# Urgent Multivisceral Transplantation for Widespread Splanchnic Ischemia

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**BACKGROUND:** Multivisceral transplantation (transplantation of the stomach, intestine, liver, and pancreas) is usually undertaken as a semi-elective procedure after thorough assessment in patients who have intestinal failure with cirrhosis, cirrhosis with portomesenteric venous thrombosis, or tumors such as desmoids involving the liver and mesentery.

**STUDY DESIGN:** Data were collected prospectively from the time of referral and held in a central database. We used it to report the first cases of urgent multivisceral transplantation (MVT) in patients with widespread splanchnic ischemia (occlusion of the celiac axis and superior mesenteric artery) resulting in small bowel infarction and hepatic failure.

**RESULTS:** Three women (ages 33, 48, and 50 years) were referred to our center with superior mesenteric artery and celiac axis occlusion. All other modes of treatment had been considered and/or attempted. After transfer to our institution, all patients were assessed, urgently listed, and underwent transplantation in 10, 7, and 5 days. Two patients are still alive after 2 years and 1 died at 8 months from multiorgan failure due to infections and graft vs host disease.

**CONCLUSIONS:** Treatment options for patients presenting with widespread splanchnic ischemia with hepatic and intestinal failure/infarction were previously limited to salvage surgery and attempted revascularization. In situations in which these failed, the only previous option would have been palliation. In selected cases, we propose that urgent multivisceral transplantation should be considered as a life-saving treatment. This represents a previously unreported indication for MVT. (J Am Coll Surg 2016;222:760–765. © 2016 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

Multivisceral transplantation (MVT) involves transplantation of a block of organs containing stomach, intestine, liver, and pancreas. The described indications include intestinal failure with cirrhosis, cirrhosis with extensive portomesenteric venous thrombosis, tumor involving the liver and mesenteric root (for example, desmoid), and a "frozen abdomen."[1] The transplantation procedure is usually undertaken on a semi-elective basis, after an extensive assessment to confirm suitability, and a variable period of time (sometimes several months) waiting for suitable deceased donor organs to become available. A small number of "urgent" multivisceral transplantations have been undertaken as rescue procedures in patients with complications of an earlier semi-elective transplant, for example, intractable graft rejection or graft thrombosis.[2]

If the diagnosis of acute mesenteric ischemia due to superior mesenteric artery (SMA) occlusion is made in a timely manner, open or endovascular revascularization should be performed. Patients with evidence of peritonitis are best managed by laparotomy, with resection of nonviable intestine followed by attempts at revascularization.[3] If extensive intestinal resection is required, patients are managed on home parenteral nutrition (PN). Subsequently, if complications of PN develop, for example, loss of venous access, recurrent line infections, or development of intestinal failure-associated liver disease, they may then be referred for consideration of intestinal or

**Disclosure Information: Nothing to disclose.**

Received January 6, 2016; Accepted February 11, 2016.

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http://dx.doi.org/10.1016/j.jamcollsurg.2016.02.010
ISSN 1072-7515/16

**Abbreviations and Acronyms**
CA = celiac axis
CMV = cytomegalovirus
MVT = multivisceral transplantation
PN = parenteral nutrition
SMA = superior mesenteric artery

multivisceral transplantation.[4] Acute symptomatic occlusion of the celiac axis (CA) is rare.[5] Case reports have suggested that endovascular treatment (for example, stenting) of the CA can be successful.[6] There is sparse literature on patients with concurrent SMA and CA occlusion (widespread splanchnic ischemia). In this situation, if revascularization fails or is not possible, then historically, there is no option other than palliation. We have performed life-saving urgent multivisceral transplantations for such patients with widespread splanchnic ischemia, which we describe here.

## METHODS

### Presentation

The first patient, a 33-year-old female nonsmoker, presented to her local hospital with acute abdominal pain. Contrast-enhanced CT performed on admission revealed acute occlusion of the celiac axis, superior mesenteric artery, and inferior mesenteric artery. At index laparotomy, extensive small bowel resection was performed, with attempted revascularization of the ileocolic and middle colic arteries with saphenous vein grafting, after which she was transferred to our center.

Repeat imaging showed further ischemia of the remaining small bowel and right colon and areas of hepatic infarction, which was confirmed at repeat laparotomy. Completion enterectomy and extended right hemicolectomy were undertaken, and a venting gastrostomy was inserted. The only functional arterial supply to the liver appeared to be from a collateral arising from the left internal mammary artery. Her liver biochemistry rapidly worsened, with an alanine aminotransferase of 203 units/mL, bilirubin of 93 μmol/L, and a prothrombin time of 23 seconds. She was listed for urgent MVT.

The second patient, a 48-year-old woman, presented to her local hospital with small bowel infarction secondary to SMA occlusion. She underwent enterectomy, and was established on PN and therapeutic anticoagulation. After a short period (10 months), she presented with acute liver failure with encephalopathy, coagulopathy, and sepsis. Contrast-enhanced CT showed occlusion of the CA, with features of liver ischemia. Small collaterals arising from the left gastric artery provided minimal hepatic arterial inflow. After transfer to the ICU in our center, she was also listed urgently for MVT.

Patient 3, a 50-year-old woman, presented to her local hospital with SMA occlusion. An attempt at stenting was made but this failed, necessitating extensive enterectomy. She was established on PN, but after a shorter period (4 months) she presented acutely with multiple ischemic liver abscesses. Contrast-enhanced CT at this time showed subsequent occlusion of the CA. Attempted revascularization of the CA with a supra-celiac aorto-hepatic graft was unsuccessful. She developed progressive liver failure, was transferred to our ICU, and was urgently listed for MVT.

### Assessment and listing

Data on all patients referred to our institution for consideration of MVT are collected prospectively from the time of referral. All patients undergo intensive assessment before transplantation, including a work-up to identify prothrombotic conditions. After this, they are discussed with members of the UK National Adult Small Intestinal Transplant (NASIT) forum, agreement at which is a prerequisite to listing for an intestine-containing graft in the UK. The patients presented here underwent a condensed version of the standard assessment and discussion process, which was completed in a few days, in view of the urgency of the situations. Agreement for listing was also sought from members of the UK liver and pancreas transplant advisory groups because they had a nonstandard indication for allocation of a deceased donor for transplantation.

### Surgical procedure

Donor and recipient operations are conducted simultaneously and performed by 2 separate surgical teams from our institution. During the donor operation, full mobilization of the block of organs takes place before cross-clamping. This requires mobilization of the right and left colon, with full Kocherization of the duodenum and full mobilization of the stomach, spleen, pancreas, and liver, including the retro-hepatic inferior vena cava (IVC). Dissection of the infra-renal and supra-celiac aorta and identification and isolation of the SMA and CA are also undertaken. After cross-clamping of the supra-celiac aorta, the block of organs is perfused with University of Wisconsin preservation solution (UW). The distal esophagus is stapled and divided, as is the colon distal to the middle colic artery. The organs (stomach, liver, pancreas, small bowel, colon, and spleen) are then retrieved as a single block with an aortic patch containing the SMA and CA and the retro-hepatic IVC. The cross-clamp and explant of the organs are carefully coordinated with the implanting team to minimize cold ischemic time.