My daughter Ellie was born in April of 2006. She came a month early, but overall my pregnancy was normal and she was initially doing very well. Things began to change after her first hour. The next 24 hours were something I wouldn’t wish on anyone. It ended with both of us in a new hospital, her recovering from exploratory abdominal surgery, and the very nice surgeon explaining to us that Ellie was born missing 90% of her small bowel and 30% of her colon. After she fully explained what Ellie’s GI system looked like, she started talking about what Ellie’s life was going to be like and what the future could be like. It was a very scary and grim conversation.

Ellie as a baby before Omegaven

Starting TPN

Ellie’s GI tract was not able to absorb enough nutrients to sustain life, so she was placed on IV nutrition support, also called Total Parenteral Nutrition. Total Parenteral Nutrition (TPN) is made up of two main parts. The first part contains all the fluids, vitamins, minerals, amino acids, and medications. The second half of the mixture is the lipid,
consisting of a fatty acid that has been broken down enough to be absorbed through the blood stream, and blended into an emulsion that keeps the fats from separating from the fluids. TPN enables an individual to live and grow even though he or she cannot eat.

However, the down side of TPN is that for most individuals on it for an extended period of time, particularly children under two years of age, it will also cause a build-up of fat in the liver causing damage. For these individuals, there is a race to rehabilitate the GI tract and get off TPN before the liver becomes too damaged. If they cannot get off TPN fast enough, they often will be listed for a liver transplant and, if needed, other organs as well. For those ineligible for transplant, liver damage can lead to death.

**What is Omegaven?**

In 2001, Children’s Hospital Boston started doing research on TPN to find out what part of TPN was causing liver damage. Mark Puder, MD, a surgeon, and Kathleen Gura, PharmD, a pharmacist, collaborated on the research with other doctors at Children's Hospital Boston. Through studies done on mice, they discovered that it was the lipid portion of the TPN that was causing the damage. But the fats contained in lipids are essential for the body, so they needed to find an alternative.

Dr. Gura had previously used Omegaven, a lipid emulsion derived from fish oil that contains omega-3 fatty acids, to treat a patient with a soy allergy and severe fatty acid deficiency. From this experience she suggested they try Omegaven in their trials.

The results were very promising.

In an article written by Children’s Hospital Boston, Dr. Puder explained the results that showed that parenteral nutrition without the fat makes the liver fatty, and by adding the Intralipid, it becomes even more so.¹ “That fat becomes more or less a fuel that burns the liver, causing it to become inflamed....But the Omegaven is an anti-inflammatory lipid that prevents fat build-up in the liver. So if there's no fuel—fat—there's no fire—injury.”
The results were so promising that on September 26, 2004, the team at Boston Children’s Hospital started the first child on Omegaven. They saw improvements in one week, and a month later the child’s liver function tests were good enough that he was taken off of the transplant list. In most children, during the first month or so the direct bili (liver function test) goes up and then comes down. It is known as the Omegaven roller coaster. But, during this time you get to watch your child turn pink again.

Ellie’s bili chart

Some hospitals are using Omegaven in combination with regular vegetable oil-based lipids such as Intralipid. Dr. Gura commented on this, stating, “Based on published papers, it appears that children with PN liver injury do better with Omegaven alone (not mixed with Intralipid). The Diamond paper from Canada actually shows this, although they still like to do the combination until the child fails and then they switch them to plain Omegaven.”

To date Children’s has treated 166 children with Omegaven and administered over 100,000 doses. Omegaven has helped almost all 166 children, but the team has learned that the faster these children get on Omegaven, the better they do. Using it as a last resort or rescue is not always successful. The damage to the liver is already done.

How to Get Omegaven

Omegaven has not been approved by the FDA to be used broadly. Because of this, it has a Compassionate Use Only status, meaning that it can only be used if it will save the child’s life. To show that the child needs Omegaven, he must have failing liver function tests, including a direct bilirubin number greater than 2 mg/dL, indicating liver damage called cholestasis.

In the beginning, patients had to transfer to Boston to get Omegaven therapy. Now, thanks to the passionate outreach by Puder and Gura to the medical community, it has been used by almost every free-standing children’s hospital in the United States.
Physicians can also apply to be able to administer Omegaven themselves, and the Boston Omegaven team has gone so far as to publish their therapy instructions with the Oley Foundation, a support group for those who rely on TPN. See http://www.oley.org/documents/How_Physicians_Can_Obtain_Omegaven.pdf

Each year, more and more insurance companies are paying for Omegaven enabling patients to be treated locally and not requiring them to travel to Boston. The FDA now allows billing of insurance companies upon request. Approval, however, isn’t mandatory, and insurance companies are not required to pay for it. For a list of the hospitals that have used Omegaven and the insurance companies that have covered it, visit the Short Gut Wiki at http://grey.colorado.edu/shortgut/index.php/Omegaven#Omegaven.

Making Omegaven available to everyone and covered by insurance will continue to be an issue until it is approved by the FDA for use in all people receiving TPN. Currently, Fresenius Kabi AG, the manufacturer of Omegaven, is working with Children’s Hospital Boston to get the necessary data for a new drug application submission to the FDA. The process to get a drug approved in the US is lengthy. There was hope in the beginning that additional animal testing would not have to be done or could be avoided; however, these tests were ultimately required and are currently underway.

Children’s Hospital Boston has not seen any adverse effects of the use of Omegaven, but they are monitoring all their children with long-term blood work and other follow up examinations.

A recent picture of Ellie
Success!

The child that received the first dose as an infant in 2004 is still on TPN and Omegaven at age seven, goes to school and has shown no adverse effects from the TPN that likely would have destroyed his liver just a few years ago.

My daughter Ellie was the 23rd child to receive Omegaven, and has now been on it for almost five years. She is doing well, growing and thriving. Both my husband and are so thankful for Omegaven, and the doctors that brought it to our attention. I will not let myself imagine where she would be without it.

Thanks to Mark Puder, MD, and Kathleen Gura, PharmD, for their personal assistance in providing information for this article.

Abby lives in the Boston area with her husband and daughter Ellie. Ellie was born in 2006, missing 90% of her small bowel and 30% of her colon due to Jejunal Atrisia. Ellie is diagnosed as having Short Bowel Syndrome. Ellie has had multiple surgeries since birth and is on tube feeds and Home Parenteral Nutrition (HPEN). Abby and her family have faced the many challenges that come along with having a child with tubes, yet lead a remarkably active lifestyle. Abby is also a consumer advocate for ThriveRx. Please feel free to contact Abby at 1-774-270-3425 or via email at abrogan@ThriveRx.net.

1http://www.childrenshospital.org/dream/dream_fall06/fishing_for_the_right_solution.html  See also http://pediatrics.aappublications.org/cgi/content/full/118/1/e197