Regence

Medical Policy Manual Transplant, Policy No. 09

Small Bowel, Small Bowel/Liver, and Multivisceral Transplant

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IMPORTANT REMINDER

Medical Policies are developed to provide guidance for members and providers regarding coverage in accordance with contract terms. Benefit determinations are based in all cases on the applicable contract language. To the extent there may be any conflict between the Medical Policy and contract language, the contract language takes precedence.

PLEASE NOTE: Contracts exclude from coverage, among other things, services or procedures that are considered investigational or cosmetic. Providers may bill members for services or procedures that are considered investigational or cosmetic. Providers are encouraged to inform members before rendering such services that the members are likely to be financially responsible for the cost of these services.

DESCRIPTION

Small bowel transplants are performed to treat intestinal failure in patients that require total parenteral nutrition (TPN) and are having serious TPN complications.

Small bowel/liver transplantation is performed in people that have both intestinal and liver failure, and may be combined with the transplantation of other portions of the digestive tract and accessory organs, including the, duodenum, jejunum, ileum, pancreas, or colon. When the small bowel and liver are transplanted in conjunction with other gastrointestinal organs, the procedure is referred to as a multivisceral transplant.

MEDICAL POLICY CRITERIA

I. A small bowel transplant using cadaveric intestine may be considered **medically necessary** for adults and children when ALL of the following are met (A. – E.):

   A. Adequate cardiopulmonary status; and

   B. Documentation of patient compliance with medical management; and

   C. Intestinal failure characterized by the loss of absorption and the inability to maintain protein-energy, fluid, electrolyte, or micronutrient balance; and

   D. Long-term dependence on total parenteral nutrition (TPN); and

E. One or more of the following severe complications due to TPN:

1. TPN intolerance to the point that multiple and prolonged hospitalizations are required to treat TPN-related complications; or
2. The development of progressive but reversible liver failure; or
3. Inability to maintain venous access.

II. A small bowel transplant using a living donor may be considered **medically necessary** when a cadaveric intestine is not available for transplantation and Criterion I. is met.

III. A small bowel/liver transplant or multivisceral transplant may be considered **medically necessary** for adults and children when all of the following are met (A. – B.)

A. Criterion I. is met; and

B. There is evidence of impending end-stage liver failure.

IV. A small bowel retransplant may be considered **medically necessary** after a failed small bowel transplant.

V. A small bowel/liver or multivisceral retransplant may be considered **medically necessary** after a failed primary small bowel/liver or multivisceral transplant.

VI. A small bowel transplant is considered **not medically necessary** for patients with intestinal failure who are able to tolerate TPN.

VII. A small bowel transplant is considered **not medically necessary** if Criterion I, II, or IV is not met.

VIII. A small bowel/liver, or multivisceral transplant is considered **not medically necessary** if Criterion III or V is not met.

NOTE: A summary of the supporting rationale for the policy criteria is at the end of the policy.

LIST OF INFORMATION NEEDED FOR REVIEW

It is critical that the list of information below is submitted for review to determine if the policy criteria are met. If any of these items are not submitted, it could impact our review and decision outcome.

- History and Physical/Chart Notes
- Diagnosis and Indication for transplant

CROSS REFERENCES

1. Liver Transplant, Transplant, Policy No. 5
2. Pancreas Transplant, Transplant, Policy No. 6

BACKGROUND

Intestinal failure is a serious medical condition which results from surgical resection, congenital defect, or disease-associated loss of absorption and is characterized by the inability to

maintain protein-energy, fluid, electrolyte, or micronutrient balance.[1] Short bowel syndrome, one type of intestinal failure, is a condition in which the absorbing surface of the small intestine is inadequate due to extensive disease or surgical removal of a large portion of small intestine. Etiologies of short bowel syndrome include: volvulus, atresias, necrotizing enterocolitis, gastroschisis, desmoid tumors, and trauma. Patients with short bowel syndrome are unable to obtain adequate nutrition from enteral feeding and become dependent upon total parenteral nutrition (TPN). Patients with complications from TPN, such as catheter-related mechanical problems, infections, hepatobiliary disease, and metabolic bone disease, may be considered candidates for small bowel transplant.

Small bowel/liver transplantation is transplantation of an intestinal allograft in combination with a liver allograft, either alone or in combination with one or more of the following organs: stomach, duodenum, jejunum, ileum, pancreas, or colon. Small bowel transplants are typically performed in patients with intestinal failure (IF) due to functional disorders (e.g., impaired motility) or short bowel syndrome (SBS), defined as an inadequate absorbing surface of the small intestine due to extensive disease or surgical removal of a large portion of small intestine. In some instances, short bowel syndrome is associated with liver failure, often due to the long-term complications of total parenteral nutrition (TPN). These patients may be candidates for a small bowel/liver transplant or a multivisceral transplant, which includes the small bowel and liver with one or more of the following organs: stomach, duodenum, jejunum, ileum, pancreas, and/or colon. A multivisceral transplant is indicated when anatomic or other medical problems preclude a small bowel/liver transplant, and the patient requires removal of all of the native gastrointestinal tract and replacement with a multivisceral graft.

Intestinal transplants, including multivisceral and small intestine/liver, represent a small minority of all solid organ transplants. In 2023 and 2024, 95 and 97 intestinal transplants, respectively, were performed in the United States, all of which were from deceased donors. In 2024, 39 multivisceral transplants involving the small intestine/liver/pancreas were performed. Small intestine/liver transplant is rare, with zero performed in 2023 and one in 2024.[2]

EVIDENCE SUMMARY

Ideally, for intestinal transplant to be considered as a replacement for total parenteral nutrition (TPN), head-to-head comparisons of transplantation versus TPN are needed, preferably in well-designed randomized controlled trials (RCTs). Further, for chronic conditions such as intestinal failure, comparative trials with long-term follow-up are necessary in order to determine the durability of any beneficial treatment effects, and to establish guidelines regarding the timing of intestinal transplant. In order to establish the net benefit of using living donors versus cadaveric intestinal transplant for treatment of intestinal failure, clinical trials that compare these therapies are needed, and the impacts on health outcomes for both the donors and recipients must be considered.

The current literature on small bowel transplantation included the following general observations:

- The importance of timely referral for intestinal transplantation was emphasized to avoid the necessity of combined liver and intestine transplantation.
- While outcomes continue to improve, obstacles to long-term survival remain. Recurrent and chronic rejections and complications of immunosuppression are significant issues in bowel transplantation.

- It has been suggested that improvements in survival over the last 10–15 years may justify removing the restriction of intestinal transplantation to patients who have severe complications of TPN.[3] However, as noted by Vianna in their report on the status of intestinal transplantation, no randomized trials compare intestinal transplantation to long-term parenteral nutrition, and optimal timing for earlier transplantation has not been established.[4]

- People with high morbidity from TPN appear to have better outcomes with transplant, but it is unknown whether ongoing home-based TPN or intestinal transplant is superior. Randomized controlled trials comparing the two forms of IF management have not been performed, primarily owing to small numbers of people with IF.[5]

REGISTRY DATA

The most recent published report from the international Intestinal Transplant Registry (ITR) reported on 4103 total intestinal transplants between January 1985 and December 2018. Of these, 2096 transplants were performed in children. Transplant subtypes are: small bowel only (1842), small bowel and liver (1251), multivisceral (small bowel, liver, stomach: 810), and modified multivisceral (small bowel and stomach: 200).[6] Improvements in the management of IF, both with and without intestinal transplant have led to a sharp reduction in the annual number of intestinal transplants being performed. Intestinal transplant volume decreased from a peak of 270 in 2008 to fewer than 50 in 2018.[5, 6] Participation in this registry was considered to be nearly 100% of all intestinal transplants performed in the world since April 1985. The following trends were identified[7]:

- Regional practices and outcomes are now similar worldwide.
- Current actuarial patient survival rates at one-, five-, and 10-years post-transplant are 76%, 56%, and 43%, respectively.
- Outcomes of intestinal transplantation improved modestly over the past decade, but rates of graft loss beyond one year have not improved.
- The reasons for late graft loss have been difficult to identify due to the low case volumes at most centers.
- Better function was found in intestinal grafts that included a colon segment and/or a liver component.

Better graft survival was also seen in patients who waited at home for intestinal transplant, used induction immune-suppression therapy, and had rapamycin maintenance therapy.

SYSTEMATIC REVIEWS

This policy was initially based on 1995 and 1999 BlueCross BlueShield Association Technology Evaluation Center (TEC) assessments.[8, 9] The 1995 assessment concluded that in children, small bowel transplant was associated with improved survival compared to TPN. This assessment also concluded that in adults, the outcomes for small bowel transplant were worse than those associated with TPN.

The 1999 TEC assessment reevaluated the data on adults, specifically focusing on the probability of adult patient and graft survival with small bowel transplant compared to TPN, and whether successful outcome of small bowel transplant improves health outcomes or reduces adverse outcomes.[9] The assessment reported that bowel transplants in adults produce patient survival rates from 27%-58% at 4 or 5 years. Graft survival rates (and presumably

independence from TPN) range from 13%-30%. It is unknown whether this represents a net benefit to these patients, since some patients may survive for long periods of time on TPN. The TEC assessment also indicated that some patients with increasingly severe TPN-associated complications may face a high probability of impending mortality such that the risk of continued medical management is higher than the risk of transplantation. However, at this point in time, it is not possible to predict which patients will survive longer on TPN versus small bowel transplant.

In 2010, Sudan published a systematic review of current literature on long-term outcomes after intestinal transplantation.[10] The author noted that intestinal transplantation has become standard therapy for patients with life-threatening complications from parenteral nutrition therapy. Data from current single-center series indicate a 1-year patient survival rate of 78-85% and a 5+ year survival rate of 56-61%. With respect to pediatric intestinal transplant patients, the majority achieve normal growth velocity at two years post-transplant. However, oral aversion is a common problem; tube feedings are necessary in 45% of children. Sudan also noted that parental surveys of quality of life in pediatric transplant patients have shown that intestinal transplant patients appear to have modestly improved quality of life compared to patients remaining on TPN and slightly worse than matched school-age controls without intestinal disease.

RANDOMIZED CONTROLLED TRIALS

No RCTs were identified that compared intestinal transplantation with ongoing parenteral nutrition with or without subsequent small bowel/liver or multivisceral transplantation.

NONRANDOMIZED STUDIES

Despite the lack of RCTs, isolated small bowel transplantation has become an accepted alternative to continued total parenteral nutrition (TPN) to avoid the need for multivisceral transplantation in carefully selected patients with intestinal failure who are developing severe complications related to total parenteral nutrition (TPN).

The following is a summary of non-randomized trials that are representative of the available data on small bowel, small bowel/liver, and multivisceral transplantation, and post-transplantation complications.

Living Donor

The literature related to living-related intestinal transplant consists of small case reports of 1 to 11 patients in which different lengths of the ileum or jejunum were used.[11-18] While there appeared to be minimal complications to the donors, of the cases reported a significant number of recipients remained on TPN for at least part of their nutrition while others remain healthy and off TPN.

Ueno reported on 21 intestinal transplant patients that underwent transplantation between 1996 and 2012 at one of five institutions.[19] Twelve transplants came from living donors. All but one patient received an isolated small bowel transplant for intestinal failure. The overall 1- and 5- year survival rates were 86% and 68%, respectively. In the 15 patients who underwent transplantation after 2006, 1-year survival was 92% and 5-year survival was 83%.

Gangemi and Benedetti published a literature review of living donor small bowel transplantation reports from 2003 to 2006; all of the reports listed Benedetti as author.[20] The

authors commented that, “Due to the excellent result in modern series of deceased donor bowel transplantation, widespread use of the procedure [living donor] should not be recommended, in consideration of the potential risks to donor. Furthermore, few centers have acquired the necessary experience with the procedure.” Benedetti also reported outcomes from four children and seven adults who underwent 12 living-related small bowel transplantations between 1998 and 2004.[21] All donors were reported to have had uneventful recovery following removal of up to 40% of the small intestine. The three-year patient survival was 82%, with graft survival of 75%. Longer follow-up from the earlier cases was not reported.

Complications

Post-transplant lymphoproliferative disorders (PTLD) are a potentially life-threatening complication of the immunosuppression required for solid organ transplant. PTLD is associated with exposure to Epstein-Barr virus (EBV). Chang (2022) performed a retrospective single-institution study of pediatric solid organ transplant recipients to determine risk factors associated with post-transplant EBV DNAemia and PTLD.[22] The study included 275 patients, of whom 20 had multivisceral transplant and 10 had intestinal transplant. Other transplant types were liver, lung, kidney, and heart. Intestinal and multivisceral transplants patients were over-represented in PTLD cases. Intestinal transplants comprised 2% of the total study population but 21% of PTLD cases. Multivisceral transplant recipients represented 3% of the study population but 14% of PTLD cases. While high post-transplant EBV DNAemia levels were a strong risk factor for PTLD ($p<0.0001$), the study found that PTLD incidence in intestinal and multivisceral transplant recipients was not explained by EBV DNAemia levels. Transplant type did not correlate with EBV DNAemia ($p=0.14$).

Santarsieri (2022) published data describing PTLD incidence and outcomes from 5365 solid-organ and hematopoietic stem cell transplants over a 20-year period in the United Kingdom.[23] Multivisceral transplants were defined as intestinal transplant, with or without simultaneous transplant of other abdominal organs. The study included both adult and pediatric cases with the median age at transplant of 52 years (range 0.8 to 79.5 years). In addition to multivisceral transplant, other transplant types were kidney, pancreas, liver, hematopoietic stem cell, heart, lung (single, bilateral, and heart-lung), and simultaneous kidney and pancreas (SPK). A total of 225 cases of PTLD were documented. It was noted that multivisceral transplant follow-up time was the shortest because the procedure was initiated after other transplant types. Despite shorter follow-up, the incidence of PTLD was highest in multivisceral transplant cases. Out of a total of 113 multivisceral transplant cases, 21 (18.6%) were diagnosed with PTLD, which was notably higher than the overall PTLD incidence of 5.9% in all transplant types.

Clouse (2019) reported on the incidence of graft-versus-host disease (GVHD) following intestine transplant at a single center.[24] Of the 236 transplants performed between 2003 and 2015, 37 patients (16%) developed GVHD. Mortality was 54% within one year of diagnosis for these patients. An increased risk of GVDH was seen with liver inclusion and increasing graft volume.

Spence (2020) published on the development of intra-abdominal infections within two years following intestinal and multivisceral transplants in adults at a single center.[25] There were 103 patients that were included, who underwent transplantations between 2003 and 2015, and 46 of these (43%) had intra-abdominal infections with the two-year follow-up. The median time to infection was 23 days post-transplant. Six patients also had concurrent blood stream

infections. While patients with intra-abdominal infections had longer hospital stays than those without (median 35 days vs. 23 days, p=0.0012), there was no difference in all-cause mortality.

A report of thrombotic and hemorrhagic complications associated with visceral transplantation was published by Raveh (2018).[26] Data from 48 adult transplantations (32 multivisceral, 10 isolated intestinal, and six modified multivisceral) between 2010 and 2017 were reviewed retrospectively. There were eight patients who experience intraoperative intracardiac thrombosis (ICT)/pulmonary embolism (PE), all of whom were undergoing multivisceral transplants. Postoperative bleeding complications at one month were found in 11% of multivisceral transplants, 20% of isolated intestinal transplants, and 17% of modified multivisceral transplants.

Danziger-Isakov (2018) evaluated the epidemiology and outcomes of inpatient respiratory virus infection in pediatric patients following solid organ transplant at nine U.S. transplant centers.[27] Among the 42 patients who underwent intestine/multivisceral transplantation, respiratory virus infection occurred in 38%, the highest rate by transplant type. Respiratory virus infection was associated with younger age at transplant.

Vo (2018) reported on the risk of invasive pneumococcal infections among pediatric patients receiving liver-small bowel-pancreas transplants at a single center.[28] Of the 122 patients who underwent this procedure between 2008 and 2016, nine patients experienced 12 invasive pneumococcal infections. The median time to first infection following transplant was three years (range 0.8 to 5.8 years), and the mortality rate was 22%. The authors noted that all patients were on prophylactic oral penicillin and the majority had received at least one dose of pneumococcal conjugate vaccine.

Nagai (2016) reported on cytomegalovirus (CMV) infection after intestinal or multivisceral transplantation at a single center in the US.[29] A total of 210 patients had in intestinal transplant, multivisceral transplant or modified multivisceral transplant between January 2003 and June 2014. The median length of follow-up was 2.1 years. A total of 34 patients (16%) developed CMV infection a median of 347 days after transplantation. Nineteen patients had tissue invasive CMV disease. CMV infection was significantly associated with rejection (odds ratio 2.6, p<0.01) and adversely affected patient survival (hazard ratio 2.7, p<0.001). A report from another center in the US, 16 of 85 (19%) patients undergoing intestinal or multivisceral transplantation developed CMV infection a mean of 139 days (range 14 to 243 days) postoperatively.[30]

Wu (2016) investigated the incidence and risk factors of acute antibody-mediated rejection (ABMR) among patients undergoing intestinal transplantation (n=175).[31] Acute ABMR was diagnosed by: clinical evidence; histologic evidence of tissue damage; focal or diffuse linear C4d deposition; and circulating anti-human leukocyte antigen antibodies. Of the 175 intestinal transplants, 58% were liver-free grafts, 36% included a liver graft, and 6.3% were retransplantations. Eighteen cases of acute ABMR were identified: 14 (14%) among the patients undergoing first liver-free transplantation, two (3%) among patients undergoing liver/small bowel transplantations, and two (18%) among the patients undergoing retransplantation. Graft failure occurred in 67% of patients with acute ABMR. The presence of a donor-specific antibody and a liver-free graft were associated with the development of acute ABMR.

In 2016, Limketkai published a retrospective study on mortality and graft rejection rates in 1115 cases of intestinal transplants performed from May 1990 through June 2014.[32] Of these, 142

transplants were done for Crohn's disease (CD). Transplants were rejected in 33.3% of patients without CD and 36.9% of patients with CD. The actuarial risk of death for patients with CD at one, five, and ten years post-transplant 22.5%, 50.3%, and 59.7%, respectively. Patients without CD had similar mortality risks.

In a case series by Cromvik (2016), five of 26 patients (19%) were diagnosed with GVHD after intestinal or multivisceral transplantation at a center in Sweden.[33] Risk factors for GVHD were malignancy as a cause of transplantation and neoadjuvant chemotherapy or brachytherapy before transplantation.

A 2015 retrospective review reported a number of parameters for intestinal and multivisceral transplants performed on Nordic patients between 1998 and 2013.[34] Twenty out of the 29 patients (69%) received liver-containing allografts. Nineteen of them were multivisceral grafts, including the stomach, the pancreaticoduodenal complex, the liver and the small intestine. The remaining liver-containing allograft was a combined liver and intestinal graft with a segmental pancreas. Three of eight patients with a spleen included in their multivisceral graft developed GVHD. One patient with GVHD and manifestations with skin rash later developed post-transplant lymphoproliferative disorder (PTLD).

In 2014, Calvo Pulido reported on 21 adults who underwent intestinal transplantation; 17 were isolated small bowel transplants.[35] Thirteen patients (62%) experienced renal failure; the etiology included high ileostomy output, immunosuppression and medical treatment.

In 2013, Boyer reported that 7 of 12 children who had an isolated small bowel transplant had renal function complications at some point after surgery.[36] Prior to treatment, all of the patients had normal renal functioning.

Florescu have published several articles retrospectively reviewing complications in a cohort of 98 pediatric patients. Twenty-one of these children (21.4%) had an isolated small bowel transplant; the remainder had combined transplants. These articles include a 2012 study that reported that 68 of the 98 patients (69%) developed at least one episode of bloodstream infection.[37] Among the patients with an isolated small bowel transplant, the median time to infection for those who became infected was 4.5 months (95% confidence interval [CI]: 2.4 to 6.7 months). Also in 2012, the researchers reported that 7 of 98 patients (7%) developed cytomegalovirus (CMV) disease; only one of these had an isolated small bowel transplant.[38] A 2010 study by this group retrospectively reported on the incidence of fungal infection after pediatric small bowel transplantation among patients treated between 2003 and 2007 at a single center.[39] The average length of follow-up was not reported. A total of 25 of 98 cases reviewed (26%) developed at least one episode of fungal infection; Candida infection was most common. During the study period, the mortality rate did not differ significantly between patients who did and did not develop a fungal infection (32.3% vs. 29.8%, respectively), but the authors stressed the importance of better screening tools to identify and prevent fungal infections.

As noted previously, Sudan reported oral aversion to be a common problem in pediatric patients with tube feedings necessary in 45% of children following small bowel transplantation.[10]

A 2012 retrospective review focused on the rate of kidney dysfunction, a recognized complication after non-renal solid organ transplantation, in 33 multivisceral and 15 isolated small bowel transplant patients.[40] A significant decline in kidney function was reported in 46% of patients at one year following transplantation. A significant correlation was found for patient

age, pretransplant serum creatinine, estimated GFR (eGFR) at post-transplant day 30, 90, 180, and 270, and tacrolimus level at post-transplant day seven. Lesser decline was found in pediatric patients and patients with multivisceral transplantation compared with adults or isolated small bowel transplantation.

A 2012 retrospective review reported on bloodstream infections among 98 children younger than age 18 years with small bowel/combined organ transplants.[37] Seventy-seven (79%) patients underwent small bowel transplant in combination with a liver, kidney, or kidney-pancreas, and 21 had an isolated small bowel transplant. After a median follow-up of 52 months, 58 (59%) patients remained alive. The one-year survival rate was similar in patients with combined small bowel transplant (75%) and those with isolated small bowel transplant (81%). In the first year after transplantation, 68 patients (69.4%) experienced at least one episode of bloodstream infection. The one-year survival rate for patients with bloodstream infections was 72% compared to 87% in patients without bloodstream infections (p=0.056 for difference in survival in patients with and without bloodstream infections).

Wu (2011) reported on complications after small bowel and multivisceral transplantation in 241 patients who underwent intestinal transplantation.[41] Of these, 147 (61%) had multivisceral transplants, 65 (27%) had small bowel transplants and 12% had small bowel/liver transplants. There were 151 children (63%) and 90 adults. A total of 22 patients (9%) developed graft-versus-host disease (GVHD). Children younger than five years old were more likely to develop GVHD; the incidence in this age group was 16 of 121 (13.2%) compared to 2 of 30 (6.7%) in children between 5 and 18 years and 9 of 90 (4.4%) in adults over 18 years. Among diseases, patients with intestinal atresia were more likely to develop GVHD than those with other conditions (22.2% vs. 2.6%, respectively, p=0.03).

Transplant Recipients with Tumors

Duchateau (2022) published a systematic review of reported experiences of combined liver-intestinal and multivisceral transplantation (MvTx) for neuroendocrine tumors (NET) extending beyond the liver.[42] Fourteen single-center and three multi-center retrospective studies reported on one combined liver-intestinal and 38 MvTx for NET and nine previously unreported MvTx were added to the analysis by the authors. Overall patient survival up to 51.2% was found with recurrence of 35%, which is similar to recurrence after liver transplantation for NET. In addition, the authors reported that patients with NET with diffuse abdominal presentation, normally considered a contraindication, may benefit from radical resection and MvTx. Additional studies to optimize post-transplant management are needed.

Cruz (2011) published results from a small case series (n=10) of patients with intra-abdominal desmoid tumors secondary to familial adenomatous polyposis who underwent multivisceral transplant.[43] All patients were able to discontinue home parenteral nutrition by an average 30 days after transplant. Estimated survival was 80% at five years, and desmoid tumors reoccurred in one patient 15 months after transplantation. However, conclusions from this study are limited by the small sample size and the lack of a comparison group, factors which do not allow for the isolation of transplant as a causative factor in patient health outcomes.

Retransplantation

Evidence for the use of retransplantation to treat individuals who have failed intestinal transplantations includes several case series, mostly from single institutions. One case series analyzed records from the United Network for Organ Sharing database.[44] Among the case

series described in Table 1, reasons for retransplantation include: acute rejection, chronic rejection, CMV, liver failure, lymphoproliferative disorder, and graft dysfunction. Survival rates for retransplantation are listed in Table 2.

Table 1. Summary of Key Case Series Characteristics for Retransplantation

Author (Year)	Location	N	Median Age (Range), y	Interventions		Follow-Up, (Range), mo
				Treatment	n	
Ekser (2018)[45]	United States	18	27 (0.9-57)	oIsolated IT oModified MVT oMultivisceral graft	1 1 16	NR
Kubal (2018)[46]	United States	23	27 (1-58)	oIsolated IT oMultivisceral graft	1 22	NR
Lacaille (2017)[47]	France	10	13 (5-16)	oIsolated IT oCombined liver IT	3 7	4
Desai (2012)[44]	United States	• 72 (adults) • 77 (children)	NR	*Adults:* oIsolated IT oCombined liver IT *Children:* oIsolated IT oCombined liver IT	 41 31 28 49	NR
Abu-Elmagd (2009)[48]	United States	47	NR	oIsolated IT oCombined liver IT oMultivisceral graft	31 7 9	NR
Mazariegos (2008)[49]	United States	14	9.4 (3.2-22.7)	oIsolated IT oCombined liver IT oMultivisceral graft	1 3 10	55.9

IT: intestinal transplantation; NR: not reported.

Table 2. Summary of Key Case Series Results for Retransplantation

Author (Year)	Interventions		Survival	Off TPN
	Treatment	n		
Ekser (2018)	oIsolated IT oMultivisceral graft oModified multivisceral graft	1 1 16	Graft survival: • 71% at 1 y, 56% at 3 y, 44% at 5 y Patient survival: • 71% at 1 y, 47% at 3 y, 37% at 5 y	NR
Kubal (2018)[46]	oIsolated IT oMultivisceral graft	1 22	All transplantations combined: o34% at 1 y	NR
Lacaille (2017)[47]	oIsolated IT oCombined liver IT	3 7	All transplantations combined: o30% at last follow-up	NR
Desai (2012)[44]	*Adults:* oIsolated IT oCombined liver IT *Children:* oIsolated IT oCombined liver IT	 41 31 28 49	*Adults:* o80% at 1 y; 47% at 3 y; 29% at 5 y o63% at 1 y; 56% at 3 y; 47% at 5 y *Children:* o81% at 1 y; 74% at 3 y; 57% at 5 y o42% at 1 y; 42% at 3 y; 42% at 5 y	NR
Abu-Elmagdl (2009)[48]	oIsolated IT oCombined liver IT oMultivisceral graft	31 7 9	All transplantations combined: o69% at 1 y o47% at 5 y	NR

Author (Year)	Interventions		Survival	Off TPN
	Treatment	n		
Mazariegos (2008)[49]	oIsolated IT oCombined liver IT oMultivisceral graft	1 3 10	All transplantations combined: o71% at last follow-up	100%

IT: intestinal transplantation; NR: not reported; TPN: total parenteral nutrition.

Survival Outcomes

The published literature consists of case series, mainly reported by single centers in the United States and Europe. Tables 3 and 4 summarize the characteristics and results of the case series, respectively. Many case series have included isolated small bowel transplantations.

Reasons for transplantations were mainly short bowel syndrome. Other reasons included congenital enteropathies and motility disorders. Most common outcomes reported were survival rates and weaning off TPN. Several studies have presented survival rates by type of transplantation, while others have combined all types of transplants when reporting survival rates. When rates were reported by type of transplant, isolated transplantations had higher survival rates than multivisceral transplants (see Table 4).

Several investigators have reported higher survival rates in transplants conducted more recently than those conducted earlier.[44, 48, 50] Reasons for improved survival rates in more recent years have been attributed to the development of more effective immunosuppressive drugs and the learning curve for the complex procedure.

Authors of these series, as well as related reviews, have observed that while outcomes have improved over time, recurrent and chronic rejection and complications of immunosuppression continue to be obstacles to long-term survival. A separate discussion of complications follows the evidence tables.

Table 3. Summary of Key Case Series Characteristics for Transplantations

Author (Year)	Location	N	Median Age (Range), y	Interventions		Follow-Up (Range)
				Treatment	n	
Raghu (2019)[51]	International	2,080	2.5 (1.1-6.3)	• Isolated IT • Combined liver IT • Multivisceral graft	725 966 389	5 y
Elsabbagh (2019)[52]	United States	174	19 (0.42–66)	• Isolated IT • Combined liver IT • Multivisceral graft • Modified multivisceral	98 44 28 4	8.1 (3-13.2) y
Lacaille (2017)[47]	France	110	5.3 (0.4-19)	• Isolated IT • Combined liver IT • Multivisceral graft	45 60 5	Of 55 alive: • 17 at <5 y • 17 at 5-10 y • 21 at ≥10 y
Garcia Aroz (2017)[53]	United States	10	1.5 (0.7-13)	• Isolated IT • Combined liver IT	7 3	6/7 alive at follow-up ≥10 y
Dore (2016)[54]	United States	30	0.2 (0.1-18)	• Isolated IT • Combined liver IT • Multivisceral graft	6 6 18	28 (4-175) mo

Author (Year)	Location	N	Median Age (Range), y	Interventions		Follow-Up (Range)
				Treatment	n	
Rutter (2016)[55]	United Kingdom	60	1.8 (0-8)	• Isolated IT • Multivisceral graft • Modified multivisceral	16 35 9	21.3 (0-95) mo
Lauro (2014)[56]	Italy	46	34 (NR)	• Isolated IT • Combined liver IT • Multivisceral graft	34 6 6	51.3 mo
Varkey (2013)[57]	Sweden	20	Adults: • 44 (20-67) Children: • 6 (0.5-13)	• Isolated IT • Combined liver IT • Multivisceral graft	4 1 15	NR
Mangus (2013)[50]	United States	100	Adults: • 48 (NR to 66) Children: • 1 (0.6 to NR)	• Multivisceral graft • Modified multivisceral	84 16	25 mo

IT: intestinal transplantation; NR: not reported.
[a] Living donors.

Table 4. Summary of Key Case Series Results for Transplantations

Author (Year)	Interventions		Survival	Off TPN
	Treatment	n		
Raghu (2019)[51]	• Isolated IT • Combined liver IT • Multivisceral graft	725 966 389	All transplantations combined: • Patient survival: 72.7% at 1 y, 57.2 at 5 y • Graft survival: 66.1% at 1 y, 47.8% at 5y	NR
Elsabbagh (2019)[52]	• Isolated IT • Combined liver IT • Multivisceral graft • Modified multivisceral	98 44 28 4	All transplantations combined: • 69.5% at 3 y • 66% at 5 y • 63% at 10 y	NR
Lacaille (2017)[47]	• Isolated IT • Combined liver IT • Multivisceral graft	60 45 5	• 59% at 10 y; 54% at 18 y • 48% at 10 y • NR	All treatments combined: • 73% at last follow-up
Garcia Aroz (2017)[53]a	• Isolated IT • Combined liver IT	7 3	All transplantations combined: • 70%	All treatments combined: • 100% at last follow-up
Dore (2016)[54]	• Isolated IT • Combined liver IT • Multivisceral graft	6 6 18	• 83% at 9 y • 33% at 10 y • 67% at 2.5 y	All treatments combined: • 71% in 31 d • 62% at last follow-up
Rutter (2016)[55]	• Isolated IT • Multivisceral graft • Modified multivisceral	16 35 9	• 92% at 1 y; 37% at 5 y • 71% at 1 y; 33% at 5 y • 85% at 1 y; 65% at 5 y	NR

Author (Year)	Interventions		Survival	Off TPN
	Treatment	n		
Lauro (2014)[56]	• Isolated IT • Combined liver IT • Multivisceral graft	34 6 6	All transplantations combined: • 77% at 1 y • 58% at 3 y • 53% at 5 y • 37% at 10 y	NR
Varkey (2013)[57]	• Isolated IT • Combined liver IT • Multivisceral graft	4 1 15	All transplantations combined: • 78% at 1 y • 50% at 5 y	NR
Mangus (2013)[50]	• Multivisceral graft • Modified multivisceral	84 16	All transplantations combined: • 72% at 1 y • 57% at 5 y	NR

IT: intestinal transplantation; NR: not reported; TPN: total parenteral nutrition.
[a] Living donors.

HIV POSITIVE TRANSPLANT RECIPIENTS

This subgroup of recipients has long been controversial due to the long term prognosis for HIV positivity and the impact of immunosuppression on HIV disease. Although HIV positive transplant recipients may be a research interest of some transplant centers, the minimal data regarding long term outcomes in these patients consist primarily of case reports and abstract presentations of liver and kidney recipients. Nevertheless, some transplant surgeons would argue that HIV positivity is no longer an absolute contraindication to transplant due to the advent of highly active antiretroviral therapy (HAART), which has markedly changed the natural history of the disease.

The Organ Procurement and Transplantation Network (OPTN) considers HIV+ organ candidates to be acceptable recipients "if permitted by the transplant hospital. Care of HIV test positive organ candidate and recipients should not deviate from general medical practice."[58]

PRACTICE GUIDELINE SUMMARY

AMERICAN GASTROENTEROLOGICAL ASSOCIATION (AGA)

In 2022, The American Gastroenterological Association published a clinical practice update on the management of short bowel syndrome (SBS) that includes best practice advice on referral for intestinal transplantation.[59] The update is focused on adult patients. In general, early referral for transplant is recommended to avoid the need for simultaneous liver transplant, which leads to increased mortality risk while on the waiting list. Referral for intestinal transplant is recommended for:

- People with SBS-IF and onset of TPN failure. Patients with SBS-IF who have high morbidity or low acceptance of TPN should be considered for referral to transplant individually.

Transplant referral is also suggested for certain patients who do not meet criteria for TPN failure:

- Post-operative referral for patients with large abdominal desmoid tumors.
- Patients with severe dysmotility syndromes who have no prospect of weaning from TPN.

XIV INTERNATIONAL SMALL BOWEL TRANSPLANT SYMPOSIUM WORKING GROUP CRITERIA FOR PLACEMENT ON A WAITLIST FOR INTESTINAL TRANSPLANTATION

In 2020, Kaufman published an update of the 2001 American Society of Transplantation Indications.[5] The new guidance was developed by a multidisciplinary team of providers and is based on practice advances since 2001 that have led to improved management of SBS both with and without small bowel transplant.

Criteria for placement on a waitlist for intestinal transplantation:

- Evidence of advanced or progressive intestinal failure-associated liver disease
    - Hyperbilirubinemia >75 µmol/L[b] (4.5 mg/dL) despite intravenous lipid modification strategies that persists for >2 months.
    - Any combination of elevated serum bilirubin, reduced synthetic function (subnormal albumin or elevated international normalized ratio), and laboratory indications of portal hypertension and hypersplenism, especially low platelet count, persisting for >1 month in the absence of a confounding infectious event(s).
- Thrombosis of:
    - 3 out of 4 discrete upper body central veins (left subclavian and internal jugular, right subclavian and internal jugular) or
    - Occlusion of a brachiocephalic vein in children (in adults, this criterion should be evaluated in a case-by-case basis).
- Live-threatening morbidity in the setting of indefinite parenteral nutrition dependence of either anatomical or functional cause, as suggested by:
    - In children, 2 admissions to an intensive care unit (after initial recovery from the event resulting in intestinal failure) because of cardiorespiratory failure (mechanical ventilation or inotrope infusion) due to sepsis or other complication of intestinal failure
    - In adults, on a case-by-case basis.
- Invasive intra-abdominal desmoids in adolescents and adults
- Acute diffuse intestinal infarction with hepatic failure
- Failure of first intestinal transplant

SUMMARY

There is enough research to show that small bowel transplant from a living donor does not improve health outcomes in certain patient populations except when a cadaveric intestine is not available. Therefore, small bowel transplant from a living donor is considered not medically necessary in all other situations except when a cadaveric intestine is not available and is indicated.

There is enough research to show that small bowel transplants can improve health outcomes in certain patients with intestinal failure with serious complications from total parenteral nutrition (TPN). Therefore, isolated small bowel transplant may be considered medically necessary in patients that meet the policy criteria.

There is enough research to show that small bowel transplant does not improve health outcomes in patients with intestinal failure who are able to tolerate TPN. Therefore, small bowel transplant may be considered not medically necessary for these patients.

There is enough research to show that small bowel retransplant improves health outcomes in patients that have had a failed small bowel transplant. Therefore, for patients with failed small bowel transplant, retransplant may be considered medically necessary.

There is enough research to show that small bowel transplant from a living donor does not improve health outcomes in certain patient populations except when a cadaveric intestine is not available. Therefore, small bowel transplant from a living donor is considered not medically necessary in all other situations except when a cadaveric intestine is not available and is indicated.

There is enough research to show that small bowel/liver and multivisceral transplant and retransplant can improve survival in certain patients. Therefore, these procedures may be considered medically necessary for patients with intestinal failure who have been managed with long-term total parenteral nutrition and who have developed evidence of impending end-stage liver failure. Transplants or retransplants are considered not medically necessary when the policy criteria are not met.

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CODES

Codes	Number	Description
CPT	43999	Unlisted procedure, stomach
	44132	Donor enterectomy (including cold preservation), open; from cadaver donor
	44133	Donor enterectomy (including cold preservation), open partial, from living donor
	44135	Intestinal allotransplantation; from cadaver donor
	44136	Intestinal allotransplantation; from living donor
	44715	Backbench standard preparation of cadaver or living donor intestine allograft prior to transplantation, including mobilization and fashioning of the superior mesenteric artery and vein
	44720	Backbench reconstruction of cadaver or living donor intestine allograft prior to transplantation; venous anastomosis, each
	44721	Backbench reconstruction of cadaver or living donor intestine allograft prior to transplantation; arterial anastomosis, each
	44799	Unlisted procedure, small intestine
	47133	Donor hepatectomy, (including cold preservation) from cadaver donor
	47135	Liver allotransplantation; orthotopic, partial or whole, from cadaver or living donor, any age
	47140	Donor hepatectomy (including cold preservation), from living donor; left lateral segment only (segments II and III)
	47141	;total left lobectomy (segments II, III and IV)
	47142	;total right lobectomy (segments V, VI, VII and VIII)
	47143	Backbench standard preparation of cadaver donor whole liver graft prior to allotransplantation, including cholecystectomy, if necessary, and dissection and removal of surrounding soft tissues to prepare the vena cava, portal vein, hepatic artery, and common bile duct for implantation; without trisegment or lobe split
	47144	;with trisegment split of whole liver graft into 2 partial liver grafts (ie, left lateral segment [segments II and III] and right trisegment [segments I and IV through VIII])
	47145	;with lobe split of whole liver graft into 2 partial liver grafts (ie, left lobe [segments II, III, and IV] and right lobe [segments I and V through VIII])
	47146	Backbench reconstruction of cadaver or living donor liver graft prior to allotransplantation; venous anastomosis, each
	47147	Backbench reconstruction of cadaver or living donor liver graft prior to allotransplantation; arterial anastomosis, each

Codes	Number	Description
	47399	Unlisted procedure, liver
	48550	Donor pancreatectomy (including cold preservation), with or without duodenal segment for transplantation
	48551	Backbench standard preparation of cadaver donor pancreas allograft prior to transplantation, including dissection of allograft from surrounding soft tissues, splenectomy, duodenotomy, ligation of bile duct, ligation of mesenteric vessels, and Y-graft arterial anastomoses from iliac artery to superior mesenteric artery and to splenic artery
	48552	Backbench reconstruction of cadaver donor pancreas allograft prior to transplantation, venous anastomosis, each
	48554	Transplantation of pancreatic allograft
	48999	Unlisted procedure, pancreas
HCPCS	S2053	Transplantation of small intestine, and liver allografts
	S2054	Transplantation of multivisceral organs
	S2055	Harvesting of donor multivisceral organs, with preparation and maintenance of allografts; from cadaver donor
	S2152	Solid organs(s), complete or segmental, single organ or combination of organs; deceased or living donor(s), procurement, transplantation, and related complications; including: drugs; supplies; hospitalization with outpatient follow-up; medical/surgical, diagnostic, emergency, and rehabilitative services, and the number of days of pre and posttransplant care in the global definition

Date of Origin: *January 1996*