Comparative Study of 2 Variants of a Modified Esophageal Transection in the Sugiura-Futagawa Operation

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Objective: To compare 2 techniques of esophageal transection in our modification of the Sugiura-Futagawa procedure for the treatment of bleeding portal hypertension in low-risk patients who cannot undergo surgery to have shunts placed.

Design: A prospective controlled trial comparing 2 variants of transection (classic, complete section of the anterior muscularis externa and whole mucosa; modified, placement of a circumferential running suture without opening the mucosa).

Setting: Academic university hospital.

Patients: Eighty-three low-risk patients (Child-Pugh score A and B) with a history of bleeding portal hypertension were operated on (35 classic, 48 modified transections) between 1989 and 1996. Both groups were comparable.

Main Outcome Measures: Postoperative dehiscence of the transection was evaluated as well as fistulization, postoperative stenosis, rebleeding, postoperative endoscopic findings, survival, and mortality.

Results: Fistulization was observed in 1 (2%) of the patients in the modified group, and dehiscence in 1 patient (2%). In the classic group, 3 (8%) of the patients had dehiscence (relative risk, 2.6) and 1 (2%) of the patients, fistulization. No differences were observed regarding rebleeding (6 patients [6%] vs 5 patients [7%]), postoperative stenosis (4 patients [8%] vs 5 patients [10%]), postoperative endoscopic findings, survival, and mortality (early and late).

Conclusion: The modified variant of the transection has a lower frequency of postoperative dehiscence, with the same long-term results.

Arch Surg. 1998;133:1046-1049

Surgery for portal hypertension has evolved greatly in the last decades. After the introduction of portal blood flow–preserving operations, the place of surgical treatment has been well established. Surgery is indicated in patients with a history of bleeding portal hypertension and good liver function who had undergone elective surgery. Selective shunts are the most electively used operations. However, there is a subset of patients, many with a noncirrhotic liver (prehepatic portal hypertension), who do not have suitable veins for a shunt. For these patients, the Sugiura-Futagawa operation offers a good alternate choice. Good long-term results can be achieved with this operation, with a low rate of postoperative rebleeding and encephalopathy.

The Sugiura-Futagawa operation is an extensive esophagogastric devascularization that includes vagotomy, pyloroplasty, and splenectomy, as well as an esophageal transection. We have modified it to make it easier for the surgeon and the patient. The operation is usually done in 2 stages (thoracic and abdominal), with an 8- to 12-week interval.

Together with devascularization, transection is one of the most important steps of the operation. Complications of transection are a great risk. The most frequent complication described is fistulization at the site of transection, with mediastinitis and empyema. It has a very high mortality rate. In 1990, two of the authors (M.A.M. and H.O.) and a colleague developed a variant of the esophageal transection, the preliminary results of which were published in 1993. Herein we present the results of a comparative study between the classic and modified technique of transection.

RESULTS

General data of the patients are given in Table 1 and Table 2. In 45% (16 classic; 21 modified) of the cases, the origin of the portal hypertension was liver cirrhosis. The diagnosis in 22% (9 classic; 10...
PATIENTS AND METHODS

Patients with acute bleeding portal hypertension are managed with pharmacotherapy and/or sclerotherapy at our institution. Very seldom (patients with good liver function and therapeutic failure to both alternatives) do we operate on emergency cases. After bleeding is controlled, liver function is classified according to the Child-Pugh score. Only patients with good liver function in bleeding-free intervals who also fulfill the following requirements are considered for surgical treatment. They must have (1) a history of variceal bleeding; (2) good cardiopulmonary and renal function; (3) good liver function with albumin values greater than 30 g/L, total bilirubin levels lower than 34 µmol/L (2 mg/dL), a prothrombin time below 2 seconds, no encephalopathy, and no ascites; and (4) good nutritional status. Patients with bad liver function are managed with a sclerotherapy program and/or long-term pharmacotherapy, others receive a transjugular intrahepatic shunt, and others are included in the liver transplantation program.

When the patient is selected for surgical treatment, the operation is planned according to the vascular anatomy of the patient after arterial and venous angiography of the splanchic area. If adequate vessels are found (patent splanchnomesosportal system, no tortuosity, good diameter), patients are considered for a selective shunt. Patients with history of sclerotherapy and related complications (esophageal ulceration, stenosis) are not eligible for our modification of the Sugiura-Futagawa procedure. The patients in these cases are considered for low-diameter shunts.

Patients selected for our modification of the Sugiura-Futagawa operation are those with thrombosis of the splanchnomesosportal system or inadequate venous anatomy (including that of the left renal vein) and those who have no evidence of repercussion of previous sclerotherapy in the esophagus.

Patients selected for this type of operation undergo surgery twice, usually starting with the abdominal stage (esophagogastric devascularization, vagotomy, pyloroplasty, and splenectomy); after 8 to 12 weeks, the thoracic stage is performed (esophagogastric devascularization with transection).

CLASSIC TRANSECTION

The left hemithorax is approached through the seventh intercostal space and the lung is then retracted anteriorly and superiorly. The mediastinal pleura is exposed and severed between the pericardium and the descending aorta. Devascularization is done from the left pulmonary vein to the level of the cardias. Transection is performed about 2.5 cm from the esophagogastric junction. Between 2 noncrushing clamps, the muscularis externa is severed, exposing the mucosa. The mucosa is severed keeping the posterior portion and remaining muscularis externa intact. An end-to-end anastomosis is done with a fine nonabsorbable suture material. The muscular layer is also sutured and the pleura is closed. The thoracic wound is closed in a conventional fashion, and a thoracic drain is left in place.

MODIFIED TECHNIC OF TRANSECTION

After esophageal dissection and devascularization, a noncrushing clamp is placed at the level of the esophagogastric junction. The anterior muscularis externa is severed and the mucosal cylinder dissected free from the posterior muscularis externa, which is also partially severed in its lateral aspects. After the entire circumference of the mucosa is dissected and freed, traction sutures are placed in 4 quadrants. A circumferential running suture is sewn between the traction sutures. Each stitch has less than a 1-mm interval and affects the whole mucosal layer. With mobilization (rotating) of the clamp from the junction, a complete exposure of the whole cylinder is obtained. The running suture obliterates the submucosal varices without opening the mucosa.

The muscularis externa is sutured and the thoracotomy closed, and a thoracic drain is left in place.

PATIENTS

Between 1989 and 1996, a total of 83 patients were treated by means of a 2-stage Sugiura-Futagawa operation. Thirty-five were operated on with the classic transection and 48 with the modified technique. Surgery was performed by 2 surgeons only (M.A.M. and H.O.). The files of these patients were reviewed and both groups were compared using the Fisher exact test (P > 0.5). Patients were assigned to each group in an aleatoric fashion. Informed consent for the operation was obtained in all cases.

Fistulization was defined as loss of continuity of the esophageal mucosa, with a leak that allows the passage of most of the contrast medium into the distal esophagus; dehiscence, as total loss of continuity of the esophageal mucosa, with total escape of the contrast medium; rebleeding, as hematemesis and/or melena with diminution of hemoglobin levels; and stenosis, as diminution of the lumen of the esophagus by more than 50% in the postoperative period that requires dilatation.

REBLEEDING

Rebleeding due to esophageal varices was demonstrated in 6 (12%) of the patients who had undergone the classic transection. In the modified transection group, the rebleeding rate was 10%. In 3 (7%) of the patients in the classic group and in 3 (6%) of those in the modified group, rebleeding was secondary to congestive gastritis. In 5 (10%) of the patients from the classic group, esophageal stenosis that required dilatation was observed compared with 4 patients (8%) in the modified group. Endoscopy findings in...
Surgical treatment of bleeding portal hypertension has a defined role in the therapeutic armamentarium. It has been demonstrated that low-risk patients who electively undergo surgery with portal blood flow–preserving operations are the best choice for this therapeutic modality. All low-risk patients are treated surgically because in our experience (also that of other groups), pharmacotherapy defines the operation as the final choice. Nevertheless, several groups have demonstrated a high rebleeding rate with these procedures, thus not recommending them as a first therapeutic option. The results with devascularization procedures in North America have been discouraging. Several groups have demonstrated good results with the Sugiura-Futagawa operation. With our modification of the procedure, we have obtained results similar to those obtained with the Sugiura-Futagawa method.

The original concept of direct attack on the esophageal varices was developed by Boerema in the Netherlands and Britton and Crile in the United States. The idea of total devascularization and a gastric transection after splenectomy. In 1977, Johnston pioneered the abdominal esophageal transection with a stapler device gun.

One of the steps of this devascularization procedure is esophageal transection. The goal of it is interruption of the submucosal varices. This event, combined with the high level of thoracic esophageal devascularization, guarantees porto-azygos disconnection through the esophagogastric area. This is the main goal of the operation and its basis. Thus, we always promote the 2-stage operation and do not favor the performance of the abdominal stage with transabdominal transection only.

In this situation, no adequate porto-azygos disconnection is obtained. One of the most difficult complications of the transection is suture insufficiency and dehiscence. In the Sugiura-Futagawa experience, its frequency is between 6% and 8%. In our own experience, it has been observed to fall between 8% and 10% and has a very high mortality rate (almost 50%). Since

**SURVIVAL AND MORTALITY**

In the modified group, 1 patient died in the first postoperative week because of mediastinitis. The patient with fistulization was doing well in his 40th postoperative month. Four long-term mortalities were observed (ie, nonoperative, defined as those that occur after day 30) (10, 12, 24, and 36 months postoperatively), 3 of them because of liver failure and 1 because of rebleeding. Survival was 91% at 1 year and 82% at 5.

In the classic group, 2 patients with fistulization died in the first month. Of the 2 survivors, one patient was unavailable for follow-up and the other was alive 39 months postoperatively. Four patients died (3, 12, 24, and 36 months postoperatively) because of liver failure. Survival was 89% at 1 year and 84% at 5.

Comparison of the groups showed no differences were observed between the 2 groups (Fisher exact test, \( P = .34 \)). Nevertheless, the relative risk of developing dehiscence was 2.6 higher for those in the classic group.

Surgical treatment of bleeding portal hypertension has a defined role in the therapeutic armamentarium. It has been demonstrated that low-risk patients who electively undergo surgery with portal blood flow–preserving operations are the best choice for this therapeutic modality. All low-risk patients are treated surgically because in our experience (also that of other groups), pharmacotherapy and sclerotherapy have a very high rebleeding rate (40%-50%). So, we do not give the low-risk patients this high chance of rebleeding. Because of this, the patients selected for surgery have no history of other therapeutic alternatives with the exception of those in whom some kind of procedures were done during the active bleeding. The selection of the operation depends on several factors, but the major determinant in our experience is the patient's vascular anatomy. If a patient lacks adequate vessels for performing a shunt (diameter, tortuosity, distance, recanalized thrombosis), a devascularization operation is a better option. The results with devascularization procedures in North America have been discouraging. Several groups have demonstrated a high rebleeding rate with these procedures, thus not recommending them as a first therapeutic choice.

Nevertheless, several groups (including ours) have demonstrated good results with the Sugiura-Futagawa operation. With our modification of the procedure, we have obtained results similar to those obtained with selective shunts. In our hospital, approximately 50% of the patients who are surgically treated are operated on with our modification of the Sugiura-Futagawa method.

The original concept of direct attack on the esophageal varices was developed by Boerema in the Netherlands and Britton and Crile in the United States. The idea of total esophageal transection to interrupt the transmural and paravesical varices should be attributed to Walker. Tanner, in his Hunterian Lecture at the Royal College of Surgeons, coined the term "porto-azygos disconnection" and recommended only the abdominal approach for the devascularization and a gastric transection after splenectomy. In 1977, Johnston pioneered the abdominal esophageal transection with a stapler device gun.

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**Table 1. General Patient Data**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Group 1: Classic Transection (N = 35)</th>
<th>Group 2: Modified Transection (N = 48)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sclerosing cholangitis</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Congenital fibrosis</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Prehepatic portal hypertension</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Primary biliary cirrhosis</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Liver cirrhosis (alcoholic, posthepatic)</td>
<td>16</td>
<td>21</td>
</tr>
</tbody>
</table>

*Classic transection is the complete section of the anterior muscularis externa and whole mucosa; modified, placement of a circumferential running suture without opening the mucosa.

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**Table 2. Results of Procedures**

<table>
<thead>
<tr>
<th>No. (%)</th>
<th>Classic Transection</th>
<th>Modified Transection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehiscence</td>
<td>3 (8)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Fistulization</td>
<td>1 (2)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Mortality</td>
<td>2 (4)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Rebleeding</td>
<td>6 (12)</td>
<td>5 (10)</td>
</tr>
<tr>
<td>Stenosis</td>
<td>5 (10)</td>
<td>4 (8)</td>
</tr>
<tr>
<td>Endoscopy, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varices</td>
<td>22 (52)</td>
<td>32 (52)</td>
</tr>
<tr>
<td>Disappearance</td>
<td>23 (52)</td>
<td>23 (52)</td>
</tr>
<tr>
<td>Diminution</td>
<td>52 (91)</td>
<td>52 (91)</td>
</tr>
<tr>
<td>% Survival</td>
<td>At 12 mo 1 (2)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>At 60 mo 1 (2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*See Table 1 for definitions of classic and modified. See “Patients” subsection of the “Patients and Methods” section for definitions of dehiscence, fistulization, rebleeding, and stenosis.

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1991, a variant of the transection was designed to decrease the frequency of this complication. This modified variant has the same goal and technical principles of the classic transection: interruption of submucosal varices and subsequent substitution by a fibrous scar. The technical placement of the continuous fine absorbable suture achieves these events. The application of traction sutures in quadrants makes the placement of the sutures easier. The sutures have to include all the mucosal layer in each stitch to obliterate the varicose veins.

Esophageal transection done with mechanical devices and staplers has not been successful in our experience. We think that certainly it has a role with some other kind of devascularization in which such extensive devascularization is not done. For limited upper-third gastric devascularization with no thoracic esophageal devascularization, the total transection of the mucosal and muscular layers (necessary with stapler devices) has a limited possibility of dehiscence and/or fistulization. These operations initially have a low rebleeding rate, but in the late postoperative period they have a higher rebleeding rate. We think that this is because of a limited devascularization (incomplete porto-azygos disconnection) that allows reproduction of varices. If a complete transection of the 2 layers is done (it has to be stressed that in the Sugiura-Futagawa technique 50% of the muscular layer is left intact) as in the extensive Sugiura-Futagawa devascularization, certainly the transection is jeopardized. We have tried it in about 8 cases with poor results (fistulization and dehiscence due to ischemia at the level of transection). This is the reason we do not recommend use of a stapler device in such an extensive devascularization.

Dagenais et al10 from Canada have recently published their experience with this operation. In their study in which transection was indistinctly done manually or mechanically, the frequency of dehiscence was 14% and the frequency of stenosis, 37%. In 1984, Weese et al.11 using mechanical devices, reported a frequency of fistulization and stenosis of 18%. In 1987, Barbot and Rosato12 reported a frequency of fistulization of 4% and of stenosis, 11%. Globally analyzed, complications of transection initially have a low rebleeding rate, but in the late postoperative period they have a higher rebleeding rate. We believe that no more maneuvering should be done that could potentially cause further devascularization of the mucosal cylinder. The goal of transection is the interruption of submucosal varices, which is obtained with a limited dissection of the mucosal cylinder and the placement of sutures. It is concluded that, indeed, the modified transection has a lower risk of fistulization and that it fulfills the principal goal of the transection, ie, interruption of submucosal varicose veins, making the operation easier and safer for both the surgeon and the patient.

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**Table 3. Comparison With Other Series**

<table>
<thead>
<tr>
<th>Source</th>
<th>Dehiscence and/or Fistulization, %</th>
<th>Stenosis, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dagenais et al13</td>
<td>14</td>
<td>37</td>
</tr>
<tr>
<td>Weese et al11</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Barbot and Rosato12</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Present series</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Modified transection</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Classic transection</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

* See “Patients” subsection of the “Patients and Methods” section for definitions of dehiscence, fistulization, and stenosis. See Table 1 for definitions of classic and modified.

**REFERENCES**