NON-TRANSPLANT SURGERY IMPROVES OUTCOME IN SHORT BOWEL PATIENTS

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agenda slides

The story so far

Intestinal Rehabilitation Programme

A.G.I.R.

Clinical scenarios

The Future
Manchester, UK 1981

-L.S. jejunal atresia
38 cm
LILT (Feb 1981)
Off PN (Sept 1981)

-21yrs BMI 20
Pregnant (B12, Folat, Iron, Zn)
Delivered 2.74 Kg Male (7th %ile)
Initial Results 1982 - 1997

- 45 % Survival
- All 40cm and greater
- IFALD
- Loss of venous access
Short Bowel Syndrome

Multisystem disorder caused by malabsorption of nutrients as a result of inadequate intestinal length

we realized........

Bowel  Elongation / Lengthening

are “procedures” alongside others

&

NOT a solution to short bowel state !!!
Therefore…

**AUTOLOGOUS GASTRO INTESTINAL RECONSTRUCTION**

In the context of an Intestinal Rehabilitation Programme
Structured Plan to Intestinal Rehabilitation 1997

**SURVIVAL**
- Liver-sparing TPN
  - Veins/CVC preservation
  - Early Oral Feeding (Brain-Bowel)
  - Social Integration

**NON TRANSPLANT SURGERY**
( A.G.I.R )

Transplant

WHY A. G. I. R. ?

- Improve absorption
- Prevent liver failure
- Treat bacterial overgrowth
- Autologous Bowel
Aims in A.G.I.R.

Optimize bowel & patients
E.A. / healthy patient

Increase absorptive surface area

Slower Transit Time

Improve peristalsis
Present results

- Survival: 92%
- Off TPN: 96%
- Median length: 25cm

- Median time off PN:
  - 6 months post reconstruction

- Median Weight centile:
  - Pre-surgery: 0.4th centile
  - Post surgery: 9th centile

*Intestinal Rehabilitation And Bowel Reconstructive Surgery: Improved Outcomes In Children With Short Bowel Syndrome*, Khalil BA, Ba'ath ME, Aziz A et al. JPGN. 2011
INDICATIONS for AGIR

- Severe Short Bowel State
- Neonatal / Paediatric mucosa sparing
- Bacterial overgrowth when on 100% PN
- Failure to progress to Enteral Autonomy
- Clinically Significant Intestinal Dilatation
further INDICATIONS

- Bowel dilatation (following AGIR)
- Bacterial overgrowth (following AGIR)
- Lack of progress to Enteral Autonomy (12-18m following first lengthening)
STAGED RECONSTRUCTION

Controlled Tissue Expansion (Bowel Dilatation)

Bowel Lengthening

Slowing transit time

Single/Multiple procedures
Controlled tissue expansion

Controlled tissue expansion (CTE)

CONTROLLED TISSUE EXPANSION (CTE)

INCREASE LENGTH

INCREASE CIRCUMFERENTIAL DIAMETER

not dilated short gut

dilated short gut

Controlled Tissue Expansion in the initial management of short bowel state.

Partial intestinal obstruction induces substantial mucosal proliferation in the pig.
Recycling of bowel content: the importance of the right timing: I. Pataki, J. Szabo, P. Varga, A. Berkes, A. Nagy, F. Murphy, A. Morabito, G. Rakoczy, T. Cserni JPS 2012
• tube-jejunostomy
• tube-colostomy
• jejunal effluent is drip-fed down the distal stoma to develop the available distal bowel
• progressive clamping of the tube-jejunostomy increases mucosal contact, create tissue expansion & absorption often sufficient to reduce PN

Recycling of bowel content: the importance of the right timing: I. Pataki, J. Szabo, P. Varga, A. Berkes, A. Nagy, F. Murphy, A. Morabito, G. Rakoczy, T. Cserni JPS 2012
Controlled obstruction results in dilatation, elongation of the intestine & **no stasis** with growth of all layers of the bowel.

**Mucosal hyperplasia**
Not hypertrophy

Partial intestinal obstruction induces substantial mucosal proliferation in the pig.
Bowel Lengthening

Longitudinal Intestinal Lengthening & Tailoring

- Doubles (100%) the length of isoperistaltic bowel while reducing its diameter

Better propulsion
No loss of mucosa
Avoids Stasis

Intestinal loop lengthening—a technique for increasing small intestinal length. Bianchi A:; JPS 15:1980
LILT  Isoperistaltic anastomosis between hemiloops
Serial Transverse Enteroplasty Procedure

STEP

- Blood supply comes from the mesenteric border & traverses the bowel remaining perpendicular to the long axis of the bowel. Increases length by 68%

Can be performed primarily or after Bianchi-LILT

(Serial transverse enteroplasty for sbs. Kim HB, JPS,38 No 6 2003)
Isolated bowel segment- Iowa model

Suturing of the SB to a host organ

Isolated bowel segment - Iowa model

once new blood supply has been achieved
Colonic interposition

Slow transit Time
Reverse segment

anti-peristaltic physiological delay
Usually between 3cm - 10cm
COMBINED techniques - The Manchester Model

Controlled Tissue Expansion
LILT - STEP - IOWA - ..... 
Single/Multiple Reversed Segment (s)
Colonic interposition (iso-anti)
Re-lengthening
CASE 1

- B.O. boy
- Elective C-section at 34/40 weeks
- Weigh: 2.542 kg
- Antenatal diagnosis of distended small bowel loop
- Finding confirmed by X-rays at birth
• 1st laparotomy: 3 atresic sections of small bowel resected

• Post resection: 40 cm of small bowel

(VCV & entire colon)
Over the following 3 months:

- TPN started

- Several unsuccessful attempts to introduce enteral feeds

- 3 episodes of life threatening line sepsis.
Options:

- **CONTINUE PRESENT MANAGEMENT**

  Liver failure?

  Line sepsis?

- **SURGERY**

  Revision of anastomosis?

  A. G. I. R. ?

- 11 weeks old
- Weight: 3.8 kg
- Feeding regimen: on 7 nights TPN
- 2nd laparotomy: serial transverse enteroplasty (STEP)

Pre STEP: 40 cm length
Post STEP: 60 cm length
Post operative care:

- TPN for 1 week
- Enteral feeding gradually introduced
- Weaned off TPN within 12 weeks
- At discharge taking 100% enteral feeds

Follow up: 30 months
○ Management of bowel dilation

○ Early intervention allows prevention of complications: Liver failure - Loss of venous access

○ Early intervention triggers bowel adaptation
CASE 2

K.G. girl:

Elective C-section at 39/40 weeks

Weight: 3.2 kg

Day 1: bilious vomit

black stools

midgut volvulus
CASE 2

- Day 2, 1st laparotomy:
  - 270 degrees volvulus
  - Cystic structure on mesenteric side
  - Caecum and appendix in normal position

- Small bowel resected: 9.5cm residual bowel
  - 7.5 cm of jejunum from DJ
  - 2 cm of ileum before ICV
  - Colon

- Stomas formation
CASE 2

- Day 9: consent to enter in the Intestinal Rehabilitation Programme
- Day 23: bowel dilatation started
  - stoma leakage
  - skin excoriation
- Day 38: 2nd laparotomy and fashion of tube stomas
**CASE 2**

- Day 45: Controlled tissue expansion started for 20 weeks
- 1 line sepsis

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**FEEDING**

**PROXIMAL CATHETER CLAMPED**

5 minutes up to 180

**CATHETER UNCLAMPED**

**PROXIMAL STOMA EFFLUENT RECYCLED INTO DISTAL**

over 30 to 45 min
CASE 2

- surgery at 6 months:

  - Findings: 4 cm not dilated jejunum
  - 6 cm dilated jejunum
  - 2 cm of ileum
  - 65.5 cm of colon
  - 12 cm small bowel
6 cm of dilated jejunum lengthened to 12 cm
10 cm of transverse colon interposed between LILT distal ileum ascending-descending colonic anastomosis
28 cm pre-ICV bowel

- 4 cm non dilated jejunum
- 12 cm LILT jejunum
- 10 cm of interposed colon
- 2 cm of ileum
- Colon 55.5 cm

Jejunum

LILT

Ascending colon

Transverse colon

Ileum

Descending colon
CASE 2

Post operative care:

- P.O day 3: oral feeding started (diary free, milk free, egg free, gluten free)
- P.O. day 30: 1 night off TPN
- P.O day 90: 4 nights off TPN, on milk free diet
- Follow up: 36 months (off PN)
LEARNING POINTS

- Management of severe short bowel
  - Intestinal rehabilitation programme
  - Controlled tissue expansion
  - Combined surgical techniques
- Individualized surgery (not based on what it is simple)
Managing short bowel patients

- lot of time
- attention to details
- personal experience & skill
- knowledge of what has been done before
- perseverance
- trust, motivation, strength of our patients & families
PABRRU TEAM

- Khalil BA
- Sprs- Fellows- Medical Students
- dietician
- play therapist
- Gastroenterologist
- Psychologist
- Radiology
- Social Services
- Nursing Staff
- Physiotherapist
unfiloperlavita.it

Un Filo per la Vita
Care Giver Evaluation and Satisfaction With Autologous Bowel Reconstruction In Children With Short Bowel Syndrome: A Pilot Study.

J Pediatr Gastroenterol Nutr. 2011
30 year of experience at RMCH

From 1982 to June 2013

82 A.G.I.R

Lengthening Procedure

- LILT: 59%
- STEP: 22%
- INTERPOSITION: 9%
- COMBINED: 6%
- SILT: 4%
30 year of experience at RMCH
30 year of experience at RMCH

<table>
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<tr>
<th>Period</th>
<th>% of Lengthening</th>
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<td>1980-1990</td>
<td>64%</td>
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<tr>
<td>1991-2001</td>
<td>69%</td>
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<td>2002-2013</td>
<td>98%</td>
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The Future: From bench to bedside !!!

Improve tissue expansion

Lengthening procedures

Tissue Engineered small intestine
Spiral Intestinal Lengthening & Tailoring (SILT)

Spiral incision
Spiral incision + incision on the mesentery
Retubularisation over a catheter
suture line in one layer
The tailored and lengthened segment
• The length increased from 15 cm to 30 cm
• The diameter reduced from 4 cm to 1 cm
Can Bowel Growth in ex vivo model?

<table>
<thead>
<tr>
<th></th>
<th>Diameter</th>
<th>Length</th>
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<tr>
<td>E12</td>
<td>149</td>
<td>148</td>
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<tr>
<td>E13</td>
<td>85%</td>
<td>102</td>
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Is it possible an intestinal primary anastomosis?
Peristalsis
The future is... 

.....autologous!...

from 

to PABRRRU

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