



Published in final edited form as:

*Transplant Proc.* 1993 February ; 25(1 Pt 2): 1200–1201.

## Nutritional Management of Intestinal Transplant Recipients

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The Advent of successful intestinal transplantation has provided significant survival in a small group of patients.<sup>1</sup> Details of the procedure and postoperative immunosuppressive management are reported elsewhere in this issue.<sup>2,3</sup> The purpose of this study is to provide a more detailed functional account of the transplanted small intestine.

### MATERIALS AND METHODS

We reviewed our experience with 23 patients submitted to small bowel transplantation between May 1990 and June 1992 at the University of Pittsburgh. Weights at operation and at latest follow-up, as well as the length of time required for complete adaptation to enteral feedings were obtained from the chart. Change in height was measured if the patient was less than 18 years old.

Total serum protein, and albumin levels were obtained. Functional studies included the absorption of D-xylose, FK 506, and fecal fat excretion. Motility of the small bowel was assessed at 7 days postoperatively by barium studies, and thereafter when clinically indicated. Abnormalities in absorption, increased stomal output, or dysmotility (rapid or slow transit) prompted aggressive immunologic work-up.

Nutritional management during the period of adaptation relied on balanced total parenteral nutrition (TPN) using dextrose, crystalline amino acids, and fat emulsions sufficient to provide 420 kJ/kg/d administered by central vein. Enteral feeding was begun once there was evidence of satisfactory gastrointestinal motility, as evidenced by output through the terminal ileostomy. Standard enteral formulas were used (Vivonex, Peptamen, Compleat-B) and advanced as tolerated. Continuous feedings were provided by either nasogastric or nasoduodenal tube, gastrostomy tube (with extension tube past the pylorus), or jejunostomy tube (into the transplanted bowel).

Daily stomal outputs were measured for volume, pH, presence of reducing substances, and quantitative bacterial cultures. Steady weight gain on enteral feeds alone was a major criteria for discharge.

### RESULTS

#### Absorption

Satisfactory absorption curves of D-xylose were documented in all patients at some point in the postoperative course. Peak values ranged between 20 and 50 ng/dL. Values tended to improve with time as the transplanted bowel recovered normal motility and enteral feeding was

advanced. Abnormalities in results have accompanied episodes of rejection (both acute and chronic) and may reflect abnormal absorptive function as well as rapid transit and hypersecretion which may accompany rejection.

The excretion of fat in the stool has been abnormal in most patients and tended to be higher early posttransplant. However, absorption improved with time and was normal in two patients. The association of this test and graft function has been notable in one small bowel recipient with chronic rejection who had significant steatorrhea. Other problems which have precipitated abnormal values have been chronic pancreatitis (two adults) and bacterial overgrowth (one child).

Oral FK 506 administration was begun between 7 to 14 days posttransplant. Adequate absorption of FK 506 as reflected by maintenance of satisfactory blood levels off intravenous therapy has occurred between 17 to 46 days (mean 27.9 days) in the small bowel/liver recipients, 19 to 44 days (mean 28.2 days) in the small bowel recipients, and 35 to 43 days (mean 39 days) in the multivisceral graft recipients.

### Laboratory Parameters

Total protein as well as albumin levels have improved and been maintained in all patients except the two recipients of multivisceral organs. The degree of improvement has been similar in the recipients of small bowel and small bowel/liver grafts, and has been more significant in the children.

### Anthropometrics

Weight has increased steadily in all pediatric patients with percentile increments of 2% to 10% as compared to pretransplant. More importantly, growth (a predictable attribute of healthy children) has also occurred at a satisfactory rate. Normal growth was seen in all children (weight  $\geq$  55th percentile, and height  $\geq$  30th percentile). Consistent weight gain was observed in eight adult patients. Two adults lost weight after transplantation, however, they maintained normal weight for their height (significant pretransplant overweight). One recipient of a multivisceral graft has consistently lost weight after transplant and requires TPN. Two patients are presently exclusively on TPN due to severe rejection.

### Radiologic Evaluation

Barium studies showed transit times between 30 minutes and 5 hours, with mean time of 2 hours. Only one adult showed delayed motility (ileus), with a transit time of 22 hours, however, this decreased to 4 hours over a period of 6 weeks. The anatomic contours were normal; however, in patients who subsequently developed episodes of severe rejection with exfoliation of mucosa, there was ablation of valvula coneventis and dysmotility.

There were significant abnormalities of the proximal gastrointestinal tract characterized by delayed gastric emptying in two adults and one child, which resolved spontaneously. One child had a severely hypotonic and dilated duodenum.

### Stomal Monitoring

Stomal outputs tended to be high during the initial postoperative period. Any change in volume (either more or less) prompted an aggressive search for rejection. Bacterial overgrowth in the presence of high stomal output has been treated with oral antibiotics, however, its relationship is still under study.

The use of paregoric, loperamide, immodium, pectin, somatostatin, or oral antibiotics were utilized as appropriate when increased stomal outputs were present. Sodium bicarbonate was added to the formula or given intravenously if metabolic acidosis was present.

## DISCUSSION

Rapid intestinal transit has been common early after intestinal transplantation and is a characteristic of early adaptation. Other factors that may worsen or maintain this status are related to enteral alimentation, fat malabsorption, bacterial overgrowth, and episodes of rejections. This has required the use of medications to reduce transit times.

Initial aversion to food has been the rule in most patients, with adults promptly recovering their desire to eat. Children, however, require significant teaching. Successful intestinal transplantation provides for adequate absorption of nutrients permitting growth and weight gain. This has permitted independence from TPN in 16 of 19 surviving patients.

## Acknowledgments

Supported by research grants from the Veterans Administration and Project Grant No DK 29961 from the National Institutes of Health, Bethesda, Maryland.

## REFERENCES

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