in experienced centers. With better anesthesia, technical refinements, and improved perioperative care, morbidity and mortality have declined remarkably over the past few decades.1 However, it remains a challenging operation.2 Due to the complex and technically demanding nature of this procedure, a number of modifications have emerged over the years. Most modifications focus on reconstruction, notably pancreatic anastomosis.3 Little attention has been paid to the technique of resection. Standard resection of PD is usually performed in a craniocaudal direction. Recently, Hackert et al4 described a retrograde dissection technique in a caudocranial direction. This technique differs from the conventional dissection technique, since the resection is performed in a retrograde way, starting with the uncinate process. Shrikhande et al5 reported that a combined artery-first and uncinate process-first approach was comparable with the uncinate process-first approach only regarding perioperative outcomes in PD (similar to that described by Hackert et al). However, they highlighted the specific value of adopting the artery-first approach and did not document the technique and advantage of the uncinate process-first approach in detail. As stated by Hackert et al, studies are needed to evaluate the possible advantages of the retrograde vs the conventional dissection technique regarding operative parameters and postoperative outcomes. With this background, we conducted a pilot study to compare the perioperative outcomes of the retrograde and conventional dissection techniques during the performance of a PD.

Methods

Patients
In this prospective comparative study from August 1, 2011, to July 30, 2012, a total of 15 consecutive patients who underwent PD with the retrograde dissection technique were compared with 15 consecutive patients who had PD with the conventional dissection technique. The indication for PD was the presence of a periampullary tumor. Consecutive patients were included to obviate any possible selection bias. All patients were operated on by the same surgeon (Z.-Q.H.), who specializes in pancreatic surgery. The study was reviewed and approved by the Committee on Ethics of Biomedicine Research, Second Military Medical University, Shanghai. Written informed consent was obtained from the patients involved in the study.

Retrograde Dissection Technique
Briefly, the retrograde dissection technique differs from the conventional dissection technique in resection order. After Kocher mobilization, the hepatoduodenal ligament is pre-
pared, including lymphadenectomy and exposure of the gastroduodenal artery and common bile duct, which can be cut at this point after removal of the gallbladder. The next step is division and translocation of the first jejunal loop to the right side of the mesenteric root. Afterward, retrograde resection of the pancreatic head is performed, starting with the uncinate process in a caudocranial direction (eFigure 1 [Supplement]). This is followed by transection of the lower portion of the stomach. As a result, the specimen is attached only to the pancreas body itself (eFigure 2 [Supplement]). Transection of the pancreas neck is performed as the last step of resection.

Data Collection
Preoperative demographic data, clinical history, examination and investigation findings, details of the surgical procedures, and all relevant perioperative variables, including the postoperative course and complications, and final histopathologic diagnosis were recorded in a prospectively maintained database.

Statistical Analysis
All continuous data were expressed as mean (SD). Categorical variables were compared using the χ2 test (or Fisher exact test when appropriate). The t test or nonparametric tests were used for continuous data according to their distribution. P < .05 was considered statistically significant.

Results
Thirty consecutive patients who underwent PD for periampullary tumors were included in this study. The first 15 patients were operated on using the conventional dissection technique (conventional group), while in the remaining 15 patients, a retrograde dissection technique was used as described earlier (retrograde group). Twenty (67%) patients were men and 10 (33%) were women. The mean age was 57.1 (9.9) years. The 2 groups were comparable regarding age, body mass index, sex, preoperative type 2 diabetes mellitus, preoperative biliary drainage, preoperative hemoglobin, and other organ resection (Table 1).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Retrograde (n = 15)</th>
<th>Conventional (n = 15)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>55.7 (10.9)</td>
<td>58.5 (8.9)</td>
<td>.45</td>
</tr>
<tr>
<td>BMI</td>
<td>22.5 (3.4)</td>
<td>21.5 (2.8)</td>
<td>.39</td>
</tr>
<tr>
<td>Sex, No.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>10</td>
<td>.99</td>
</tr>
<tr>
<td>Female</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Preoperative type 2 diabetes mellitus, No.</td>
<td>3</td>
<td>6</td>
<td>.43</td>
</tr>
<tr>
<td>Preoperative biliary drainage, No.</td>
<td>3</td>
<td>6</td>
<td>.43</td>
</tr>
<tr>
<td>Preoperative hemoglobin, g/dL</td>
<td>12.0 (1.6)</td>
<td>12.3 (1.6)</td>
<td>.61</td>
</tr>
<tr>
<td>Other organ resection, No.</td>
<td>1</td>
<td>0</td>
<td>.99</td>
</tr>
<tr>
<td>Intraoperative blood loss, mL</td>
<td>407 (202)</td>
<td>423 (253)</td>
<td>.84</td>
</tr>
<tr>
<td>Intraoperative blood transfusion, mL</td>
<td>133 (279)</td>
<td>93.3 (249)</td>
<td>.68</td>
</tr>
<tr>
<td>Duration of operation, min</td>
<td>255 (57)</td>
<td>264 (54)</td>
<td>.66</td>
</tr>
</tbody>
</table>

The mean intraoperative blood loss was 407 (202) mL in the retrograde group compared with 423 (253) mL in the conventional group (P = .84). The mean volume of blood transfused was 133 (279) mL (3 patients; range, 0-800 mL) in the retrograde group and 93.3 (249) mL (2 patients; range, 0-800 mL) in the conventional group (P = .68). The mean operative duration was 255 (57) minutes in the retrograde group compared with 264 (54) minutes in the conventional group (P = .66) (Table 1).

There was no perioperative mortality in either group. The overall morbidity was 7 of 15 patients (47%) in the retrograde group and 6 of 15 (40%) in the conventional group (P > .99). Details of the postoperative course and complications of both groups are shown in Table 2. Both groups were comparable regarding postoperative complications. The mean postoperative stay was 16.8 (8.2) days in the retrograde group compared with 15.6 (7.8) days in the conventional group (P = .68). There was no readmission within 30 days after surgery in either group.

Table 3 provides details of postoperative pathologic outcomes. Both groups were comparable regarding tumor type, size, differentiation, and TNM staging. The mean number of lymph nodes (LNs) retrieved was 10.0 (6.2) in the retrograde group compared with 9.5 (5.7) in the conventional group (P = .82). The mean number of metastatic LNs retrieved was 0.7 (1.1) in the retrograde group compared with 0.7 (2.0) in the conventional group (P = .99). Also, there was no positive resection margin in either group.

Discussion
From our experience, the retrograde dissection technique has 3 potential advantages. First, bleeding control is easy to achieve. The initial mobilization of the first jejunal loop and transposition to the right side allow wide mobility, with the advantage of having an excellent overview of all small vessels with the chance to selectively clip or ligate them. Moreover, manual control of the pancreatic head by the surgeon’s left hand can help to create tension, which facilitates the dissection and avoids any accidental injury. Second, it offers the opportu-
nity to completely lateralize the uncinate process to the right side and dissect it from the retroperitoneum and superior mesenteric vessels under direct vision. Thus, the surgical margins are clearly viewed throughout the whole resection stage, which could possibly result in a favorable oncologic outcome. Last, such a technique is particularly useful when the tumors involve the main portal vein or, when portal vein resection is anticipated, the portomesenteric junction. With such a technique, portal vein anastomosis could be conducted after removing the specimen, providing sufficient room to conduct a meticulous and precise end-to-end anastomosis.

Several preoperative factors are associated with operative difficulty and could perhaps influence perioperative outcomes, such as body mass index, preoperative biliary drainage, and anemia.6-8 In this study, both groups were comparable regarding these factors. Therefore, preoperative characteristics would not confound the outcomes.

The mean operative duration in both groups of patients showed no significant difference. Since the overall operative duration of a PD is affected by a number of factors and steps, time savings by using the retrograde dissection technique probably are not reflected in our series of patients. One reason might be that in the present study, retrograde dissection is a new technique that is time-consuming until surgeons become familiar with it.

The mean blood loss and volume of blood transfused in both groups showed no significant difference. Furthermore, there was no significant difference in the overall and specific morbidity between the 2 groups. None of the complications required further surgical intervention, and all were successfully treated by conservative therapy. These results imply that the retrograde dissection technique is as safe as the conventional dissection technique.

As seen in Table 3, the retrograde dissection technique can be used in all indications for PD and is not limited to any special anatomical situations. In addition, the present study demonstrates that tumors up to 5 cm can be safely handled by the retrograde dissection technique.

Another concern regarding the use of the retrograde dissection technique is the adequacy of LN retrieval and the risk

Table 2. Postoperative Course and Complicationsa

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Retrograde (n = 15)</th>
<th>Conventional (n = 15)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>0</td>
<td>0</td>
<td>.99</td>
</tr>
<tr>
<td>Complication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pancreatic fistula, grade B</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Intra-abdominal abscess</td>
<td>2</td>
<td>2</td>
<td>.99</td>
</tr>
<tr>
<td>Bile leakage</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Wound infection</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Delayed gastric emptying</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Postoperative stay, mean (SD), d</td>
<td>16.8 (8.2)</td>
<td>15.6 (7.8)</td>
<td>.68</td>
</tr>
<tr>
<td>Readmission</td>
<td>0</td>
<td>0</td>
<td>.99</td>
</tr>
</tbody>
</table>

* Values are given as numbers unless otherwise indicated.

Table 3. Postoperative Pathologic Outcomesa

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Retrograde (n = 15)</th>
<th>Conventional (n = 15)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tumor type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duodenum</td>
<td>5</td>
<td>4</td>
<td>.99</td>
</tr>
<tr>
<td>Pancreas</td>
<td>4</td>
<td>7</td>
<td>.45</td>
</tr>
<tr>
<td>Bile duct</td>
<td>4</td>
<td>2</td>
<td>.65</td>
</tr>
<tr>
<td>Papilla</td>
<td>2</td>
<td>2</td>
<td>.99</td>
</tr>
<tr>
<td>Tumor size, mean (SD), cm</td>
<td>2.6 (1.0)</td>
<td>3.0 (1.5)</td>
<td>.40</td>
</tr>
<tr>
<td>Tumor differentiation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>8</td>
<td>7</td>
<td>.99</td>
</tr>
<tr>
<td>Moderate</td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Well</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TNM stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>2</td>
<td>.99</td>
</tr>
<tr>
<td>II</td>
<td>10</td>
<td>7</td>
<td>.46</td>
</tr>
<tr>
<td>III</td>
<td>3</td>
<td>6</td>
<td>.43</td>
</tr>
<tr>
<td>IV</td>
<td>1</td>
<td>0</td>
<td>.99</td>
</tr>
<tr>
<td>No. of LNs dissected, mean (SD)</td>
<td>10.0 (6.2)</td>
<td>9.5 (5.7)</td>
<td>.82</td>
</tr>
<tr>
<td>No. of metastatic LNs, mean (SD)</td>
<td>0.7 (1.1)</td>
<td>0.7 (2.0)</td>
<td>.99</td>
</tr>
<tr>
<td>R0 resection</td>
<td>15</td>
<td>15</td>
<td>.99</td>
</tr>
</tbody>
</table>

Abbreviation: LN, lymph node.
* Values are given as numbers unless otherwise indicated.
of positivity of the retroperitoneal margin, which are signifi-
cantly associated with local recurrence and impair long-term
survival.9 We did not perform an extended lymphadenec-
tomy because of the lack of evidence for improved survival but
instead removed LNs around the head of the pancreas, com-
mon hepatic artery, and hepatoduodenal ligament.10 The
present study showed that the number of LNs retrieved was
not different between the 2 groups. In addition, none of the
patients in both groups had positive margins on final histo-
pathologic examination.

Postoperative hospital stay was not different between the 2
groups. This is not surprising since a prolonged hospital stay
is mostly caused by the complications of pancreatic fistula and
delayed gastric emptying, which were not influenced by the
dissection technique.11

Conclusions
Since perioperative outcomes are comparable to the con-
tventional method of dissection, the retrograde dissection
technique can now be considered a viable option in modern
PD to supplement the standard technique. Future larger
multicenter long-term studies may help to evaluate the
oncologic outcomes of the retrograde vs conventional dis-
section technique.

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data analysis.
Study concept and design: Zhou, Y. Wang, Hu.
Acquisition, analysis, or interpretation of data:
Zhou, Zhang, Ruan, W.-J. Wang, Sun, Hu.
Drafting of the manuscript: Zhou.
Critical revision of the manuscript for important
intellectual content: All authors.
Statistical analysis: Zhou, Zhang.
Administrative, technical, or material support:
Y. Wang, Ruan, W.-J. Wang, Sun.
Study supervision: Hu.
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Abstract.
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