



The Lennard-Jones
Intestinal Failure Unit



Dietary management

Dr Alison Culkin

Lead Intestinal Failure Dietitian

St Mark's Hospital

RSM December 2017



Overview

- Effect of resection on absorption
- Evidence for dietary management in short bowel
- Practicalities of integrating diet with the short bowel treatment plan
- Patient education

© St Mark's Hospital, Harrow, London, UK.
All rights reserved. No part of this publication may be reproduced,
stored in an information retrieval system or transmitted by any other means,
whether electronic, mechanical, photocopying, Internet publication,
recording or any other medium without the written consent of the publisher.



Bowel resection

Nutritional consequences depend upon

- Site & extent of resection
- Integrity, function & adaptation of remaining bowel

© St Mark's Hospital, Harrow, London, UK.
All rights reserved. No part of this publication may be reproduced,
stored in an information retrieval system or transmitted by any other means,
whether electronic, mechanical, photocopying, Internet publication,
recording or any other medium without the written consent of the publisher.

Oesophagus

Stomach

Duodenum

Bile

Pancreatic enzymes

Jejunum

Ileum

Colon

Fat

Vitamins

Protein

CHO

Minerals

Fatty acids

Water & fat soluble vitamins

Amino acids and peptides

Mono & disaccharides

Bile salts

Vitamin B12

Water & sodium

© St Mark's Hospital, Harrow, London, UK. All rights reserved. No part of this publication may be reproduced in any form or by any means, whether electronic, mechanical, photocopying, recording or any other medium without the written consent of the publisher.

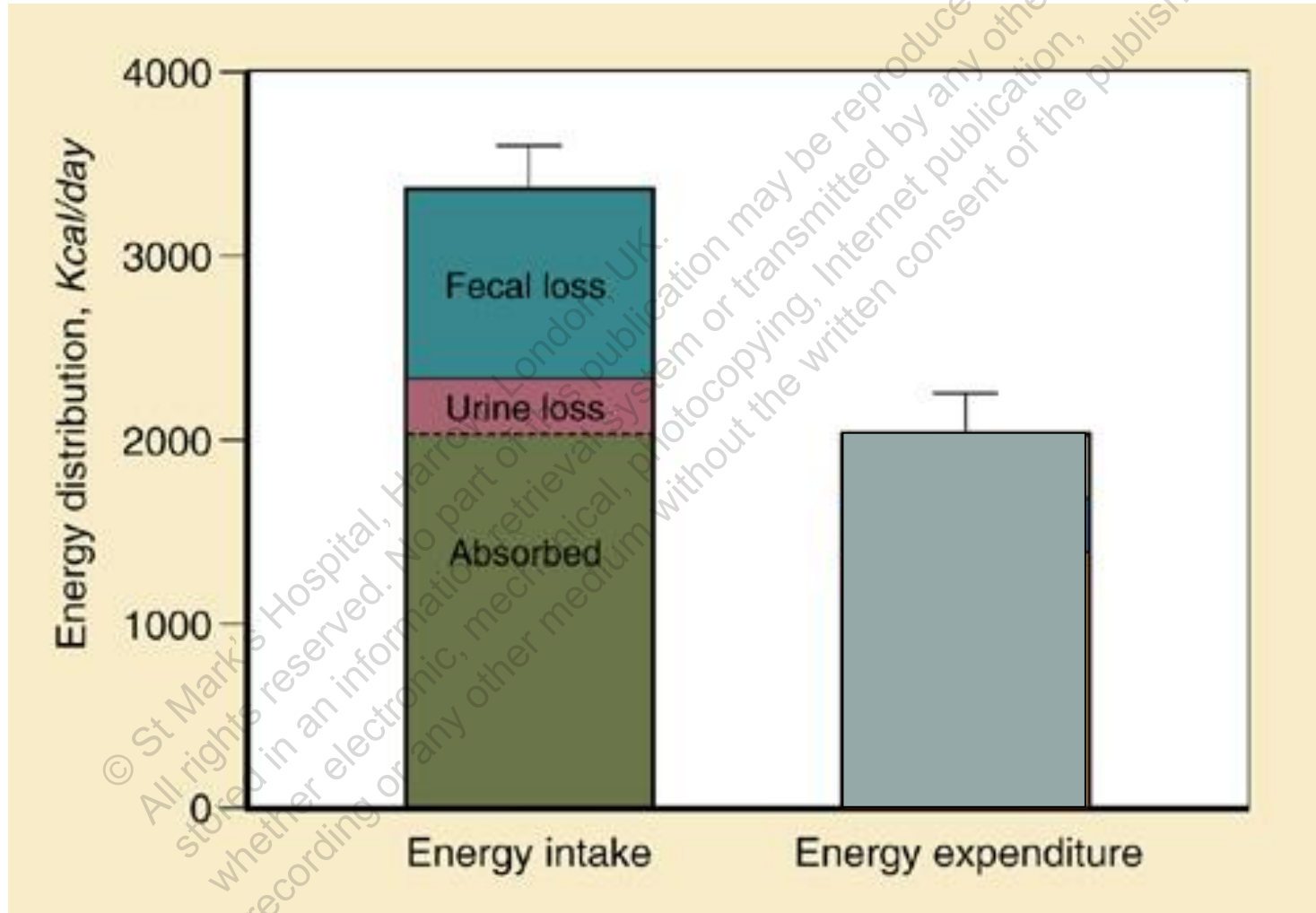
Macronutrient absorption

Study	Woolf (n=8)	Messing (n=10)	Crenn (n=39)
Jejunum (cm)	100-200	0-200	22-190
Colon (n)	3/8	9/10	34/39
% Absorption			
Protein	81 ± 5	61 ± 19	70 ± 17
Energy	62 ± 3	67 ± 12	68 ± 15

High energy 30-60kcal/kg/d = 2000-3000kcal/d

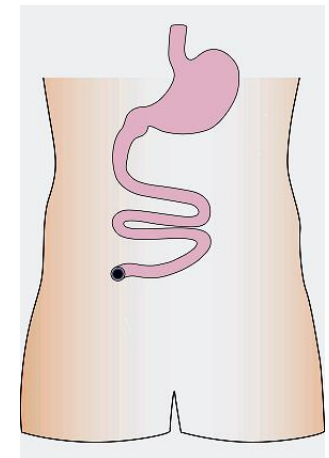
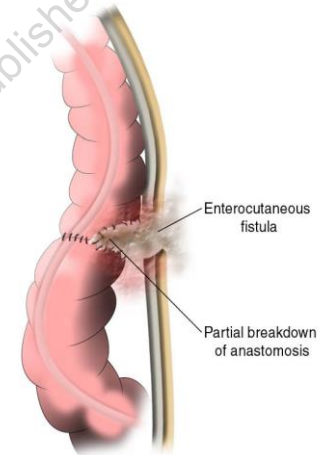
High protein 0.2-0.25gN₂/kg/d = 80-100g protein/d

Energy balance



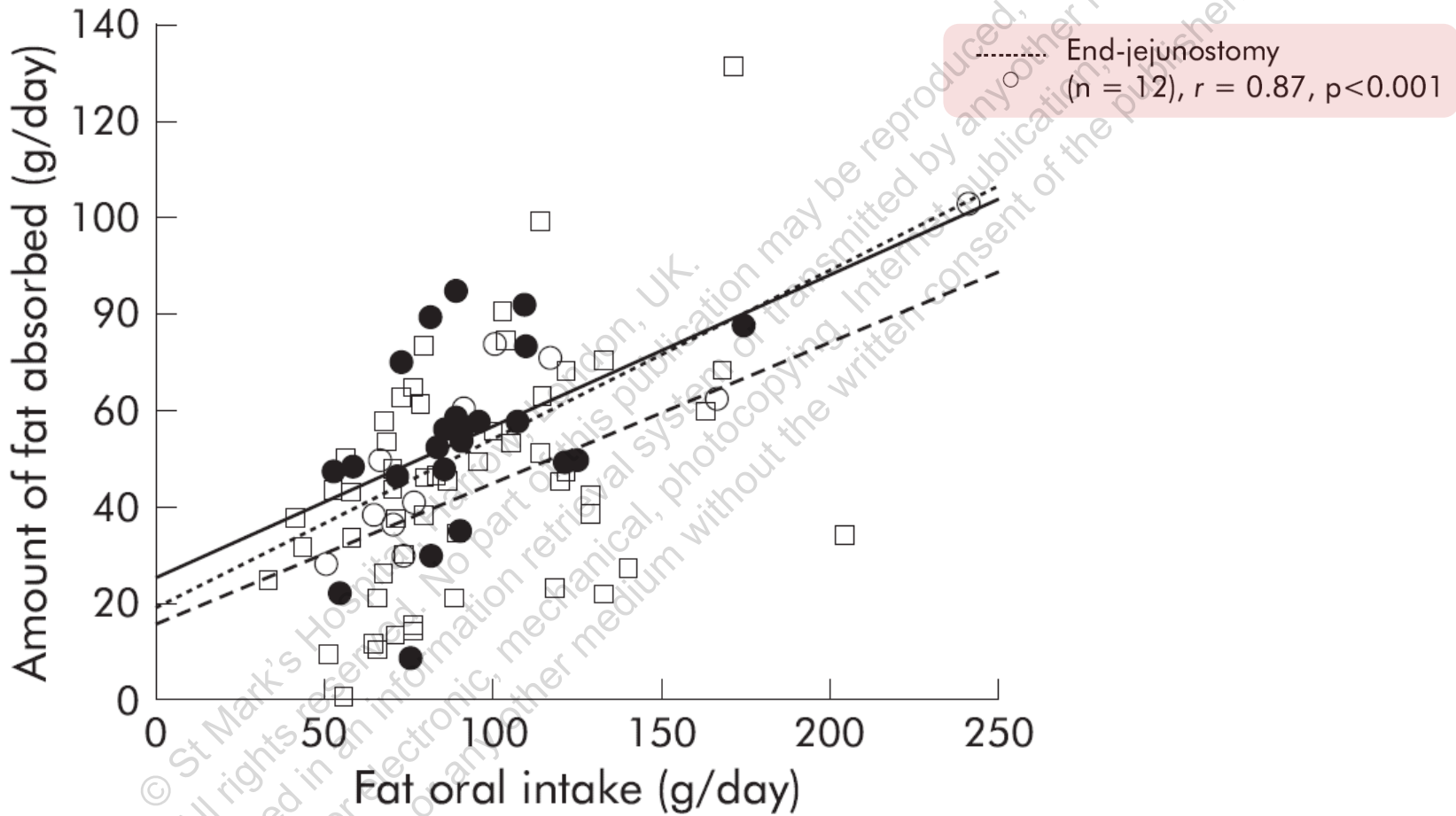
Jejunostomy (& EC fistula)

- Loss of ileum & colon causes
 - Fluid & electrolyte depletion
 - Fast transit
 - Malabsorption of macronutrients, vitamin B₁₂ & bile acids, fat & fat soluble vitamins
- Resulting in weight loss & malnutrition



>100cm jejunum = diet + supplements +/- fluid & electrolytes
<100cm jejunum = Parenteral nutrition + diet

Jejunostomy: Fat



High fat diet recommended



Jejunostomy: Fibre

- Limited evidence
- Studies with mixed patient populations
- Theoretical benefit
 - ↑ intestinal transit time
 - ↑ contact time with gut lumen
- Low fibre diet useful if strictures & adhesions

Low fibre diet recommended

Jejunostomy: Oral supplements

Polymeric, peptide or elemental?

	McIntyre (n=7)	Cosnes (n=6)	Pironi (n= 8)
Jejunum (cm)	80-150	90-150	20-150
Route	Oral & NG	NG	Oral
Intervention	Elemental vs polymeric	Peptide vs polymeric	Peptide vs polymeric
% Absorption			
Fat	→	→	-
Protein	→	↑ Peptide	-
Energy	→	→	↑ Polymeric

No clear benefit from elemental or semi elemental

Oral nutritional supplements

1st line complete

- High energy & protein
- Low volume
- Low osmolality
- Fibre free¹
- Polymeric
 - 1-1.5kcal/ml

1st line modular

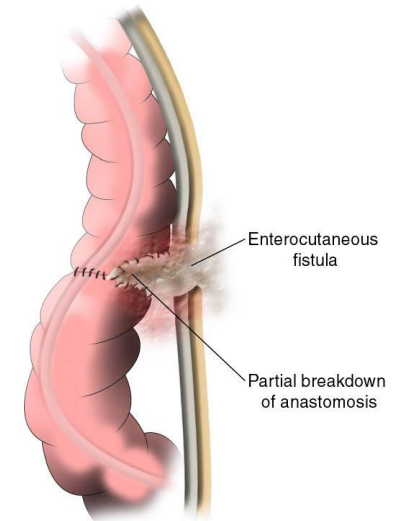
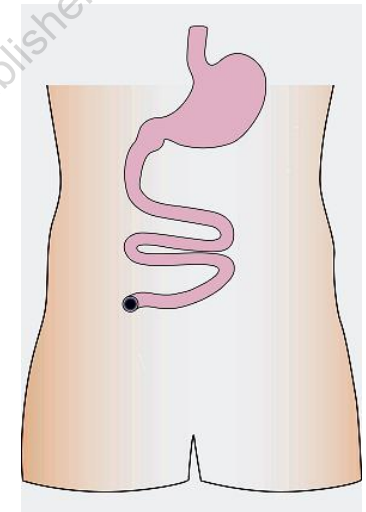
- High energy & protein
- Low volume
- Low osmolality
- Fibre free
 - Calogen extra (LCT)
 - Procal shot (LCT & MCT)
 - Fresubin shot (LCT & MCT)
 - Prosource

Aim to maximise absorption and minimise losses
No benefit from elemental

Recommended diet:

Jejunostomy (and ECF)

Nutrient	Recommendation
Energy	30-60kcal/kg/d
Protein	0.2-0.25g/kg/d
Fat	High
Carbohydrate	Moderate
Fibre	Low
Salt	High
Oral nutritional supplements or enteral feed	Polymeric 1.5kcal/ml fibre free



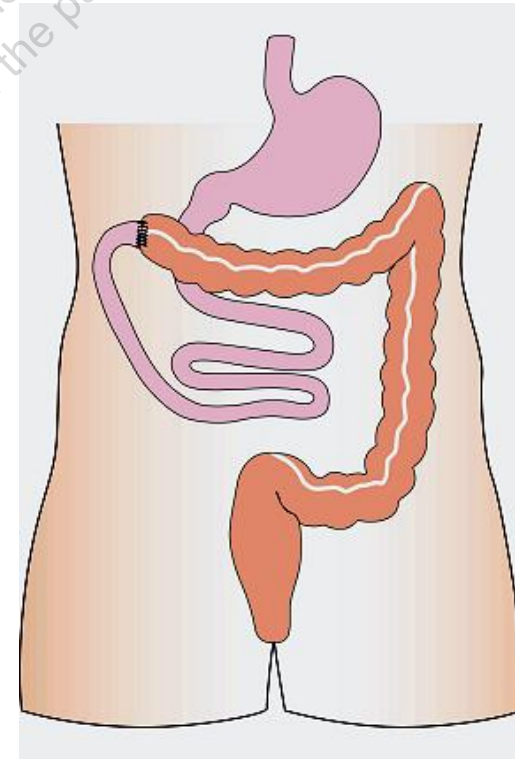
Jejuno-colic anastomosis (JCA)

Loss of terminal ileum causes malabsorption of

- Vitamin B₁₂ & bile acids
- Fat soluble vitamins
- Calcium & magnesium

Presence of colon allows

- Water & sodium absorption
- Slower intestinal transit
- Nutrient absorption
- Salvage of energy from SCFA by microflora



>100cm jejunum + colon = diet +/- supplements

50-100cm jejunum + colon = diet + supplements

<50cm jejunum + colon = PN

JCA: Carbohydrate

14 patients (8 JCA; 6 Jejunostomy)¹

2500kcal

- High CHO
- Low fat

2500kcal

- Low CHO
- High fat

JCA: high CHO

↑Energy from 49 to 69%

CHO colonic digestion can supply 1000 kcal/day²

High CHO diet recommended

JCA: Lactose

Arrigioni *et al* (1994) *Am J Clin Nutr*,
60;926

n=17, 11 JCA & 6 jejunostomy

Mean SB length 67cm

Lactose absorption

- 76% for yogurt
- 50% for milk

Marteau *et al* (1997) *Nutrition*,13;13

n=14, 8 JCA & 6 jejunostomy

Mean SB length 67cm

Lactose free or 20g of lactose
(milk/yogurt/cheese)

Lactose absorption

- 61% JCA, 53% jejunostomy
- No intolerance or difference in faecal weight

No need to limit lactose

JCA: Fat

Unabsorbed fats in colon

↑ Diarrhoea
↑ Ca²⁺ & Mg²⁺ losses
↑ Oxalate absorption & risk of renal stones

Low fat diet (40g)

↓ Diarrhoea & ↓ oxalate absorption¹
↓ Losses of Ca & Mg²

Medium chain triglycerides

10 JCA & 9 jejunostomy³
Diet: 50% LCT or 25% LCT & 25% MCT
MCT: ↑ Fat absorption from 23 to 58%
↑ Energy absorption from 46 to 58%

Moderate fat with MCT diet recommended

JCA: Fibre

Pectin

Water soluble, non-cellulose fibre fermented by microflora to SCFA. Enhanced absorption in rodent studies

Methods

N=6, SB length 50cm
4g of oral pectin tds for 2 weeks

Results

↑ SCFA production & excretion (p=0.2)
No difference in absorption or faecal volume
Non significant ↑ in gastric emptying & orocolonic transit

Conclusion: Pectin ↑ SCFA production but no effect on intestinal absorption

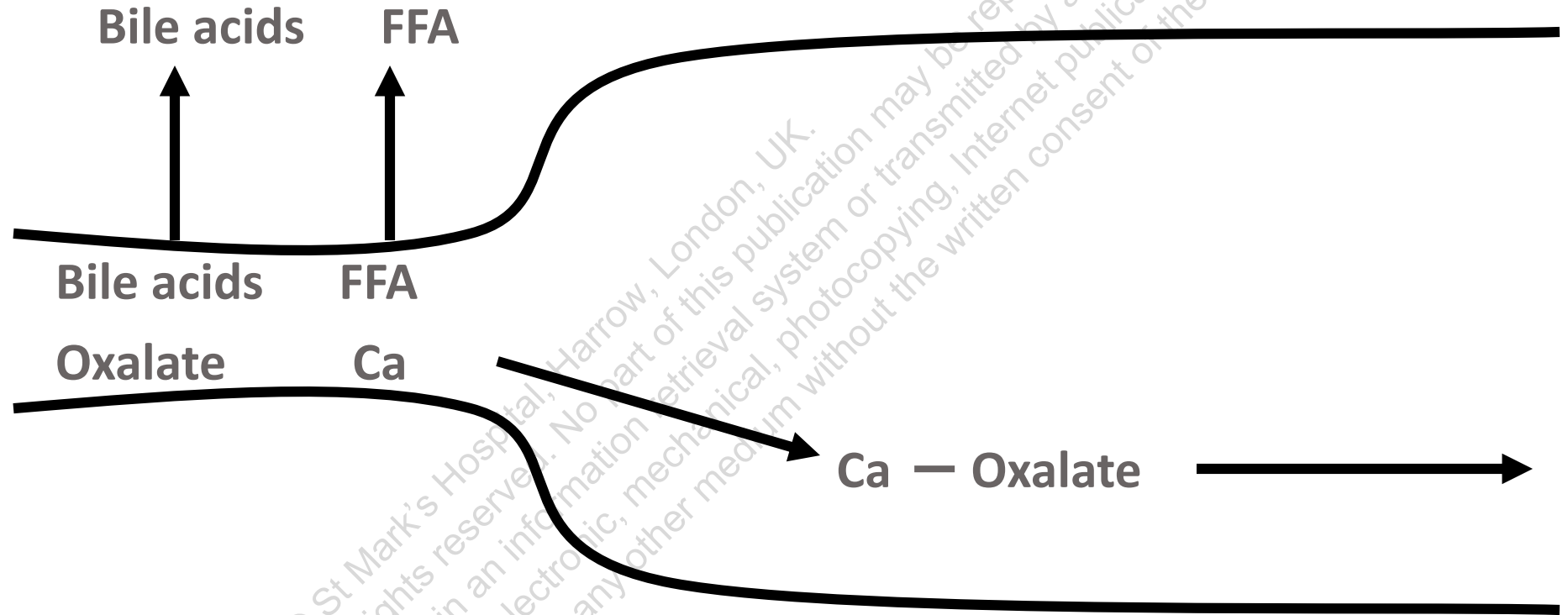


Renal stones

25% JCA patients develop
symptomatic renal stones

© St Mark's Hospital, Harlow, London, UK.
All rights reserved. No part of this publication may be reproduced,
stored in an information retrieval system or transmitted by any other means,
whether electronic, mechanical, photocopying, Internet publication,
recording or any other medium without the written consent of the publisher.

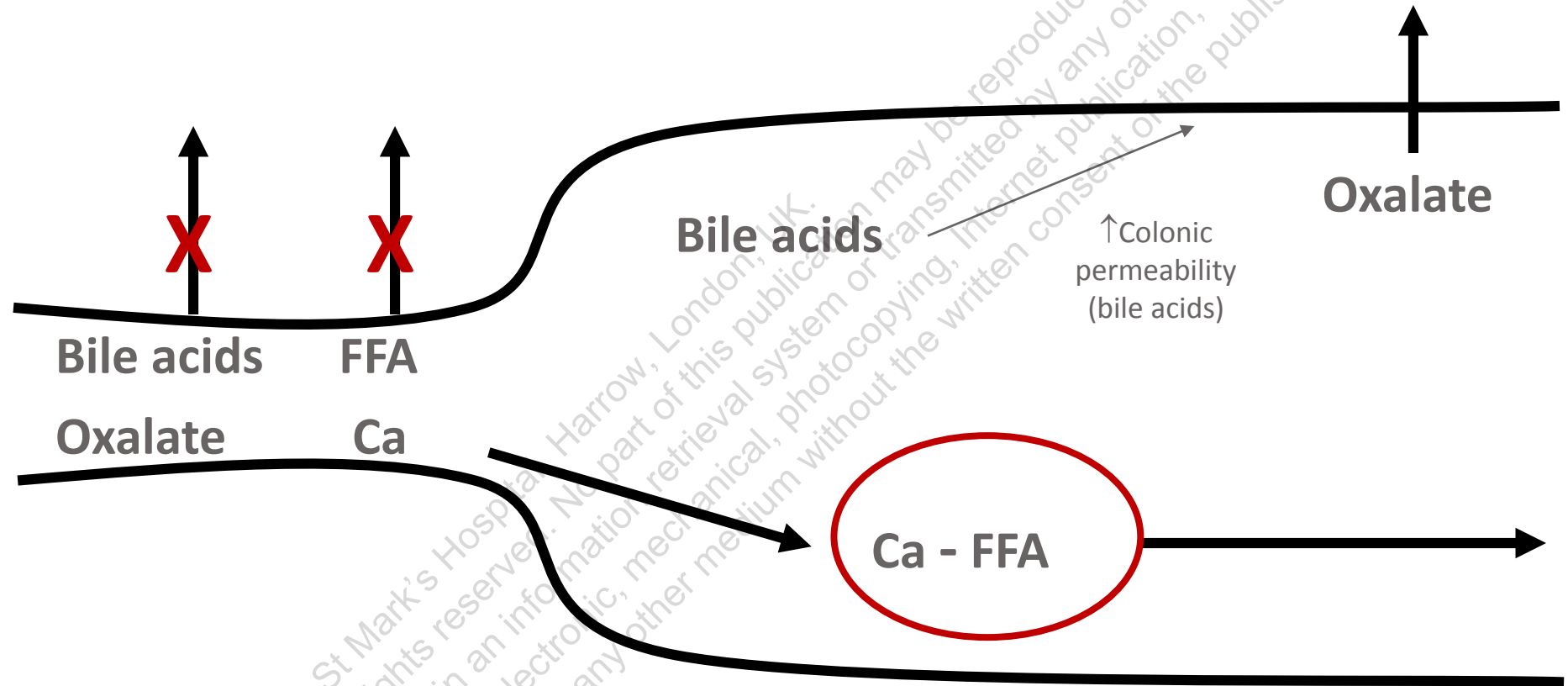
Normal absorption



FFA – free fatty acids

© St Mark's Hospital, Harrow, London, UK.
All rights reserved. No part of this publication may be reproduced,
stored in an information retrieval system or transmitted by any other means,
whether electronic, mechanical, photocopying, Internet publication,
recording or any other medium without the written consent of the publisher.

JCA



Preferential binding of Ca^{2+} by unabsorbed fats releases oxalate for absorption resulting in increased colonic oxalate absorption



Prevention

- Avoid oxalate
 - Spinach, beetroot, rhubarb, peanuts, branflakes, nuts, chocolate, parsley & tea
- Fat in moderation
- Encourage calcium
- Avoid chronic dehydration

© St Mark's Hospital, Harrow, London, UK.
All rights reserved. No part of this publication may be reproduced,
stored in an information retrieval system or transmitted by any other means,
whether electronic, mechanical, photocopying, Internet publication,
recording or any other medium without the written consent of the publisher.

Oral nutritional supplements

1st line complete

- High energy & protein
- Low volume
- Low osmolality
- Fibre free
- MCT based
 - 1-1.5kcal/ml
 - Peptamen
 - Vital 1.5

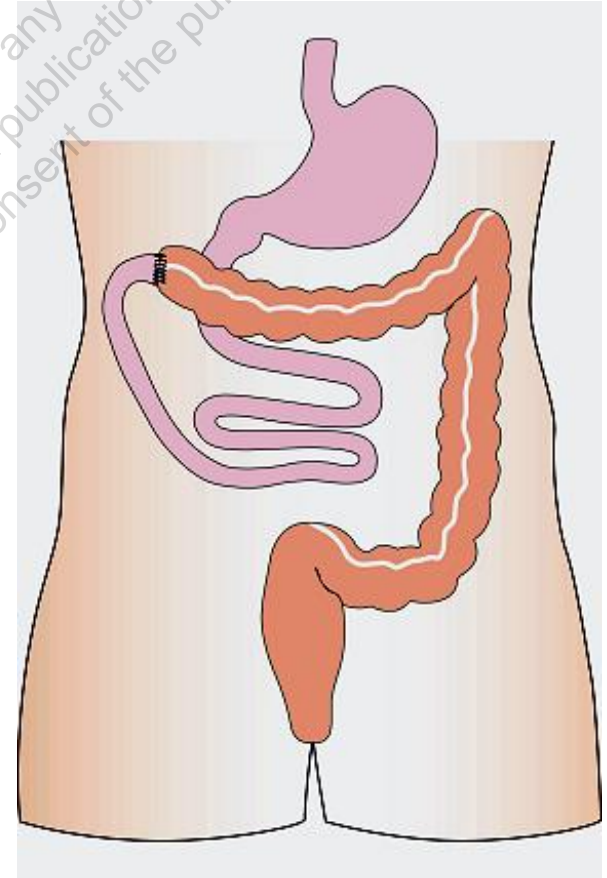
1st line modular

- High energy & protein
- Low volume
- Low osmolality
- Fibre free
 - Liquigen & MCT oil
 - MCT Duocal
 - Procal shot (LCT & MCT)
 - Fresubin shot (LCT & MCT)

Aim to maximise absorption and minimise losses
No benefit from elemental

Recommended diet: JCA

Nutrient	Recommendation
Energy	30-60kcal/kg/d
Nitrogen	0.2-0.25g/kg/d
Fat	Low (MCT)
Carbohydrate	High
Fibre	Low - medium
Salt	Normal
Oxalate	Low
Oral nutritional supplements or enteral feed	MCT based



Micronutrients

Deficiencies can develop

- B₁₂ if >60cm terminal ileum resected
- Mg & zinc if intestinal losses high

Monitor for deficiencies & toxicities

- Vitamin C, E & K were suboptimal when weaning off PN^{1,2}

If deficiency identified

- Appropriate individual supplement
- 1-2 x RDA from complete supplement



Treatment plan

Maximise oral intake & hyperphagia

Choose nutritious meals

- Include protein - meat, fish, cheese, eggs, milk, yogurt, pulses (if vegetarian)
- Include carbohydrate - cereals, bread, rice, pasta, potato

Choose nutritious puddings

- Milk pudding, custard, trifle, yogurt, ice cream

Choose nutritious snacks

- Sandwiches, cereal, cakes, crisps, biscuits, chocolate, cheese & biscuits

Supplement meals with energy

- Butter, margarine, sugar, honey, cheese, milk powder, cream



Treatment plan: monitoring response

Outcome

- If adequate absorption achieved, withdraw PN & prepare patient for discharge
- If inadequate absorption achieved proceed to enteral nutrition



Enteral nutrition

- Supplementary
- Commence via NG tube before inserting gastrostomy
- Slow process
- Whole team (& patient) need to understand

© St Mark's Hospital, Harlow, London, UK.
All rights reserved. No part of this publication may be reproduced,
stored in an information retrieval system or transmitted by any other means,
whether electronic, mechanical, photocopying, Internet publication,
recording or any other medium without the written consent of the publisher.



Continuous enteral feeding

4 jejunostomy & 11 JCA (SB length 25-130cm)

Polymeric via NG vs usual diet vs polymeric + usual diet

Results

- No difference in faecal volume
- ↑ macronutrient absorption NG polymeric + usual diet compared to usual diet ($p < 0.001$)
- Energy gain $> 1000 \text{ kcal/d}$ with polymeric via NG

Continuous administration crucial for ↑ absorption

Enteral Feeds

Jejunostomy

- High energy & protein
- Low volume
- Low osmolality
- Fibre free
- Polymeric
 - 1-1.5kcal/ml

Jejunocolic anastomosis

- High energy & protein
- Low volume
- Low osmolality
- Fibre free
- Polymeric
 - 1-1.5
- Semi elemental with MCT
 - 1-1.5kcal/ml

Aim to maximise absorption and minimise losses
No benefit from elemental

Sodium

- Need additional sodium to reach optimum concentration of sodium in jejunal lumen
- Aim 100mmol sodium/1000ml of feed
- 30% sodium chloride solution (10ml = 50mmol)
- Use oral rehydration solutions for flushing if unable to tolerate orally



Education

Method

- Out patients recruited
- Baseline assessment
 - Knowledge
 - Oral intake & intestinal output
 - Nutritional status
 - Quality of life

Intervention

- Information booklet given and explained with guidance tailored to the individual depending on:
 - Clinical & nutritional status
 - Intestinal anatomy and current intake
- Follow-up assessment 3-6 months later

Results

- 48 patients
- Knowledge improved after receiving education
- Increase in oral energy
- Reductions in HPN energy, nitrogen, volume & frequency

Positive effect of education resulting in clinical benefits

Education



The Lennard-Jones
Intestinal Failure Unit

Short Bowel
Your guide to eating and
drinking with a very high
output stoma or fistula

Name: _____

Date: _____

Dietitian: _____

<50cm



The Lennard-Jones
Intestinal Failure Unit

Short Bowel
Your guide to healthy
eating and drinking with a
stoma or fistula

Name: _____

Date: _____

Dietitian: _____

<200cm BMI >25



The Lennard-Jones
Intestinal Failure Unit

Short Bowel
Your guide to eating and
drinking when you have
your colon

Name: _____

Date: _____

Dietitian: _____

>50cm healthy BMI



The Lennard-Jones
Intestinal Failure Unit

Short Bowel
Your guide to eating and
drinking with a stoma or
fistula

Name: _____

Date: _____

Dietitian: _____

<200cm & colon



Conclusion

- Aim of diet is to optimise residual intestinal function
- Improvements in absorption due to hyperphagia should be encouraged to maintain nutritional status
- Diet composition crucial and relates to anatomy and nutritional status
- Patient education is essential to minimise dependence or achieve independence from parenteral support