The Evolution of Portal Hypertension Surgery

Lessons From 1000 Operations and 50 Years’ Experience

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Hypothesis: Surgery for portal hypertension has evolved widely in the past decades. Selection criteria and the type of operations have evolved because of the appearance of other therapeutic alternatives, such as pharmacotherapy, endoscopic therapy, transjugular intrahepatic portosystemic shunt, and liver transplantation. We believe the surgical approach has a therapeutic role in a select patient population.

Design: Retrospective review of the medical records of patients operated on for bleeding portal hypertension in the past 50 years.

Setting: An academic tertiary care university hospital.

Patients and Methods: In a 50-year period, 1000 operations for the treatment of bleeding portal hypertension have been done, including shunts and devascularization procedures. In the past years, in low-risk (Child-Pugh classification A) selected patients, only portal blood flow–preserving operations have been done.

Results: Non–portal blood flow–preserving procedures had a wide spectrum of results, with a high encephalopathy rate and short long-term survival. The results with portal blood flow–preserving procedures in the past 10 years are as follows: operative mortality, 2.7%; postoperative encephalopathy, 6%; rebleeding, 6%; and shunt obstruction, 4%.

Conclusions: Portal hypertension surgery has a role in elective operations and in low-risk selected patients, when portal blood flow–preserving procedures are done. The type of operation is selected according to the individual characteristics of each patient.


INCE THE introduction of the portacaval shunt in 1945 by Whipple for the treatment of bleeding portal hypertension,1 surgery has evolved widely. It is difficult to find a syndrome in medicine for which so many types and variants of surgical techniques have been developed. Moreover, several other forms of treatment (pharmacological, endoscopic, and interventional radiology) have appeared, offering a wide variety of alternatives to the patient and physician. There is a large spectrum of choices that range from swallowing daily a simple pill to a formidable operation such as a liver transplantation.2

Four years after the portacaval shunt was done by Whipple in the United States, Robles and Muñoz-Kappellmann performed the first portasystemic shunt in Mexico (in 1949). It was a proximal splenorenal shunt (Linton shunt), and the patient survived several years. In 1973, the portal hypertension clinic was founded in our hospital, and since that year several protocols for the surgical treatment of portal hypertension have been tried. In 1999, operation number 1000 was performed. Herein, we describe the experience and evolution of the surgical technique and the status of portal hypertension surgery.

RESULTS

SELECTIVE SHUNTS

Six years after the introduction of the concept of selectivity by Warren et al in 1967,3 the first selective shunt was performed at our institution. At that time, a variant of this selective shunt was also done: the splenocaval shunt.4 This type of shunt had the same principles as the Warren shunt, with the only variant that the splenic vein was directly anastomosed to the inferior vena cava. Some individual anatomic features are necessary for this type of shunt (rotation of the mesenteric axis with a large splenic vein). For some other cases, the indirect variant (termino-terminal splenorenal) was used, using the distal renal vein...
MATERIALS AND METHODS

The medical records of 1000 consecutive patients operated on for bleeding portal hypertension at our institution between February 1949 and December 1999 were reviewed. The operations were divided into 4 periods (Table 1). The results of these operations regarding survival, rebleeding, and postoperative encephalopathy were analyzed. Since the surgical procedures overlapped in the different periods, they were analyzed separately. The Fisher exact test was used for comparison of the operations.

as an autologous graft between the splenic vein and the inferior vena cava, suturing the proximal renal vein stump.

A total of 296 of these operations have been done (253 Warren shunts and 43 splenocaval shunts). In the past 5 years, low mortality has been achieved (<5%), together with low rebleeding (6%) and encephalopathy (8%). Also, we have shown that portal blood flow is preserved in more than 80% of the cases. In a few cases, portal vein obstruction secondary to thrombosis has been observed. In other cases, the so-called pancreatic siphon has been observed, and not only in alcoholic patients. In the early 1990s, a comparison between the selective shunt and the low-diameter mesocaval shunt was conducted, showing a significantly (P = .03) lower obstruction rate for the distal splenorenal shunt, a lower rate of postoperative encephalopathy, and better portal blood flow preservation. In a few instances, the shunt was used on an emergency basis. Since 1989, we perform only elective operations.

LOW-DIAMETER SHUNTS

Thirty-seven procedures were done in the mesocaval position, and 2 in the portocaval position. Most of these were performed between 1989 and 1994. Although in our hands the operation had a low mortality (<3%), the obstruction rate of the shunt in the first postoperative month was 19%. Also, a high encephalopathy rate was shown (38%), as well as postoperative portal vein alterations (obstruction or diameter diminution) due to the deviation of the portal blood flow through the graft. Rebleeding was 15%.

MESORENAL AND MESOCAVAVAL SHUNTS

The classic Drappanas shunt and the mesorenal shunt were done in 27 patients. They had high encephalopathy (40%) and obstruction (30%) rates. Rebleeding was 5%. These shunts have not been performed in the past 15 years.

PROXIMAL SPLENORENAL SHUNTS

The Linton shunt was the first of the 1000 operations. Thirty-eight shunts were done, and they functioned hemodynamically as a total shunt. Although at that time it was difficult to determine the patency of the shunt, only the rebleeding rate could be studied. In the experience reported by Quijano and Muñoz-Kapellmann, the global mortality was 28% for the total group and 14% for the low-risk group (good liver function). Reported rebleeding for survivors was 11% at the 5-year follow-up. Encephalopathy was 40%.

PORTACAVAL SHUNTS

The termino-lateral portacaval shunt was the most commonly performed shunt in the first period. It was done in 103 patients. The results were reported by Cárdenas et al: the operative mortality was 11%, the survival was 35% at 5 years, and rebleeding was 10%. Encephalopathy was recorded in 43% of the patients.

PORTACAVAL SHUNTS WITH ARTERIALIZATION

When the world realized that deprivation of portal blood flow was deleterious to liver function, Adamsons and Maillard and their colleagues described a surgical technique that included arterIALIZATION of the distal or hepatic stump of the portal vein. The results were not encouraging, and most of the patients had thromboses of the arterialized graft at short follow-up. We performed only 10 of these procedures, and all of the patients developed graft obstruction.

MAKESHIFT SHUNTS

These were done in 4 patients, and they were long-term failures. A coronariocaval shunt was done in 1 patient who experienced early thrombosis.

<table>
<thead>
<tr>
<th>Table 1. Types of Operation by Period</th>
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<tbody>
<tr>
<td><strong>Shunts</strong></td>
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<td>--------------------------------------</td>
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<tr>
<td><strong>Selecting shunts</strong></td>
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<tr>
<td>Distal splenorenal</td>
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<tr>
<td>Splenocaval</td>
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<tr>
<td>Low-diameter</td>
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<tr>
<td>Portacaval</td>
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<tr>
<td>Arterialized</td>
</tr>
<tr>
<td>Proximal splenorenal</td>
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<tr>
<td><strong>Mesosystemic shunts</strong></td>
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<tr>
<td>Renal</td>
</tr>
<tr>
<td>Caval</td>
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<tr>
<td>Atrial</td>
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<tr>
<td>Makeshift shunts</td>
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<tr>
<td><strong>Devascularizations</strong></td>
</tr>
<tr>
<td>Sugiura-Futagawa</td>
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<tr>
<td>Abdominal</td>
</tr>
<tr>
<td>Thoracic</td>
</tr>
<tr>
<td>1-Stage</td>
</tr>
<tr>
<td>Stapled</td>
</tr>
<tr>
<td>Non-Sugiura-Futagawa</td>
</tr>
<tr>
<td>Splenectomy</td>
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<tr>
<td>Selective surgery</td>
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MESOATRIAL SHUNTS

Ten patients with Chiari syndrome have been treated with this shunt. Long-term results were excellent in patients with preserved liver function. Four of the 10 patients are doing well with a patent shunt after a mean follow-up of 6½ years. For patients with a low hepatic reserve, the operative mortality was high.

ABLATIVE PROCEDURES

Since the beginning of the institution’s experience, ablative procedures have been used for nonshuntable patients. A total of 14 devascularizations (Womack or Tanner) were carried out in the early years. A high rebleeding rate was recorded (40%). Some resective procedures (gastrectomy and esophagogastrectomy) were also done, all of them with a high operative mortality (approximately 30%).

In 1967, Sugiura and Futagawa designed a new surgical technique, and in 1979, we began the extensive 2-stage (thoracic and abdominal) esophagogastrectomy devascularization with splenectomy and esophageal transection. Initially it was an alternate choice for patients with cirrhosis and unsuitable shunt anatomic features, and in patients with extrahepatic portal vein thrombosis. We found that the operation described had similar results when compared with those obtained with the selective shunts. A total of 251 abdominal stages were done, 167 thoracic stages, and 27 one-stage procedures. Also, 6 abdominal stages with stapler transection of the esophagus were done.

The operative mortality was less than 6%, with 10% rebleeding and low encephalopathy (<4%).

The operation has evolved at our institution in past years. We now perform a 2-stage procedure. In the abdominal stage, the stomach and the esophagus are devascularized (afferent and efferent vessels), with complete ablation of the vessels in the lower third of the esophagus, ablation of the short gastric vessels and the left gastro-omental vessels, coronary vein and artery ablation, and ligature of the vessels in the lesser curvature (connection between the right and left gastric veins). Also, a selective ligature of the right gastro-omental vein is done. A truncular vagotomy and a pyloroplasty are done. The spleen is routinely preserved (except in cases of massive splenomegaly and severe hypersplenism). In the thoracic stage, the esophagus is devascularized from the left pulmonary hilum to the cardiae and a modified transection (that has less complications than the classic transection) is done, achieving a complete portoazygos disconnection. We have shown similar results to those obtained with the Sugiura-Futagawa operation, but with less complications.

SPLENECTOMY

This has been done in 22 patients, all of them indicated because of segmentary portal hypertension secondary to splenic vein thrombosis.

PAST 5 YEARS

In the past 5 years, only elective operations and portal blood flow–preserving procedures have been done, ie, selective shunts, complete portoazygos disconnection, Sugiura-Futagawa devascularization, and partial portosystemic shunts. The selection of patients is stressed, and only low-risk patients who fulfill the following criteria are included for surgical treatment: good cardiopulmonary function, no pulmonary hypertension, good renal function, good liver function, an albumin level greater than 30 g/L, a total bilirubin level less than 34 µmol/L (<2 mg/dL), a prothrombin time of less than 2 seconds, no ascites, and no encephalopathy. Patients with bad liver function are considered for combined therapy (pharmacological and endoscopic), and some of them undergo transjugular intrahepatic portosystemic shunt. Other patients are included in our small liver transplantation program.

With adequate patient and angiographic selection of the portal blood flow–preserving operation, we have achieved low mortality (2.7%) and excellent postoperative results, with 6% encephalopathy, 6% rebleeding, and 4% obstructions of shunts in those treated by a derivative procedure.

EMERGENCY OPERATIONS

At the beginning, many emergency procedures (selective shunts, low-diameter shunts, and devascularizations) were done, with a high mortality rate. In the 1980s, the mortality was close to 40%. Thus, in the past 10 years, virtually no more emergency procedures have been performed.

COMPARISON OF THE MAIN TYPES OF OPERATIONS

When the operations were compared, 2 main differences were observed. There is a significant lower operative mortality that favors the elective selective shunts and the Sugiura-Futagawa procedure. Indeed, the operative mortality was lower than 2% in the past 5 years. This difference is due without doubt to the eras in which the procedures have been performed. Now, there is better preoperative, transoperative, and postoperative care that results in better results. No difference was found regarding rebleeding, and a significant difference was found be-
tween the groups when postoperative encephalopathy was analyzed, favoring the portal blood flow–preserving procedures (Table 2).

### Table 2. Comparison of the Main Types of Procedures*

<table>
<thead>
<tr>
<th>Variable</th>
<th>DSRS</th>
<th>LDMS</th>
<th>Mesorenal or</th>
<th>Proximal</th>
<th>Portacaval</th>
<th>Sugiyama-Futagawa</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>296</td>
<td>37</td>
<td>27</td>
<td>38</td>
<td>103</td>
<td>27 one-stage and 251 abdominal-stage</td>
</tr>
<tr>
<td>Operative mortality, %</td>
<td>5/3‡</td>
<td>3</td>
<td>10</td>
<td>14</td>
<td>11</td>
<td>6/2‡</td>
</tr>
<tr>
<td>Rebleeding, %</td>
<td>6</td>
<td>15</td>
<td>5</td>
<td>11</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Encephalopathy, %</td>
<td>8‡</td>
<td>38</td>
<td>40</td>
<td>40</td>
<td>43</td>
<td>4‡</td>
</tr>
</tbody>
</table>

*DSRS indicates distal splenorenal shunt; LDMS, low-diameter mesocaval shunt.
‡Significant difference (P<.05).

Surgery for portal hypertension has evolved widely in techniques and indications. Our institution, which has been devoted to the treatment of bleeding portal hypertension for the past 50 years, is no exception to this worldwide trend.

The initial enthusiasm for the surgical treatment of portal hypertension and its subsequent failure to demonstrate a positive impact on patient survival was also seen at our hospital in the late 1960s. Indeed, we confirmed that total shunts were excellent for the prevention and control of variceal bleeding, but survival and life quality were not improved. Sclerotherapy later appeared as an alternate choice for the treatment of these patients, obtaining a place in the therapeutic armamentarium for the treatment of emergency cases and high-risk patients.

In 1967, the concept of selectivity developed by Warren et al gained popularity, and the performance of selective shunts was routinely begun in our hospital. Indeed, selective shunts have survived all the new treatment approaches. At the beginning, patient selection was not carried out and operative mortality was high (14%). We also learned that emergency cases had a high mortality rate and when combined with bad liver function, the result was completely negative.

Case selection was begun, and only patients undergoing an elective procedure who had a low risk and a Child-Pugh classification of A or B+ were considered for surgical treatment. Also, careful angiographic selection was started, and only patients with anatomic features suitable for a shunt were included. The others were sent for devascularization procedures.

We reserved partial shunts (low diameter) for those patients in whom a shunt and/or complete portoazygos disconnection was not feasible. These were patients with a history of splenectomy or upper left abdominal surgery that precluded a devascularization and/or made it a difficult and dangerous option.

Orloff et al, from San Diego, Calif, have shown excellent results with the portacaval shunt, in elective and in emergency situations, with good survival and extremely low encephalopathy and rebleeding rates. Because of the initial results observed with total shunts in our experience, with a high encephalopathy rate and concomitant hepatic failure, we began to do portal blood flow–preserving procedures. We have not done a prospective, controlled, randomized trial between selective and total shunts to support the preference for selective shunts, but historically compared (Table 2) the encephalopathy rate is lower in our experience with the selective shunts. This has been also observed by Sarfeh and Rypins, who in a superb controlled, randomized, and prospective study showed a significant difference in portal blood flow preservation and encephalopathy between total and partial shunts. The results obtained with transjugular intrahepatic portosystemic shunt all over the world also support this idea. In the emergency situation, endoscopic therapy and pharmacotherapy have also shown comparable results to surgery to stop the bleeding, avoiding an emergency procedure that, in our experience, deteriorates the liver function and carries high morbidity and mortality.

The only historical evidence in our experience to support the performance of portal blood flow–preserving procedures is the encephalopathy rate. We have observed that patients with postoperative portal vein thrombosis have a higher encephalopathy rate, as do those with the pancreatic siphon, a condition in which the selective shunt has the behavior of a total shunt.

In relation to a low-diameter mesocaval shunt, we have shown in a prospective, controlled, not randomized study that patients with selective shunts have a better postoperative outcome. We believe that, indeed, they are a good alternative for patients in whom a selective shunt or extensive devascularization cannot be done. Although Paquet et al have demonstrated a lower encephalopathy rate with this type of shunt, this is probably due to the systematic prophylactic use of lactulose. No other difference can be considered, because the procedures are technically done in the same fashion. We do not have experience with low-diameter portacaval shunts, which have been reported to have good postoperative results, comparable to that of selective shunts.

There is evidence supported by the work of Johansen and Rosemurgy et al that encephalopathy is unrelated to postshunt direction of portal flow. We have in our experience no data to support this hypothesis. What we have observed in our patients is that the frequency of encephalopathy is higher in patients who undergo nonportal blood flow–preserving procedures.
The underlying liver disease certainly has a role in the postoperation outcome. In our experience, almost 40% of the cases are due to alcohol (18% of the patients keep on drinking in the postoperative period), 40% are the various forms of postnecrotic cirrhosis, and 20% are secondary to extrahepatic portal vein thrombosis and/or idiopathic portal hypertension. This last subset of patients have good liver function most of the time and are treated by devascularization, because they are unsuitable for a shunt in most cases.

Although we will have achieved good results with the Sugiura-Futagawa operation and complete portoazygos disconnection, this type of operation is only done when a shunt is not feasible, because the disadvantage is that it has to be done in a 2-stage procedure (2 different operations with a 2-month interval). This is why we reserve it for patients in whom a shunt cannot be done.

For those cases in which a shunt was not feasible, the Sugiura-Futagawa operation and the complete portoazygos disconnection offered an excellent choice, with results comparable to those obtained with selective shunts.21

Surgery for portal hypertension in 1999 has a defined role in the treatment of bleeding portal hypertension. Only low-risk patients undergoing elective surgery should be treated with a carefully selected portal blood flow–preserving operation. These surgical procedures do not affect the hepatic hilum and do not preclude the performance of a liver transplantation, if the liver disease evolves to hepatic failure. After bleeding was controlled as a result of a successful operation, most of our patients did not develop progression to hepatic failure and they did well postoperatively, with a good quality of life. This has also been observed by Rikers et al.22

Versatility is important when selecting an operation. Not all patients are candidates for one type of operation and not all have a good postoperative course. The operation must be selected according to patient anatomy and medical history. Thus, it is unwise to perform an esophageal transection in patients with a history of several sclerotherapy sessions. It is our belief that a selective shunt is not indicated in patients with small vessels and morbid obesity even if they have patent vessels. We cannot fight anatomy.

One major concern in developed countries in which liver transplantations are routine is the availability of surgeons trained in portal hypertension surgery.23 We think that most hepatopancreatobiliary and liver transplantation surgeons can perform these operations. These units have the necessary human and technological infrastructure to carry out these operations. Donor shortage is also a major inconvenience for the routine use of liver transplantation as treatment of bleeding portal hypertension. There are also some complications of liver transplantation (immunosuppression-rejection, suppression, retransplantation, and recurrent liver disease) that are undesirable for patients with good liver function in whom a well-selected operation can successfully control the bleeding, allowing a good quality of life. We are convinced that no other form of therapy can provide better long-term results for low-risk patients whose only problem is variceal bleeding than the portal blood flow–preserving operations performed in experienced centers.24

Clemente Robles, MD; Rafael Muñoz-Kappellmann, MD; Manuel Quijano, MD; Manuel Campuzano, MD; and Sergio Cárdenas-Silva, MD, were the surgeons between 1949 and 1973.

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REFERENCES

The authors are to be congratulated on their excellent documentation of the 50-year evolution of portal hypertension surgery in their unit. They have performed 1000 operations. For elective long-term management, they currently favor portal flow–preserving procedures, particularly the distal splenorenal shunt, and when not possible, an extensive 2-stage Sugiura devascularization operation. They have abandoned emergency shunt surgery for acute variceal bleeding.

They do not document which patients should be selected for endoscopic therapy rather than surgery nor the number of similar good-risk patients who were treated by endoscopic therapy at their institution. Even though the article is an analysis of their surgical experience, the role of nonsurgical therapy needs to be clarified.

We believe that endoscopic therapy or drugs (propranolol and nitrates) should be the primary therapy for all patients. We favor endoscopic therapy using sclerotherapy or banding. Only when endoscopic therapy fails should surgical procedures be undertaken. Here we agree that a selective shunt, particularly the distal splenorenal shunt, is the preferred treatment. Because of the success of endoscopic therapy, our group performs very few shunts today. Our indications for an elective shunt are similar to theirs, viz, use in good-risk patients. However, a shunt should only be performed because of failure of endoscopic therapy (varices difficult to eradicate or repeated bleeds), or of noncompliance, or for those patients living a distance from the treatment center.

When a surgical shunt is not possible, they advocate the extensive 2-stage Sugiura operation. We believe that a single-stage transabdominal procedure is as effective. However, we have abandoned devascularization and transection procedures because we have demonstrated in a randomized controlled trial (unpublished data 2000) that despite sclerotherapy and devascularization and transection procedures being equally effective, sclerotherapy is more cost efficient.

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Hirschsprung's disease is a congenital failure of distal migration of the intestinal ganglion cells in the myenteric (Auerbach) and submucosal (Meissner) plexuses, resulting in functional intestinal obstruction; also called congenital aganglionosis coli.