Multivisceral Harvest With In Vivo Technique: Methods and Results

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ABSTRACT

Multivisceral transplants are gaining acceptance worldwide for patients with chronic gastrointestinal failure with or without irreversible total parenteral nutrition (TPN)-related liver failure. We describe our experience with nine multivisceral harvests reporting our in vivo technique. Multivisceral grafts included stomach, duodenum, pancreas, small bowel, and part of large intestine with or without the liver. After a careful evaluation of the liver and the bowel, we isolated the superior mesenteric artery origin. Then we identified the distal part of the graft isolating the middle colic vein and stapling the transverse colon to its left. After esophagus isolation and stapling, we mobilized the graft, starting from the spleen to the pancreaticoduodenal block, near the celiac trunk. After cross-clamping and cold perfusion, we created an aortic patch including the superior mesenteric artery and celiac trunk as a multivisceral harvest without the liver. A total hepatectomy is added for a liver multivisceral graft.

We harvested four multivisceral grafts without the liver and five multivisceral grafts with the liver. We performed seven multivisceral transplants on adult recipients, four without the liver and three with the liver, as well as two liver and one isolated small bowel transplants. Postreperfusion hemostasis was always satisfactory with a mean ischemia time of 6.5 hours. Four recipients died: there was one intraoperative death due to disseminated intravascular coagulopathy. Another patient underwent graftectomy 1 day after transplantation due to vascular thrombosis.

In conclusion, our in vivo technique allows a shorter ischemia time with a minimal postreperfusion bleeding and reduced production of lymphatic ascites, without jeopardizing organ function.

MULTIVISCERAL transplants with or without the liver are gaining worldwide acceptance for patients with short bowel syndrome or gastrointestinal motility disorders like chronic intestinal pseudo-obstruction (CIPO) associated or not with irreversible total parenteral nutrition (TPN)-related liver failure. Other diseases are represented by massive splanchnic thrombosis involving the mesoportal axis or abdominal tumors like desmoids in Gardner syndrome or neurofibromatosis involving all abdominal structures. Sometimes previous extensive abdominal surgeries are indications to extend the transplant from an isolated small bowel to a multivisceral one. Indications for transplant are TPN-related complications, like recurrent central line sepsis, loss of central venous access, and liver failure. Harvest of the multivisceral graft, because of its complexity, represents a possible pitfall of transplantation, considering

that ischemia time must be short to better preserve the graft functionality. Several techniques have been developed to obtain a shorter ischemia and improve the postreperfusion hemostasis. We describe our experience with nine multivis-

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ceral harvests performed between February 2001 and November 2004, using an *in vivo* technique.^{1,2}

PATIENTS AND METHODS

Careful selection of the donor was performed with the utmost attention paid particularly to body weight and residual abdominal cavity of the recipient. If judged suitable, the donor underwent selective bowel decontamination following our protocol, as described elsewhere.^{1,2} Most donors were under 30 years of age, died for cerebrovascular accident, were hemodynamically stable, had minimal or no vasoactive amine support. After laparotomy, we carefully evaluated the liver and the bowel. If there was any doubt, we decided not to proceed with the operation. The first step was isolation of the superior mesenteric artery (SMA) origin from the aorta. To achieve this, we performed a Kocher plus Cattell maneuver, mobilizing the ascending colon toward the left, cutting the Treitz ligament and all mesenteric ligaments as well. In this way, locating the left renal vein and the mesenteric root, we isolated the SMA origin, cutting part of the celiac ganglion surrounding the artery. The second step was to dissect the coloeiploic ligament, opening the lesser sac with isolation of middle colic vein, as necessary to create the distal part of the graft, represented by transverse colon with the middle colic vein. For this purpose, a linear GIA 75 stapler can be used to cut the transverse colon on the left anatomic side of the middle colic vein, to preserve it with the graft. The third step was to isolate the proximal part of the graft, the esophagus: cutting the left triangular ligament of the liver and the diaphragmatic crura. We achieved this target by dividing the distal part of the esophagus again with the aid of a linear GIA 75 stapler. We completely mobilized the graft from the distal esophagus to the transverse colon, cutting all the ligaments with electrocautery. The fourth step was to isolate the pancreas and the aortic origin of the celiac trunk. To accomplish this, we mobilized the spleen from the retroperitoneum and, working on a surgical plane above the left Gerota's fascia, we completely mobilized the tail and body of the pancreas as well as the pancreaticoduodenal block, achieving in this way the celiac trunk origin. The vessel must be freed from the celiac ganglion surrounding it. Then we completed the isolation of the proximal and the distal parts of the abdominal aorta for cross-clamping and flushed the gallbladder. After cross-clamping and cold perfusion, usually using Celsior solution, we created an enlarged aortic patch comprehensive of the origin of SMA and celiac trunk. In the case of multivisceral retrieval without the liver, earlier in the warm phase we prepared the hepatic hilum, isolating the main biliary duct, proper hepatic artery, and portal vein for sharing with the liver team. Usually the main biliary duct was cut just above the duodenum, hepatic proper artery close to the gastroduodenal artery (GDA) origin, and portal vein to share with the liver team. If multivisceral harvest with the liver was necessary, a total hepatectomy was performed, cutting the inferior vena cava above the diaphragm and above the origin of renal veins (Fig 1). The operation was concluded by harvesting the iliac vessels as vascular grafts. An aortic conduit can be created by harvesting the thoracic aorta. In this way, we minimized the cold part of the harvest and the ischemia time. The back table is a fast procedure, requiring only preparation of the origin of the vessels for anastomosis.

RESULTS

From February 2001 to November 2004, we performed nine multivisceral harvests. We evaluated a larger number of

Fig 1. Multivisceral graft.

donors for this purpose but, for the reasons described we aborted the procedure when any doubt was present concerning the donor. If accessory right or left branches to the liver (from SMA or left gastric artery) were present in cases of multivisceral harvests without the liver, we left the donor for the liver team. We harvested four multivisceral grafts without the liver and five multivisceral grafts with the liver including one combined liver-intestinal harvest. We performed seven multivisceral transplants on adult recipients, four without the liver and three with the liver, and used the two remaining donors for two liver and one isolated small bowel transplants. Average harvest time was 2.5 hours and average total ischemia time was 6.5 hours. Postreperfusion hemostasis was always satisfactory with this technique and no graft suffered because of a longer ischemia time or postreperfusion syndrome. Reperfusion was rapid and homogeneous, vascular pulses and peristalsis were always present from the beginning with an acceptable degree of bowel edema with vascular congestion. Postoperative massive lymphatic ascites was always well controlled with this technique.³⁻⁵ Four multivisceral recipients died, but only one on the table due to disseminated intravascular coagulopathy. One patient had a graftectomy the day after transplantation for vascular thrombosis.

DISCUSSION

The *in vivo* technique allows a shorter ischemia time compared to an en block retrieval followed by prolonged, tedious back table dissection. There is minimal postreperfusion bleeding and reduced production of lymphatic ascites, the other landmarks of this technique. Our preliminary results on a small sample of patients seem to show that the *in vivo* technique is feasible without jeopardizing organ function.

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