

# Evolution of Surgical Techniques in Clinical Intestinal Transplantation

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**T**HE key word in describing the techniques used in intestinal transplantation is flexibility. Flexibility is needed because there are many variables in each patient necessitating a custom-made operation. The nature and extent of the underlying pathology will determine which organs have to be removed and implanted. The complexity of the procedure is amplified by previous surgeries which the recipients almost invariably have had. We present alterations in the surgical techniques as they evolved with increasing clinical experience.<sup>1</sup>

## PORTAL VENOUS RETURN WHEN THE LIVER IS NOT TRANSPLANTED

Portal venous return is desirable to restore the normal anatomy and perhaps avoid the Eck fistula effect on the liver. Such drainage has almost always been possible in our experience using modifications of the conventional end-to-end superior mesenteric vein anastomosis.

An expedient solution is the piggy back intestinal transplantation onto the extrahepatic portal vein<sup>2</sup>: The duodenum is Kocherised and the extrahepatic portal vein is exposed as in portocaval shunts. If an ectopic right hepatic artery originating from the superior mesenteric artery is found, the exposure takes place between the right hepatic artery and the common bile duct. An end (donor superior mesenteric vein) to side (native portal vein) anastomosis is performed.

The extrahepatic portal vein is a dependable site for anastomosis. It is of adequate size at any age. It is also generally spared from previous surgery, because the hilum is not commonly dissected during laparotomies for short gut syndrome.

The three-dimensional disposition of the vascular pedicle requires attention. The donor superior mesenteric artery, which is frequently too long, usually needs to be trimmed. This is not necessary if the native splenic vein or the confluence of the splenic and superior mesenteric veins is used for outflow of the graft. The approach to these vessels is most simple from the inferior edge of the pancreas, as in distal splenorenal shunts. Usage of the confluence will necessitate resection of residual native jejunum because its venous drainage is sacrificed.

## PRELAPAROTOMY ARTERIAL EMBOLIZATION OF THE VISCERAL ARTERIES

This technique has been used (n = 3) when resection is expected to be bloody and prompt control of the arterial inflow is impossible. This is usually due to multiple previous surgeries and portal hypertension. The combination of inferior vena cava and portal vein thrombosis necessitating multivisceral transplantation as well as intestinal retrans-

plantation are such examples. Two of our patients with the former condition died of hemorrhage during attempted evisceration and multivisceral transplantation, one of them despite prelaparotomy embolization.

The patient is anesthetized after the graft is examined and found to be satisfactory by the donor team. All access and monitoring lines are inserted. The operation starts after transferring the patient to the vascular radiology suite. An aortogram is performed through the femoral artery and the visceral arteries are cannulated and embolized with metal coils or balloons. An arterial cannula is left in the femoral artery to prevent bleeding from the puncture site. The patient is moved back to the operating room and the laparotomy performed.

During the laparotomy the margins of the dearterialized specimen are demarcated. This is particularly useful during retransplantation, because it helps distinguish between donor and recipient intestine. The dissection can proceed in a fairly bloodless field.

The importance of timing of the various stages cannot be overemphasized. Attention is also required during the dissection to avoid dislodgment of the material used for embolization, particularly balloons embolized near the aortic orifice.

## ADDITION OF THE COLON

The colon, omitted in the first cases of our series, is now included (n = 31) to avoid the diarrhea that was frequently seen. The ileocecal valve as well as missing parts of the colon are transplanted. Arterial blood supply is based on the colic branches of the superior mesenteric artery and the marginal artery. Venous return is through the superior mesenteric vein.

The colon was pulled through the rectum on two occasions in our series. In the first case, a child with diffuse intestinal polyposis involving the entire gastrointestinal tract underwent abdominal evisceration. Native liver function was almost normal. The liver was preserved with its arterial blood supply intact. The rectum was removed submucosally. The gastrointestinal tract including the pan-

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creatoduodenal complex was implanted. Arterialization was through the infrarenal abdominal aorta. The venous outflow was into the native portal vein. The ascending, transverse, and descending colon were included in the graft. The descending colon was pulled through using the Soave-Ravitch technique. A loop ileostomy was used for proximal fecal diversion. Recovery was complicated by a retroperitoneal abscess, which was treated with drainage and antibiotics. An anastomotic rectal stricture was treated with transrectal dilatations.

The second child had intestinal pseudoobstruction distal to the duodenum due to absence of the myenteric plexus. Her course was complicated by liver failure and portal hypertension. The native liver, small intestine distal to the duodenum, and large intestine were removed. The sigmoid colon and rectum were left intact at this stage. The native inferior vena cava was preserved. A portovaval shunt decompressing the native stomach and pancreaticoduodenal complex was performed. The liver, small intestine, ascending, transverse, and descending colon were implanted using standard techniques. After the coagulopathy was corrected, the native sigmoid colon and rectum were removed. Resection of the rectum was submucosal. The Soave-Ravitch technique was again used to pull the colon through. Proximal decompression was with a Bishop-

Koop ileostomy. Recovery was complicated by respiratory and renal failure as well as abdominal dehiscence, which healed by secondary intention. There was no complication of the pull-through procedure per se. The patient recovered from her complications completely.

Both patients have seven to eight semiformal stools per day 7 and 4 months posttransplantation, respectively. They have not had toilet training. They are both enterally fed and require no intravenous therapy.

#### CONCLUSION

The techniques of intestinal transplantation are at the stage of continuous evolution as clinical experience is accumulating. Portal venous drainage is possible in almost every case. Preoperative arterial embolization may render resection safer in complex cases. Addition of the colon is possible, including its use for a pull-through procedure.

#### REFERENCES

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