

Giving Hope to Preemies and Crohn's Patients

Babies who arrive from eight to twelve weeks early and adults who suffer from Crohn's disease are both at risk for developing short bowel syndrome, a condition that may tie them to an IV for feeding and greatly reduce the quality of their lives--medically, economically, and socially.

Research in Kelly Tappenden's University of Illinois lab offers hope to babies who arrive eight to twelve weeks early and adults who have had parts of their small intestine surgically removed, making it difficult for them to absorb nutrients. Tappenden has found that adding butyrate, a short-chain fatty acid, to an intravenous nutrition solution not only causes intestine to grow back but makes it more functional as well.

"Babies born at 28 to 32 weeks sometimes develop necrotizing enterocolitis, a kind of gangrene of the intestine," said Tappenden. "In 2003, 11.6 percent of births in the United States were preterm infants, and removing necrotized intestine is the most common surgical emergency in preemies.

"Surgery saves their lives, but with so much intestine removed, they're unable to digest or absorb nutrients. They can't eat by mouth like the rest of us do, and we have to use a process called total parenteral nutrition to feed them intravenously," she said.

Around 10,000 patients in the United States are totally reliant on intravenous feeding because their intestines have been surgically shortened, Tappenden said.

"Being on an IV for all nutritional needs really affects a person's quality of life, and it puts him at risk for long-term complications, such as bone demineralization and liver failure. Many of these children eventually require organ transplants to survive. Our goal is to take kids who've had this resection and cause their gut to grow and adapt."

Tappenden said if a portion of intestine is removed, the remaining segment will grow and become more functional in an attempt to compensate for the part that's

gone. "But you have to be able to feed patients orally for that change to happen, and these patients can't take food orally because they get diarrhea, and other digestive issues come into play."

Tappenden became interested in modifying IV solution so that it would cause the intestine to grow the way that taking oral nutrition does. She began by adding short-chain fatty acids, acids that are reduced when dietary fiber is fermented in the colon.

"For a long time, we've known that consuming a lot of dietary fiber causes the gut to grow, so we wondered what would happen if we added fermentative products to our IV solution," she said.

She tested her hypothesis using newborn piglets, an excellent model for the human infant because it has similar metabolism and physiology.

"And not only was there more gut, the gut that was there was more functional," she said. "When we added butyrate, the villi in the intestine increased in size, and they were able to transport more nutrients."

Tappenden said feeding butyrate intravenously should cause the intestine to grow so that eventually patients won't have to rely on IVs. "But it will depend on the patient, how much intestine he has left, and where that intestine is," she said.

"We may not be able to take some patients off intravenous nutrition completely, but if patients can eat and just have one supplemental IV feeding daily, it would reduce the number of complications a great deal and increase their quality of life so much," she said.

Other researchers who contributed to the study were Anne L. Bartholome, David M. Albin, and David H. Baker, all of the University of Illinois, and Jens J. Holst of The Panum Institute, Copenhagen, Denmark. The study was funded by the National Institutes of Health.

