



# Prescribing IV & PN safely: A case based discussion

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A decorative mosaic border at the top of the slide, featuring a stylized face with large eyes and a wide mouth, rendered in blue, red, and yellow tiles.

# Introduction

- Case
- Fluid management post operatively
- Refeeding syndrome



# Case

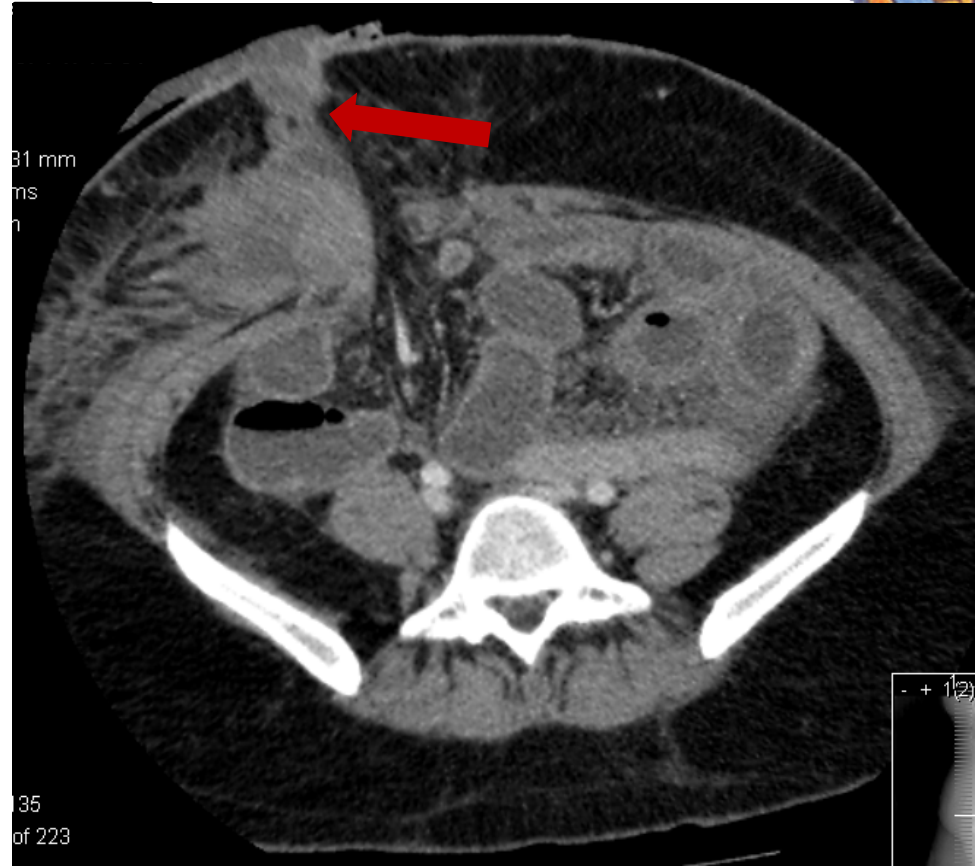
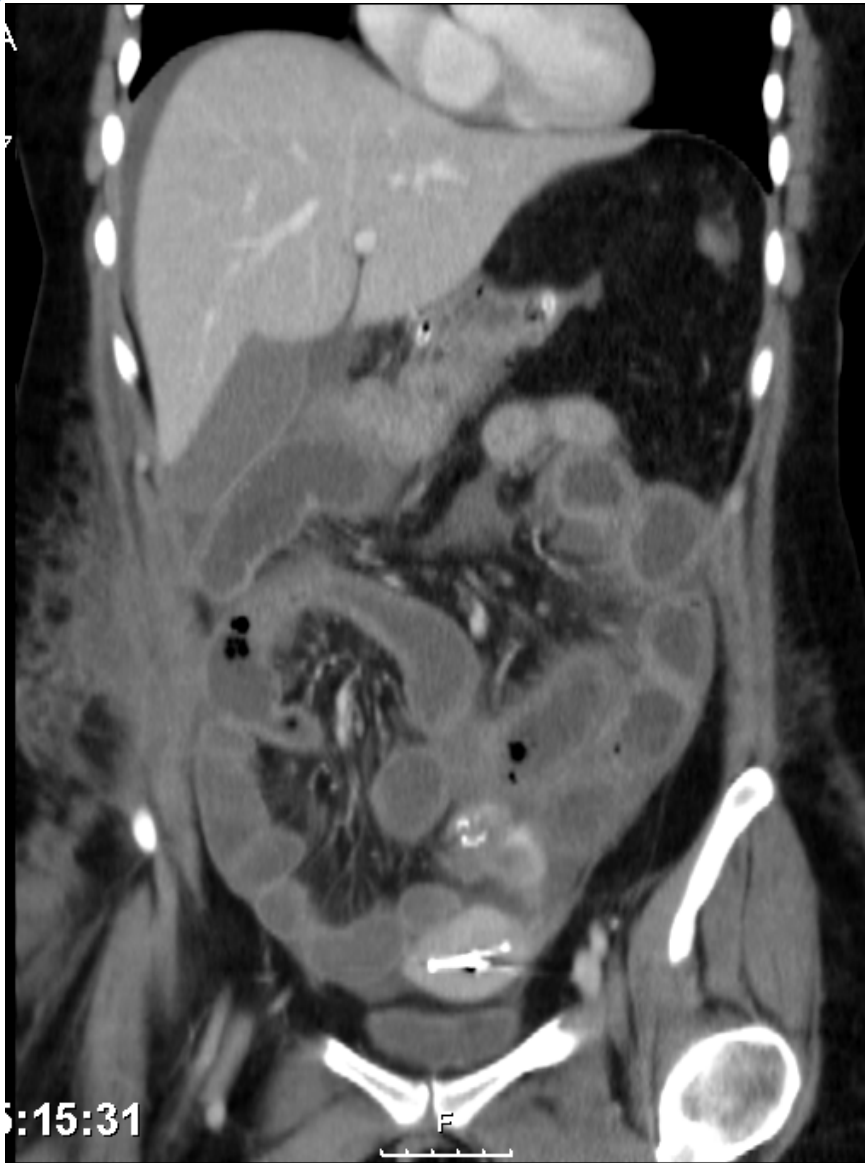
- 23 year old female
- Diagnosed with ulcerative colitis in 2008
- Previous PE x 2 in 2009
- Daily medications
  - Prednisolone 30mg od
  - Omeprazole 20mg od
  - Azathioprine 150mg od
  - Mesalazine 800mg tds
  - Adcal D3 1 tab bd
  - Warfarin 7mg od
- Failed medical therapy
- Admitted for 2 stage panproctocolectomy with pouch

# Progress

Day	
0	Restorative proctocolectomy & loop ileostomy
2	Started soft diet, stoma working
3	Stoma not working with
4	Vomited 800 ml Stoma not working CVC in

What now?

Day	Intake	Output	Volume
-1		111	1000
0		111	1000
1		90	3000
2	1L	30	1000
3	1L O	154	1000
4	1250ml 2 units b	193	1250
<b>TOTAL</b>		<b>729</b>	<b>8.25L</b>



Report: Small bowel obstruction with transition point at the prestomal segment.  
No evidence of pouch leak. No drainable collection

# Progress

Day	
5	U/O 40-50ml/hr (range 10-100)
6	Surgery Ischaemic small bowel at level of loop ileostomy Small bowel resection and closure of loop ileostomy U/O not fully recorded as in theatre
7	U/O 10-50ml/hr and >30 recorded in notes

Day	Fluids	Electrolytes	Sodium	Chloride	Volume
5	1500ml Gelofusine 1L 0.9% saline 2 units blood 1L Hartman's	5mmol KCL	516	445	3500
6	2L Hartman's 1L Dextrose saline 1L Gelofusine 2 units blood	10mmol KCL 20mmol KCL	446	372	4000
	<b>TOTAL</b>		<b>1691</b>	<b>1506</b>	<b>15.75L</b>



# Post operative fluid recommendations

## Recommendation 18

Patients requiring continuing iv maintenance fluids, these should be:

- Sodium poor
  - Low volume
- } until the patient has returned their Na & fluid balance over the perioperative period to zero

## Recommendation 21

Patients who are oedematous

- Must treat hypovolaemia if present
- Followed by a gradual persistent negative sodium & water balance (based on urine sodium concentration)

# Assessment & monitoring of fluid balance



Dry mouth, sunken face, skin turgor



Systolic bp <100mmHg  
Heart rate >90 beats/minute  
Respiratory rate >20 breaths/minute  
National Early Warning Score (NEWS)  $\geq 5$



Capillary refill  
>2 seconds or cold peripheries



Fluid balance  
Serum sodium poor indicator of sodium status. Use urine sodium

# Progress

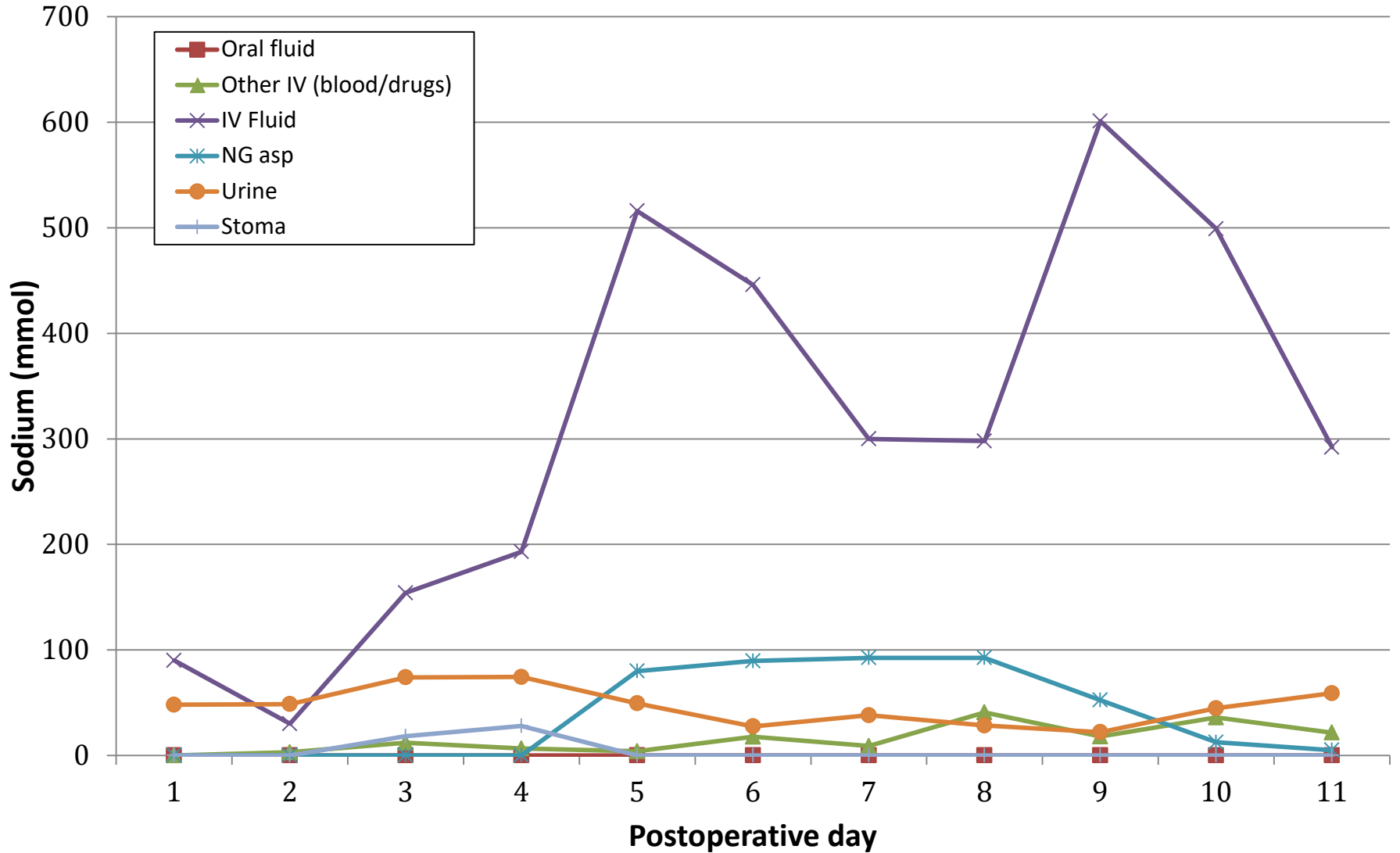
Day	
10	<p>CVC infection <i>Klebsiella pneumoniae</i>. Peripheral access for IV Aim to maintain U/O &gt;30ml/hr</p> <p>Discussed with anaesthetic SHO re fluids – no evidence of pulmonary oedema, JVP not raised 2 hours later JVP clearly visible U/O 15ml/hr Urea 5.5, Creatinine 46 Room to fill 3rd space losses (500ml Gelofusin + 1L Hartman's)</p>
11	<p>U/O 13ml/hr. No improvement despite Gelofusin. Pedal oedema. Stoma dusky with foul smelling fluid from edges. U/O ↑ to 40ml/hr after urinary catheter flushed Abdomen slightly distended &amp; free fluids</p>
12	Pt improvement
13	O/E oedematous. NGT ~100ml

# Post-operative fluids

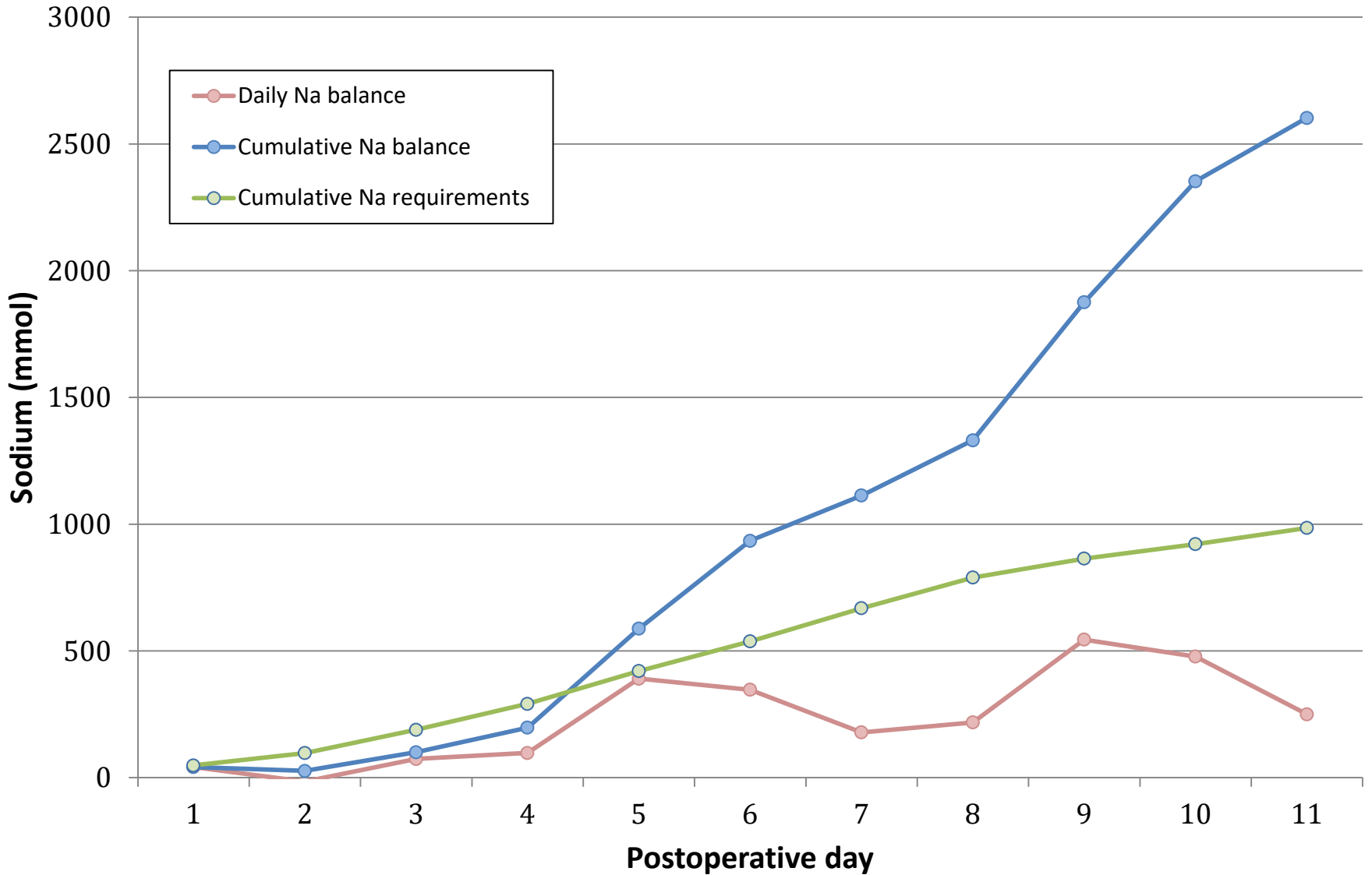
Day	Fluids	Electrolytes	Sodium	Chloride	Volume
7	1L Hartman's 3L Dextrose Saline 500ml Gelofusine	5mmol KCL	298	261	4500
8	4L Hartman's 500ml Gelofusine	20mmol KCL	601	504	4500
9	1L Gelofusine 1L Hartman's 2L Dextrose Saline 1L 0.9% Saline	8mmol Mg 5mmol KCL 20mmol KCL	499	445	5000
10	1L Dextrose Saline 2L Hartman's	20mmol KCL 10mmol KCL	292	252	3000
	<b>TOTAL</b>		<b>3381</b>	<b>2968</b>	<b>32.75L</b>

High risk of hyperchloraemic acidosis

# Sodium balance



# Sodium balance



# Right fluid for losses

## Vomiting and nasogastric tube loss

Gastric fluid contains:

- 20–60 mmol Na<sup>+</sup>/l
- 14 mmol K<sup>+</sup>/l
- 140 mmol/l Cl<sup>-</sup>/l
- 60–80 mmol H<sup>+</sup>/l.

Excessive loss causes a hypochloraemic (hypokalaemic), metabolic alkalosis. Correction requires supplemental K<sup>+</sup> and Cl<sup>-</sup>.



**How would you feed this patient ?**

•A Oral nutritional supplements

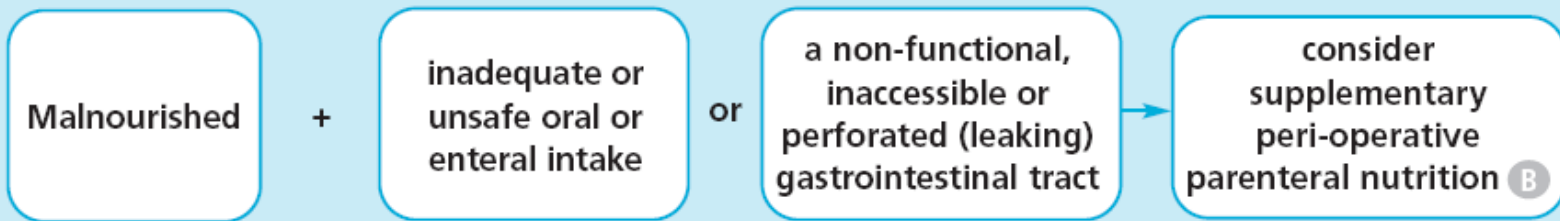
•B: **Parenteral Nutrition**

•C Continue NG aspiration & NBM

•D: Start NG Feeding

# NICE 2006 - Parenteral nutrition

## Surgical patients



If intestinal tolerance persistently limits enteral tube feeding in surgical or critical care patients, use parenteral nutrition to supplement or replace enteral tube feeding. **B**

# Parenteral nutrition: assessment

## Anthropometry & Biochemistry

- **BMI =28.2kg/m<sup>2</sup>**
  - ▣ Weight 87kg but oedematous
  - ▣ Estimated dry weight 73 kg
- **% weight loss = 8.8%**
  - ▣ Weight gain due to steroids ~80kg
  - ▣ Usual weight 78kg (5 months ago)
  - ▣ No nutrition for 12 days

WCC	8.5
Sodium	138
Potassium	4.0
Urea	3.4
Creatinine	41
CRP	41↑
Bilirubin	31↑
AP	147
ALT	28
Albumin	17
Adj Ca	2.35
Magnesium	0.6↓
Phosphate	0.95

**Risk of refeeding?**



# Definition

- Metabolic and physiological problems of feeding malnourished patients
- Key factors involved
  - ▣ Glucose
  - ▣ Phosphate, potassium & magnesium
  - ▣ Vitamins (thiamine)
  - ▣ Fluid & sodium
- No internationally agreed definition making comparisons difficult

# Starvation & refeeding

Hypokalaemia

Hypomagnesaemia

Hypophosphataemia

Thiamine deficiency

Salt & water retention –  
refeeding oedema

Glycogen stores utilised

↓ Insulin production  
↑ Glucagon secretion

Gluconeogenesis =  
Protein catabolism &  
mobilisation of lipid

**Refeeding  
syndrome**

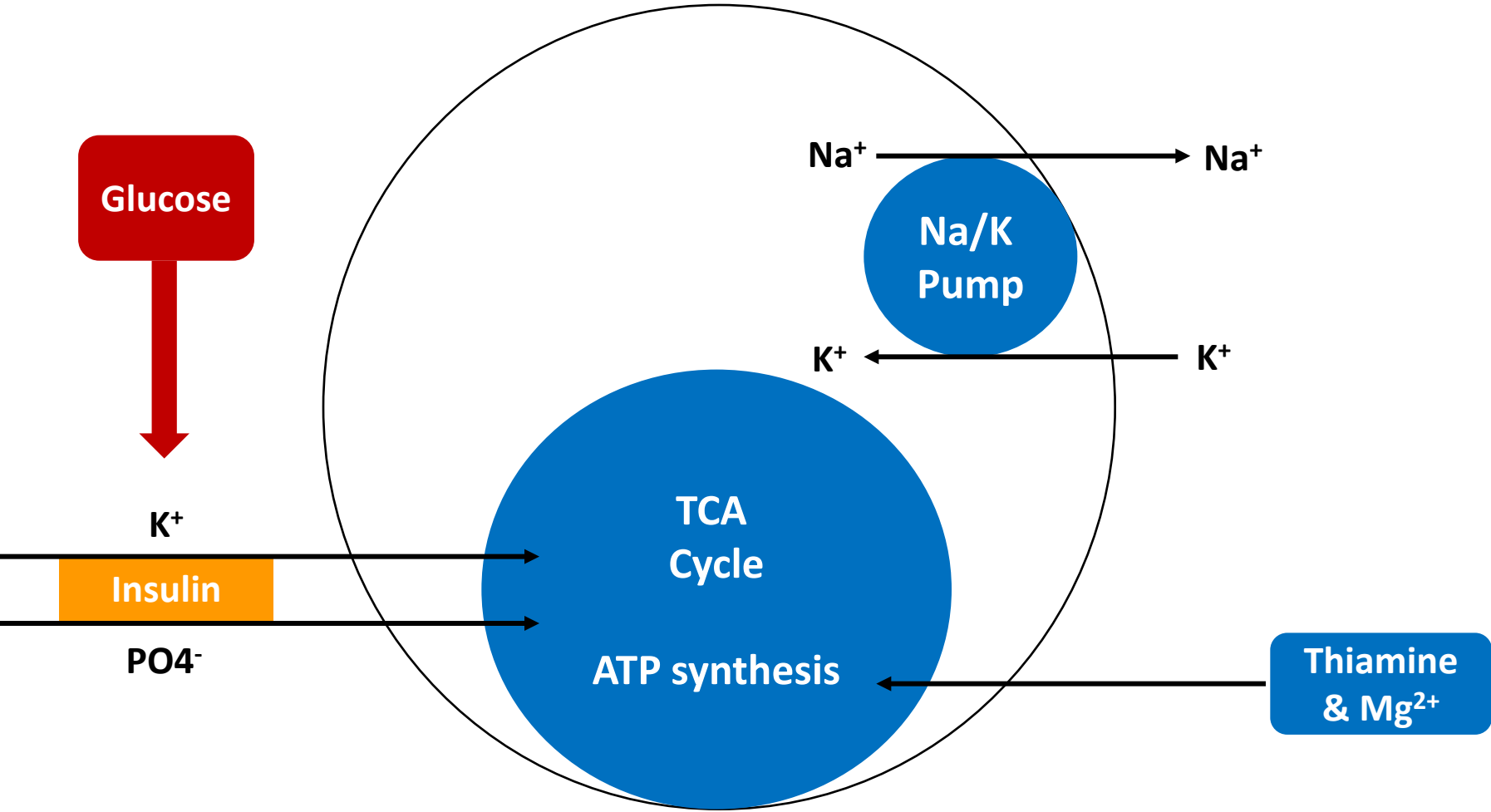
Protein, fat, mineral,  
electrolyte & vitamin  
depletion – sodium &  
water intolerance

Nutrition  
CHO main source of  
energy (anabolism)

↑ Insulin  
secretion

↑ Uptake of  
 $K^+$ ,  $Mg^{2+}$  &  $PO_4^-$   
↑ Utilisation of  
thiamine

# Refeeding syndrome



# Consequences

	Cardiac	Respiratory	Neuro- muscular
Phosphate	Altered myocardial function, Arrhythmia, congestive heart failure	Acute ventilatory failure	Lethargy, weakness, seizures, confusion, coma, paralysis, rhabdomyolysis
Potassium	Arrhythmia, cardiac arrest	Respiratory distress	Paralysis, weakness, rhabdomyolysis
Magnesium	Arrhythmia, tachycardia	Respiratory depression	Ataxia, confusion, muscle tremors, weakness, tetany
Thiamine	Congestive heart failure & lactic acidosis		Wernicke-Korsakoff syndrome, muscle weakness



# Who is at risk?

## Patients at high risk

- Patient has one or more of the following:
  - BMI  $<16\text{kg}/\text{m}^2$
  - Unintentional weight loss  $>15\%$  over 3-6 months
  - Little or no nutritional intake for  $>10$  days
  - Low levels of K, PO<sub>4</sub> or Mg prior to feeding

## OR

- Patient has two or more of the following:
  - BMI less than  $18.5\text{kg}/\text{m}^2$
  - Unintentional weight loss  $>10\%$  over 3-6 months
  - Little or no nutritional intake for  $>5$  day
  - Chemotherapy. History of alcohol abuse or drugs including insulin, antacids & diuretics.



# Risk of refeeding?

Patients with any <b>one</b> of the following:	Yes	No
BMI <16kg/m <sup>2</sup>		
Unintentional weight loss >15% in 3-6/12		
Very little or no food for > 10 days		
Low levels of K, PO <sub>4</sub> or Mg before feeding		

# Risk of refeeding?

Patients with any <b>one</b> of the following:	Yes	No
BMI <16kg/m <sup>2</sup>		<b>X 28.2kg/m<sup>2</sup></b>
Unintentional weight loss >15% in 3-6/12		<b>X 8.8%</b>
Very little or no food for > 10 days	<b>✓ 12 days</b>	
Low levels of K, PO <sub>4</sub> or Mg before feeding	<b>✓ Mg 0.6</b>	

High risk of refeeding according to NICE criteria

A decorative mosaic at the top of the slide features a stylized face with large, expressive eyes, rendered in a palette of blue, red, orange, and yellow. The mosaic is composed of small, irregular tiles.

# How to feed patients at high risk

- **Consider** starting nutrition support at a maximum of 10kcal/kg increasing levels slowly to meet or exceed needs by 4 -7 days
- **Consider** restoring circulatory volume and monitoring fluid balance and overall clinical status closely



# How to feed patients at risk

- **Consider providing immediately before and during the first 10 days of feeding:**
  - Oral thiamine 200-300 mg/day
  - Vitamin B co strong 1 or 2 tablets tds **OR**
  - Full dose intravenous vitamin B preparation if necessary
  - A balanced multivitamin/trace element supplement
- **Consider providing oral, enteral or intravenous supplements of:**
  - Potassium = 2-4mmol/kg/d
  - Phosphate = 0.3-0.6mmol/kg/d
  - Magnesium = IV 0.2 or oral 0.4mmol/kg/d
  - Pre feeding correction of low plasma levels unnecessary

# Refeeding guidelines



1. Solomen & Kirby (1990) *JPEN*, 14:90. 2. Dewar & Horvath (2001) A pocket guide to clinical nutrition (PENG). 3. Crook et al (2001) *Nutrition*, 7:632. 4. National Collaborating Centre for Acute Care, February 2006. *Nutrition support in adults Oral nutrition support, enteral tube feeding and parenteral nutrition*. ISBN 0-9549760-2-9. 5. Stanga et al (2008) *Eur J Clin Nutr* 62:687. 6. Khan et al (2011) *Gastro Res Pract*, ii: 410971

# NCEPOD 2010 - refeeding

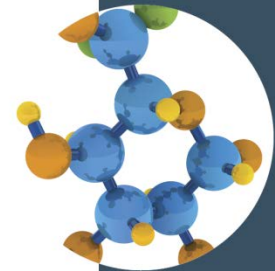
No definition of refeeding syndrome provided but not solely based on hypophosphataemia

- 60% deemed at risk
- Occurred in 19% deemed at risk
- Over diagnosis?



## A Mixed Bag

An enquiry into the care of hospital patients receiving parenteral nutrition



# Refeeding & parenteral nutrition

Nutrient	NICE	PN
Energy (Kcal)	730	1550
Nitrogen (g)	6.2 (50%)	9
Sodium (mmol)	n/a	22.5
Potassium (mmol)	146-292	80
Calcium (mmol)	n/a	7
Magnesium (mmol)	14.6	18
Phosphate (mmol)	22-44	30
Glucose oxidation rate (kcal)	n/a	1000
Fluid (ml)	n/a	1500

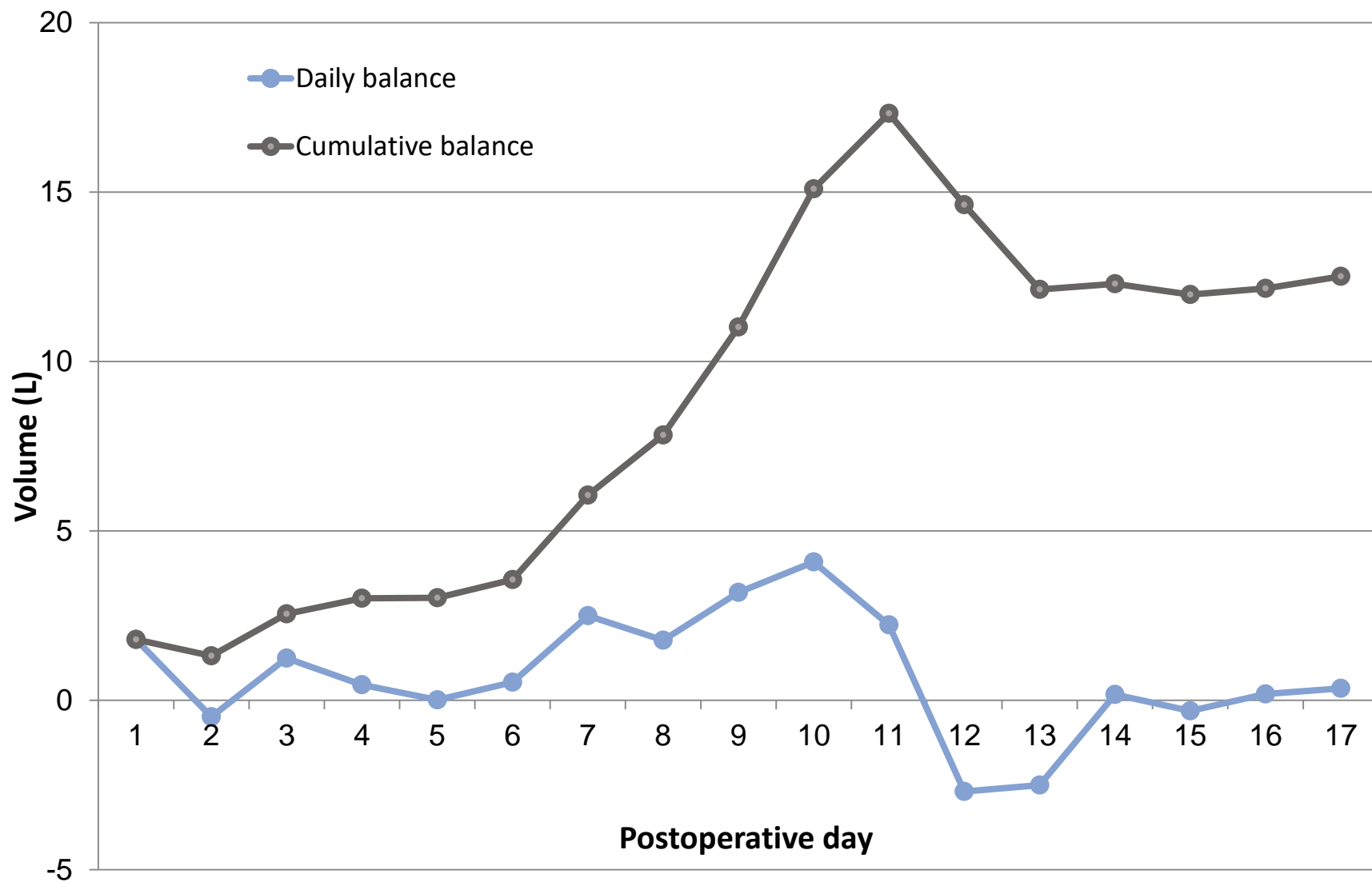
Started IV Pabrinex bd  
No evidence of refeeding during 8 days of PN



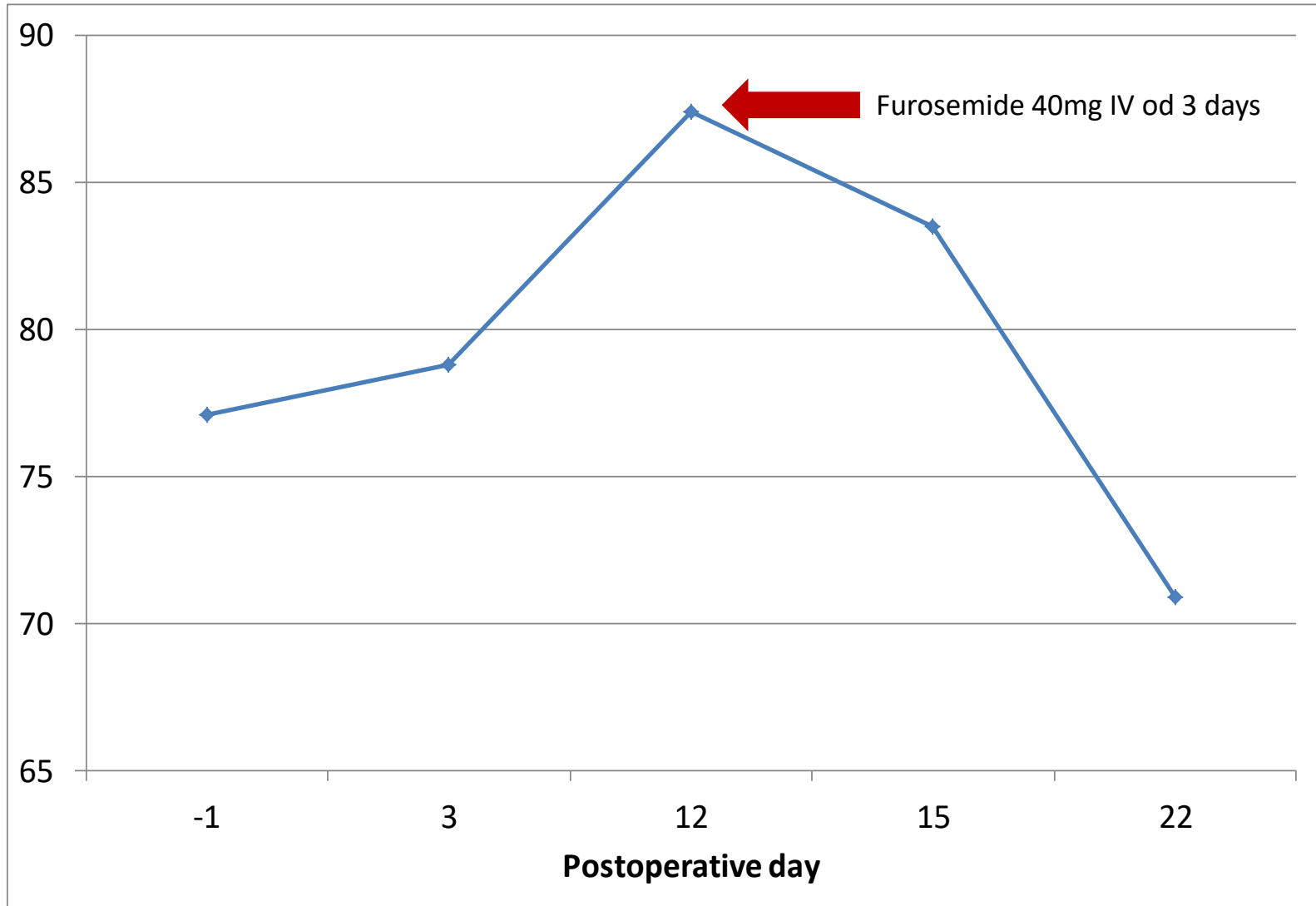
# Food for thought...

- Do we over diagnose risk of re-feeding syndrome?
  - How accurate is percentage weight loss reported?
  - How easy is it to determine if little or no nutrition has been consumed over the last 10 days?
  
- Do we under-feed and have a negative impact on the existing degree of malnutrition
  - Is there a difference depending on the route of feeding e.g. parenteral, enteral or oral
  
- Do we focus on total calorie provision and neglect the composition of the feed and adequate electrolyte provision?
  - Is the proportion of carbohydrate important?

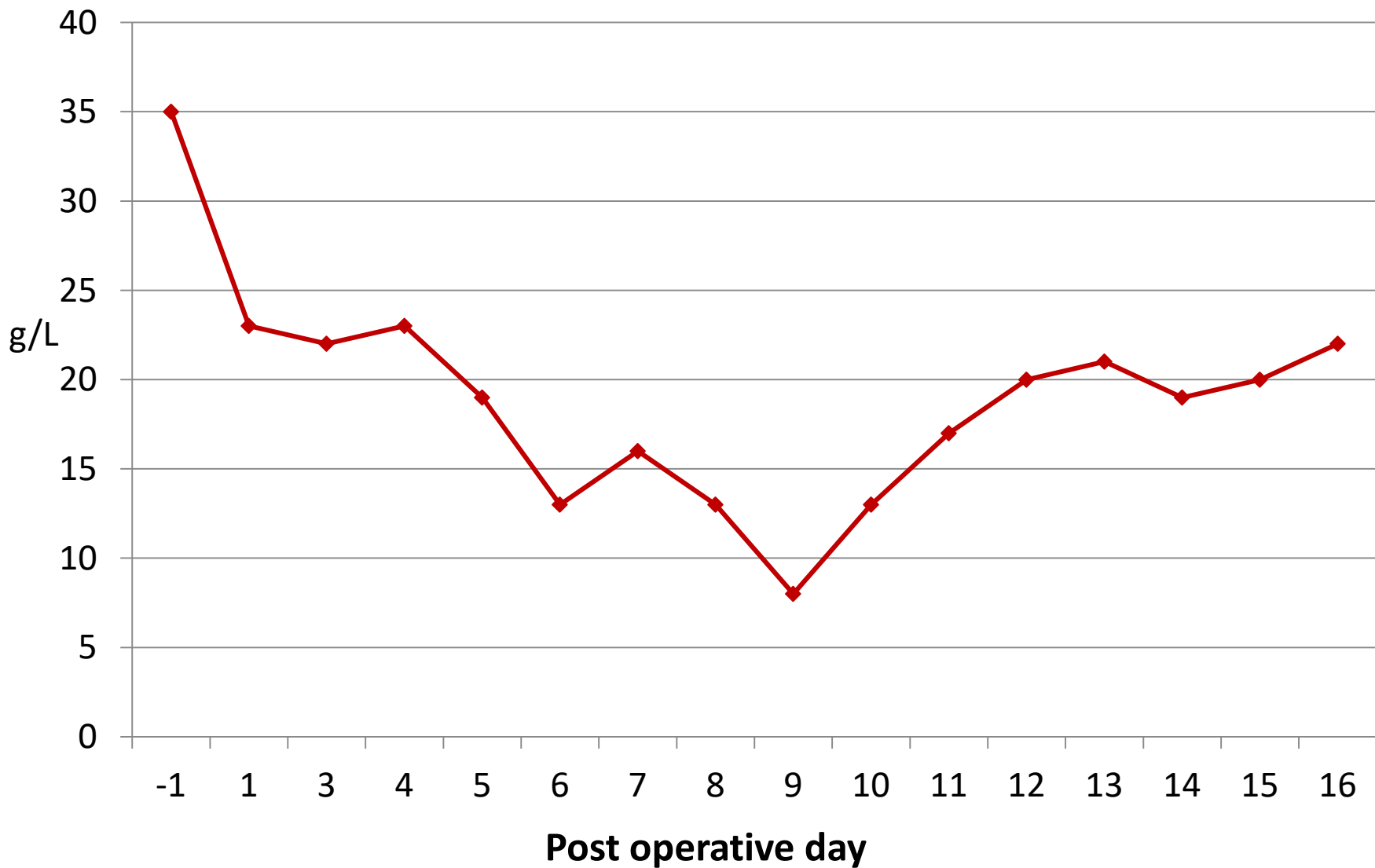
# Fluid balance



# Weight



# Albumin





# Conclusion

## Fluid balance is complex

- Fluid balance charts can be inaccurate, confusing and misleading
- Don't look at the daily balance (it does not represent the actual picture)
- A cumulative balance can be helpful
- Urine sodium best gauge of sodium status

## Daily weight is a good gauge

- Keep asking the nursing staff to weigh the patient
- It may seem mundane but it is the best way to look after your patient

## Don't forget to look at the patient

- If there is oedema, you have given too much sodium and too much water

## Refeeding can be avoided with generous provision of electrolytes

- NICE guidelines too cautious