Surgery for Intestinal Failure

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What is short...?

It is not how long it is, but what you do with it, my dear....

Anonymous, about 500 BC
Strategies for Intestinal Rehabilitation

TPN “dependent”

Intestinal Rehabilitation

Medical Strategies

Surgical Strategies

Intestinal Transplant
Surgical Philosophy

• Retain
  – Conservative strategies to preserve marginal bowel
  – Planned ‘second look’ operations
  – Beware abdominal compartment syndrome

• Recruit
  – All unused bowel
  – No place for stomas (except “functional” disease)

• Refine
  – ‘lengthening’ procedures
  – Procedures to slow transit

From Dilbert, 11/3/2007!
Dilated segments
The Bianchi Procedure
- splits the bowel lengthwise
- 2 hemi-loops
- puts the 1/2 loops end to end
The Bianchi Procedure
Experience With Bianchi Procedure

• Bianchi’s reported experience:
  – 32 children over about 24 years
  – long term survival of 55%, majority of survivors off TPN
  – Survivors
    • > 40 cm small bowel
    • minimal or no liver disease

• Extended application of the Bianchi procedure
  • Patients with advanced liver disease
  • Patients awaiting transplantation
  • N = 30 procedures in 8 years

Iyer et al, 2003
STEP Enteroplasty

Figure 8.6 STEP Enteroplasty

Kim et al, 2003
Bianchi v STEP?

- N = 77 lengthening procedures in 64 patients (25 yrs)
- 62 pts on tpn (median 80% calories)
- 50 pediatric patients, 14 adults
- F/u Bianchi (5.9 y) > STEP (1.7 y)
- 5 patients repeat STEP after previous Bianchi

Sudan et al, Ann Surg, 2007:246; 593-604
Complications

<table>
<thead>
<tr>
<th>Intraoperative</th>
<th>Postoperative</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complication</td>
<td>N</td>
<td>Complication</td>
</tr>
<tr>
<td>Staple line leak</td>
<td>2</td>
<td>Bowel obstruction</td>
</tr>
<tr>
<td>Aspiration</td>
<td>1</td>
<td>Hypertension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hematoma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Abscess</td>
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<td></td>
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<td>Pleural effusion</td>
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</tbody>
</table>

Total n=38

*All mortality occurred from complications of liver failure after referral for transplant
Take home - Bianchi v STEP

- Median length 45 cm (11-150) to 68 (B) or 65(S)
- 58% patients weaned off tpn
- Trend toward longer time to wean after Bianchi
- Resolution of jaundice* after lengthening in 83%
  - Even if TPN not weaned*
- ? Bianchi as primary, STEP as salvage
- Intestinal transplant in 9 patients in this series

Sudan et al, Ann Surg, 2007:246; 593-604;
Intestinal Transplantation - when?
Survival with Home PN*

• North American HPEN Registry
  – SBS: 1 & 4 year survival 94% and 80%

• UCLA, Alabama, Omaha, Denver, Paris
  – similar

uncomplicated*
Indications for Intestinal Transplantation

Irreversible intestinal failure

and

Life threatening complications of PN
Intestinal Transplant Registry

Surgery

Intestine / Liver 44.5%
Multivisceral 13.6%
Intestine 41.8%

May 2001
Intestine Waiting List Annual Death Rates Per 1,000 Patient-Years at Risk, 1997 to 2006

- LI-IN
- IN and combos

Waiting List Survival (Kaplan-Meier) by Initial Waitlisting for Intestine Alone or Liver-Intestine

Survival

Survival curves for Intestine and Liver-Intestine against time since transplant in days.

SRTR
Evolution of Intestinal Transplant

1997-2003
- Isolated Intestinal Tx
- Multiorgan Tx

2003-2009
- Isolated Intestinal Tx
- Multiorgan Tx
Intestinal Failure

Is it permanent?

no → PN ± EN

yes → PN ± EN

Stable?

yes → Monitor growth

no → Sepsis/loss of access → Liver disease

Is it permanent?

no → EN

yes → adaptation

Bowel anatomy normal?

yes → AGIR

no → no

no → yes

Evaluate for transplant

Stop iv lipid
Empiric Rx SBBO
URSO
Biliary irrigation

Etiology
Residual length
Residual anatomy
Residual motility
H/O enteral tolerance

Liver disease

Etiology
The future is here!??

*Yogi Berra
Reversal of Parenteral Nutrition–Associated Liver Disease in Two Infants With Short Bowel Syndrome Using Parenteral Fish Oil: Implications for Future Management

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ABSTRACT
Here we report the reversal of cholestasis in 2 infants with intestinal failure and parenteral nutrition–associated liver disease. Treatment involved the substitution of a conventional intravenous fat emulsion with one containing primarily omega-3 fatty acids. Biochemical tests of liver function improved significantly. One child was removed from the liver transplantation list because of improved hepatic function, and the second child had complete resolution of cholestasis while solely on parenteral nutrition. This suggests that fat emulsions made from fish oils may be an effective means of treating and preventing this often-fatal condition. A randomized, controlled trial is necessary to study the efficacy of this new approach to parenteral nutrition–associated liver disease.
Preliminary Results: Treatment vs. Control
n=18

Puder and Gura
Retrospective study of 12 patients treated with Omegaven
9 of 12 had sustained resolution of hyperbilirubinemia and avoided liver replacement
3 of the 12 had combined liver-intestine transplantation
When is TPN associated liver disease irreversible?

- GB, born with very long segment HD
- High jejunostomy, distal stump closed
- Seen at 10 months

- T Bili = 24.8, platelets = 32, wt = 8.4 kg
- Feeds = 15 cc/hr, down to 5 cc/hr
- Massive hepatosplenomegaly
- ? Liver-small bowel transplantation
Liver salvage follows intestinal salvage

- Surgery
  - Modified Kimura
  - Pull-Through
  - Biliary irrigation
- Intensive medical Rx
- Intensive nutritional manipulation
Liver salvage follows intestinal salvage – *often without transplant!!*

- Now: FULL ORAL diet!
- Bilirubin = 0.6/0.4
- Albumin = 3.4
- Platelets = 96
- Off TPN for about 2 years
- Central line removed!
- Growing well!
Failure

To...

Rehabilitation!

*Without Omegaven or transplant!*
Summary

1. A multi-disciplinary approach in patients with intestinal failure, allows some patients who appear to have failed PN to avoid intestinal transplantation.

2. Early referral of patients may prevent the need for combined liver-intestinal transplant, in most cases.

3. Better understanding and new lipid emulsions for PN may be the basis for a paradigm-shift in management of PNAC.

4. Rapid access to intestinal transplantation is a prerequisite for this approach.