Tarmsvikt:
Prevention och Behandling

SK-Kurs i Kolorektalkirurgi, Stockholm 19 Okt 2022

Mattias Soop MD PhD

Sectionschef, IBD- och Tarmsviktkirurgi
Karolinska University Hospital, Stockholm

@matt_soop mattias.soop@ki.se

Intestinal Failure Units in Europe

Intestinal failure

Definitions

Prevention

Acute intestinal failure

Chronic intestinal failure

Intestinal failure

Definitions

Prevention

Acute intestinal failure

Chronic intestinal failure

Intestinal Failure
ESPEN 2015 Definition

IF: Reduction of gut *function* below the minimum necessary for the absorption of macronutrients, *water or electrolytes*, such that *IV supplementation* is required

Type I
<28 d

Type II
Unstable

Type III
HPN

Pironi L et al, Clin Nutr. 2015;34(2):171

Intestinal Failure Unit

Type I
<28 d

Type II
Unstable

(40%)

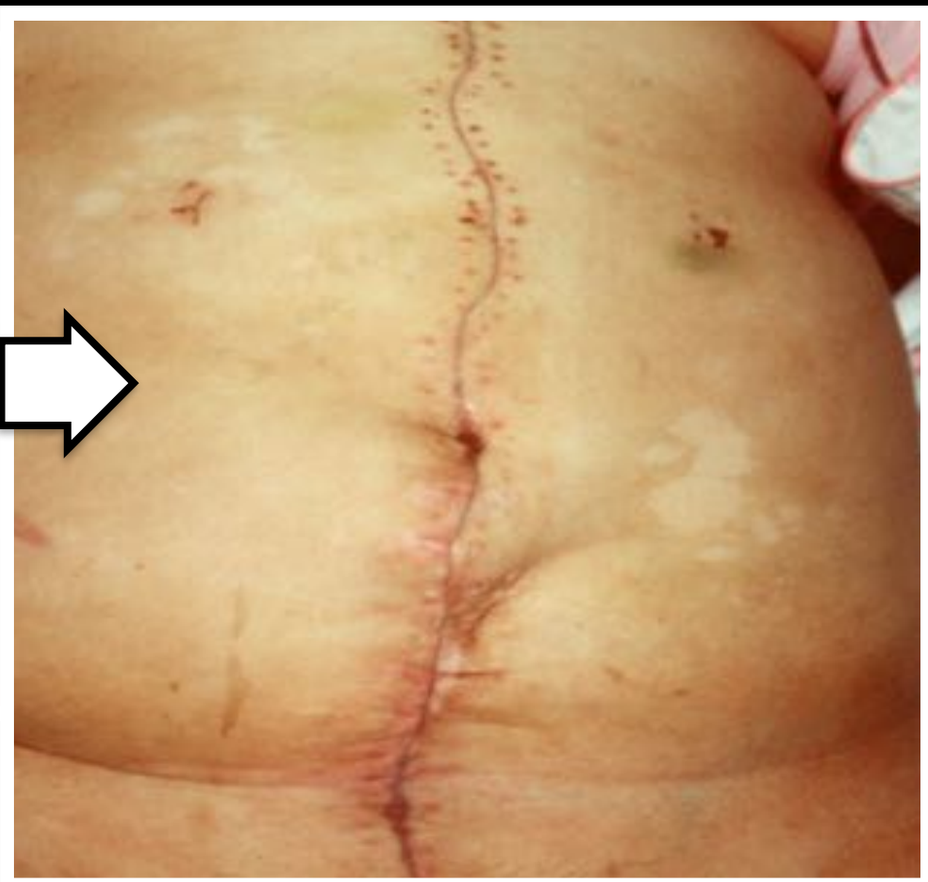
Type III
HPN

Settles

Death (5%)
Oral (50%)
Enteral (5%)

Reconstruction
Transplant
Growth factor
Lengthening

Type II → Type III → Reconstruction



Intestinal failure

Definitions

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Chronic intestinal failure

Mechanisms leading to intestinal failure

Surgical causes

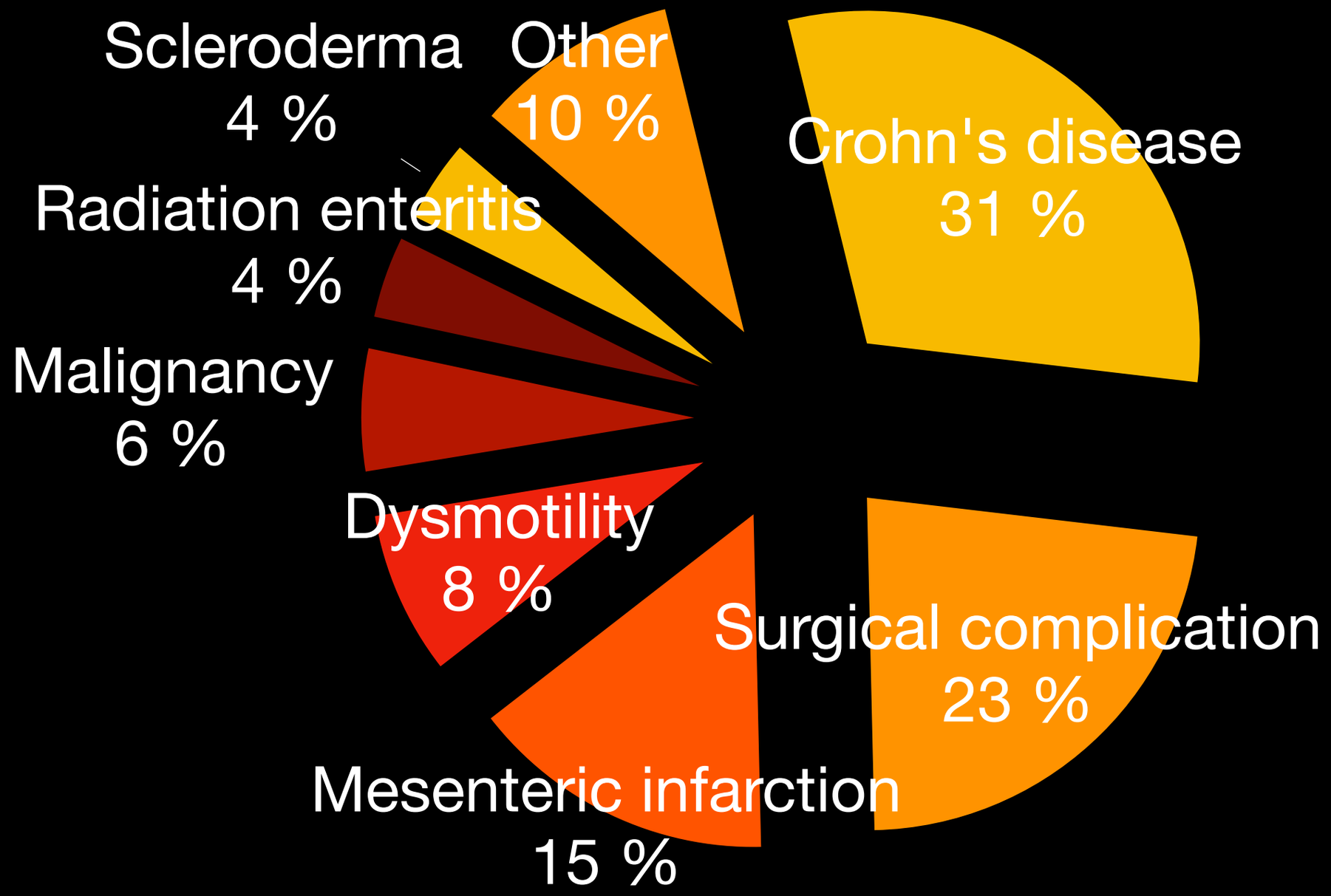
Enteric fistulas

- Enterocutaneous
- Enteroatmospheric fistula

Mechanisms leading to intestinal failure

- Surgical causes
  - Enteric fistulas
    - Enterocutaneous
    - Enteroatmospheric fistula
  - Proximal stomas
  - Short bowel syndrome
- Non-surgical causes
  - Congenital
    - Intestinal neuropathy
    - Intestinal myopathy
  - Acquired
    - Radiation enteritis
    - Scleroderma
    - Tuberculosis

Diseases leading to intestinal failure

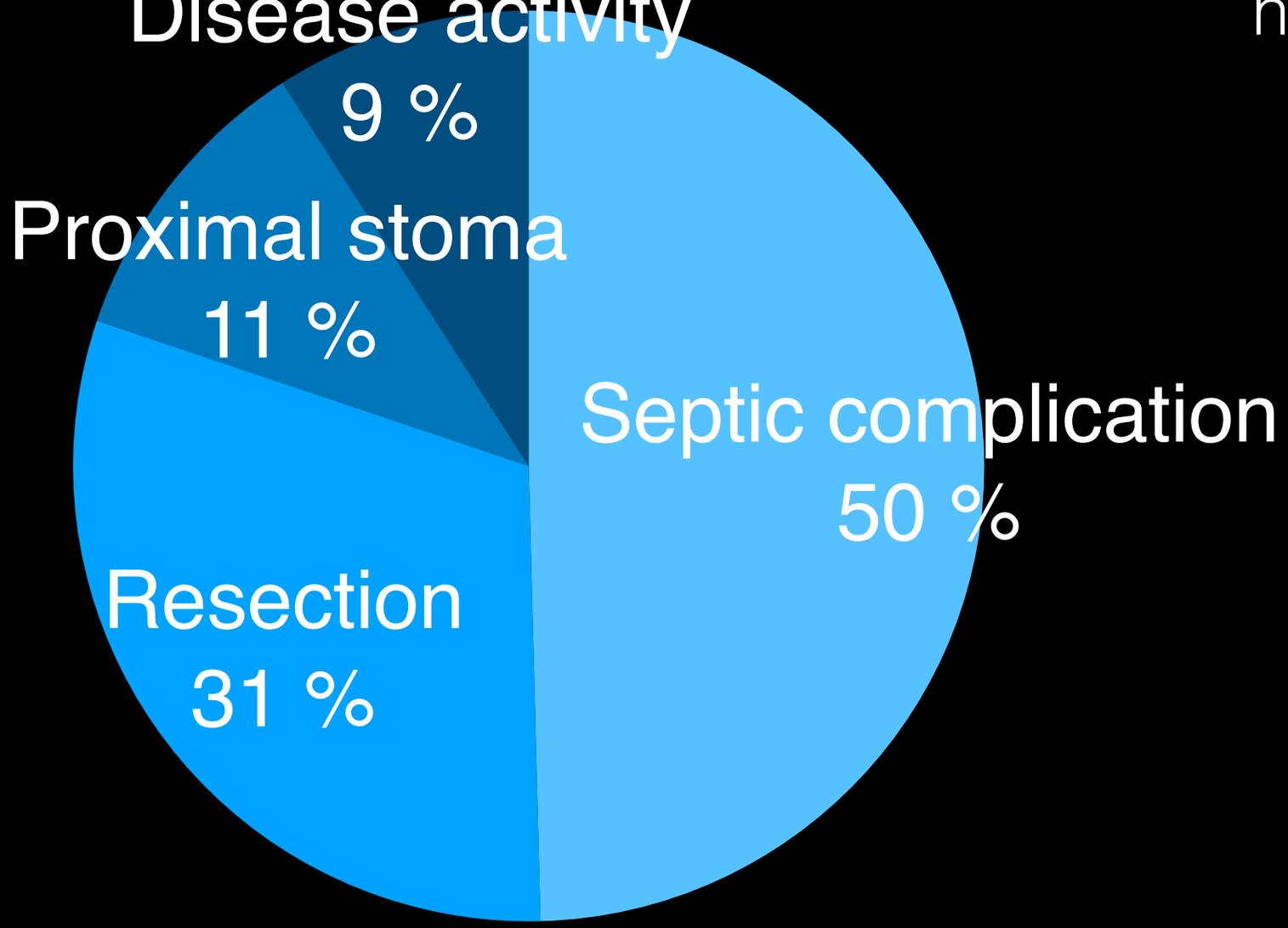


1978-2011
n=545

Dibb M, Soop M, Teubner A *et al*, Clin Nutr 2017;36:570.

Why do people with Crohn's disease get intestinal failure?

n=121 (2000-2017)



Soop M *et al*, J Crohns Colitis 2020;14:1558.

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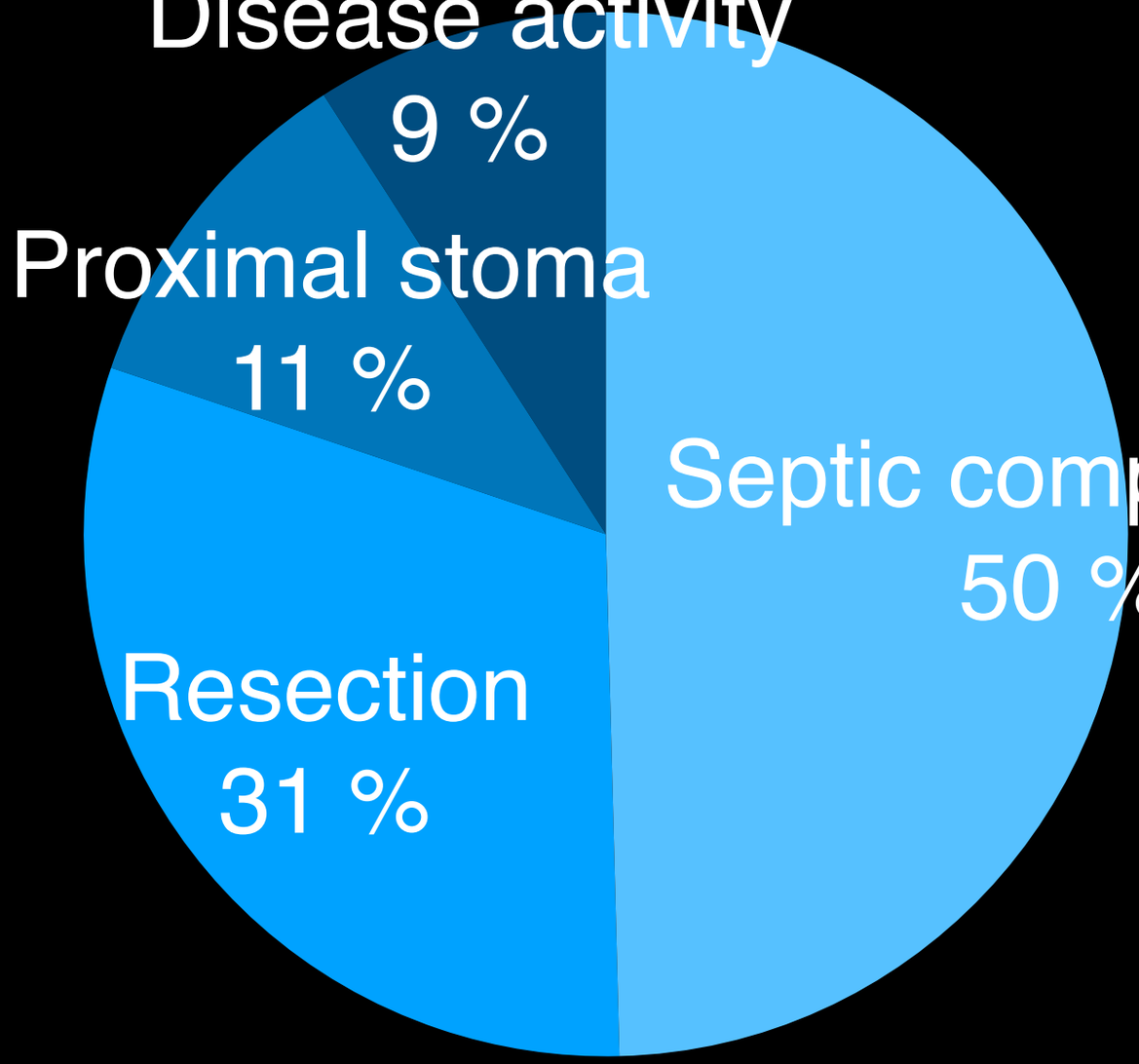
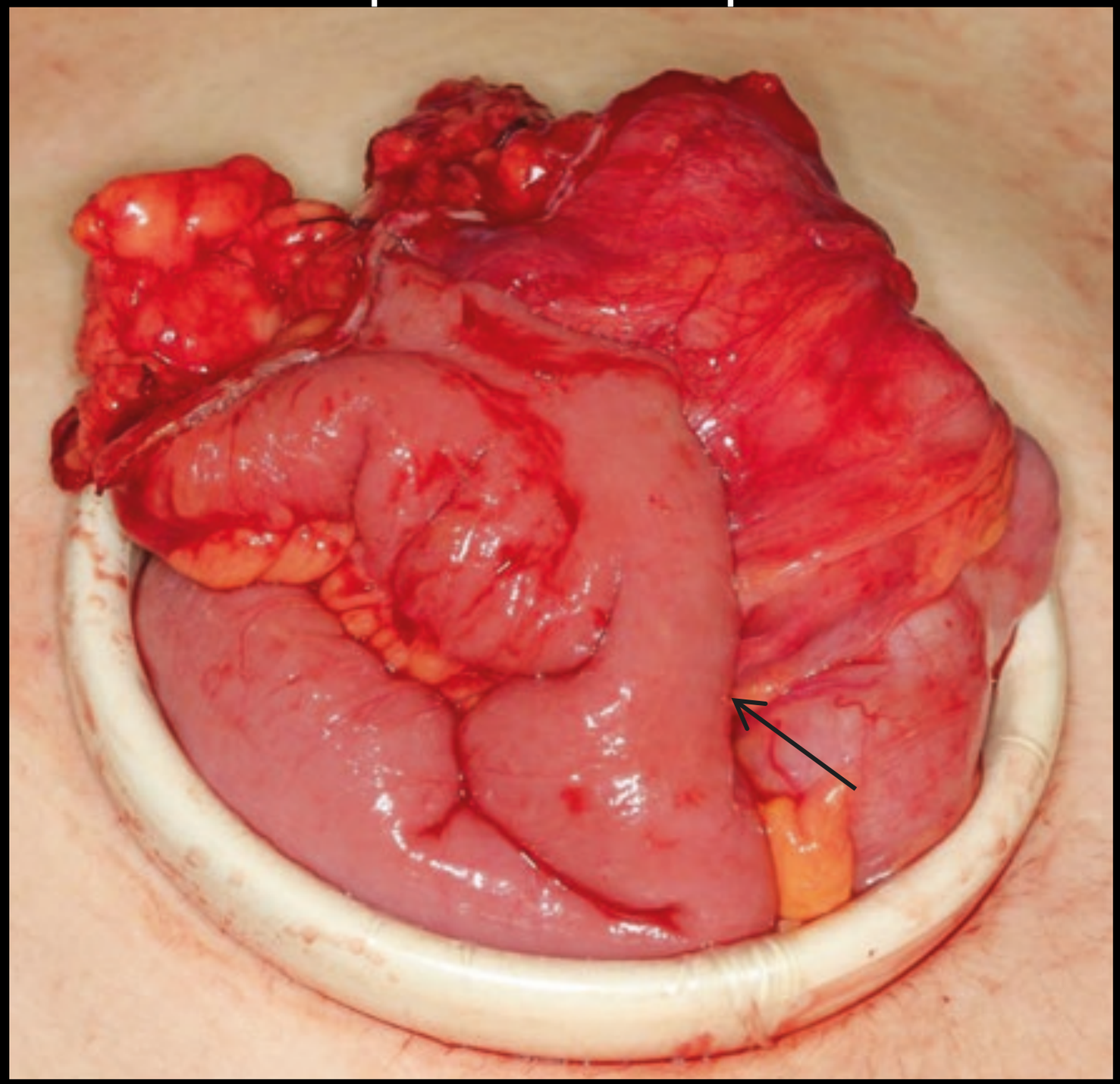


Anastomotic leak 52%
Fistulation 40%
Abscess 8%

Soop M *et al*, J Crohns Colitis 2020;14:1558.

One key goal:
Avoid septic complications



Safer Crohn's surgery: Who leaks?

Preoperative abscess

Steroids (≥10 mg prednisolone within 4 weeks of surgery)

Malnutrition (>10% weight loss)

Risk of leak:

0 risk factors 4%

1 risk factor 15%

2 risk factors 35%

Tzivanakis et al, Dis Colon Rectum. 2012; 55: 558

Optimisation Pathway
4-6 weeks before surgery

OPTIMISATION TARGETS

ERSTA SJUKHUS

Manage abdominal infection:
CRP normal, albumin >32 g/l

Manage weight loss:
Stable weight 2w preop

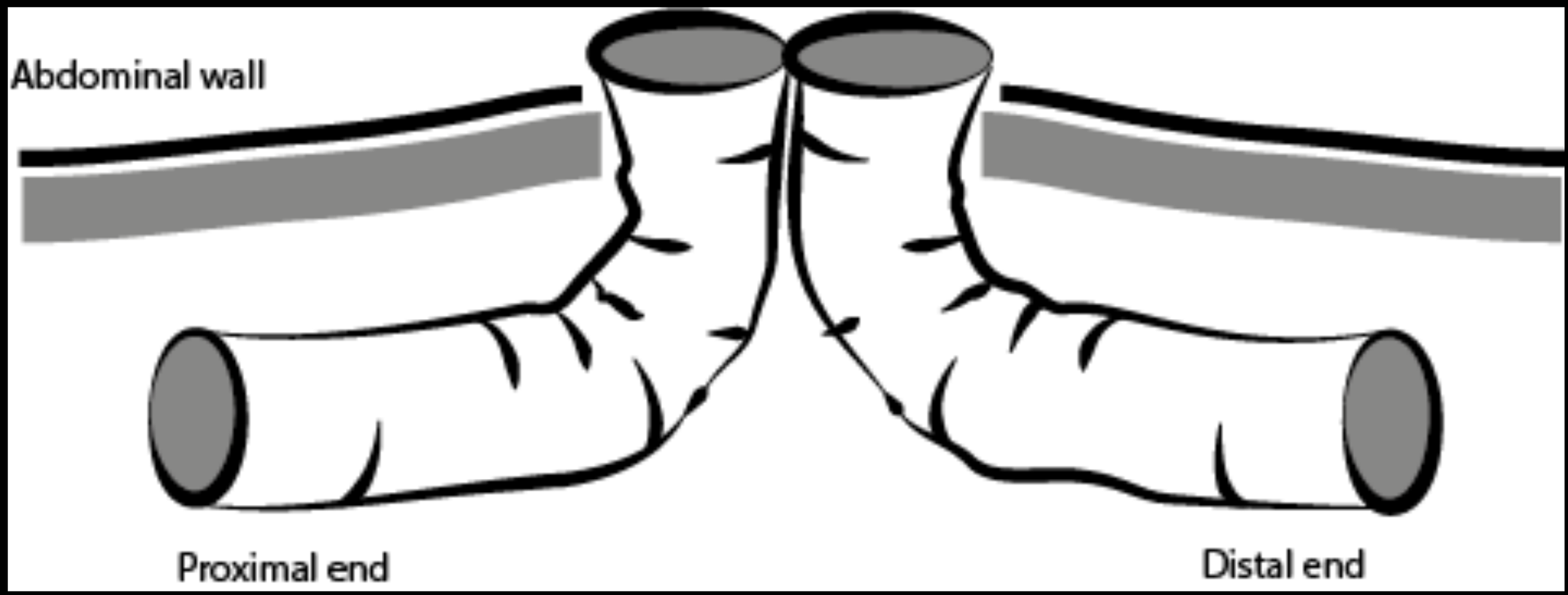
Manage medications:
Prednisone <10mg/d for 4w preop
IFX 4w washout
ADA 2w washout
USTE, VEDO 6w washout
MTX 2w washout
AZA, 6MP no washout
Consider EEN

Manage mental health:
Referral to psychologist

Manage smoking:
Smoking cessation >4w preop

Manage anaemia:
Hgb >120 g/l preop

Don’t anastomose if it’s not safe



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SNAP concept

The management of patients referred to this unit is guided by a set protocol that can be remembered by the mnemonic SNAP, which identifies the major stages of fistula management as: identification and eradication of sepsis (S), maintenance of nutritional status (N), defining the anatomy of the fistula (A), and definitive surgical procedure (P) if and when indicated. Patients were initially managed by the detection and eradication of sepsis and maintenance of nu-

NMA Williams *et al*, Am J Surg 1997;173:240

Sepsis causes death in type II IF

	Maastricht 1990-2005	Mexico City 1995-2004	St Mark's 1992-2002
Overall mortality	13/135 (10%)	23/174 (13%)	30/277 (11%)
Sepsis cause of death	10/13 (77%)	22/23 (96%)	23/30 (77%)

Visschers RG et al. World J Surg 2008; 32, 445.
Martinez JL et al. World J Surg 2008; 32, 436. Hollington P et al. Br J Surg 2004; 91, 1646.

Sepsis prevents anabolism

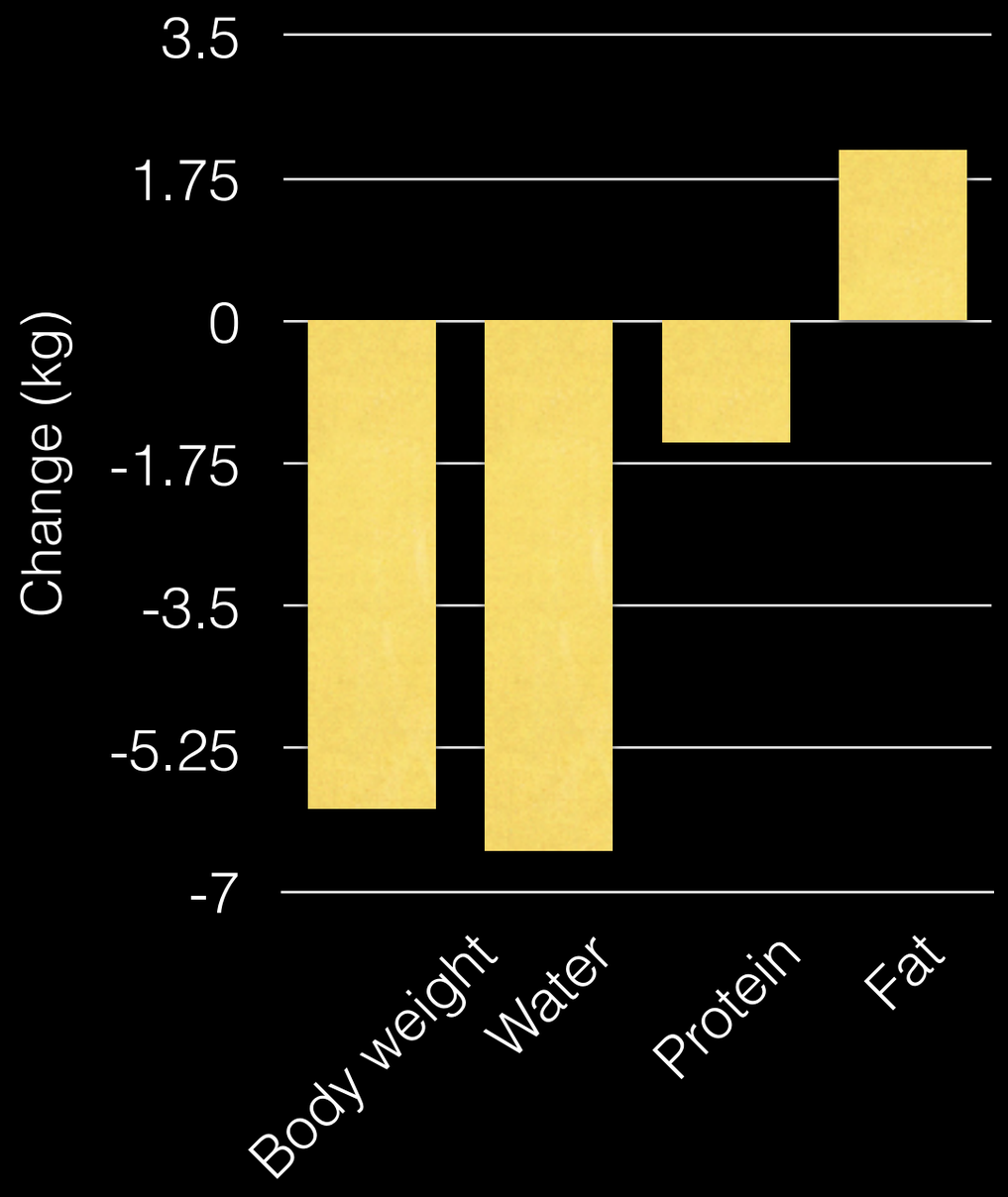
8 pts w intraabdominal sepsis

10 days of aggressive TPN:

1400 glucose calories

1400 lipid calories

22.6g nitrogen



Streat SJ et al, J Trauma 1987;27:262

Source control is time sensitive

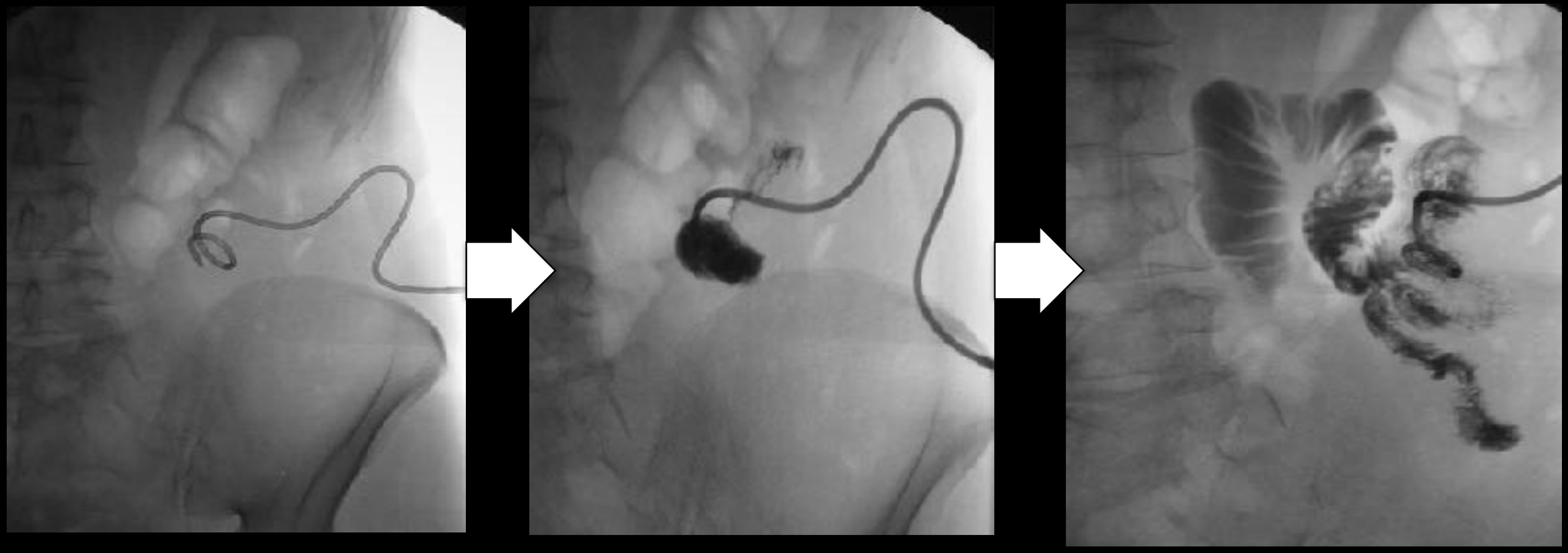
Guideline	Region	Infection without systemic inflammation	Sepsis	Severe sepsis	Septic shock
Surviving Sepsis Campaign (2013)[1]	Global	–	–	12 h after diagnosis	12 h after diagnosis
National Institute for Health and Care Excellence (2016)[5]	England	–	–	–	–
Department of Health and Royal College of Surgeons of England (2011)[7]	England	As soon as possible (07·00–22·00 hours)	Within 18 h (07·00–22·00 hours)	6 h	Immediate
National Clinical Effectiveness Committee (2014)[6]	Ireland	–	–	12 h after stabilization	12 h after stabilization

Soop M & Carlson GL, Br J Surg 2017;104:65.

Most valuable player: Percutaneous drainage

Contained cavity, stable patient

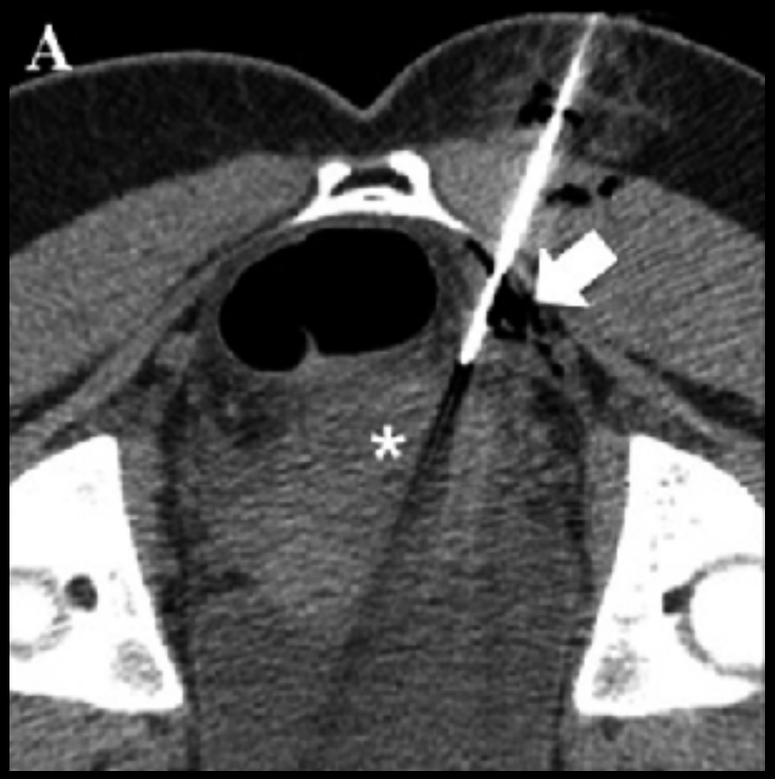
80% success rate (20% need repeat drain)



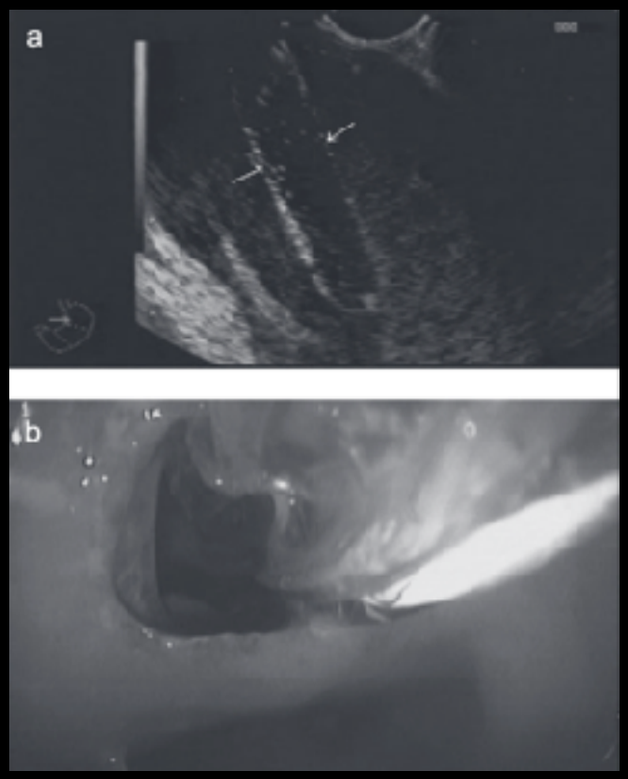
Khurrum Baig M et al, Tech Coloproctol. 2002;6:159. Felder S et al, Am J Surg. 2014;208:58.
Soop M & Carlson GL , Br J Surg 2017;104:65.

Reaching less common locations

Pelvic:
Transgluteal CT



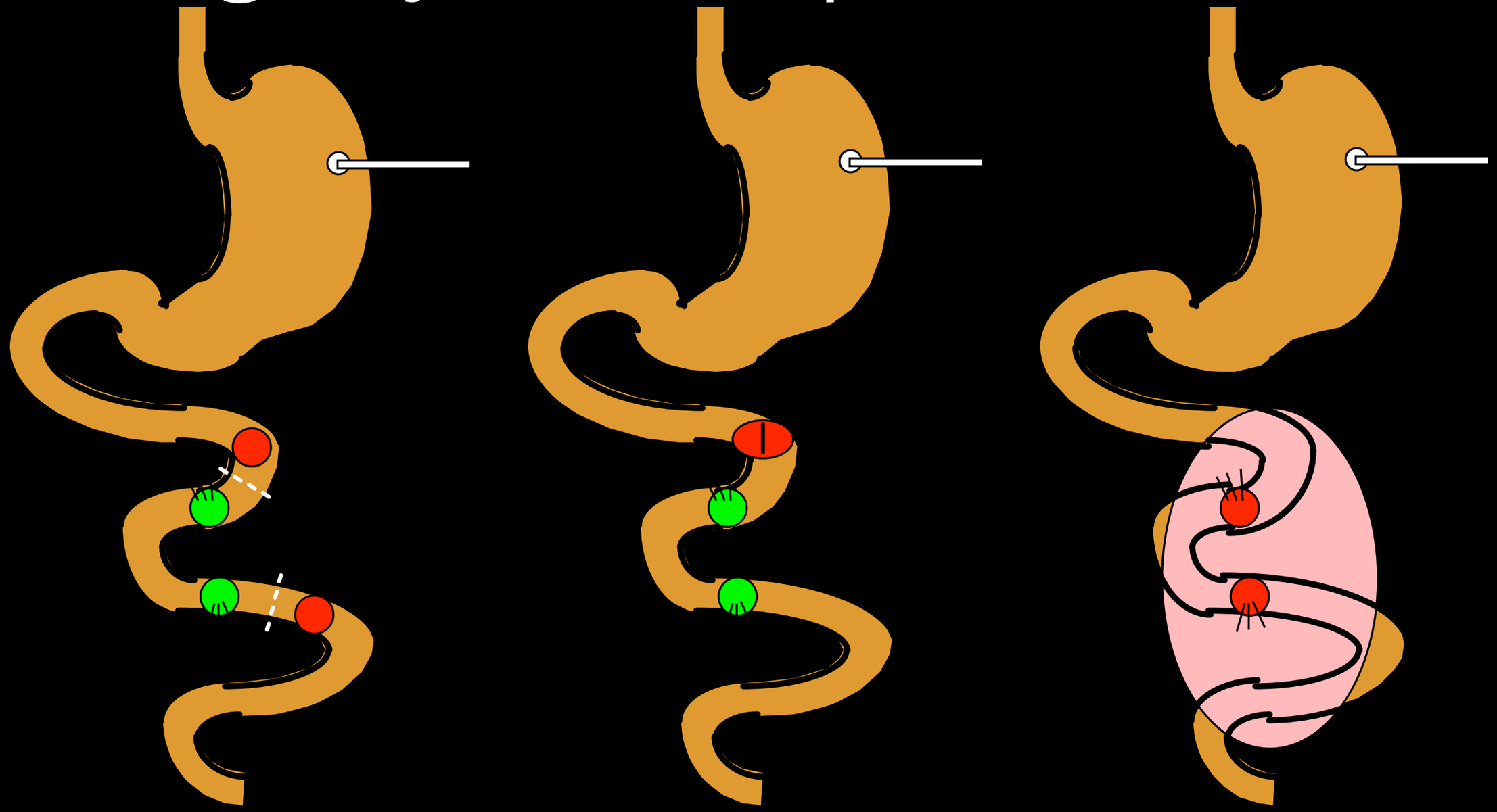
Pelvic:
Transrectal USS



Upper abdomen:
Transgastric USS

Robert, B *et al*, J Visc Surg 2016;153:3. Mandai, K *et al*, World J Gastroentero 2015;21:3402.

Surgery for sepsis control



Exteriorise & Resect

Exteriorise as High Loop Jejunostomy

Exteriorise as Laparostomy

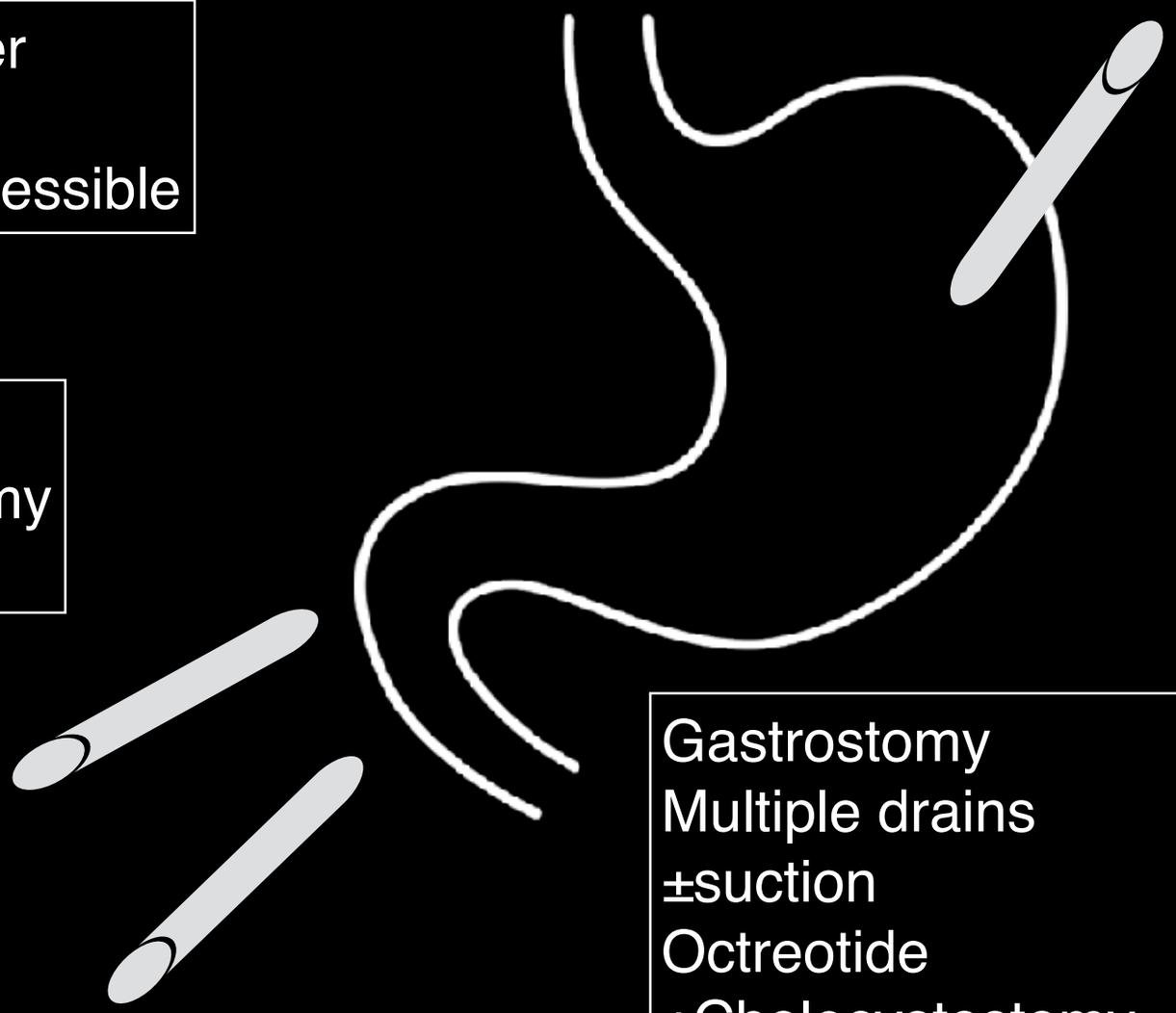
Courtesy of Mr Nigel Scott, Salford Royal Hospital, Manchester

Surgery for sepsis control

Left upper quadrant often accessible

Midline laparotomy best

*Duodenal source:

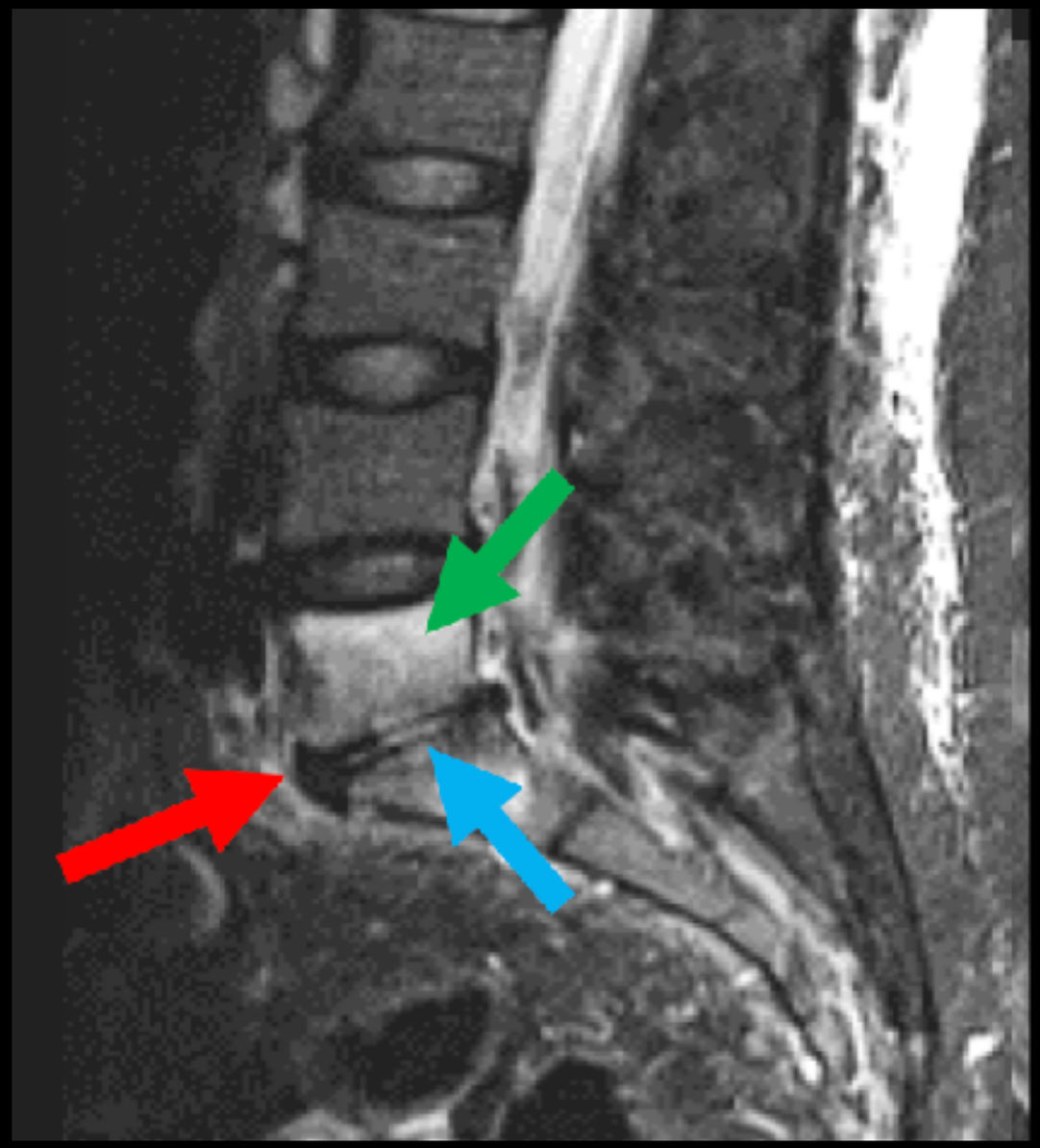


Gastrostomy
Multiple drains
±suction
Octreotide
±Cholecystostomy

Occult sepsis?

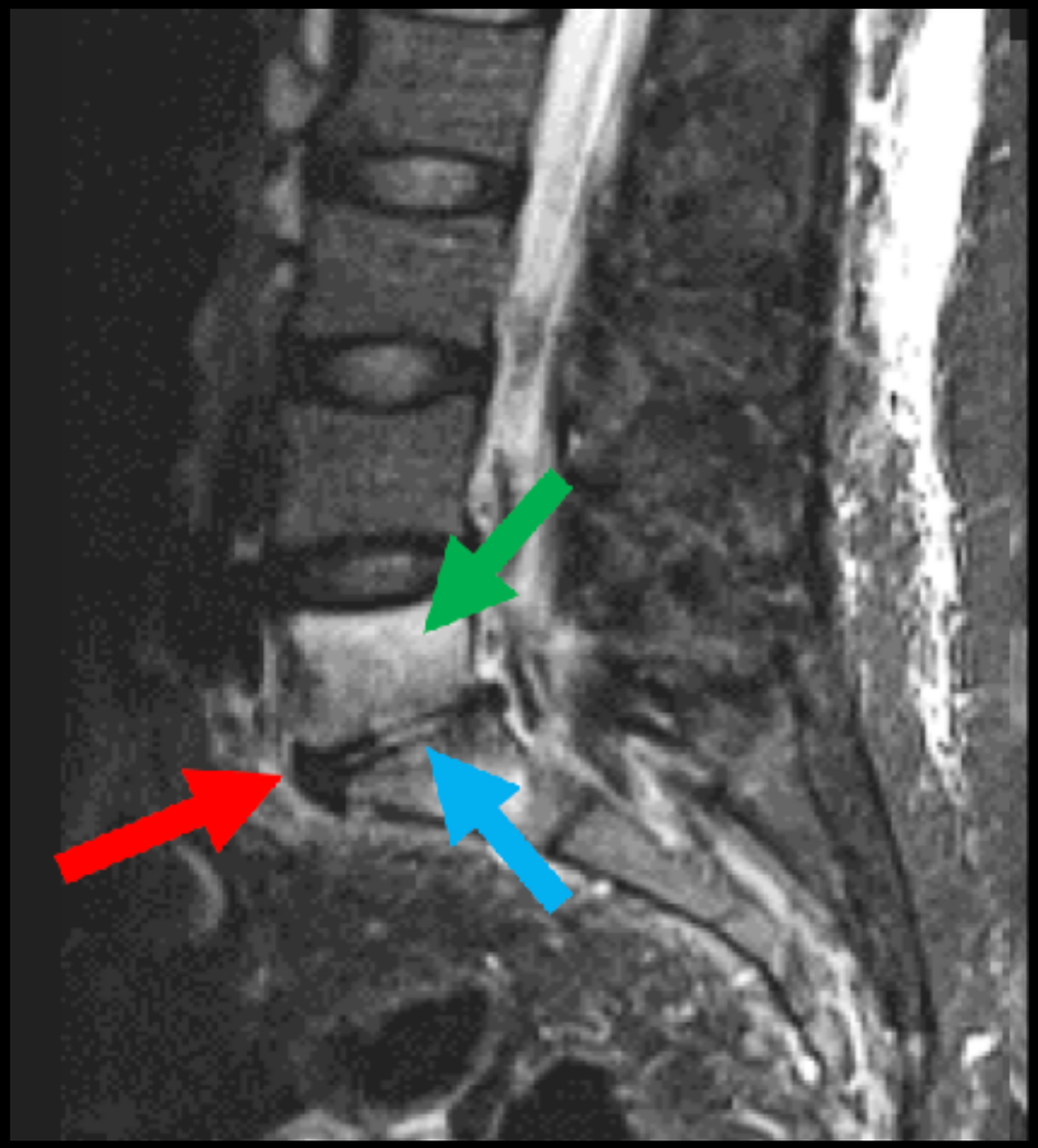
Subtle signs:

- Hypoalbuminaemia
- Liver dysfunction
- Lymphopenia
- Hyponatremia

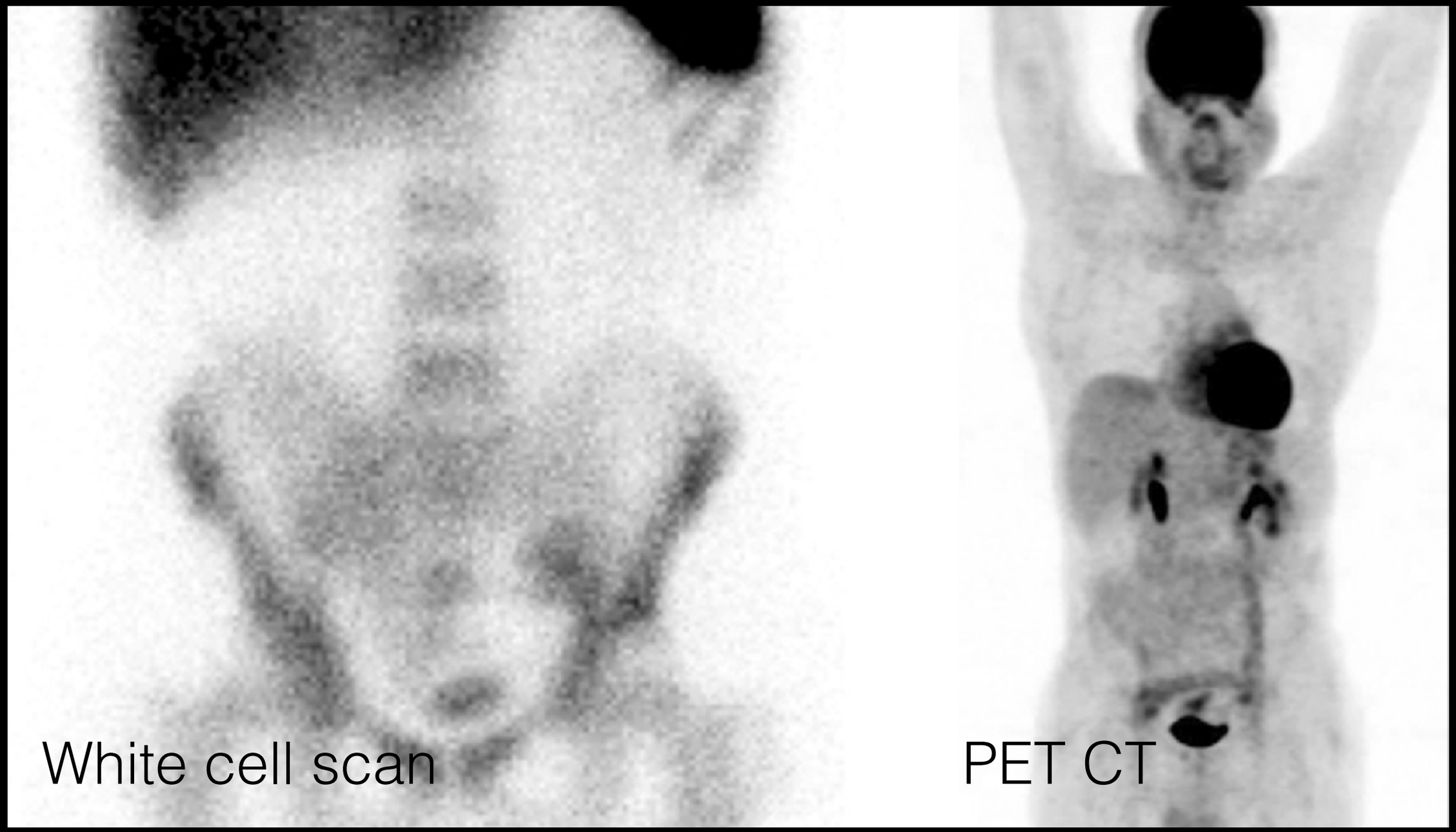


Occult sepsis?

- Abdomen, pelvis
- Abdominal wall
- Vascular access
- Endocarditis
- UTI, chest
- Osteomyelitis
- Discitis

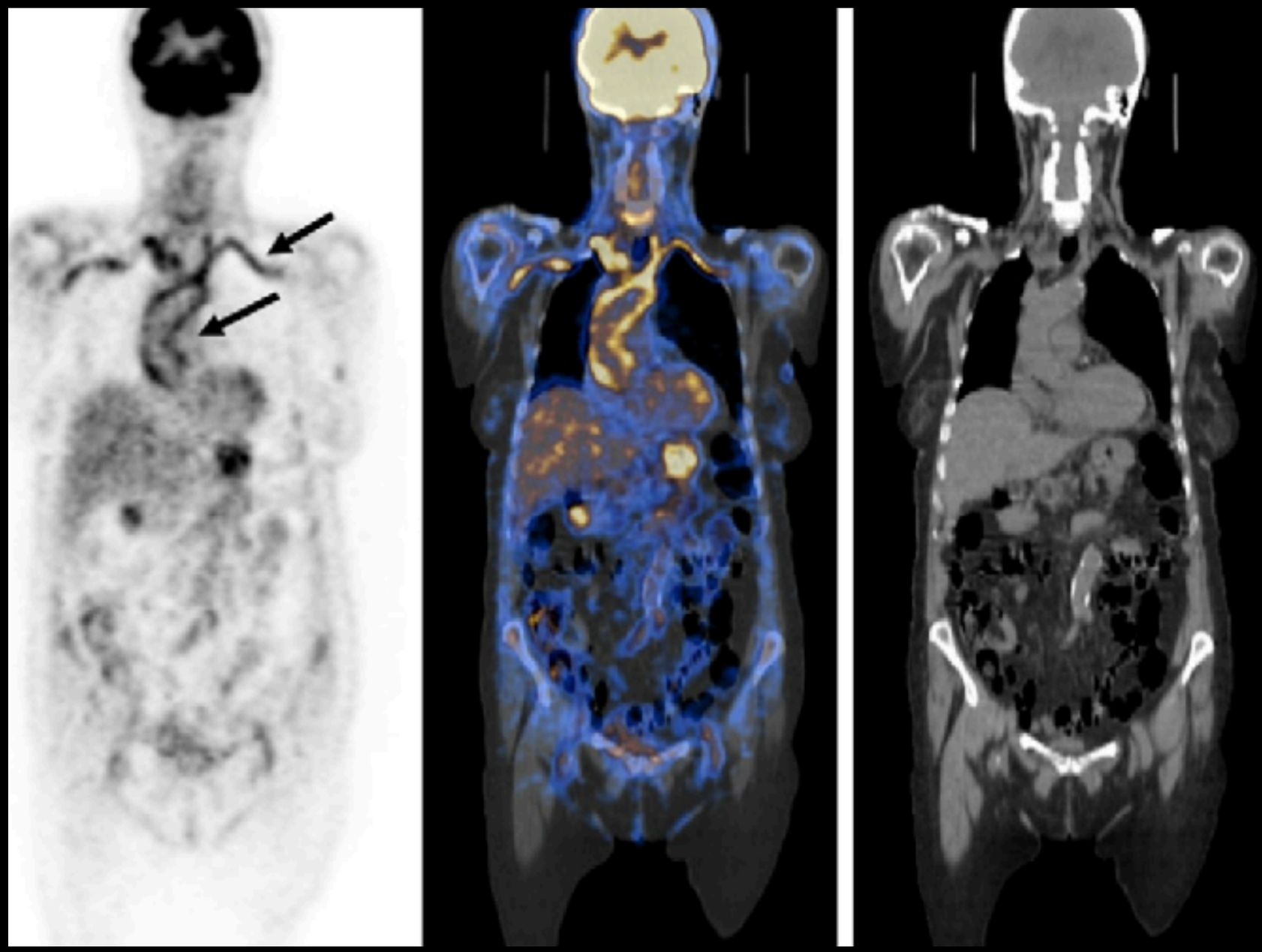


Occult sepsis:
White cell scan vs FDG-PET CT



Gardet E et al, Int Cardiovasc Thorac Surg 2009 17;10:142

Occult sepsis:
White cell scan vs FDG-PET CT



Keidar Z *et al*, J Nucl Med 2008;49:1980.

Nutrition: Three Phases

Unstable phase

- PN
- Minimise malnutrition

Spontaneous closure phase

- 6 weeks PN
- If chance of spontaneous closure

Rehabilitation phase

- >6 months
- Rehab lean tissue mass
- Rehab bowel integrity

Could this fistula spontaneously close?

10-65% of postoperative ECFs close spontaneously
Some do not:

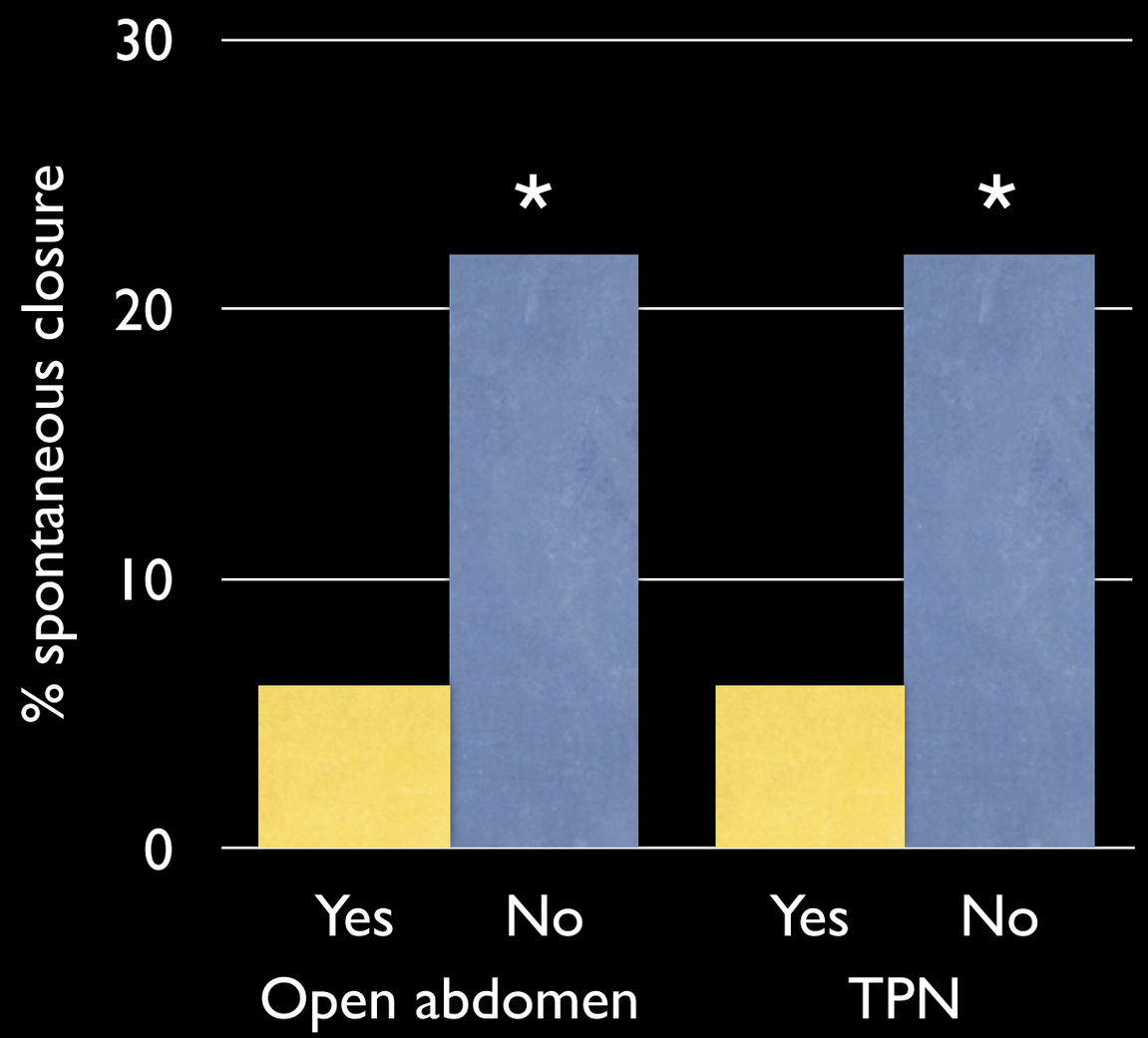
Fistula	Short, wide
	Mucocutaneous continuity
	High output (>500 ml/day)
	Multiple
	Open abdomen
Bowel	Duodenum or jejunal
	Distal obstruction
Patient	Unresolved sepsis
	Malnutrition

Martinez JL *et al*, World J Surg 2007;32:436. Visschers, RGJ *et al*, World J Surg 2008;32:445.

Could this fistula spontaneously close?

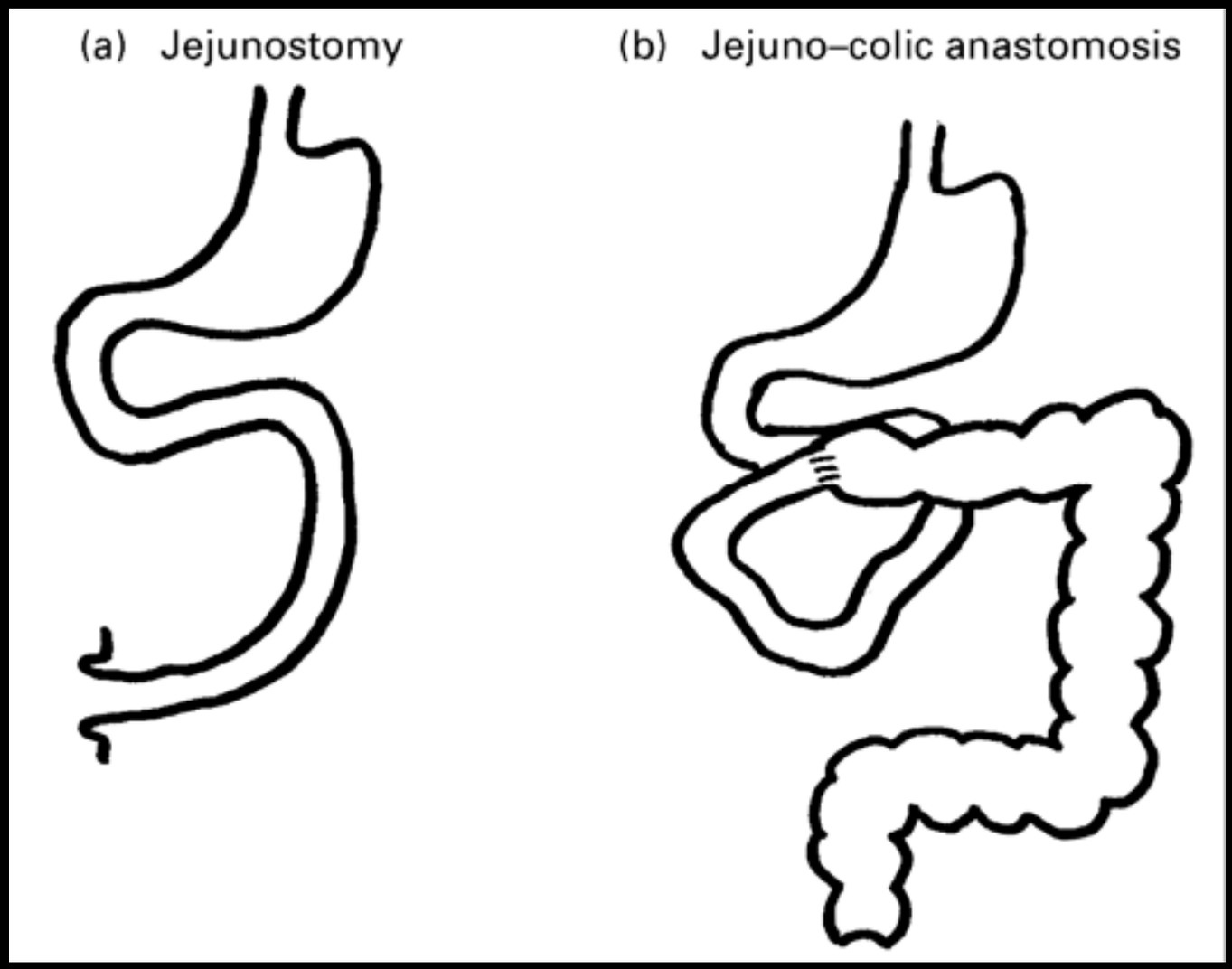
If yes:

- Give it 6 weeks
- Bowel rest, feed parenterally



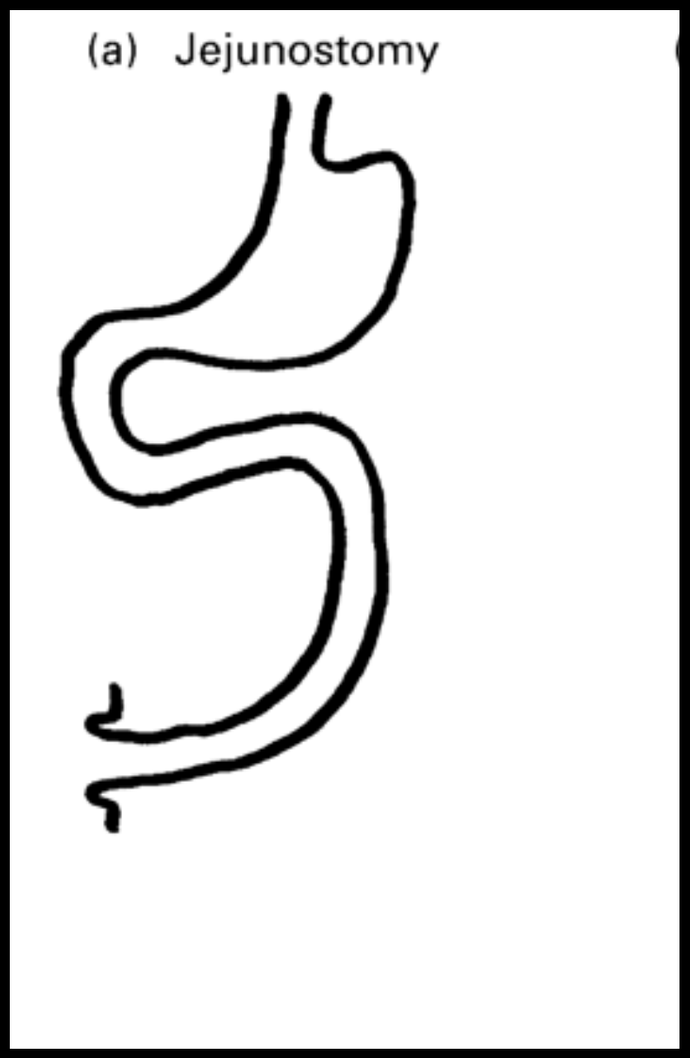
Visschers, RGJ *et al*, World J Surg 2008;32:445.

Maximising absorption from a short bowel

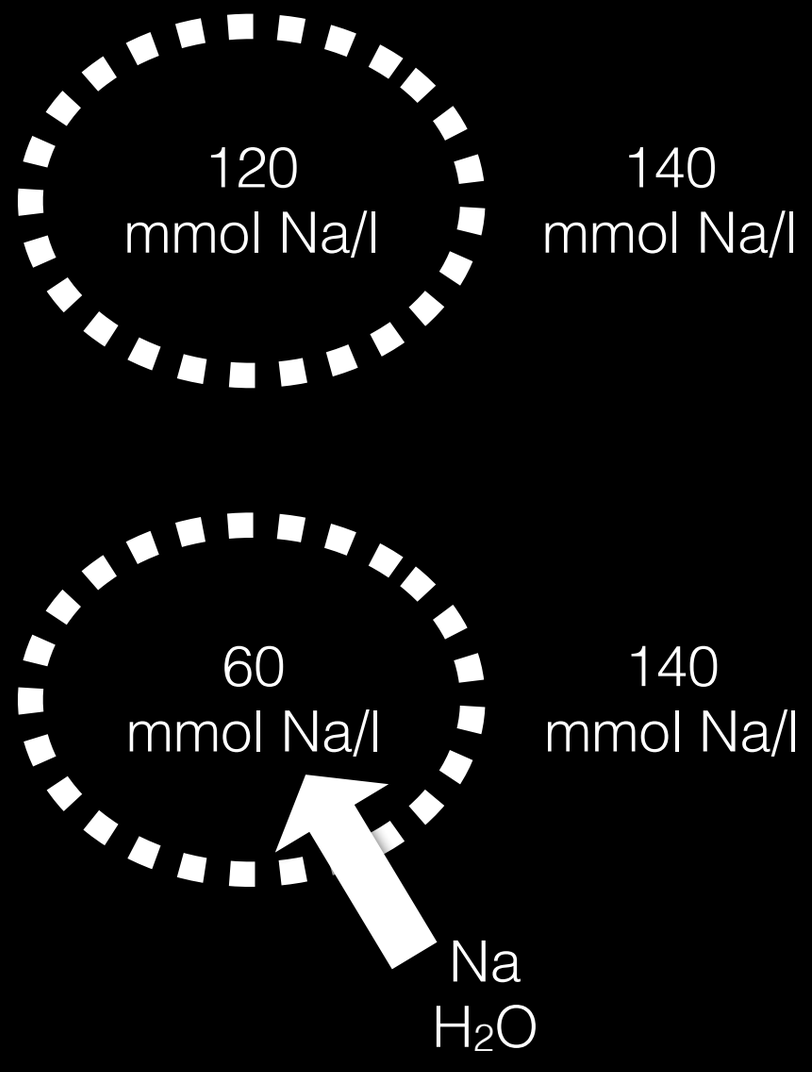


Nightingale, JMD, P Nutr Soc 2003:62:703.

Jejunostomy: Physiology



Jejunum *leaky* to H2O and Na



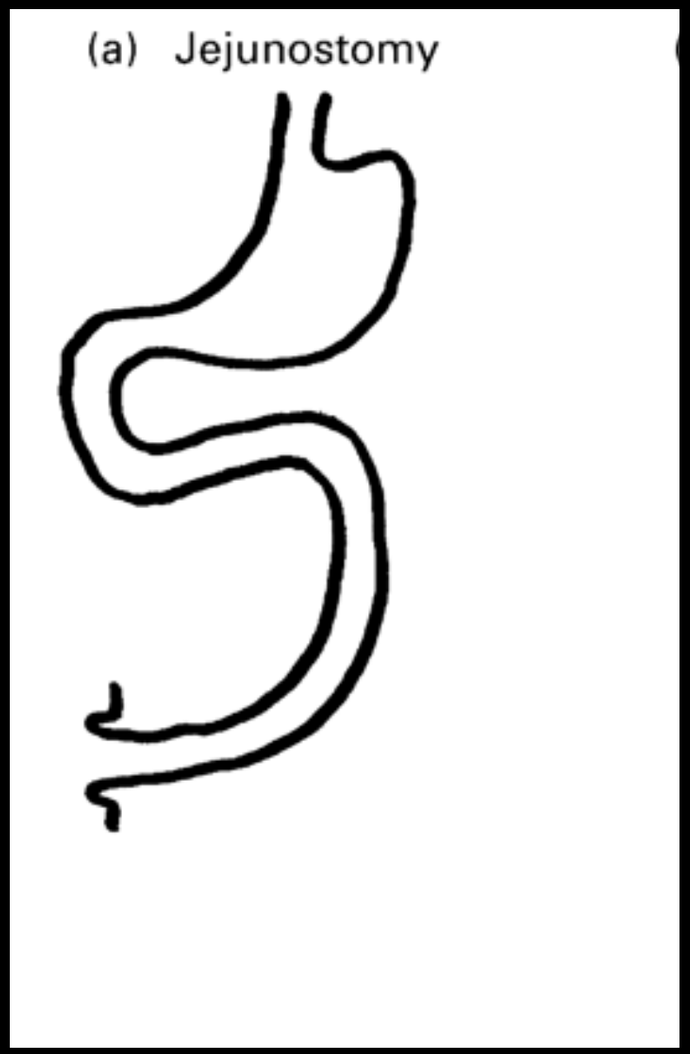
<1m: net secreters

>2m: net absorbers

Check U-Na <10mmol/l: Na depleted

Check plasma Mg

Jejunostomy: Management



Restrict intake of hypotonic (normal) fluids to 1000-500 ml/day

Give salt, rehydration solution 100-120 mmol Na/l

No fast carbs, limit fiber

Increase fat and protein intake, salt intake

Up to 160mg omeprazole/day (pH>6)

Up to 48mg loperamide/day

Up to 90mg codeine/day

Somatostatin analogue only if near pancreas

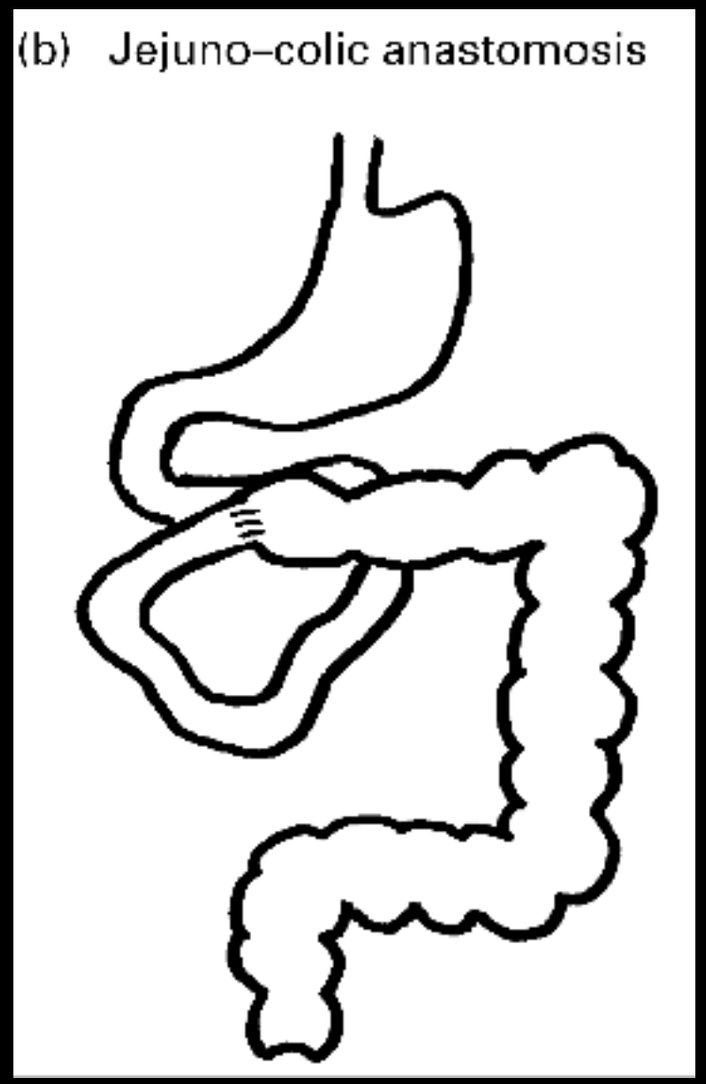
Jejuno-colic anastomosis

>100cm ileum resected: bile salt malabs

Steatorrhea

Oxalate renal stones

D-lactic acidosis (D-isomer produced by bacteria)



Reduce oxalate intake

Consider cholestyramine

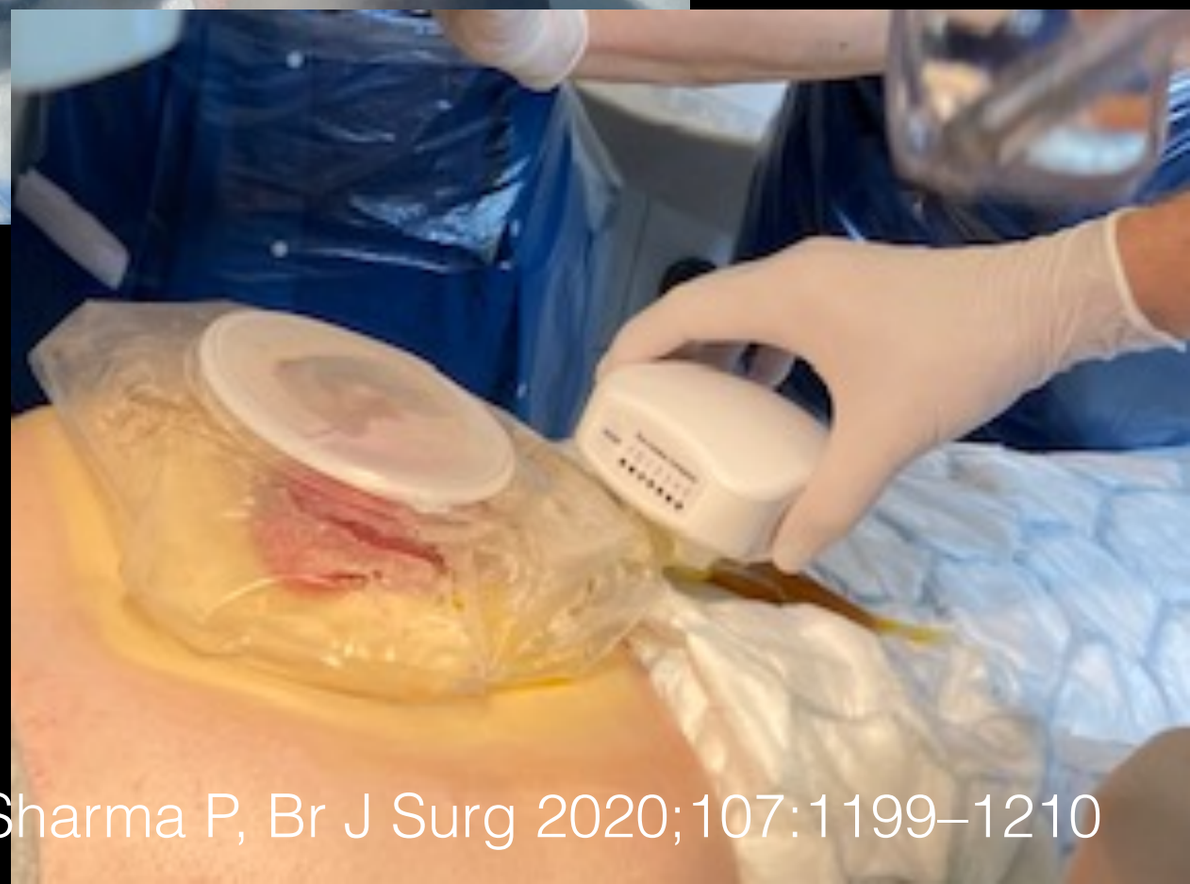
Soluble fibre

Alternatively, chyme reinfusion

Standard polymeric feed or chyme reinfusion

Conditions distal bowel before re-anastomosis

Replaces parenteral nutrition (92%)



Teubner A, Br J Surg 2004;91:625-31. Sharma P, Br J Surg 2020;107:1199–1210

Intestinal failure

Definitions

Prevention

Acute intestinal failure

Chronic intestinal failure

Type III HPN

Lifelong HPN

- Conventional reconstructive surgery
- Intestinal Tx
- Growth factor therapy
- Intestinal lengthening

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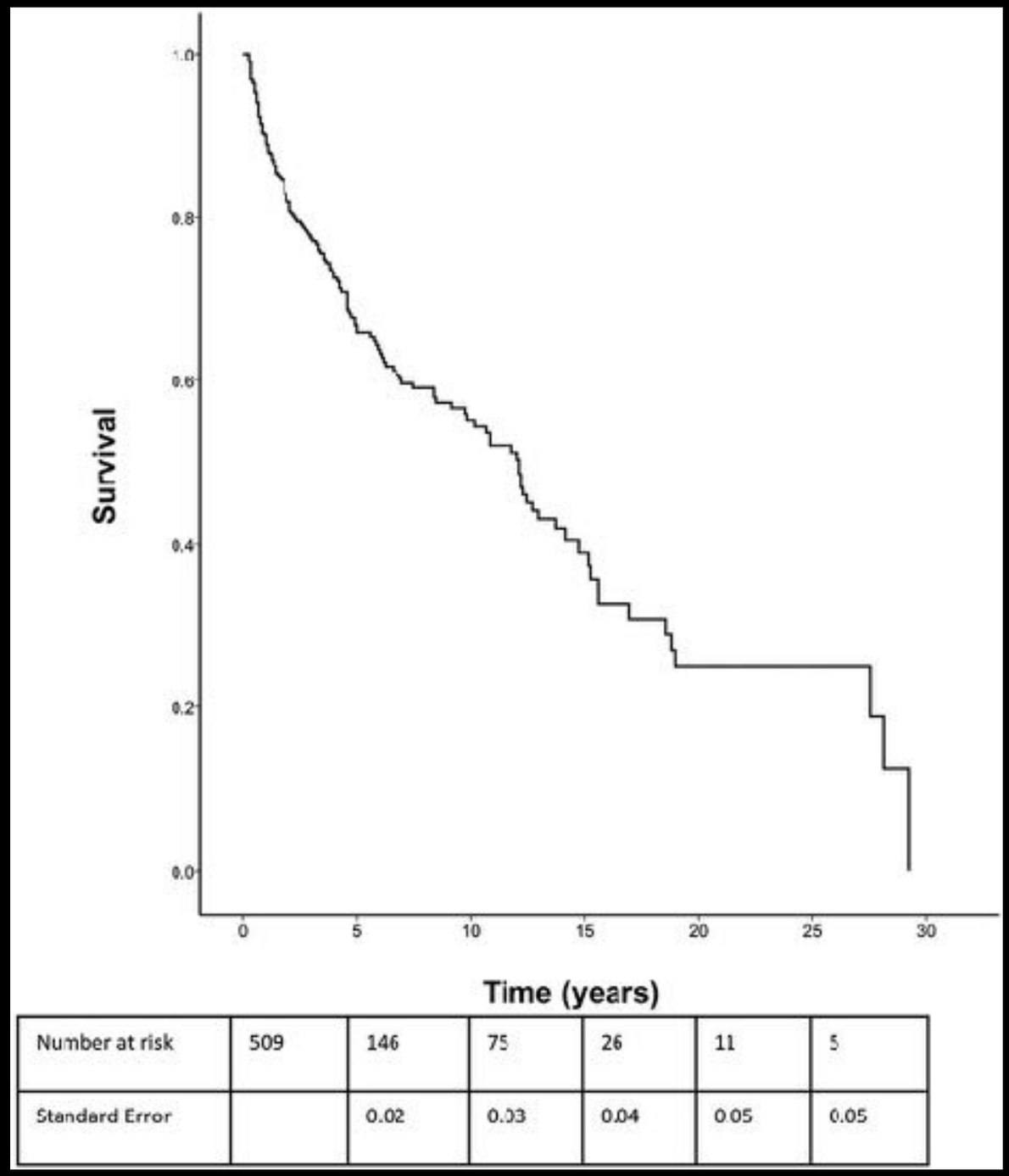
HPN: 30-year outcomes

n=545 patients on HPN for benign disease

5-year survival 70%

10-year survival 60%

HPN-related deaths: IFALD, sepsis



Number at risk	509	146	75	26	11	5
Standard Error		0.02	0.03	0.04	0.05	0.05

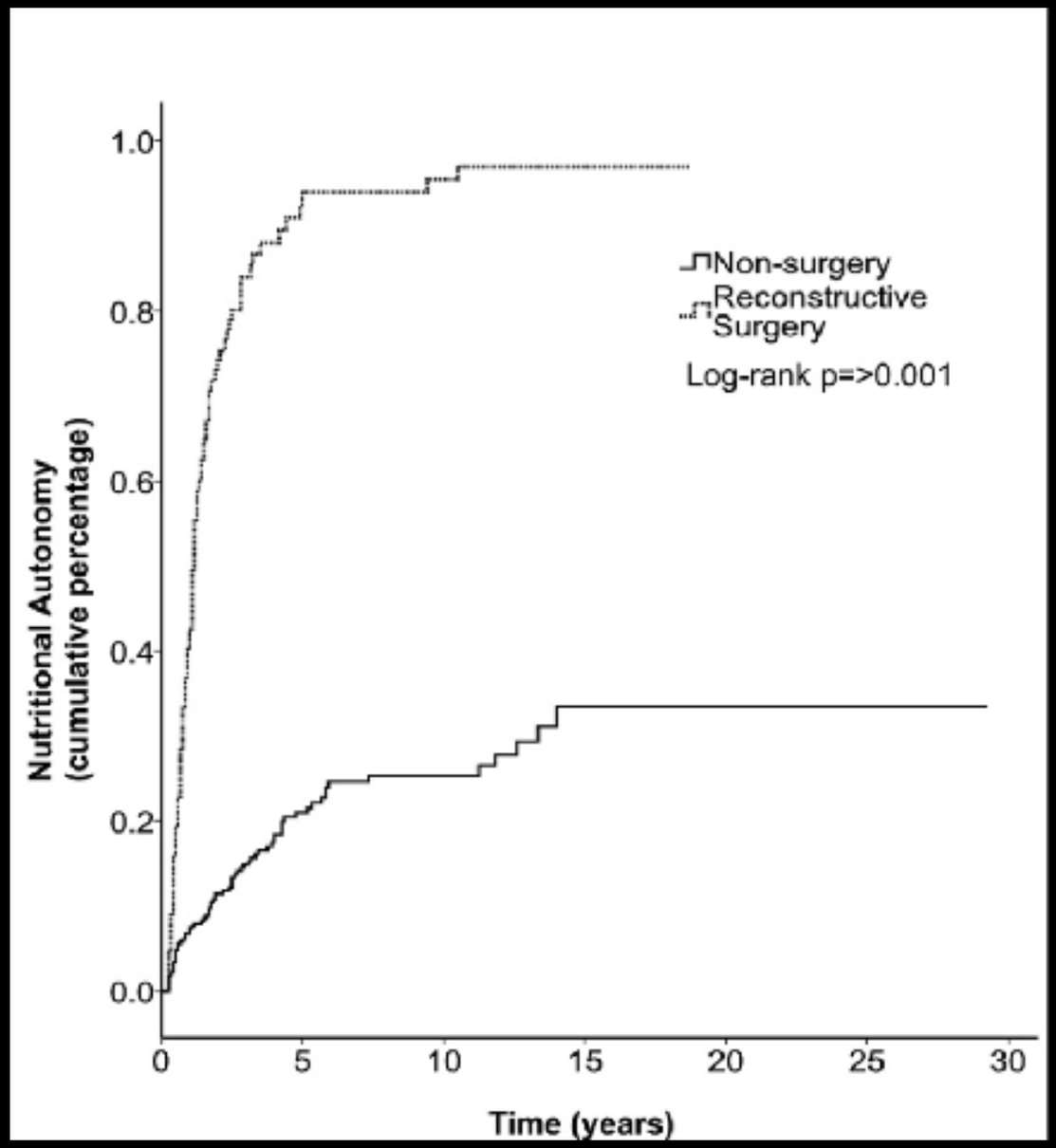
Dibb M et al, Clin Nutr. 2017;36:570

HPN: 30-year outcomes

Spontaneous weaning of HPN in 40%

Adaptation continues up to 15 years

Mechanisms not clear



Dibb M et al, Clin Nutr. 2017;36:570

Type III
HPN

Lifelong
HPN

Conventional reconstructive surgery

Intestinal Tx

Growth factor therapy

Intestinal lengthening

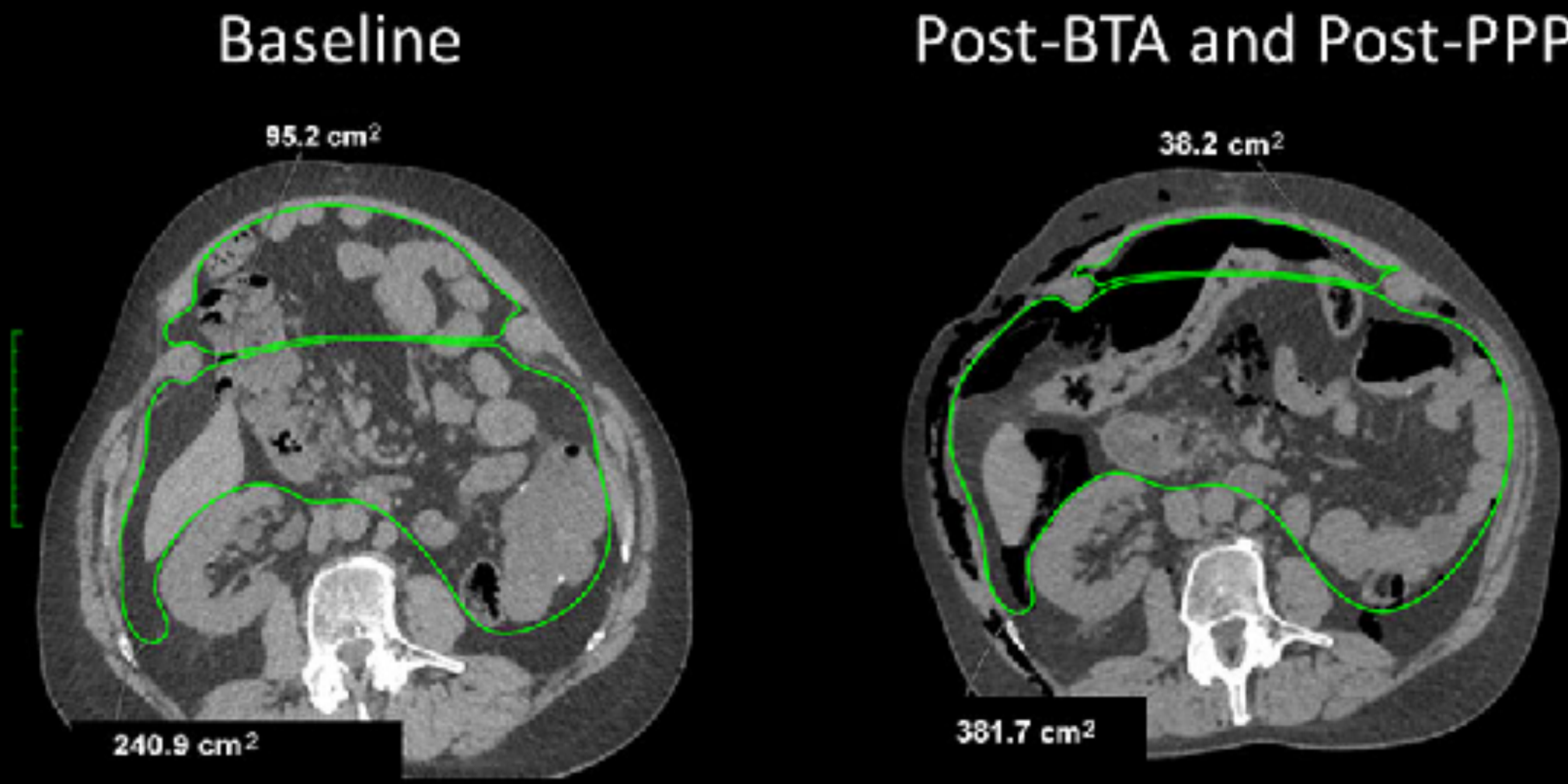
Questions for the radiologist

What does the fistula look like?

What does the bowel upstream and downstream look like?

Questions for the radiologist

What does the abdominal wall look like?



Timing of definitive surgery

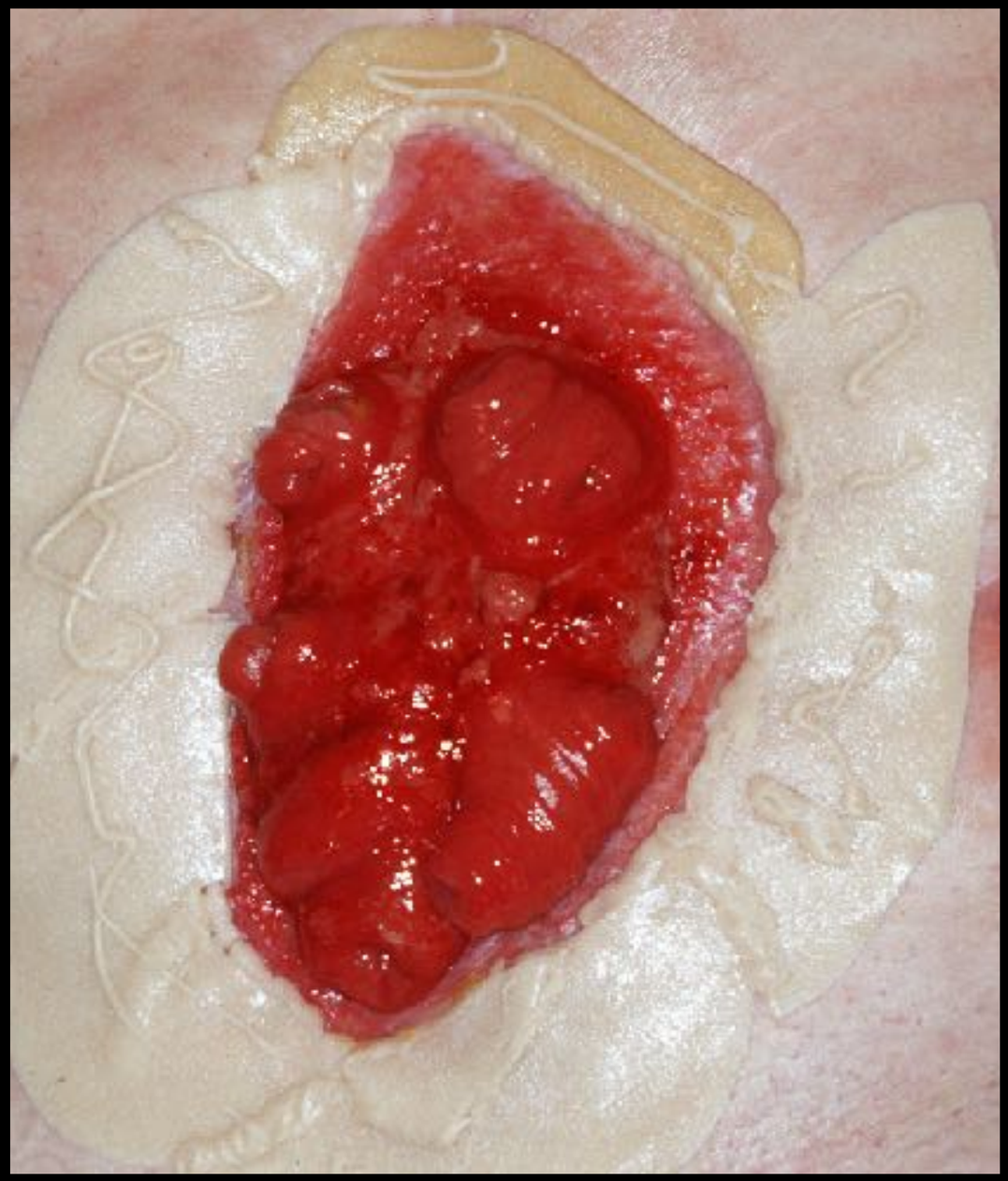
When is the patient ready:

- *psychologically?*

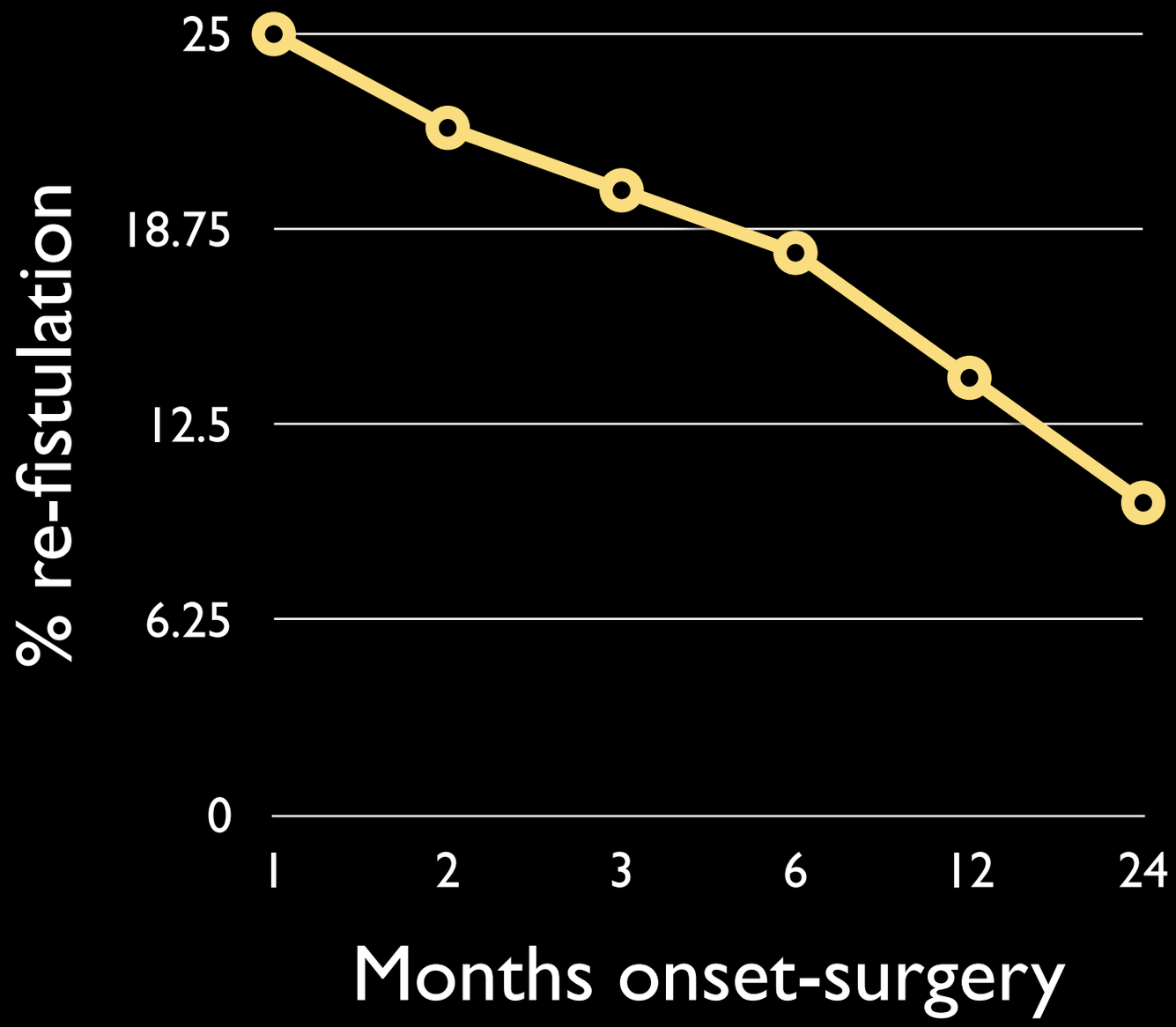
- *locally* (abdomen)*?* soft, peritoneal cavity re-formed

- *physiologically?* SIRS, nutritional state, CPET

12+ months



Early surgery for enterocutaneous fistula often fails



Lynch AC et al, Ann Surg 2004; 240, 825.

Goals

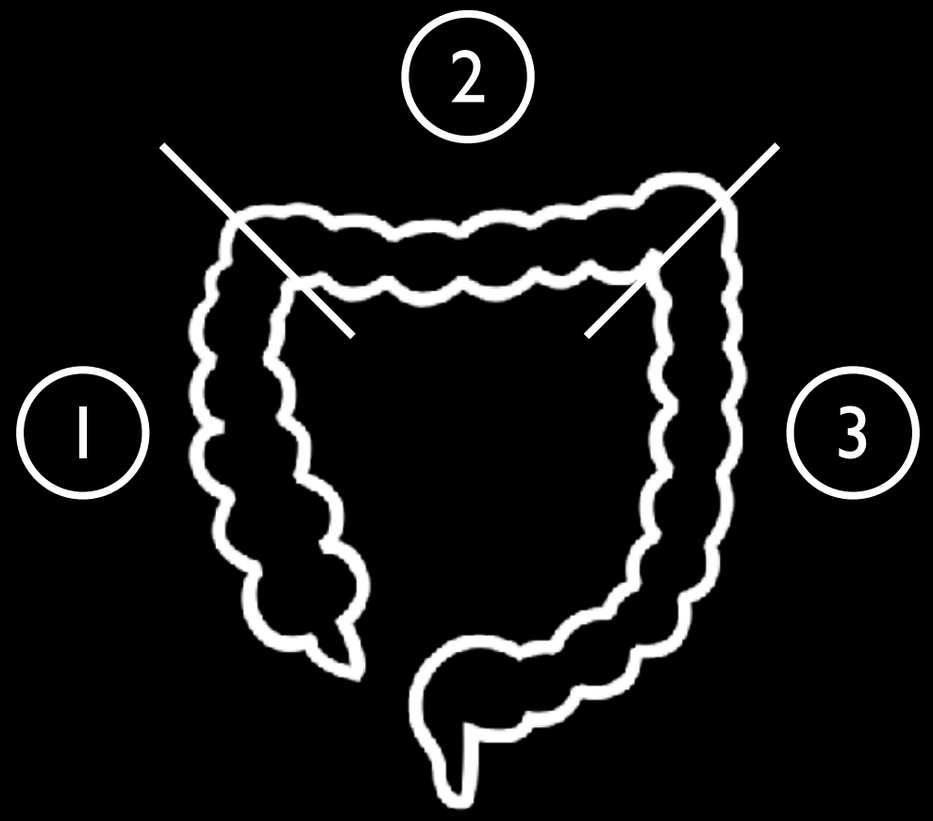
Improve nutritional autonomy

Improve effluent control

Manage chronic abdominal sepsis

When is out-of-circuit bowel worth an anastomosis?

20cm or more

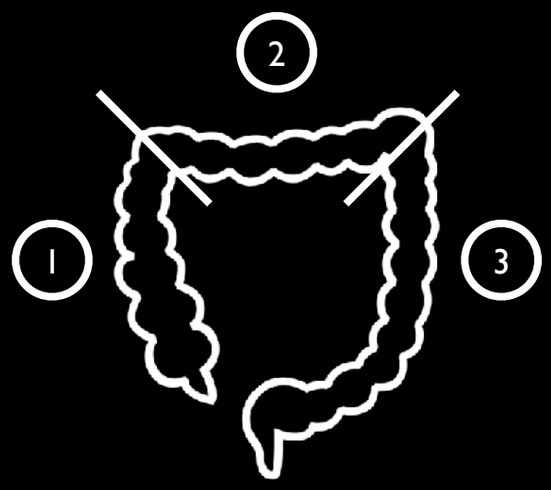


One segment or more

Chyme reinfusion to condition bowel

How will recruitment of additional bowel affect parenteral requirements?

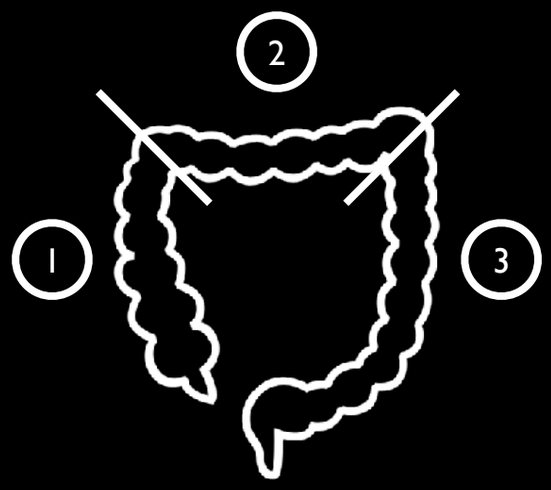
Look at current parenteral needs
1) calories and 2) volume



Look at amount of small and large bowel available

Is a colostomy best?

Look at stoma output - rather than small bowel length



At least one segment per litre

Look at anorectal function before stoma and now

Type III HPN

Lifelong HPN

- Conventional reconstructive surgery
- **Intestinal Tx**
- Growth factor therapy
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Small bowel transplantation

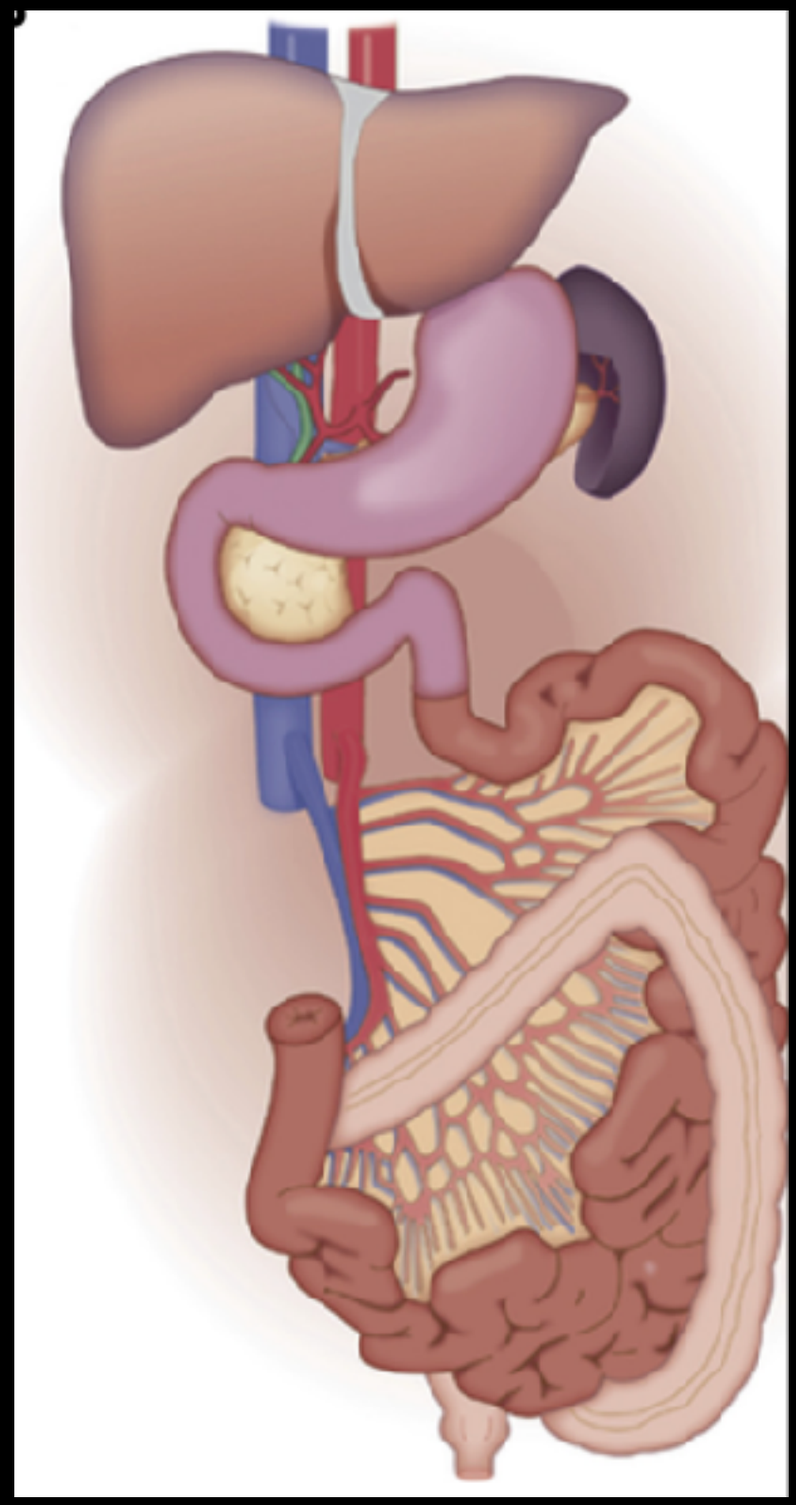
2 widely accepted indications:

End-stage IFALD (fibrosis)

Loss of vascular access

Emerging indication:

Quality of life



Small bowel transplantation

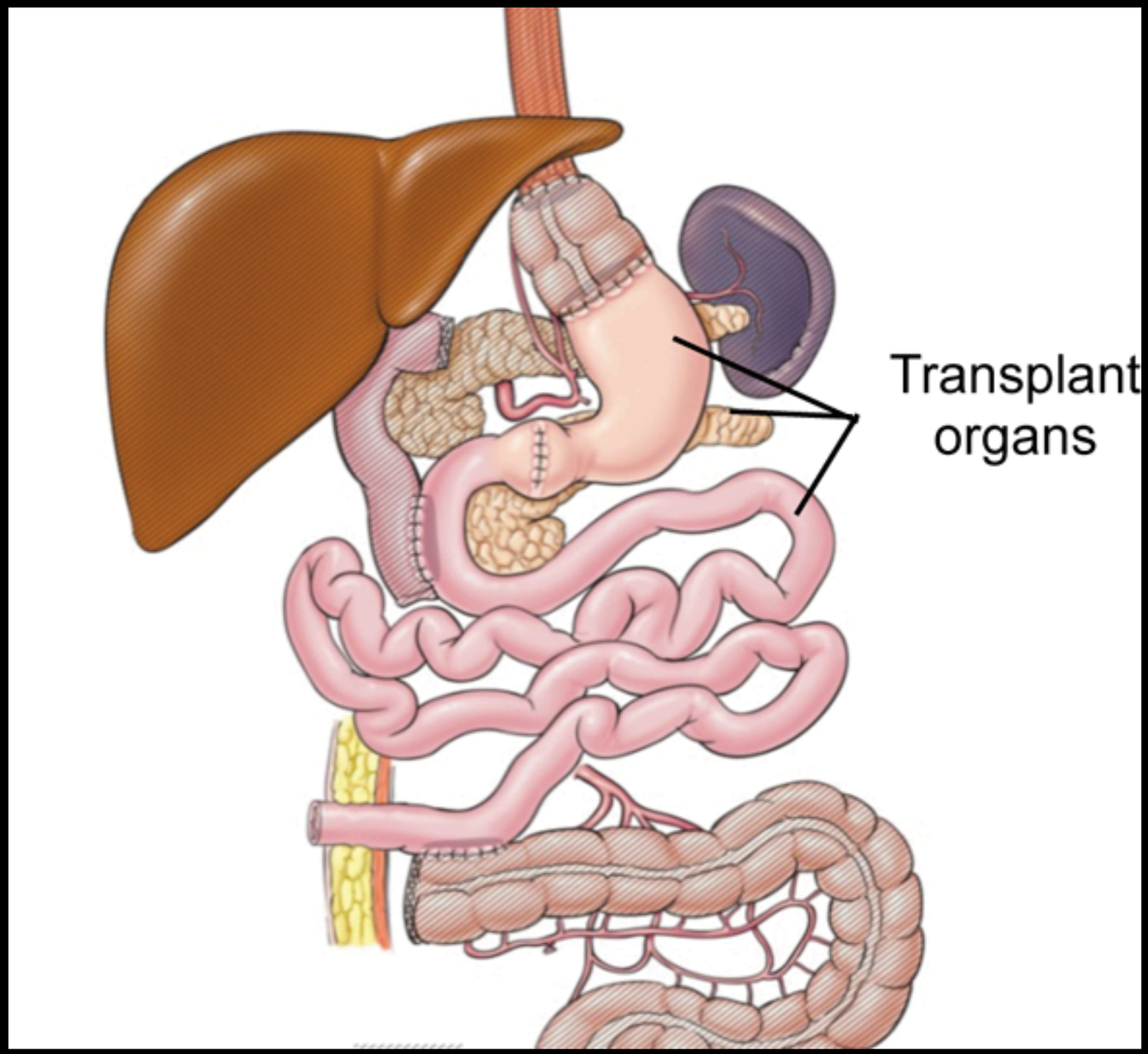
Cambridge, Oxford: 130+

Gothenburg: 36

SBT - small bowel (+colon)

MVT - multivisceral: liver, stomach, pancreas, small bowel

MMVT - modified multivisceral: no liver



Rutter CS et al, Transplantation Proc 2016;48:468.

Small bowel transplantation

Immunosuppression since 2007:

Induction: alemtuzumab + methylprednisolone

Maintenance: tacrolimus + prednisolone + azathioprine

Rejection: methylprednisolone ± rabbit anti-thymocyte globulin (ATG)

Small bowel transplantation

UK experience 2011-2021

	n	90 days	1 year	5 years
Small bowel	81	95 %	83 %	74 %
Small bowel and liver	51	88 %	70 %	39 %

https://www.gov.uk/government/publications/nhs-blood-and-transplant-annual-report-and-accounts-2020-to-2021

Type III HPN

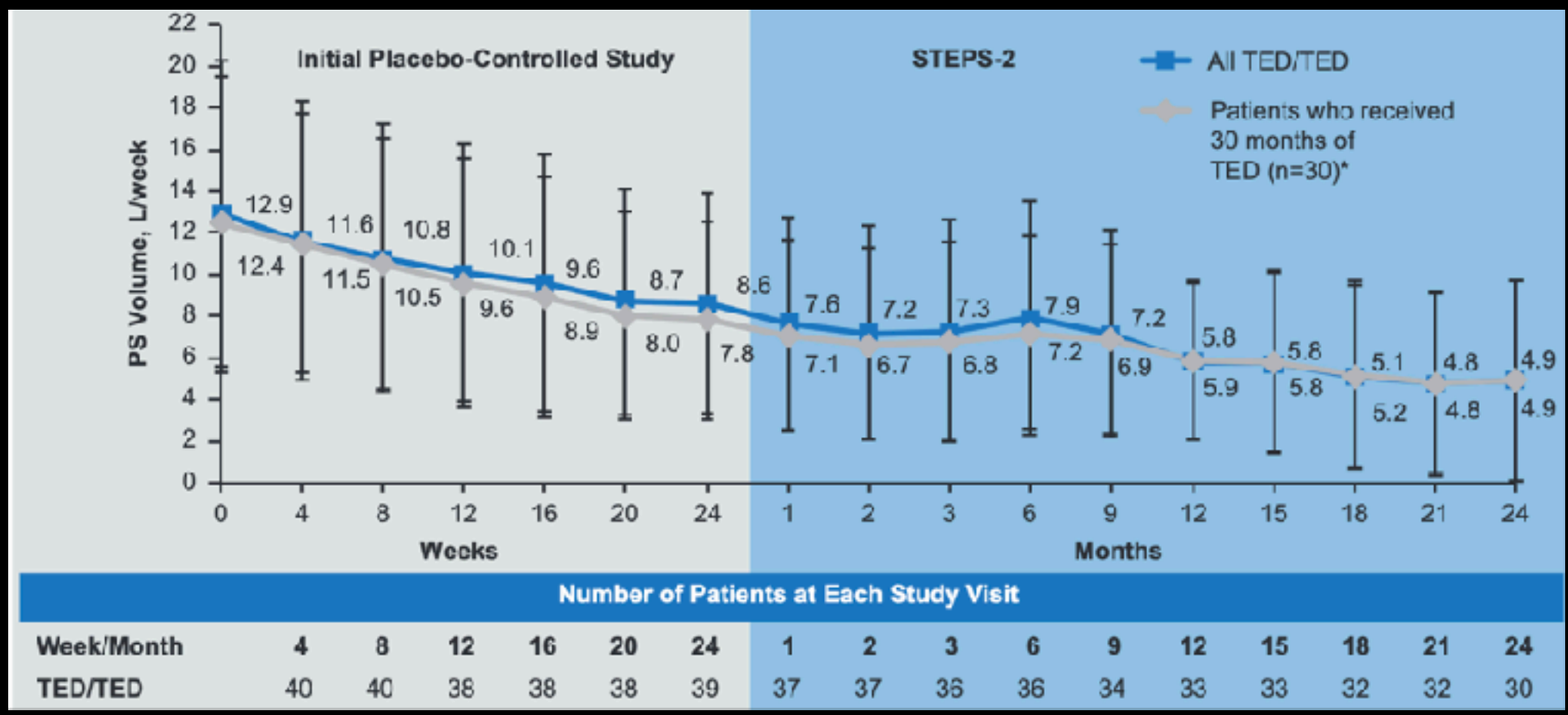
Lifelong HPN

- Conventional reconstructive surgery
- Intestinal Tx
- **Growth factor therapy**
- Intestinal lengthening

Growth factor therapy

GLP-2 analogues (teduglutide)

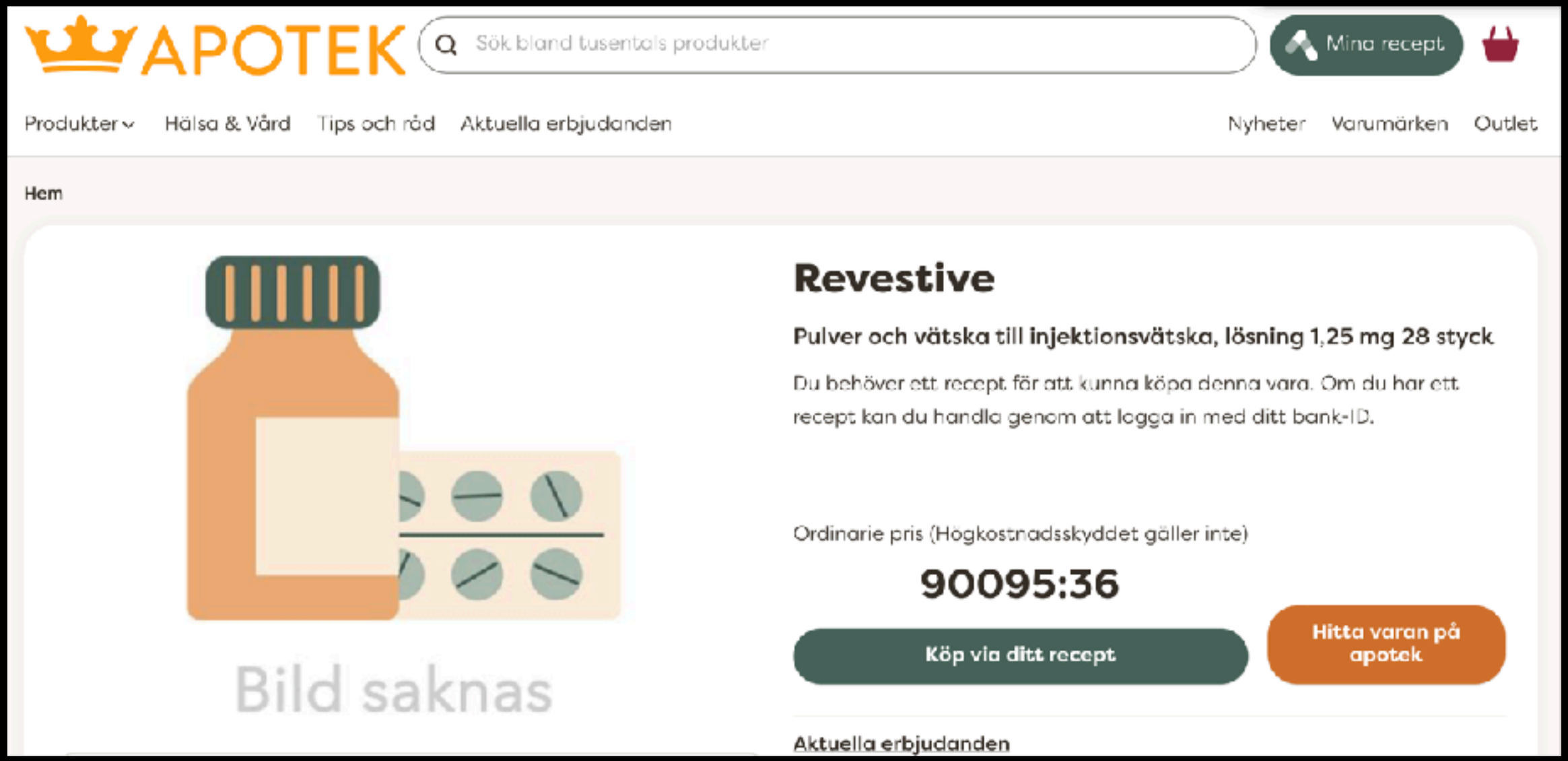
Trophic, ileocolonic brake hormone



Number of Patients at Each Study Visit																
Week/Month	4	8	12	16	20	24	1	2	3	6	9	12	15	18	21	24
TED/TED	40	40	38	38	38	39	37	37	36	36	34	33	33	32	32	30

Schwartz, LK *et al*, Clin Transl Gastroen 2016;7, e142

Growth factor therapy



€ 250,000 per year

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- Conventional reconstructive surgery
- Intestinal Tx
- Growth factor therapy
- **Intestinal lengthening**

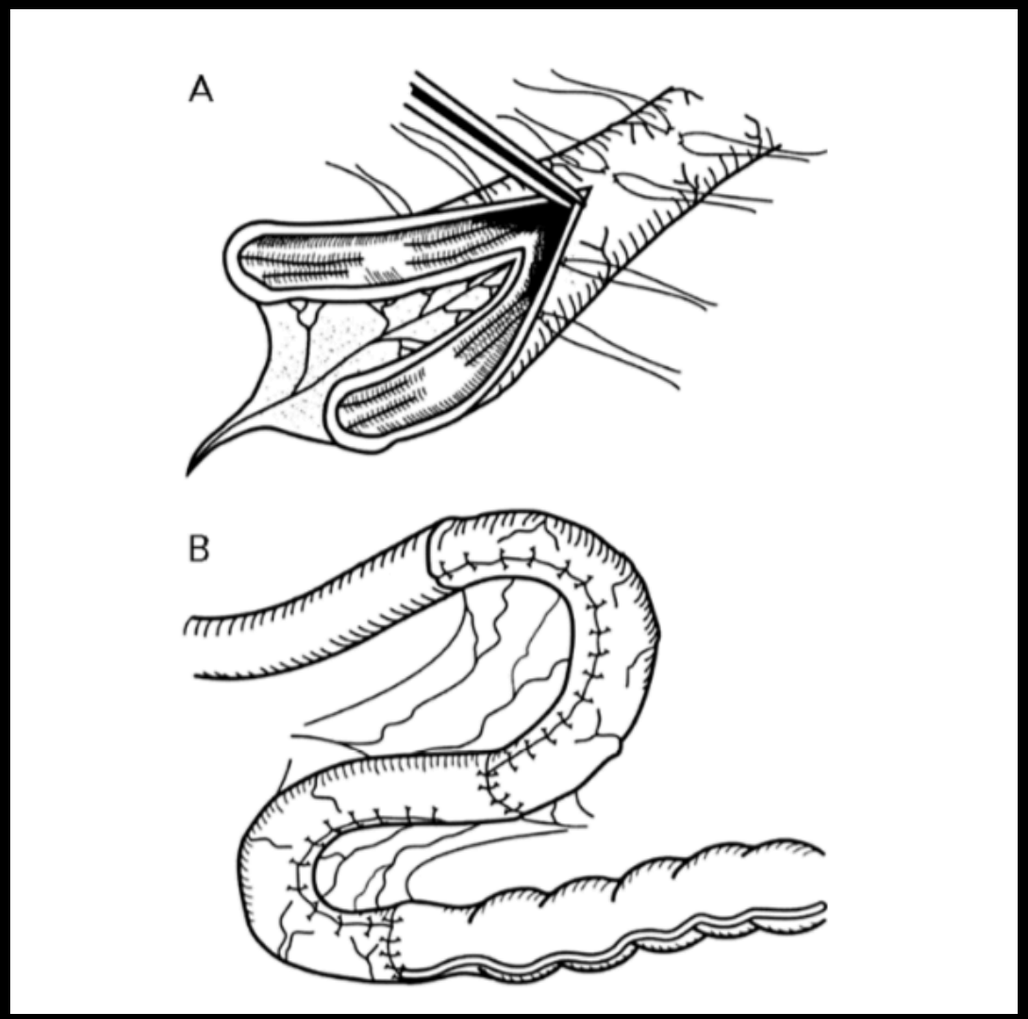
Intestinal lengthening in children

Bianchi procedure, Royal Manchester Children's 1980

Longitudinal intestinal lengthening and tapering (LILT)

Aim: *tapering* to reduce bacterial overgrowth

Also increased absorption



King B *et al*, World J Surg 2012;37:694

Intestinal lengthening in children

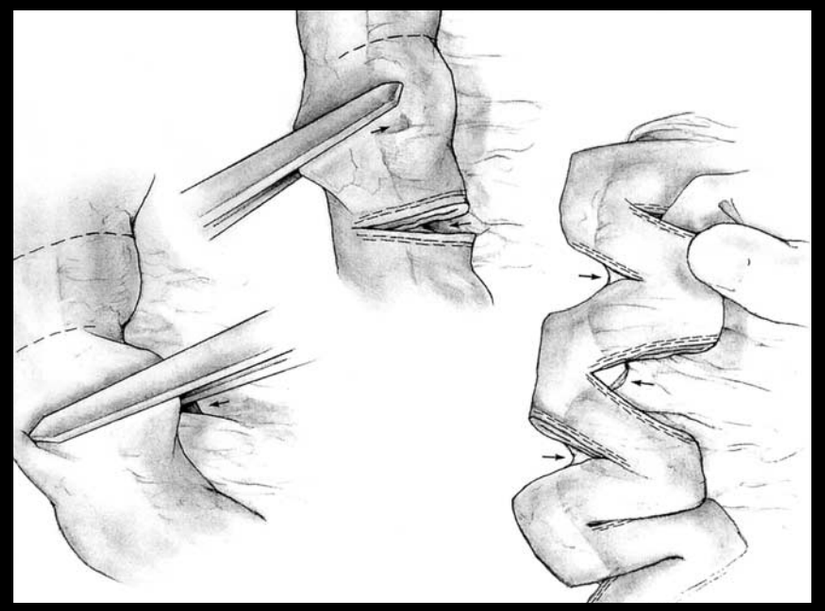
Kim's STEP procedure,
Harvard 2003

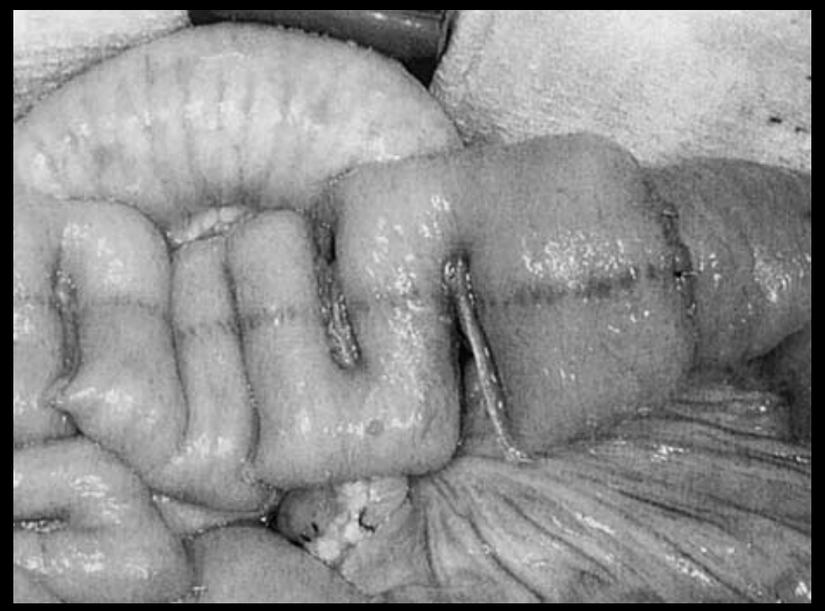
Serial Transverse EnteroPlasty (STEP)

Less complex, repeatable

International registry

>403 children worldwide

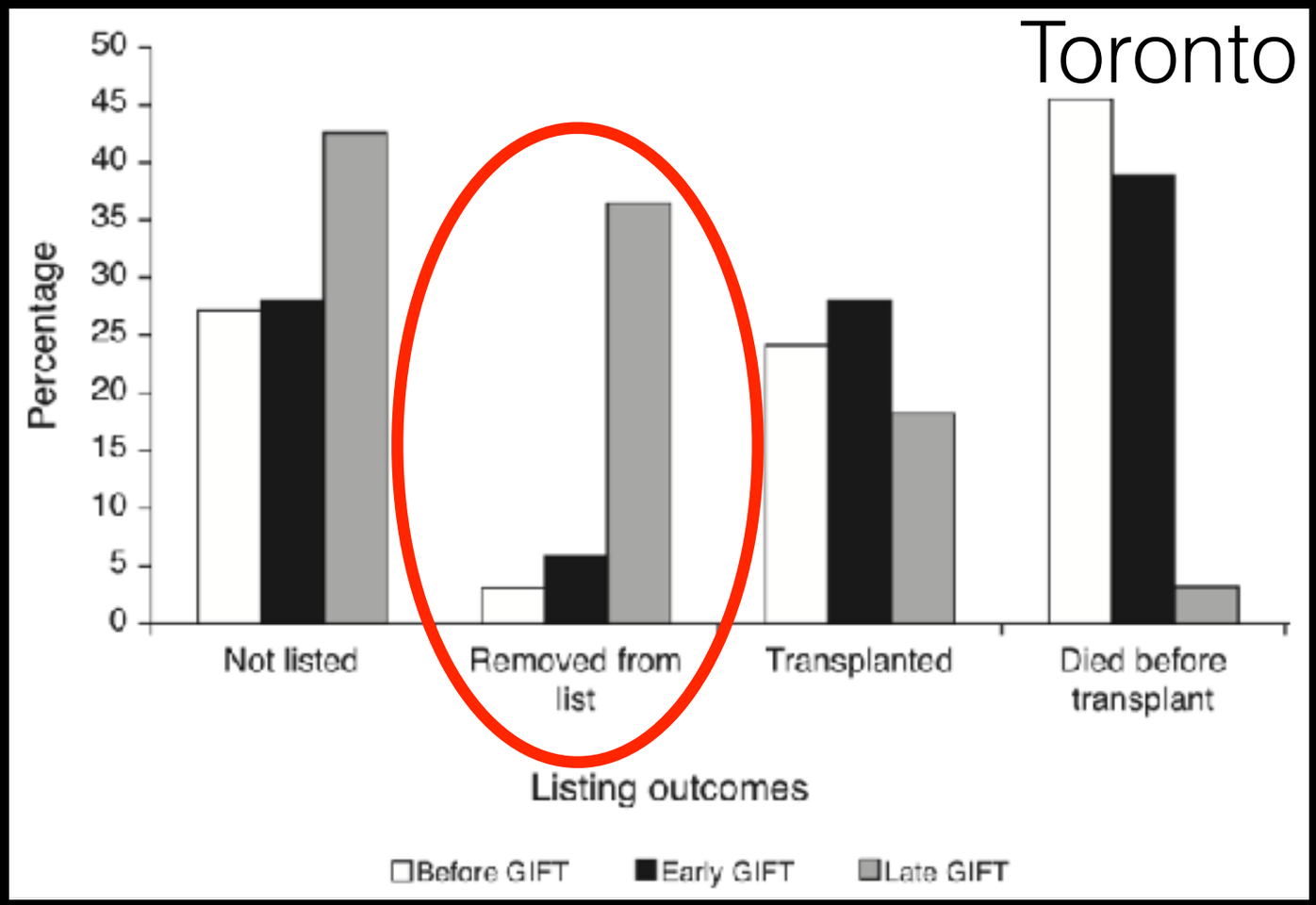




Kim HB *et al*, J Pediatr Surg 2003;38:425. King B *et al*, World J Surg 2012;37:694

Small bowel lengthening vs transplantation

Nebraska: 14% of lengthened *children* required intestinal Tx at 4yrs



Sudan D, *et al*, Ann Surg 2007;246:593. Avitzur Y *et al*, Journal Pediatr Gastroenterol Nutr 2015;61:18

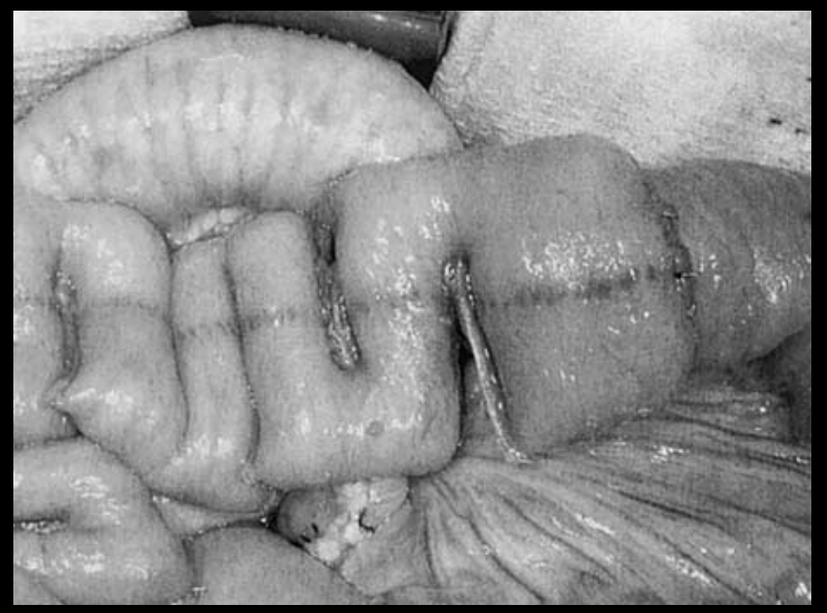
Intestinal lengthening in adults

Published literature:

20 Nebraska

68 Cleveland Clinic

11 Antalaya, Turkey



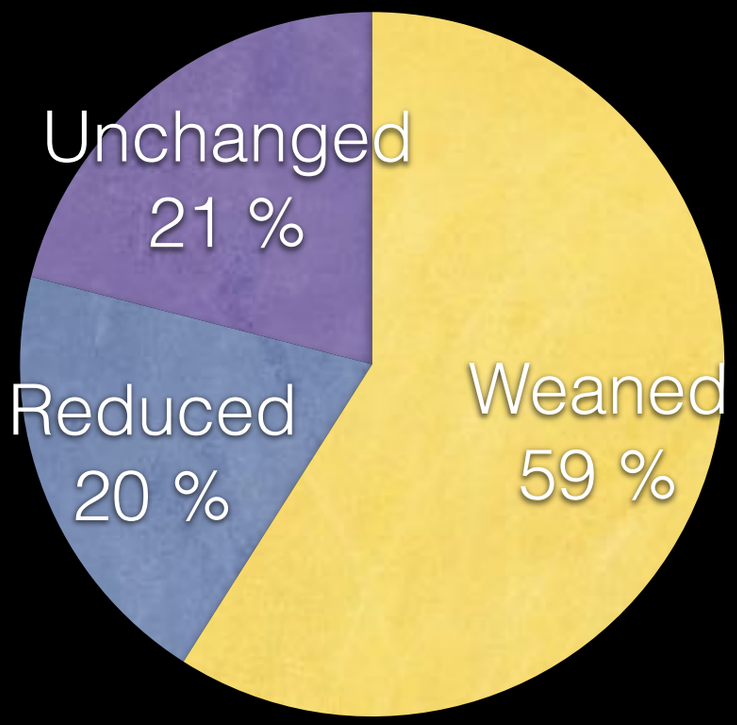
Yannam GR et al, J Gastrointest Surg 2010;14(12):1931. 1.Abu-Elmagd K et al, Ann Surg 2019;270:656.
Yaprak M et al, Turk J Gastroent 2020;32:11.

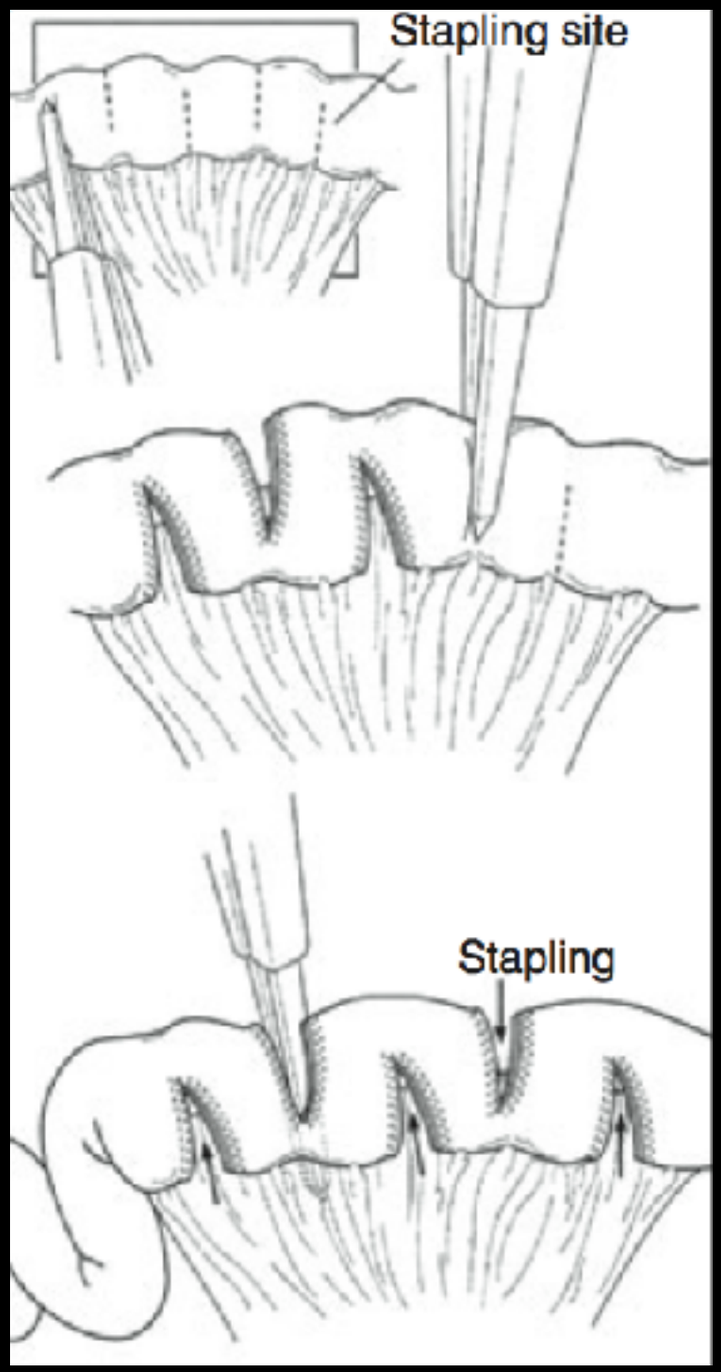
Intestinal lengthening in adults

Outcomes:

20% relaparotomy <30d

0% mortality <30d





Yannam GR et al, J Gastrointest Surg 2010;14(12):1931.

Lifelong HPN

70% survival

Conventional reconstructive surgery

6/10 autonomy

Intestinal Tx

74% survival
Refer *before* cirrhosis!

Growth factor therapy

Evolving

Intestinal lengthening

Underutilised
Promising