REFEEDING SYNDROME: PREVENTION AND MANAGEMENT

POLICY©

DOCUMENT SUMMARY/KEY POINTS

- This document is to be used in conjunction with Parenteral nutrition refeeding management outlined in the Parenteral Nutrition Practice Guideline
- This policy is **not appropriate** for use in the management of refeeding syndrome for
  - neonates aged under 28 days old or
  - for children with a diagnosed eating disorder.

Refeeding Syndrome

- Adverse body response that occurs with the initiation and/or increased provision of nutrition after a period of poor intake or starvation, especially in the already malnourished patient.
- Involves derangement of serum electrolytes (specifically changes in phosphate, potassium and magnesium), vitamin deficiencies, and sodium and fluid retention.
- Can be life threatening and can lead to cardiac, neurological and haematological complications (refer to Table 1).
- Refer to the 'Summary of Recommendations' (Section 2) and the 'Management' flowchart (Section 3) for details.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1st September 2022	**Review Period**: 3 years
Team Leader:	Dietitian	**Area/Dept**: Nutrition and Dietetics

Date of Publishing: 31 August 2022 9:36 AM Date of Printing: 31 August 2022

CHANGE SUMMARY

- New document replacing the rescinded 'Refeeding Syndrome: Prevention and Management – SCH 2013'.

READ ACKNOWLEDGEMENT

- Nurses, dietitians and other clinical staff, with direct responsibilities for patients being refed after a period of prolonged inadequate intake, must read and acknowledge that they have a clear understanding of this policy.
- For all other staff, the local manager to determine which staff, if any, are to read and acknowledge the document.
- Line managers are to maintain records of staff read acknowledgements for quality review and compliance audit processes.

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1 Refeeding Syndrome

1.1 What is refeeding Syndrome?

- A range of metabolic and electrolyte alterations occurring as a result of the initiation of calories, in particular those from carbohydrate, after a period of decreased or absent calorie intake.
- Electrolyte disturbances, notably a measurable reduction in levels of one or any combination of phosphate, potassium, and/or magnesium, or the manifestation of thiamine deficiency, developing shortly (hours to days) after initiation of calorie provision to an individual who has been exposed to a substantial period of undernourishment.
- Refeeding syndrome may manifest in a wide variety of severities. This includes slight, clinically insignificant decrements in electrolyte levels to severe and sudden decreases which lead to, or risk development of, end organ failure if not pre-empted or corrected.
- Can be life threatening and can lead to cardiac, neurological and haematological complications in particular cardiac failure, arrhythmia, delirium, seizures and anaemia.

1.2 What are the Signs and Symptoms of Refeeding Syndrome?

The main signs of refeeding syndrome can be thought of as complications due to hypophosphatemia, hypokalaemia and hypomagnesaemia (see Table 1) as well as:

- Abnormalities of fluid balance (e.g. peripheral oedema, pulmonary oedema, congestive cardiac failure).
- Vitamin deficiency (e.g. thiamine deficiency – symptoms can include peripheral neuropathy, vomiting, ataxia, confusion and ocular cranial nerve palsies, tachycardia and fluid overload).
- Abnormalities of glucose metabolism (hypo or hyper-glycaemia).

Table 1: Complications of Refeeding Syndrome

Effects	Hypophosphataemia	Hypokalaemia	Hypomagnesaemia	Thiamine Deficiency	Sodium retention
Cardiovascular	Congestive heart failure, sudden death, arrhythmias, cardiomyopathy, decreased cardiac contractility, hypotension	Hypotension, ventricular arrhythmias, cardiac arrest, bradycardia or tachycardia, premature atrial or ventricular beats	Paroxysmal atrial and ventricular dysrhythmias, repolarisation alternans	Wet Beriberi	Cardiac decompensation Fluid overload
Neurological	Acute areflexic paralysis, ataxia, coma, confusion, cranial nerve palsies, diffuse sensory loss, Guillain-Barré-like syndrome, lethargy, paraesthesia, seizures, weakness.	Lethargy, delirium or other mental status changes, decreased muscle strength, decreased tendon reflexes, tetany, fasciculation, rhabdomyolysis	Hyperactive deep tendon reflexes, muscle cramps, muscle fibrillation, weakness, ataxia, seizures, vertigo, paraesthesia	Nystagmus Neuropathy Dementia Wernicke's syndrome Korsakoff psychosis, dry beriberi	
Respiratory	Respiratory failure, ventilator dependency	Hypoventilation, respiratory distress, respiratory failure			Fluid overload, Pulmonary oedema
Other	Altered red blood cell function, haemolytic anaemia, haemorrhage, thrombocytopenia, white blood cell dysfunction, Paralytic Ileus, constipation, rhabdomyolysis	Paralytic ileus, abdominal distension, nausea, vomiting, anorexia, constipation	Anaemia , Hypokalaemia, hypocalcaemia, abdominal pain, diarrhoea, constipation, anorexia		

1.3 Identifying at Risk Patients

Refeeding syndrome risk is believed to be closely associated with a patient's degree of malnutrition, particularly starvation-related malnutrition. Short periods of nutrient deprivation may have a more significant effect in children compared to adults because of the added metabolic demands of growth.

The most important point is to **recognise patients who are potentially at risk.** The highest risk is for patients with severe malnutrition but refeeding syndrome can occur in any patient where nutrition (enteral or parenteral) is restarted after a period of decreased intake. The highest risk is in the first 5 days after feeding is re-started but refeeding syndrome may develop up to 2 weeks after restarting nutrition.

Patients at risk include:

- No or negligible nutritional intake for 5 or more days
- Weight loss of >10% in the past few months
- Patients who are malnourished (Weight for length/BMI z score <-2, Paediatric Subjective Global Nutrition Assessment (PSGNA) score of moderately or severely malnourished
- Abnormal electrolytes prior to refeeding (low phosphate, potassium and/or magnesium)
- Prolonged and severe vomiting or diarrhoea (including as a result from a large consumption of aperients)
- Prolonged QTc interval on ECG
- Pre-existing cardiac or respiratory conditions

For further stratification of at risk patients refer to Appendix: ASPEN Consensus Criteria for Identifying Patients at Risk for Refeeding Syndrome

High-risk clinical groups include:

- Eating disorders (e.g. anorexia nervosa)
- Patients with faltering growth
- Patients with chronic malnutrition
- Major stressors or surgery without nutrition for prolonged periods of time
- States of malabsorption (e.g. short bowel syndrome, Crohn's disease, Cystic Fibrosis, pancreatic insufficiency)
- Oncology patients

2 Management Guideline

- Identify patients at risk of refeeding syndrome, document in medical notes and refer to Dietitian urgently for nutritional assessment and prescription prior to commencing nutrition.
- Collect recent weight history
- Measure patients weight, height and plot on their Growth Chart in eMR

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Baseline investigations and clinical assessment:
Serum potassium, magnesium and phosphate prior to commencing nutrition. Consider ECG.

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Correct electrolyte abnormalities before refeeding, aiming for mid normal range
Critically low levels – seek urgent senior medical advice
Phosphate < 0.8mmol/L, Potassium < 3mmol/L, Magnesium < 0.6mmol/L, BSL < 3mmol/L
Temperature < 35.5, HR <50, BP <80/40 or apostural BP drop > 15mmHg, QTc > 450msec

Refer to sub-specialities if appropriate (e.g. cardiology if abnormal ECG, ICU for patients with pre-existing respiratory or cardiac conditions).

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Prescribe supplements before starting refeeding (see table 2)
- Thiamine, multi-vitamin/mineral supplement, +/- phosphate

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Nutrition prescription by dietitian: Commence nutrition at 40-50% of requirements. If after hours refer to Table 3 for plan

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Monitor during refeeding period:
- Monitor HR, RR, BP and BSL (initially 4-5 hourly). Consider pulse oximetry and cardiac monitoring if required.
- Monitor fluid input and output. Repeat ECG as required.
- Review patient at least twice daily initially – especially monitoring cardiovascular, neurological, mental and respiratory status and fluid balance.
- Monitor electrolytes at least every 24 hours for the first 3 days (every 12 hours in high-risk patients). Note electrolyte disturbances can occur up to 5 days post commencement of feeding.
- Weigh daily initially (first 4 days) then twice weekly (excessive weight gains may indicate fluid retention).

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Clinically stable, electrolytes stable for at least 24 hours

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Increase feeds as guided by Dietitian. 10-20% calorie increments daily until final requirements are met.

Electrolytes drop but still in normal range, clinically stable
- Do not increase feeds
- Correct electrolytes using oral supplements or IV sidelines
- Recheck electrolytes at least every 24 hours

Electrolytes drop outside normal range or any signs or symptoms of refeeding syndrome develop
- Discuss with senior staff, reduce or consider ceasing feeds
- Correct electrolytes and stabilise clinically
- Recheck electrolytes at least every 24 hours

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Continue supplementation and monitoring for refeeding syndrome at least until electrolytes and clinical status are stable. The greatest risk is in the first 5 days after starting nutrition. Consider ceasing supplementation when intake meeting RDI (recommended dietary intake).

Table 2: Electrolyte/Vitamin supplementation in children at risk of refeeding syndrome

Supplement	Dosing	Additional notes
Thiamine	1-2mg/kg to a maximum of 100mg IV or oral for 5 days. [14] Administer at least 30 minutes prior to refeeding.	Absorption of oral thiamine may be impaired in malnourished patients, so suggest giving first few doses intravenous. Intravenous injection should be administered slowly (over 30-60 minutes) and facilities for treating anaphylaxis should be available when administering.
Multivitamin with trace elements	Daily supplementation, preferably oral/ enteral age appropriate multivitamin available	Patients on parenteral nutrition who are receiving Soluvit/Cernevit and trace elements will usually not require an additional multivitamin. In some cases patients will receive very little from the bag and may need additional.
Phosphate	Serum levels should be closely monitored and doses increased or decreased accordingly. For patients at high risk of refeeding syndrome prophylactic oral phosphate for the first week could be considered. 2-3 mmol/kg/day phosphate daily, divided into 2-4 doses. (Meds4Kids) Available as Phosphate Phebra: each tablet contains 16.1mmol Phosphate.	Phosphate may need to be given intravenously if hypophosphataemia is severe as large doses of oral phosphate may cause diarrhoea and intestinal absorption may be unreliable. Please refer to Electrolyte Replacement Prescribing-SCH Practice Guideline

2.1 Initial Refeeding Prescription

Initial feeding rate should commence at 40-50% of estimated requirements as advised by a Dietitian. Nutrition should then be increased by increments of 10-20% until estimated energy requirements are met. If a patient's electrolytes drop or they become clinically unstable please follow the Management Guideline flowchart (Figure 1).

If a Dietitian is unable to provide recommendations in relation to refeeding the at risk patient the following guidelines are recommended to be used for the initial refeeding period at the discretion of the medical team in charge. Recommendations for safe starting rates are outlined in Table 3, patients can continue on these rates for 2-3 days until they are able to be reviewed by a Dietitian. For patients with comorbidities such as renal failure, or intolerances, alternative feeds or their usual feed may be more appropriate:

- Weigh patient or estimate patient's weight as accurately as possible
- Calculate starting fluid prescription (see table 3)
- Continuous or bolus feeds should be up to the managing clinician's discretion

Commence vitamin and electrolyte supplements as per Electrolyte Replacement Prescribing-SCH Practice Guideline

Table 3: Safe starting prescription prior to Dietitian review*^

Age	Starting prescription (1/3 of maintenance fluid requirements)
0-1 years	60-80 mL/kg of EBM/ standard infant formula
1-10 years	Nutrini at 1/3 maintenance fluids
11 years + (or >20kg)	Jevity with fibre/ Nutrison at 1/3 maintenance fluids

Titrate enteral intake with non-glucose containing fluid (IV or enteral) so that fluid maintenance requirements are met. The above prescription will provide less than 50% of estimated energy requirements.

*For example if Dietitian not available due to being after hours
^If listed feed is not available please choose an age and weight appropriate feed.

3 Summary of Recommendations

The following may reduce the risk of development of refeeding syndrome:

1. Recognise at risk patients: remember that a short period of fasting or under-nutrition can lead to refeeding syndrome in paediatric patients.
2. Refer to dietitian early for appropriate assessment and nutritional prescription.
3. Supplement thiamine and multivitamins in all patients at risk prior to commencing feeding and consider phosphate supplementation. Monitor and supplement other electrolytes as required.
4. For those at risk, caloric intake should be restricted and feeding should be commenced slowly, with caloric intake spread over the day and increased gradually according to clinical stability and as guided by a dietitian where possible.
5. Feeds may need to be temporarily reduced or even ceased if electrolyte or clinical instability occurs.
6. Refeeding syndrome usually occurs within 5 days of reintroduction of nutrition. Monitor regularly – including weight, biochemistry, fluid balance and cardiovascular stability.
7. The main biochemical abnormalities include any one or more of hypophosphatemia, hypomagnesemia, hypokalaemia. In addition, sodium and fluid retention and thiamine deficiency may develop.
8. Clinical signs of refeeding syndrome include acute cardiac failure, fluid imbalance, delirium, arrhythmias, seizures and sudden death.

4 References

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5 APPENDIX

5.1 ASPEN Consensus Criteria for Identifying Paediatric Patients at Risk for Refeeding Syndrome

	Mild Risk: 3 Risk Categories Needed	Moderate Risk: 2 Risk Criteria Needed	Significant Risk: 1 Risk Criteria Needed
Weight-for-length z-score (1-24 months) or BMI-for-age z-score (2-20 years)	-1 to -1.9 z-score that is a change from baseline	-2 to -2.9 z-score that is a change from baseline	-3 z-score or greater that is a change from baseline
Weight loss	<75% of norm for expected weight gain	< 50% of norm for expected weight gain	< 25% of norm for expected weight gain
Energy intake	3-5 consecutive days of protein or energy intake < 75% of estimated need	5-7 consecutive days of protein or energy intake < 75% of estimated need	>7 consecutive days of protein or energy intake < 75% of estimated need
Abnormal refeeding serum potassium, phosphate or magnesium concentrations	Mildly abnormal or decreased to 25% below lower limit of normal	Moderately/significantly abnormal or down to 25-50% below lower limit of normal	Moderately/significantly abnormal or down to 25-50% below lower limit of normal
Higher-risk comorbidities	Mild disease	Moderate disease	Severe disease
Loss of subcutaneous fat	Evidence of mild loss **OR** Mid-upper arm circumference z-score of -1 to -1.9	Evidence of moderate loss **OR** Mid-upper arm circumference z-score of -2 to -2.9	Evidence of severe loss **OR** Mid-upper arm circumference z-score of -3 or greater
Loss of muscle mass		Evidence of mild or moderate loss **OR** Mid-upper arm circumference z-score of -2 to -2.9	Evidence of severe loss **OR** Mid-upper arm circumference z-score of -3 or greater

** Adapted from da Silva, J.S.V., Seres, D.S., Sabino, K., Adams, S.C., Berdahl, G.J., Citty, S.W., Cober, M.P., Evans, D.C., Greaves, J.R., Gura, K.M., Michalski, A., Plogsted, S., Sacks, G.S., Tucker, A.M., Worthington, P., Walker, R.N., Ayers, P. and (2020), ASPEN Consensus Recommendations for Refeeding Syndrome. Nutrition in Clinical Practice, 35: 178-195. https://doi.org/10.1002/ncp.10474