Identification and management of patients with Refeeding Syndrome

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Malnutrition among hospital inpatients

- Incidence between 20-50%
- Beaumont Hospital – factors affecting nutritional status
  - 53% patients had no recorded weight
  - 5% had incorrect meal provision
- Analysis of contributing factors (750 patients in 3 centres)
  - Lack of malnutrition screening
- BAPEN Nutritional Screening Week 2010
  - 1 in 3 Irish patients malnourished on admission

Refeeding Syndrome

- Potentially fatal shifts in fluids and electrolytes that may occur in malnourished patients receiving feeding resulting in hormonal and metabolic changes causing serious clinical complications.

- True incidence unknown due to lack of universally accepted definition.

- 34% of ICU patients in one prospective cohort study
  - 236 patients
  - *Mehanna et al. 2008*

Refeeding Syndrome

- The metabolic and hormonal changes caused by rapid refeeding.
- Protein and fat as main energy source
- BMR reduces by 20-25
- Muscle and tissues decrease use of ketone bodies – fatty acids as energy source.
- Brain – uses ketones as main energy source.
- Liver – reduces rate of gluconeogenesis.
- Several intracellular minerals severely depleted.

Physiology

- Glycaemia leads to increased insulin secretion and decreased glucagon secretion.
- PO4, Mg and cofactors such as thiamine are consumed.
- Insulin stimulates potassium absorption into cells through sodium-potassium ATPase transporter
- Water follows by osmosis.
- Reduced serum levels of potassium, magnesium and phosphate which are already depleted.

Phosphorus

- Predominantly intracellular mineral
- Essential for intracellular processes and integrity of cell membrane.
- Enzymes and second messengers activated by phosphate binding.
- Energy storage as ATP
- Regulates affinity of Hb for oxygen and regulates delivery to tissues
- Renal acid-base buffer system

Phosphorus

- Chronic whole body depletion.
- Insulin surge causes greatly increased uptake and use in cells.
- Deficit in intracellular and extracellular phosphorus.
- Widespread dysfunction of cellular processes affecting almost every physiological system.

Potassium

- The major intracellular cation
- Anabolism leads to increased intracellular uptake, as well as uptake due to direct action of insulin
- Deranged electrochemical membrane potential

Magnesium

- Predominantly intracellular cation
- Cofactor in most enzyme systems
  - Oxidative phosphorylation
  - ATP production
- Structural integrity of ribosomes, DNA and RNA
- Affects membrane potential

Complications

Respiratory

Failure or ventilator dependency

- Pulmonary oedema
- Retention of carbon dioxide

Cardiovascular

- Arrhythmia
- Congestive Heart Failure
- Digoxin toxicity
- Hyper/Hypotension
- Reduced cardiac contractility
- Sudden death

Complications

Renal

- Osmotic diuresis
- Pre renal azotemia
- Inability of renal tubules to concentrate urine.

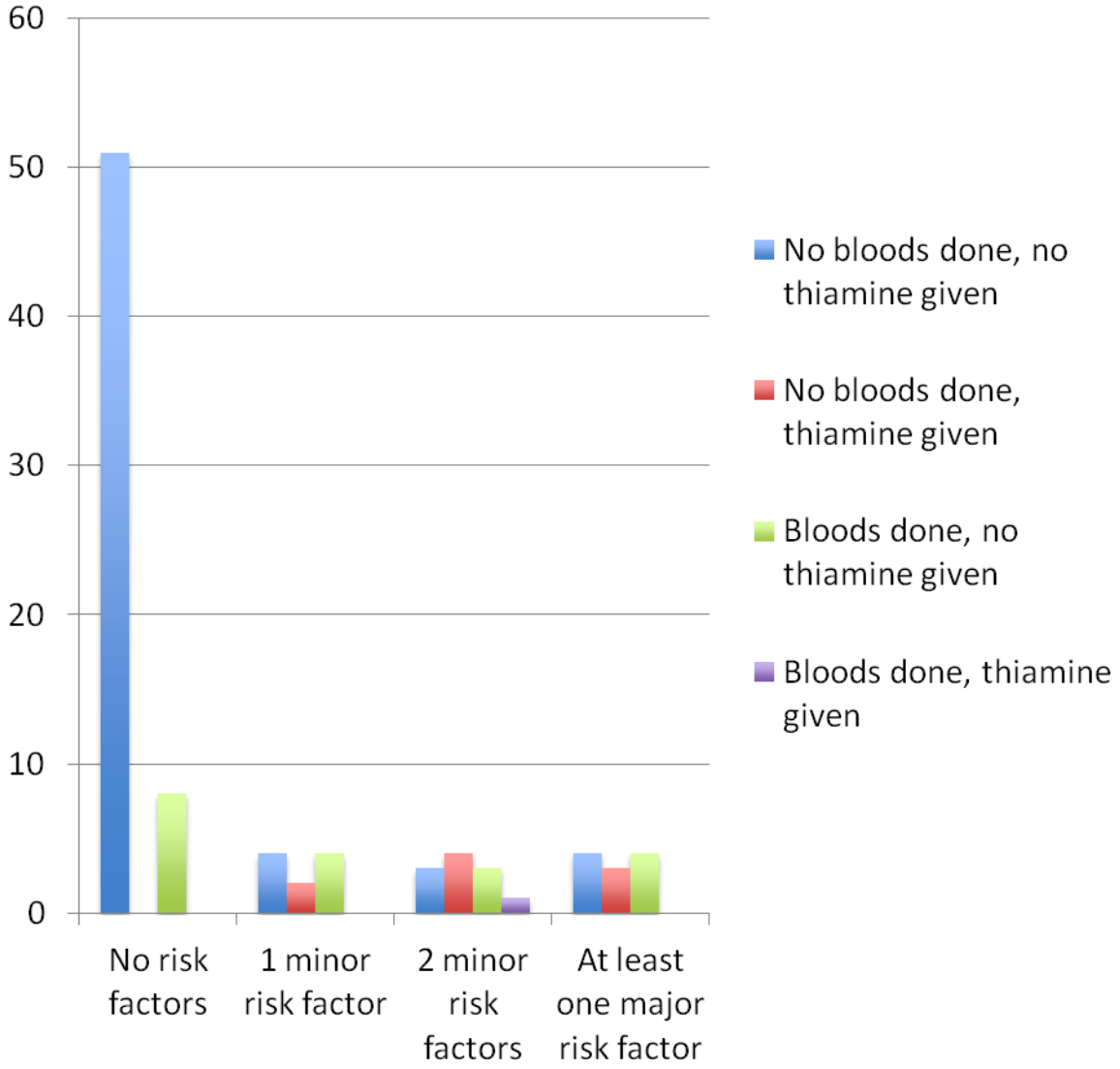
Neurological

- Paraesthesia
- Weakness
- Altered mental state
- Paralysis
- Ataxia
- Tremor
- Tetany
- Seizures
- Wernickes Encephalopathy

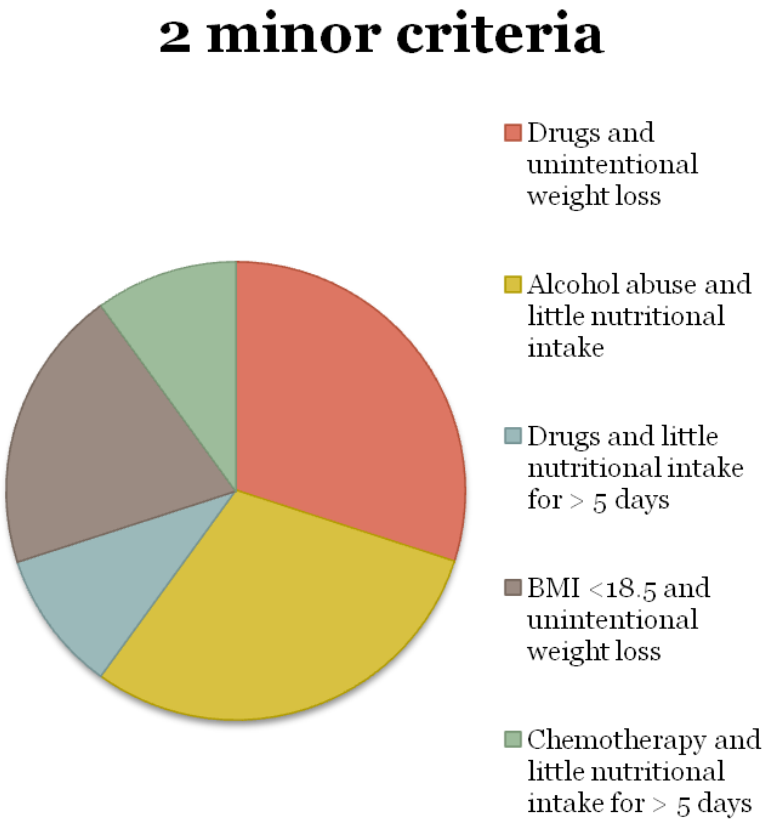
Audit on identification of patients at risk of Refeeding Syndrome

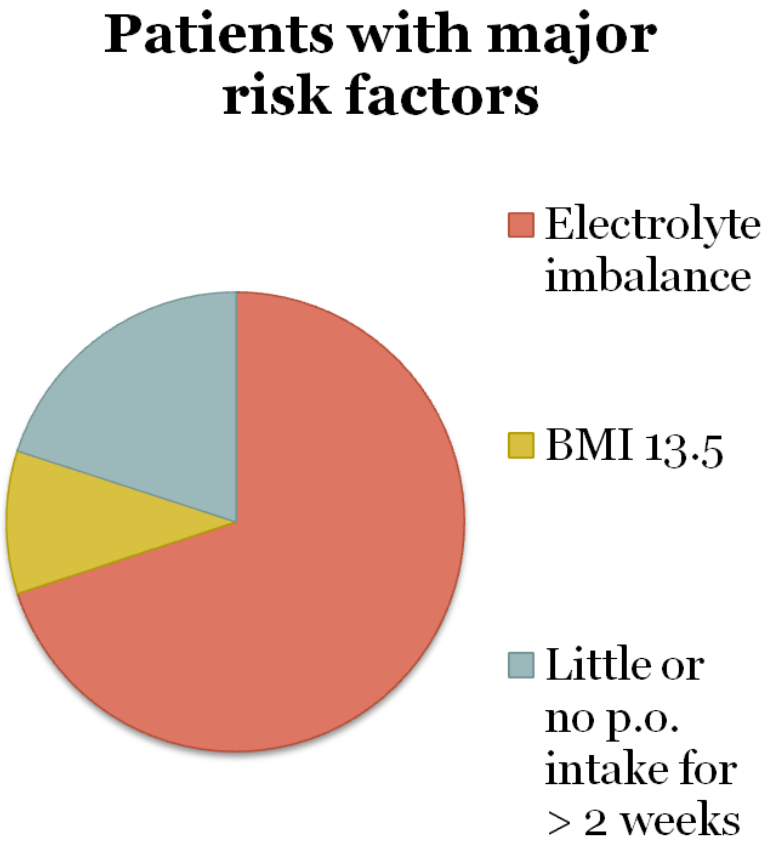
- 102 patients
- 78.5% not at risk
- 21.5% at high risk
  - 11.2% - 2 minor risk factors
  - 9% - at least 1 major risk factor

- 2 patients – Refeeding Syndrome
- 32% of those at high risk treated according to guidelines



Patients at high risk





Management of patients with major risk factors

- 3 patients – No Pabrinex
  No electrolyte monitoring
- 4 patients – No Pabrinex
  Electrolytes monitored
- 3 patients – Pabrinex
  Electrolytes monitored

- 8 patients were referred to dietician service

- 2 patients (9%) progressed to refeeding syndrome


ANOREXIA
NERVOSA

Optimising nutritional care 2009-2012

- Department of Gastroenterology & Hepatology
  - Karen Boland
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  - Grainne Corrigan
  - Carmel O Hanlon
  - Paula O Connor
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NICE Guidelines

2 or more minor risk factors

- BMI < 18.5
- Unintentional weight loss of >10% over previous 3-6 months
- Little nutritional intake for >5 and < 10 days
- History of alcohol abuse or drugs including antacids, insulin, diuretics or chemotherapy

1 major risk factor

- BMI < 16
- Unintentional weight loss >15% of body weight over previous 3-6 months
- Little nutritional intake over previous 10 days
- Low potassium, phosphate or magnesium prior to refeeding

High risk patients

- Anorexia nervosa
- Chronic alcoholism
- Oncology patients
- Postoperative patients
- Elderly - reduced physiological reserve
- Uncontrolled diabetes mellitus
- Marasmus
- Prolonged fasting
- Morbid obesity with profound weight loss
- Malabsorption
- Long term diuretic users
- Long term antacid users

Issues around phosphate repletion

- Typical regimens require multiple infusions based on weight with frequent monitoring of serum phosphate.

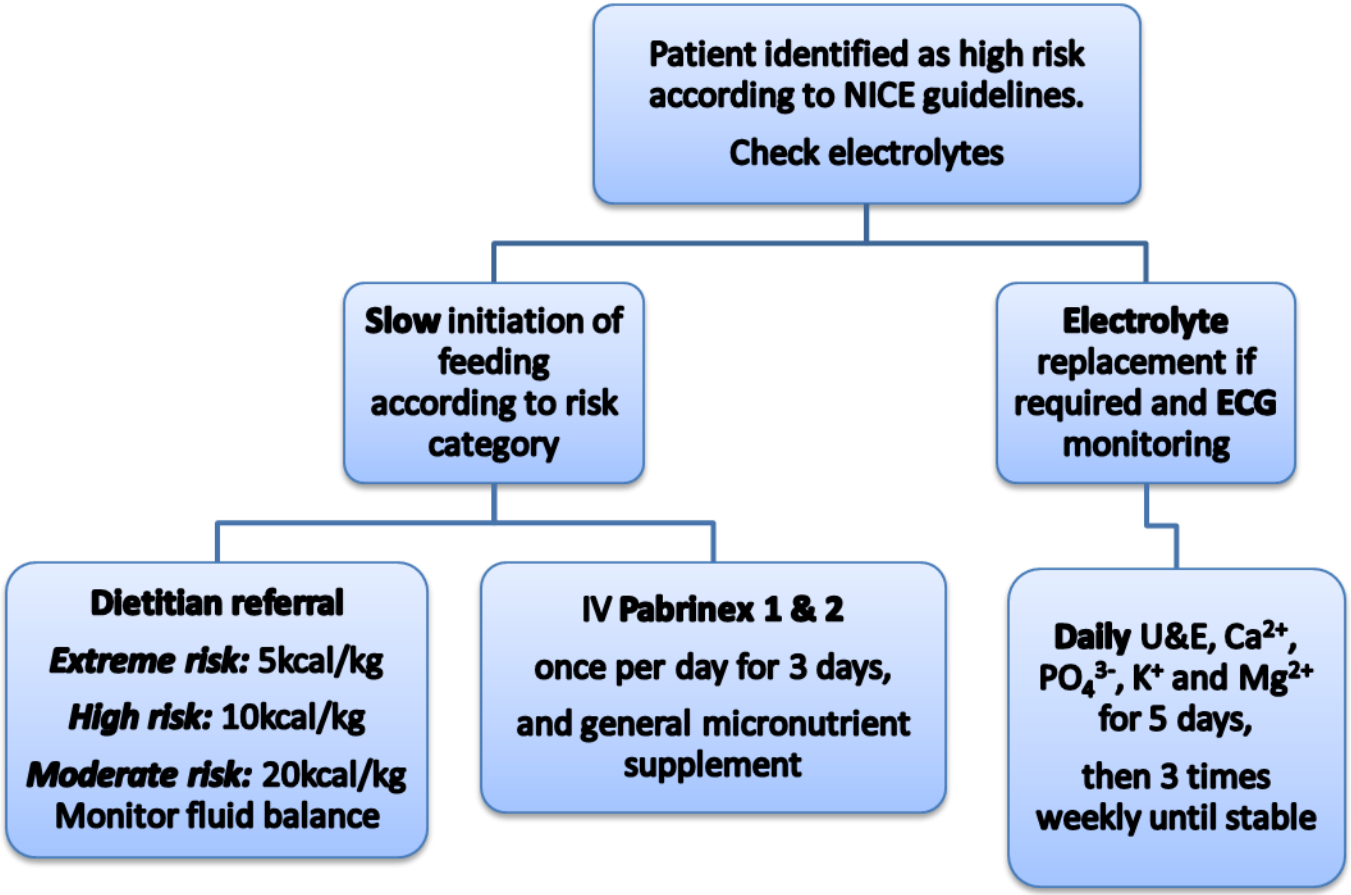
- Intracellular nature of phosphate makes prediction of amount required to replenish stores difficult

- 30 patients with refeeding syndrome and normal renal function and PO4 <0.5mmol/L treated with 50mmol PO4 over 24 hours.
- 93% (n=28) achieved level >0.5mmol/L after 4 days.
  - *Terlevich et al 2003*

- Optimal regime still has to be confirmed with RCT

Prevention – NICE CG32

- Start nutritional support at maximum of 10kcal/kg/day. Increase levels slowly to meet requirements at 4-7 days.
- Use 5kcal/kg/day in extreme cases, monitoring cardiac rhythm continuously.
- Restore circulatory volume and maintain fluid balance
- Immediately before and during first 10 days, oral thiamine 200-300mg and trace element supplement.
- Correction of electrolytes.



Phosphate replacement:

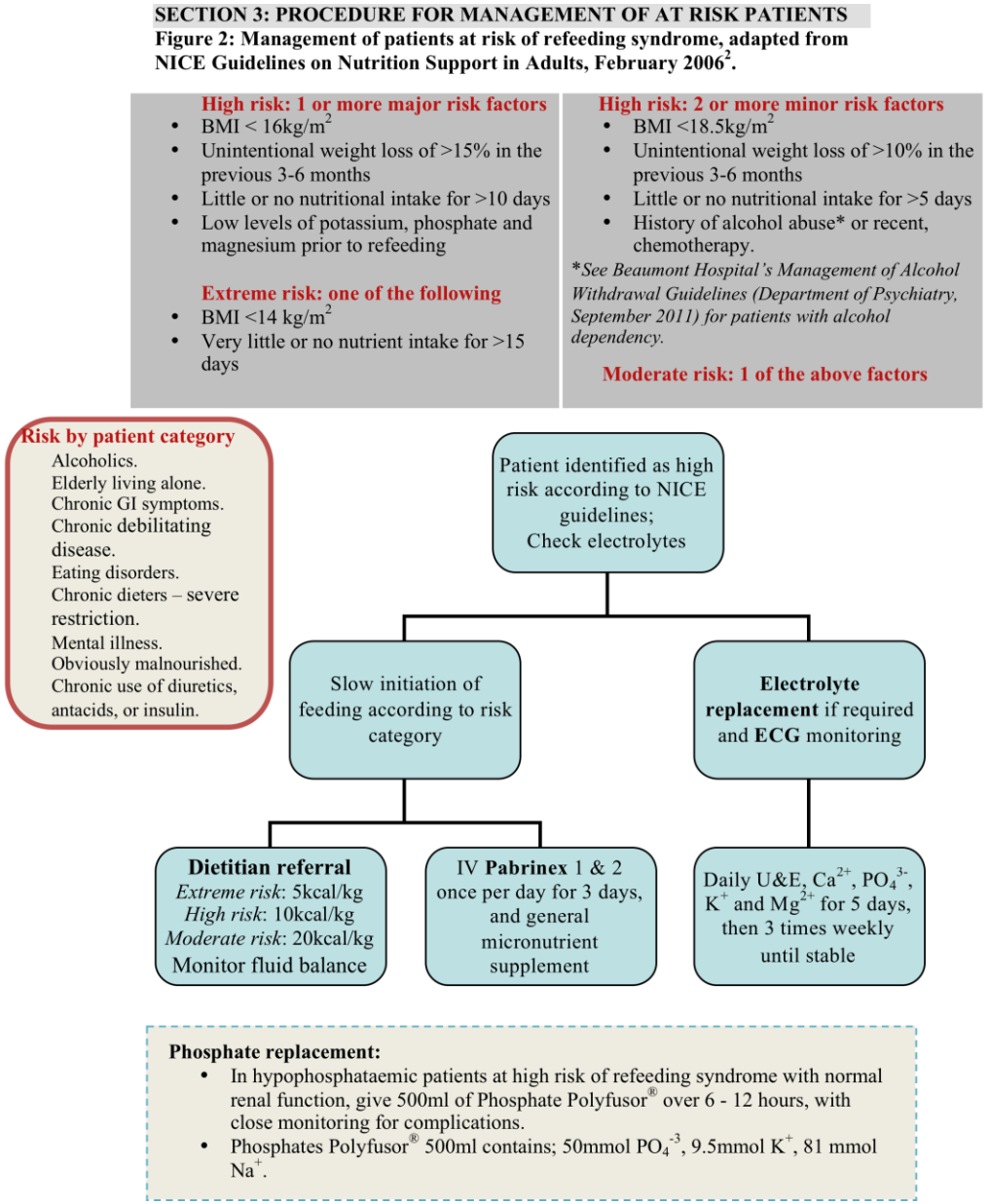
- In hypophosphataemic patients at high risk of refeeding syndrome with normal renal function, give 500ml of Phosphate Polyfusor® over 6 - 12 hours, with close monitoring for complications.
- Phosphates Polyfusor® 500ml contains; 50mmol PO_4^{3-}, 9.5mmol K^+, 81 mmol Na^+.

Schematic for publication on intranet and wards.

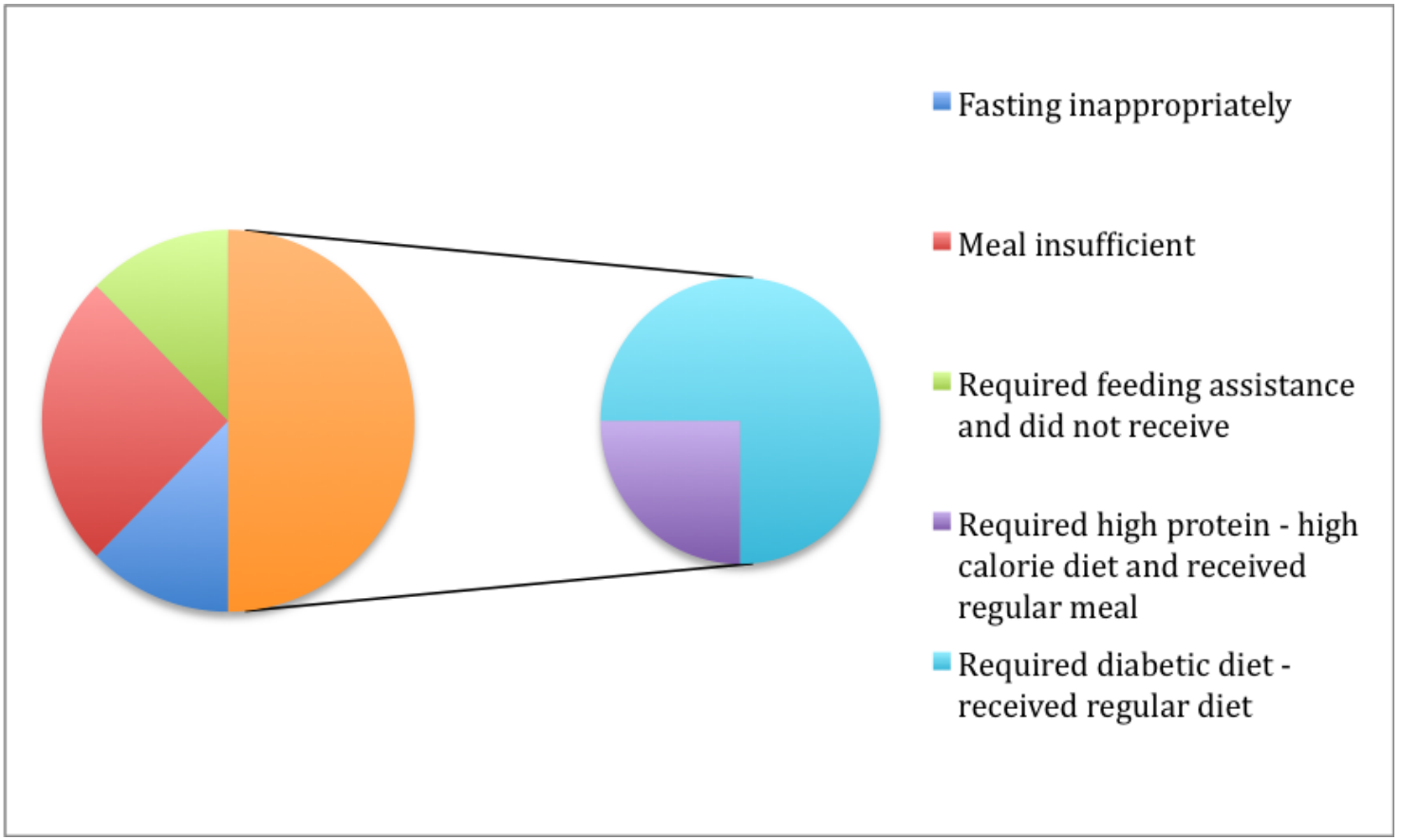
Nutritional Screening

- Scales audit
- Further training for nursing staff
- Addition of patient weights to nursing care plan

- Available on wards, intranet and interns handbook
- Education through Grand Rounds
- Development of Electrolyte Guidelines



Audit of factors affecting nutritional intake at Beaumont Hospital



Audit of factors affecting nutritional intake at Beaumont Hospital

- 53% of patients with prescribed special diets had documentation of requirements at end-of-bed.

- 47.4% of patients had record of recent weighing.

- 12.5% were non-compliant with oral nutritional supplements

Serum potassium level	Guideline for repletion
Critical deficit K^+ <2mmol/L or K^+ <2.5mmol/L with ECG changes characteristic of hypokalaemia	Likely to require replacement in intensive setting, seek specialist advice
Severe Deficit K^+ 2-2.5mmol/L without critical conditions or ECG changes	Intravenous replacement via peripheral line*[10,11] 1.40mmol K^+/L premixed solution$^+$ of potassium and fluid, given at 125mL per hour dependent on fluid status of patient. 2.Check serum potassium after 8 hours of commencement of infusion. 3.If serum potassium not corrected to normal levels, repeat step 1. Correct serum potassium to normal levels. 80mmol K^+ usually required in cases of severe deficit.
Moderate deficit Serum K^+ 2.5-3.0mmol/L	Intravenous replacement via peripheral line*[10,11] 1.40mmol K^+/L in premixed solution$^+$ at 125mL per hour, dependent on patient fluid status. 2.Check serum potassium level after 8 hours. 3.If not corrected to normal levels, give further 20mmol K^+/500mL fluid. 4.Check serum potassium level 4 hours after last dose. Repeat infusion at step 3 as necessary to correct serum potassium to normal level.
Mild deficit Serum K^+ 3.1-3.5mmol/L	Oral replacement:[10] Slow K® – 2 tabs tds (8mmol K^+/ tablet) Sando-K® - 2 tabs bd (12mmol K^+/tablet) Kay-Cee-L® – 10mL bd (1mmol K^+/mL) or Intravenous replacement with premixed solution$^+$ of 20mmol K^+/500mL.

Serum calcium (corrected) level	Guideline for repletion
Acute severe hypocalcaemia Symptomatic hypocalcaemia and Ca^{2+} <2.12mmol/L or Ca^{2+}<1.9mmol/L	1.1g calcium gluconate injection in 50mL glucose 5% infused over 20 -30 minutes. Then 1.Solution of ~10mg/mL calcium gluconate made by diluting 11g calcium gluconate in 1 litre glucose 5% or normal saline and infused at a rate of 50mL/hour. This can be adjusted to maintain the calcium level at the lower limit of normal.[15] Serum calcium level should be closely monitored during infusion. Calcium gluconate injection 10% (1g in 10mL)
Acute mild hypocalcaemia Asymptomatic hypocalcaemia 1.9mmol/L < Ca^{2+}< 2.12mmol/L	1500-2000mg elemental calcium daily in divided doses between meals.[17] Calcichew® (Calcium 500mg) - 2 tablets bd Sandocal 400® (Calcium 400mg)- 3 tablets bd

Serum magnesium level	Guideline for repletion
Acute or Severe Hypomagnesaemia Mg^{2+} <0.7mmol/L + symptoms or Mg^{2+} <0.4mmol/L	5g magnesium sulphate injection diluted in 500mL Sodium Chloride 0.9%. Infuse over a minimum of 5 hours for 3 to 5 days, depending on serum levels.[16,17] Often requires oral magnesium to maintain at normal serum levels.
Mild Hypomagnesaemia Mg^{2+} 0.5 – 0.7mmol/L no symptoms	Give by mouth 20 to 24mmol Mg^{2+} per day in divided doses for 5 days.[10] Magnesium Verla® 2 sachets bd

Serum phosphate level	Guidelines for repletion
Severe hypophosphataemia with refeeding syndrome	Intravenous therapy 50mmol PO_4^{3-} over 6 – 12 hours. (i.e. Phosphate Polyfusor®)[19]
Severe defecit PO_4^{3-}<0.4mmol/L	Intravenous replacement via peripheral line. 1.Calculate phosphate requirement of 0.16mmol/kg[20] and administer over 6 hours in patients who are unwell or have multiple risk factors for hypophosphataemia. *i.e. in 70kg patient, give 20mL potassium phosphate or sodium phosphate injection diluted in 500mL Sodium Chloride 0.9% or Glucose 5% over 6 hours.*[11] 2.In critically unwell patients, increase to 0.24mmol/kg[21] over 6 hours. *i.e. in 70kg critically ill patient, give 28mL sodium phosphate injection diluted in 500mL Sodium Chloride 0.9% or Glucose 5% over 6 hours.*[11] 3.Recheck serum phosphate after 6 – 12 hours following infusion and repeat if necessary. Maximum of 50mmol PO_4^{3-} in 24 hours.[19] 4.Check serum phosphate levels daily for 48 hours following infusion. 5.Stop infusions when serum phosphate levels > 0.8mmol/L.
Moderate deficit PO_4^{3-} = 0.41-0.6mmol/L	Intravenous replacement via peripheral line. 1.Calculate phosphate requirement of 0.08mmol/kg[20] over 6 hours in patients who are unwell or have multiple risk factors for hypophosphataemia. *i.e. in 70kg patient, give 10mL of potassium phosphate or sodium phosphate injection diluted in 500mL Sodium Chloride 0.9% or Glucose 5% over 6 hours.*[4] 2.Recheck serum phosphate after 6 – 12 hours following infusion and repeat if necessary. Maximum of 50mmol PO_4^{3-} in 24 hours.[19] 3.Check serum phosphate levels daily for 48 hours following infusion. 4.Stop infusions when serum phosphate level > 0.8mmol/L.
Mild deficit PO_4^{3-} = 0.61-0.79mmol/L	Oral replacement therapy 1000mg phosphorus /day (32.2mmol/day) Phosphate -Sandoz® 1 tablet bd can go up to 6 tablets daily in divided doses.[10]

Summary

- Identify patients at risk – NICE guidelines
- Order appropriate investigations
- Thiamine
- Appropriate electrolyte replacement
- Early referral to dietician service
- Repeat ECG or cardiac monitoring in at risk patients
- Low threshold for monitoring and treating patients with liver disease

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- www.ispen.ie
- www.nice.org.uk
- www.espen.org