Multivisceral Transplantation

Where Do We Stand?

Kalyan Ram Bhamidimarri, MD, MPH[a], Thiago Beduschi, MD[b], Rodrigo Vianna, MD[b,*]

KEYWORDS

• Liver transplantation • Intestinal transplantation • Multivisceral transplantation • Intestinal failure

KEY POINTS

- Intestinal transplantation is the definitive therapy for patients with irreversible intestinal failure (IF) and can be combined with transplantation of other abdominal organs: multivisceral transplantation—stomach, intestine, pancreaticoduodenal complex, and liver (MVTx) or modified MVTx—without liver (MMVTx).
- There has been an increasing trend in the volume of intestinal transplantation and MVTx in the past few decades and there is also increasing trend in patient and graft survival primarily due to improved patient selection, advances in immunosuppression, and improved perioperative management.
- This review summarizes the various key elements in patient selection, types of grafts, and updates in the perioperative management involved in MVTx.

INTRODUCTION

The first human small bowel transplant was performed in humans in 1964 at the Boston Floating Hospital for Children.[1] Subsequently, the first MVTx was performed as part of a "cluster graft" by Thomas Starzl at the University of Pittsburgh in 1984.[2] The introduction of cyclosporine in the 1980s allowed a few centers around the world to perform allogeneic intestinal transplantation with improved success, but it was not until the discovery and clinical application of the then novel drug, FK506 (tacrolimus), in the early 1990s that intestinal transplantation moved from an experimental intervention to a clinical reality.[3,4] Although initially hampered by poor results, intestinal transplantation has evolved and currently stands as the only chance of cure for patients

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[a] Miami Transplant Institute, University of Miami, 1500 Northwest 12th Avenue, Suite 1101, Miami, FL 33136, USA; [b] Miami Transplant Institute, University of Miami, Highland Professional Building, 1801 Northwest 9th Avenue, Suite 310, Miami, FL 33136, USA
* Corresponding author.
E-mail address: rvianna@med.miami.edu

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with IF who develop serious complications from parenteral nutrition (PN). Since the inception of intestinal transplantation, there have been various modifications of the graft, based on the number of organs transplanted simultaneously, which include isolated intestinal transplantation (ITx), liver-intestinal transplantation (LITx), MVTx, and MMVTx. According to the Intestinal Transplant Registry, approximately 3000 intestinal transplants and MVTxs have been performed around the world from 1985 to 2013 (**Table 1**). Because of the complexity of the intrinsic immune system of the intestine, resulting in cycles of rejection, sepsis, and graft-versus-host disease (GVHD), successful transplantation of the intestine is only now being accomplished with acceptable survival rates. In the past 10 years, graft and patient survival for ITx and MVTx have significantly improved because of advancements in the field, improved patient selection, refinement in the surgical technique, immunosuppression protocols, and improved perioperative management.[5]

INTESTINAL FAILURE

IF is characterized by the inability of the gastrointestinal tract to maintain adequate nutrition, fluid and electrolyte balance, for normal growth and development of the body.[6] Acute or chronic loss of the enteric absorptive mass beyond the critical limit can occur due to anatomic loss (congenital anomalies, surgery, or short gut syndrome) or physiologic loss (intestinal dysmotility, malabsorption, enterocyte dysfunction, or vasculopathy), which can all result in IF. Short gut syndrome may occur with a loss of 50% of the enteric mass but is certain with a loss of 70% of the enteric mass or if the remaining length of small intestine is less than 100 cm. Other variables, such as mucosal health of the intestinal remnant, presence of ileocecal valve, and remnant colon, also play an important role in the long-term prognosis of such patients. IF can be subclassified into 3 types based on the duration, severity, and prognosis:

Type 1 IF: Self-limiting, which usually follows abdominal surgery. Patients typically need short-term PN and are expected to make full recovery.

Type 2 IF: Occurs in severely ill patients who develop infectious and metabolic complications and require prolonged PN support and multidisciplinary management to ensure recovery.

Type 3 IF: Requires long-term PN combined with surgical interventions or transplantation.

The most common causes of IF in children are necrotizing enterocolitis, gastroschisis, intestinal atresia, volvulus, pseudo-obstruction, and aganglionosis. In adults, ischemia, inflammatory diseases, trauma, and tumors are the most common causes of IF. In several patients with gastrointestinal disease, a combination of massive resection and dysmotility of remnant bowel can be present.[7]

INDICATIONS

Intestinal transplantation is indicated in patients who experience life-threatening complications from the chronic use of PN. The indications for bowel transplantation

Table 1
Global clinical activity—Intestinal Transplant Registry

Number of Transplants	Total Number
Isolated intestinal	1309
Liver/intestine	898
Multivisceral	680