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REVIEW

The Australasian Society of Parenteral and Enteral Nutrition: Consensus statements on refeeding syndrome

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Abstract

Aims: This consensus statement document describes the recommendations of the Australasian Society of Parenteral and Enteral Nutrition regarding the identification and management of refeeding syndrome and refeeding syndrome risk.

Methods: An expert working group completed a review of the literature to develop recommendations for the consensus statements. Review of the drafted consensus statements was undertaken by highly experienced clinicians.

Results: The identification and management of refeeding syndrome requires a multidisciplinary approach. Actual refeeding syndrome is rare; however, all patients should be assessed for the risk of its development. Refeeding syndrome should only be diagnosed if the patient has had adequate nutrition intake (≥50% of estimated requirements), with electrolyte imbalances and clinical symptoms emerging after its commencement. Thiamin and multivitamin supplementation and regular electrolyte monitoring should be provided to all patients at risk of developing refeeding syndrome. There is no evidence that patients at risk of developing refeeding syndrome should be started at an initial lower enteral feeding rate than already recommended for checking tolerance to enteral feeds. Goal nutrition rates should be reached within 24–72 h for all routes of nutrition. Low electrolyte levels should be replaced as per local guidelines, with consideration given to the route of replacement.

Conclusion: These consensus statements are expected to provide guidance at a national level to improve the identification and management of refeeding syndrome and refeeding syndrome risk.

KEYWORDS
AuSPEN, electrolyte imbalance, hypophosphataemia, inpatients, malnutrition, nutrition support, refeeding syndrome

1 | INTRODUCTION

Refeeding syndrome is a potentially life-threatening cluster of signs and symptoms caused by metabolic and electrolyte disturbances, particularly hypophosphataemia, occurring alongside the reintroduction of nutrition in an individual who has been exposed to a substantial period of undernourishment.[1,2] As refeeding syndrome is a complex condition, presenting as a varying range of signs and symptoms, validated risk identification tools and diagnostic criteria are still yet to be established.[2]

Risk screening tools developed by both the National Institute for Health Care and Excellence[3] and the American Society for Parenteral and Enteral Nutrition[1] have low sensitivity and specificity[4,5] and imprecision.[6] Using solely hypophosphataemia as a risk identification strategy can also lead to false identification due to the numerous other causes of a decreased serum phosphate level.[7]

Similarly, suggested diagnostic criteria for refeeding syndrome vary across the literature. Rio et al.[8] suggest the use of a combination of a severely low serum electrolyte level, peripheral oedema or acute circulatory overload, and a severe disturbance to organ function, whereas the recently published recommendations from the American Society of Parenteral and Enteral Nutrition suggest the use of a combination of a decrease of at least 10% in at least one serum electrolyte and/or organ dysfunction resulting from these electrolyte decreases and/or secondary to thiamin deficiency, developing within 5 days after the commencement of nutrition support.[1] The differences in using these criteria result in 0%–2%[8–12] of the hospital population being diagnosed with refeeding syndrome versus 90%.[6] Using solely hypophosphataemia in these population groups as a diagnostic tool also results in inaccuracy, with up to 74% of inpatients appearing to develop refeeding syndrome.[13]

Alongside the international variation in diagnosing, and assessing risk of, refeeding syndrome, there is limited consensus on feeding management. Over the past decade, the 'start low, go slow' method of feeding has been largely disproven.[2] However, with research evidence taking roughly 17 years to be translated into clinical practice, it is understandable as to why there is variation in recommendations included within policies and procedures in Australasian health care settings, and why some Australasian clinicians are still hesitant in adopting more assertive feeding practices.[14,15] Permissive underfeeding is a risk that can cause increased morbidity and mortality[16] and should be avoided.

This document outlines the position of the Australasian Society of Parenteral and Enteral Nutrition on the role of health professionals and health services in recognising and managing patients with, or at risk of developing, refeeding syndrome. It is intended for use by clinicians and policy and procedure makers to ensure appropriate management of refeeding syndrome and refeeding syndrome risk. While refeeding syndrome can also occur in the paediatric population, this document is intended to address the condition only in adults.

2 | METHODS

An expert working group of 19 clinicians from Australia and New Zealand was convened to develop the consensus statements via an Expression of Interest through Australasian Society of Parenteral and Enteral Nutrition members. Members of the working group met via teleconference between May 2022 and July 2024, with further communication by email to facilitate progress in between meetings. Based on the various research questions and topics of investigation, multiple systematic reviews were not deemed feasible. Therefore, the working group divided into topical work groups to conduct literature reviews, synthesise evidence, and draft consensus statements. Literature reviews were undertaken using PubMED, EMBASE, EMCARE, CINAHL and Cochrane databases from 1 January 2017 to 6 November 2022, with an update performed on 20 November 2024. This date range was chosen to capture evidence published since the American Society of Parenteral and Enteral Nutrition consensus recommendations literature searches were conducted. The search terms were formulated to be relevant to each consensus statement topic, including 'refeeding syndrome', alongside terms such as 'definition', 'risk assessment', and 'enteral nutrition'. Studies were restricted to the adult population (≥18 years of age) and published in English. Case studies were excluded unless evidence was extremely limited. The evidence was graded using the National Health and Medical Research Council (NHMRC) Levels of evidence and recommendation grading tool.[17] This tool was used due to their use in previous Australasian Society of Parenteral and Enteral Nutrition guidelines[18,19] along with the recommendation from NHMRC to avoid the use of the Grading of Recommendations, Assessment, Development, and Evaluations framework when there is a scarcity of high-quality evidence.[20] Consensus opinion was used where evidence was limited. After the initial draft statements were formulated by the topical work groups, all statements were reviewed by the wider working group and reworked until consensus was reached (over 90% agreement was considered to represent consensus). Subsequent review of the formulated consensus statements was undertaken by experienced clinicians that had expressed interest to the Australasian Society of Parenteral and Enteral Nutrition working group lead in doing so. Relevant feedback was incorporated into the consensus statements.

As this project falls outside of the NHMRC statement of research, ethics committee review was not sought.

3 | RECOMMENDATIONS

Due to the lack of randomised controlled trials in the refeeding syndrome literature, most of the evidence reviewed was in the form of retrospective cohort studies and hence all statements are graded as Level D evidence unless stated otherwise. Table 1 summarises the Australasian Society of Parenteral and Enteral Nutrition's consensus statements on refeeding syndrome assessment, identification and management.

3.1 | Multidisciplinary team approach

Refeeding syndrome should be identified and managed using a multidisciplinary approach. The authors recommend that, at a minimum, health professionals should undertake the following tasks:

- Nursing staff, dietitians and physicians can all be involved in identifying the risk of refeeding syndrome and documenting of same.
- Nursing staff, dietitians and physicians can all be involved in the monitoring and documenting of changes in serum electrolyte levels and relevant changes to the patients' clinical presentation (i.e. vital signs, cardiac monitoring, oedema) in relation to refeeding syndrome.
- Nursing staff, dietitians, physicians and pharmacists should all be involved in managing the risk of, and actual, refeeding syndrome.

TABLE 1 The Australasian Society of Parenteral and Enteral Nutrition consensus statements on refeeding syndrome.

Refeeding syndrome should be identified and managed with a multidisciplinary team.
Patients should have at least TWO of the following to be considered at risk of refeeding syndrome: • Unintentional weight loss of more than 10% of body weight in the preceding 3 months OR diagnosed with moderate–severe malnutrition based on Subjective Global Assessment or Patient Generated-Subjective Global Assessment. • Fasting or limited nutritional intake for ≥7 days • Problematic alcohol use • Gastrointestinal losses
To be diagnosed with refeeding syndrome, patients should be having adequate nutrition intake (≥50% of estimated requirements), and develop electrolyte imbalances and clinical symptoms after nutrition intake has commenced.
Thiamin supplementation is recommended prior to the commencement of nutrition intake and for the first 7–10 days to mitigate refeeding syndrome risk.
Multivitamin supplementation is recommended for 10 days from the commencement of nutrition support.
For patients at risk of refeeding syndrome, commence feeding at ≥50% of estimated energy requirements ensuring that close electrolyte and clinical monitoring, and concurrent supplementation are provided as needed. Patients should reach goal energy requirements within 24–72 h of the commencement of nutrition support provided that medical monitoring is available.
In cases of severe electrolyte derangement (>30% decrease from baseline and outside of normal range) after the commencement of nutrition support, it is recommended to wait until levels stabilise prior to progressing towards goal nutrition provision.
It is recommended that existing guidelines for commencing nutrition support in critically ill patients are also applied to those patients at risk of developing refeeding syndrome.
There is insufficient evidence to make a specific recommendation as to how to feed medically compromised adult patients with eating disorders, however 'start low, go slow' is no longer best practice.
Oral intake can be variable and patients at risk of refeeding syndrome on oral diets require regular monitoring to ensure mitigation of refeeding syndrome risk.
There is no evidence to suggest that patients at risk of refeeding syndrome should be given a lower commencement rate of enteral nutrition than already in use for checking patient tolerance of enteral feeds.
Electrolyte derangement associated with refeeding syndrome is most likely to occur within 72 h of increased nutrition provision. It is recommended that serum electrolytes be monitored and replaced until deemed stable by the treating medical team.
There is insufficient evidence to make a broad recommendation regarding routine cardiac monitoring for all patients at risk of refeeding syndrome.
Electrolyte disorders are frequently encountered in many hospitalised population groups, particularly the critically ill and elderly patient populations. This is due to multiple contributing factors and should not be linked solely to refeeding syndrome.
Abnormal low electrolytes should be replaced based on established guidelines. Consider the route of electrolyte administration with respect to the clinical situation and the severity of the electrolyte disturbance/s.
No recommendations can be made for whether prophylactic dosing of electrolytes should be given to patients at risk if pre-feeding electrolyte levels are normal. Prophylactic replacement of electrolytes should be considered at the discretion of the treating medical team.

- Physicians, with consultation from dietitians, are responsible for the diagnosis of refeeding syndrome.

Summary of evidence:

There is minimal evidence regarding the ideal make-up of a multidisciplinary team for identifying and managing refeeding syndrome. Since 2017, 25 articles and case studies mention multidisciplinary team involvement. It should be noted that none of these articles examine the best make-up of a multidisciplinary team but provide a narrative perspective only.

By examining this literature, it was strongly accepted that a dietitian is to be present (95% of the articles) along with a physician or medical team (68%). Both professions should be involved with the screening, managing and monitoring of refeeding syndrome. Their roles are to ensure that patients are receiving nutrition while regularly having serum electrolyte levels and clinical observations checked. Pharmacy and nursing, despite low levels of discussion in the articles reviewed, are essential members of the multidisciplinary team in terms of medication provision, identifying risk and the provision of nutrition.[21–25]

3.2 | Identifying patients at risk of refeeding syndrome

3.2.1 | Risk criteria

Refeeding syndrome is a rare phenomenon. The current literature regarding the risk of refeeding syndrome is limited and of poor quality, with international guidelines

based largely on expert opinion. The following list (while not exhaustive) of symptoms and conditions is primarily agreed upon as risks within the literature.

Patients should have at least two of the following to be considered at risk of refeeding syndrome*:

- Unintentional weight loss of more than 10% of body weight in the preceding 3 months OR diagnosed with moderate–severe malnutrition based on Subjective Global Assessment or Patient Generated–Subjective Global Assessment or other validated malnutrition diagnostic tool
- Fasting or limited nutritional intake for ≥7 days.
- Problematic alcohol use.
- Gastrointestinal losses as per the WHO definitions of diarrhoea or vomiting, alongside clinical judgement.[26,27]

*Clinical judgement regarding other conditions is required.

Summary of evidence:

Between 2017 and 2024, 39 journal articles examined refeeding syndrome risk diagnostic tools or criteria and refeeding syndrome-related outcomes. Nine studies specifically examined the National Institute for Health Care and Excellence criteria, with the majority (including the only randomised controlled trial in this space) concluding that the tool has low sensitivity and specificity surrounding its widespread use in identifying refeeding syndrome risk.[4,5,28–34] Seven studies examined the use of the American Society of Parenteral and Enteral Nutrition screening tool, reporting imprecision and poor validation due to a lack of a universal refeeding syndrome diagnosis criterion.[6,25,35–38] Twenty-three studies examined the use of electrolyte decreases to screen for refeeding syndrome risk; however, half the studies demonstrated that these electrolyte decreases were also associated with low BMI and unintentional weight loss.[9,22–24,39–52] Liu et al.[53] compared four different screening tools, finding that a modified National Institute for Health Care and Excellence criterion and the American Society of Parenteral and Enteral Nutrition tool were superior to using the Simplified Nutritional Appetite Questionnaire or Global Leadership Initiative on Malnutrition criteria to predict decreases in serum phosphate; however, they were only moderately predictive. The authors deemed the American Society of Parenteral and Enteral Nutrition risk criteria the most promising but still requiring further modification. Our proposed risk criteria address this requirement, being less conservative. The evidence supporting previously recommended risk screening tools is Level D.

TABLE 2 Population groups that are likely to be at risk of developing refeeding syndrome.

Prolonged undernutrition or fasting	Conditions that can cause malabsorption or maldigestion of nutrients
• Patients undergoing chemotherapy • Patients who have undergone prolonged fasting for surgery or due to post-operative complications • Patients with an eating disorder (e.g. anorexia nervosa) or disordered eating • Patients with dysphagia • Patients who have undertaken intentional hunger strikes • Patients with chronic alcohol and/or other drug use • Patients experiencing food insecurity	• Short-bowel syndrome • Crohn's disease • Cystic fibrosis • Bowel stenosis or obstruction • Hyperemesis gravidarum • Pancreatic insufficiency • Untreated or undiagnosed coeliac disease • Oesophageal or gastric dysmotility, including achalasia

3.2.2 | Population groups most likely to be at risk of developing refeeding syndrome

Clinical conditions that may cause a patient to be at risk of developing refeeding syndrome can vary widely. Similarly, there are a variety of environmental situations that can impact an adult's ability to maintain energy intake. In Table 2, the authors have documented a range of clinical conditions and environmental situations that may precipitate two of the key risk identification criteria. These examples are not exhaustive.

3.3 | Diagnosis of refeeding syndrome

To be diagnosed with refeeding syndrome, patients are expected to meet all the criteria outlined in Table 3.

Summary of evidence:

Despite the long-standing recognition of refeeding syndrome as a mechanism for potentially serious complications, high-quality scientific evidence regarding its diagnosis is lacking. Of the 90 studies (including 18 focusing on those with eating disorders) examining adult patients published between 2017 and 2024, only 46 specifically addressed refeeding syndrome diagnosis. Of the 41 non-eating disorder studies, 6 were systematic reviews,[24,40,45,54–56] 1 was a randomised controlled trial,[57] 1 was a secondary analysis of a randomised controlled

trial,[33] and the remainder were observational studies ($n = 33$). Similarly, the eating disorder-focused studies ($n = 5$) were all observational studies. Study populations were all hospitalised patients. Therefore, the level of evidence arises from studies predominantly Grade III-2 or III-3 or below.

TABLE 3 Australasian Society of Parenteral and Enteral Nutrition refeeding syndrome diagnostic criteria.

Diagnostic criteria	Definition
Nutrition provision	Patient meeting at least 50% of estimated nutrition requirements for a 24-h period
Electrolyte imbalance	A 30% decrease in serum phosphate levels from baseline within the first 72 h of meeting at least 50% of estimated nutrition requirements, without another cause. *Potassium and magnesium levels may also decrease as a patient is experiencing refeeding syndrome. However, there is insufficient evidence to quantify the decrease.* *Assess the entire clinical picture, including underlying medical conditions such as acid–base imbalance and therapies such as renal replacement therapy, when interpreting electrolyte shifts.*
Clinical symptoms	Documented signs and symptoms of electrolyte imbalance (see Table 4 below). *Whether these clinical signs are linked to electrolyte imbalance post nutrition provision rather than a pre-existing medical/surgical complication or comorbidity, should be determined in conjunction with the treating medical or surgical team.*

TABLE 4 Signs and symptoms of refeeding syndrome.

Hypophosphataemia	Hypokalaemia	Hypomagnesaemia	Thiamin deficiency	Sodium retention
Hypoxia	Neurological paralysis or weakness	Weakness	Encephalopathy (including Wernicke's syndrome and Korsakoff psychosis)	Fluid overload
Impaired cardiac function including hypotension	Cardiac arrhythmias and/or ECG changes	Muscle twitching	Lactic acidosis	Pulmonary oedema
Impaired diaphragm contractility	Respiratory failure	Tremor	Nystagmus	Cardiac decompensation
Respiratory failure	Nausea	Altered mental status	Neuropathy	
Paresthesias	Vomiting	Anorexia		
Weakness	Constipation	Nausea		
Lethargy	Muscle necrosis	Vomiting		
Somnolence		Diarrhoea		
Confusion		Refractory hypokalaemia and hypocalcaemia		
Disorientation/delirium		Cardiac arrhythmias and/or ECG changes		
Restlessness		Tetany		
Encephalopathy		Convulsions		
Areflexic paralysis		Seizures		
Seizures		Coma		
Shock				
Haemolysis				
Thromboyctopaenia				
Leukocyte dysfunction				
Coma				

Note: Adapted from Kraft et al.[102] and da Silva et al.[1]

In all 46 studies, hypophosphataemia was included as a key diagnostic criterion. There were different cut-off levels specified, with the most common highlighting a 30% decrease from baseline,[22,31,48,55,56,58–62] and/or a 0.16 mmol/L decrease below a specific phosphate serum level.[31,47,53,55,56,63] Other aspects of the diagnostic criteria varied greatly. Some studies based diagnosis solely on hypophosphataemia,[6,31,43,45,47,52,53,55,56,58,64–67] some on a combination of electrolyte imbalances including hypophosphataemia,[5,22,23,36,37,48,50,57,59–61,68–73] and some on electrolyte imbalances in conjunction with clinical symptoms.[9,24,28,30,33,54,74–78] Every study that specified clinical signs and symptoms indicative of refeeding syndrome included fluid-balance abnormalities (i.e. oedema), and/or organ failure, specifically respiratory failure and/or cardiac failure.[9,24,28,30,33,54,75–78] Two studies in the eating disorder literature incorporated creatine kinase within their definitions.[78,79] No studies sufficiently considered other causes of electrolyte imbalances when exploring the prevalence of refeeding syndrome.

The timeframe for diagnosing refeeding syndrome ranged from 36 h[31] to 28 days[79] with the most common timeframe being up to a 72-h period ($n = 7$) following nutrition commencement.[22,48,52,53,59,65,76] Overall, the variations highlight the complexity and variability in diagnosing and defining refeeding syndrome in clinical practice and research. A validated diagnostic criterion for refeeding syndrome is required.

3.4 | Prophylactic supplementation

The following supplementation recommendations are based on the available evidence. However, caution should also be taken to avoid the ongoing provision of thiamin and multivitamins once refeeding syndrome risk has been mitigated.

3.4.1 | Thiamin

Thiamin supplementation is recommended prior to the commencement of nutrition intake and continuing for the first 7–10 days to mitigate refeeding syndrome risk. Level B evidence.

- Recommended Daily Intake: 1.1–1.2 mg.[80]
- Intravenous supplementation: 100 mg.
- Oral supplementation: 100–300 mg daily.[1,7,22,25,42,48,58,81–84]

Summary of evidence:

There is no specific evidence evaluating the role of thiamin in the prevention of refeeding syndrome; however, all available studies included thiamin in their protocols, with dosages varying between 100 and 300 mg, with dose and route determined by clinical judgement. Given thiamin is widely accepted as common practice in refeeding syndrome prevention and is unlikely to cause any adverse effects, it is recommended to be supplemented prior to the commencement of nutrition support and daily for 7–10 days, with dosage as per the medical team's clinical judgement.

3.4.2 | Multivitamin

Multivitamin supplementation is recommended for 10 days after the commencement of nutrition support. Level C evidence.

- Intravenous supplementation: one dose daily.
- Oral supplementation: dosage equivalent to one complete multivitamin dose.[1,2,7,22,25,30,36,42,48,82]

Summary of evidence:

There is no specific evidence that a multivitamin will reduce the risk or severity of refeeding syndrome. This is included as a recommendation as all studies included multivitamins in their protocols, multivitamin provision is considered common practice in refeeding syndrome prevention, and multivitamin provision is unlikely to cause any adverse events. A multivitamin can also assist with addressing any micronutrient deficiencies patients may be experiencing alongside malnutrition.

3.5 | Treatment and Intervention

3.5.1 | Commencement of nutrition support

For patients at risk of refeeding syndrome, commence feeding at ≥50% of estimated energy requirements provided that close electrolyte and clinical monitoring, and concurrent supplementation are provided as needed. No adverse events have been reported in studies that have used this feeding method. Feeding assertively prevents any unnecessary prolonged underfeeding in a population who are at high risk of malnutrition and its associated morbidities. Patients should reach goal energy requirements within 24–72 h of the commencement of nutrition support provided that medical monitoring is available.

In cases of severe electrolyte derangement (>30% decrease from baseline and outside of normal range) after the commencement of nutrition support, it is recommended to wait until levels stabilise prior to progressing towards goal nutrition provision. There is no evidence to

suggest reducing rate or ceasing feeding is beneficial in preventing refeeding syndrome. The traditional 'start low, go slow' approach to nutrition support in patients at risk of refeeding syndrome is not supported by current evidence and may delay the provision of adequate nutrition in nutritionally compromised populations. Level C evidence.

Summary of evidence:

Patients at risk of refeeding syndrome are often nutritionally compromised due to prolonged reduced energy intake, unintentional weight loss, and underlying malnutrition. The controlled environment of an acute care setting allows for close monitoring of electrolytes and supplementation as needed. This contrasts with historic descriptions of refeeding syndrome, often in extreme circumstances including famines and for prisoners of war where medical monitoring was minimal or unavailable.[85] A more liberal approach to commencing nutrition support in those at risk of refeeding syndrome is supported by the literature and acknowledges the risk of underfeeding in this population.

Two systematic reviews published in 2021 examined the incidence of refeeding syndrome in relation to energy initiation rates. There was no clear association between feeding rate (10–20 kcal/kg vs. 21–42 kcal/kg) and the incidence of severe hypophosphataemia and severe hypokalaemia.[2,45] Olsen, Hesseberg[45] found that refeeding hypophosphataemia occurred even when feeding cautiously (<15 kcal/kg).[45] This is supported by a two-centre, prospective, double-blinded randomised controlled trial that found commencing feeding at 100% of estimated energy requirements (compared to a control group receiving 50% estimated energy requirements) did not increase the incidence of electrolyte or fluid disturbances, hyperglycaemia, or other potential clinical problems in patients at moderate or high risk of refeeding syndrome as per the National Institute for Health Care and Excellence criteria.[86]

Similarly, a second randomised controlled trial investigated whether electrolyte and other abnormalities related to refeeding syndrome varied between initial rates of parenteral nutrition support (15 kcal/kg vs. 30 kcal/kg) in patients at moderate to high risk of refeeding syndrome.[4] They found no difference in the incidence of refeeding syndrome or indicators for refeeding syndrome (electrolyte imbalances, hyperglycaemia requiring insulin and/or QTc interval disturbance) between the different nutrition support commencement rates. A primary disadvantage of this study, however, was that they excluded patients at very high risk of refeeding syndrome (BMI <14 kg/m^2 OR ≥2 of the National Institute for Health Care and Excellence criterion) despite neither the National Institute for Health Care and Excellence nor the American Society of Parenteral and Enteral Nutrition recommendations stratifying risk in this way.

Drysdale et al.[30] conducted a retrospective cohort study of general inpatients in 2020 examining electrolyte levels, peripheral oedema/acute fluid overload, and disturbance of organ function related to being fed cautiously (<50% estimated energy requirements) or liberally (≥50% estimated energy requirements) via oral, enteral, or parenteral routes and found no difference in the incidence of adverse outcomes.[30] A more liberal approach to nutrition support did not increase the risk of adverse outcomes (regardless of feeding route) provided that close electrolyte and clinical monitoring was conducted.

There was limited available evidence to guide the progression of nutrition support in patients at risk of refeeding syndrome. The studies discussed above all recommend an initiation rate at or close to the patient's goal (varying between 21 and 42 kcal/kg and 50% and 100% estimated energy requirements) and did not provide any recommendations on incremental feed increases. The American Society of Parenteral and Enteral Nutrition recommend advancing by 33% every 1–2 days and replacing electrolytes prior to increasing or, in the case of severely low electrolytes, waiting until levels are normalised prior to progressing.[1] De Silva and Nightingale[36] suggested increasing nutrition rates at least daily to minimise the period of underfeeding, provided that monitoring and replacement of electrolytes occur as indicated.[36] This was supported by Drysdale et al.[30] who found no difference in adverse outcomes in patients who reached goal rate in <24 h versus >24 h.[30] Therefore, the consensus recommendation is that nutrition support should reach goal rate within 24–72 h of commencement, provided patients at risk are closely monitored.

3.5.2 | Commencing nutrition support in critically ill patients at risk of refeeding syndrome

It is recommended that existing guidelines for commencing nutrition support in critically ill patients are also applied to those patients at risk of developing refeeding syndrome.

Summary of evidence:

There are insufficient high-quality studies to guide the increase of nutrition provision in critically ill patients at risk of refeeding syndrome. Three studies have investigated the effects of calorie restriction compared to standard care; however, all studies based refeeding syndrome diagnosis on hypophosphataemia alone, potentially falsely inflating the prevalence of refeeding syndrome.[43,65,87] One multicentre randomised

controlled trial implemented a calorie restriction protocol compared to standard care resulting in no difference in the primary outcome of the number of days alive post-Intensive Care Unit (ICU) admission, but found the calorie-restricted group experienced significantly fewer major infections and airway or lung infections and better quality of life.[87] One small retrospective study found lower six-month mortality in those who received <50% estimated calorie requirements in the first 72 h of ICU, whereas another small retrospective study found hypophosphataemia was not associated with how quickly nutrition was initiated, and no difference in ICU or hospital length of stay or mortality with rapid nutrition progression compared to slow introduction of nutrition support.[43,65]

The randomised controlled trial was the only study to attempt to exclude patients with other potential causes of hypophosphataemia such as dialysis, recent parathyroidectomy, or patients who were already receiving treatment for hypophosphataemia. However, the exclusion criteria for other causes of hypophosphataemia were not exhaustive, and the other studies made no attempt to exclude these patients, indicating a potential risk of bias.[87] Existing guidelines regarding nutrition support for critically ill patients already tend to recommend more conservative feeding approaches to prevent overfeeding, and the recommendation is that these are also applicable to those at risk of refeeding syndrome.

3.5.3 | Commencing nutrition support for medically compromised patients with eating disorders

There is insufficient evidence to make a specific recommendation as to how to feed medically compromised adult patients with eating disorders; however, 'start low, go slow' is no longer best practice.

Summary of evidence:

While there are many studies examining assertive refeeding in the paediatric population, evidence is still emerging within the adult eating disorder space. The studies conducted thus far have demonstrated that it is safe to feed adult patients assertively[77,78,88–91]; however, there is no consensus on the commencement feed rate, the route of feeding, or the pace at which to advance to the goal rate of feeding. There is also limited evidence as to which goal rate to use.[92] It is suggested that nutrition provision for adult patients with medically compromised eating disorders be guided by specific eating disorder services, for example, the Queensland Eating Disorder Service protocol.[93]

3.5.4 | Considerations for route of feeding

Oral nutrition

Oral intake can be variable, and patients at risk of refeeding syndrome on oral diets require regular monitoring of biochemistry, weight, and clinical signs and symptoms to ensure mitigation of refeeding syndrome risk. Level C evidence.

Summary of evidence:

Despite historical hesitancy regarding feeding rates for patients at risk of refeeding syndrome, the evidence does not support restricting oral intake to decrease the risk of refeeding syndrome. Oral intake is usually self-limiting, and higher energy intakes in patients at risk of refeeding syndrome do not cause significantly more adverse events than lower energy intakes.[1,7,22,30,59,94,95] Limiting oral intake in an already undernourished patient may cause further harm and should be avoided.

Enteral nutrition

There is no evidence to suggest that patients at risk of refeeding syndrome should be given a lower commencement rate of enteral nutrition than the recommended lower starter rates already utilised to check patient tolerance of enteral feeds.

Summary of evidence:

There is no clear association between the rate of enteral nutrition and adverse events, particularly hypophosphataemia. Similar rates of hypophosphataemia are seen in cautious feeding commencement rates versus more liberal commencement rates.[2]

Parenteral nutrition

Parenteral nutrition goal rates should be achieved within 72 h to prevent underfeeding.

Summary of evidence:

There is no high-quality data supporting a cautious approach for parenterally fed patients to prevent refeeding syndrome. Underfeeding parenterally-fed patients does not prevent refeeding syndrome.[5,29,50,61,82,96,97] When parenterally fed patients are under close supervision with daily monitoring of electrolytes, there are no differences in outcomes (length of hospital stay, period in ICU, mortality) between those who do or do not develop refeeding syndrome.[4,36,86] There are also several studies which suggest patients fed parenterally are at lower risk of refeeding syndrome due to the reduced incretin-mediated insulin response seen in parenteral feeding compared with enteral or oral feeding.[7,98]

Overall, regardless of the route of feeding, refeeding syndrome can occur in any patient who is assessed to be at risk. The avoidance of underfeeding or overfeeding is

considered more important than attempting to alter 'risk' with the feeding route.[2,9,99]

3.6 | Monitoring

3.6.1 | Electrolyte Monitoring

Electrolyte derangement associated with refeeding syndrome is most likely to occur within 72 h of increased nutrition intake. It is recommended that serum electrolytes be monitored and replaced until deemed stable by the treating medical team. Level C evidence.

Summary of evidence:

There is a lack of consistency in the literature to guide specific recommendations for the frequency and duration of electrolyte monitoring after increasing nutrition intake in patients at risk of refeeding syndrome. A systematic review of predominantly observational trials, encompassing 45 studies and 6608 patients, showed that regardless of the definition of refeeding syndrome, most symptoms appeared within 72 h of increased nutrition provision and there was no association between refeeding syndrome and adverse clinical outcomes (mortality and hospital length of stay).[55] This is supported by several review papers where refeeding syndrome is acknowledged as typically being diagnosed as the onset of electrolyte derangement within 72 h of increased nutrition intake.[48,58,100] Three narrative reviews[25,56,57] have published slightly different recommendations for electrolyte monitoring. Ponzo et al.[25] and Friedli et al.[55] suggest daily electrolyte monitoring for the first 72 h followed by second/third daily for days 3–10 while Koekkoek[56] suggest daily electrolyte monitoring until medically stable. Ponzo et al.[25] also recommends monitoring of sodium, calcium, glucose, urea, and creatinine; however, this is not supported by other literature available. Therefore, this should be considered based on individual patient circumstances and at the discretion of the treating medical team.

Due to the lack of high-quality studies in this area, the evidence guiding the monitoring of electrolytes is inconsistent. The available evidence is primarily in the form of retrospective observational studies (Level III evidence) and narrative reviews (Level IV evidence). Recommendations for daily monitoring of electrolytes range from 3 to 10 days. Due to the lack of consensus on recommendations and the large number of variables (including diagnostic criteria for refeeding syndrome) we suggest taking a case-by-case approach and monitoring daily until medically stable. Caution should be taken to avoid over-ordering blood tests.

3.6.2 | Cardiac Monitoring

There is insufficient evidence to make a broad recommendation regarding routine cardiac monitoring for all patients at risk of refeeding syndrome.

Summary of evidence:

There is no evidence to support the routine use of cardiac monitoring for all patients who meet the criteria for risk of refeeding syndrome. De Silva and Nightingale[36] recommend cardiac monitoring for inpatients at risk of refeeding syndrome who present with cardiac manifestations and/or evidence of ECG changes. It is suggested that clinical judgement by the treating medical team is used to guide the use of cardiac monitoring in patients at risk of refeeding syndrome.[36]

3.7 | Electrolyte disturbance intervention

3.7.1 | Non-refeeding syndrome-related electrolyte disturbance

Electrolyte disorders are frequently encountered in many hospitalised population groups, particularly the critically ill and elderly patient populations. This may be due to multiple contributing factors and should not be linked solely to refeeding syndrome.

Summary of evidence:

Electrolyte disturbances, particularly hypophosphataemia, are multifactorial and common in critically ill and elderly patients.[50,68] Refeeding syndrome should be considered as a potential cause only for patients who have risk factors (as outlined above) and who develop electrolyte disturbances after increased nutrition intake without other causative factors. Studies in critically ill patients generally have not used diagnostic criteria for refeeding syndrome, instead defining it in terms of hypophosphataemia, which coincided with the initiation of nutrition support.[35,49,56,58,65,68,82,100,101] Therefore, existing literature in critically ill patients has potentially incorrectly conflated refeeding syndrome with hypophosphataemia from other causes. Limited evidence exists for the prevalence of refeeding syndrome in critically ill patients, and current recommendations rely on expert opinion. Similarly, the elderly population have higher incidence of metabolic complications including hypophosphataemia; however, it is unlikely this is attributable solely to refeeding syndrome, as other confounding factors (including but not limited to intravenous iron supplementation, sepsis, and the recovery phase of diabetes-related ketoacidosis) have not been appropriately considered in these studies.[22,45,50]

3.7.2 | Refeeding syndrome-related electrolyte disturbance

Low electrolyte levels should be replaced based on established guidelines. Consider the route of electrolyte administration based on the clinical situation and the severity of electrolyte disturbance/s.

Summary of evidence:

Electrolytes should be corrected if below normal levels at the initiation of nutrition therapy[36,56] but feeding does not need to be withheld until this is normalised. Electrolytes should be corrected to established reference ranges[35] and ideally be guided by local institutional guidelines if available. The oral route should be considered for electrolyte replacement in mildly decreased states (10%–20% below normal) or when patients are asymptomatic.[1,102,103] Otherwise, intravenous replacement should be used when the enteral route is unable to be utilised or in moderately to severely depleted cases (>20% below reference range).

3.7.3 | Prophylactic supplementation of electrolytes

No recommendations can be made for whether prophylactic dosing of electrolytes should be given to patients at risk if pre-feeding electrolyte levels are normal. Prophylactic replacement of electrolytes should be considered at the discretion of the treating medical team.

Summary of evidence:

There is limited evidence as to whether prophylactic supplementation of electrolytes improves outcomes. Further research is required examining prophylactic supplementation in different populations and settings to determine its effectiveness.[104] There are certain medical conditions such as renal failure or adrenal insufficiency where the calculation of prophylactic dosing of electrolytes can be challenging due to already elevated levels. It is recommended that relevant treating medical teams and/or specialists are consulted in this instance if prophylactic supplementation is deemed necessary.

4 | CONCLUSION

Although rare, refeeding syndrome requires appropriate identification and management to mitigate its adverse effects. These expert-led consensus statements provide recommendations for identification and management based on best-available evidence. Implementation of these recommendations within health services will require the support and training of multidisciplinary health professionals and those involved in workplace policy and procedure development. These consensus statements are expected to improve the identification and management of refeeding syndrome and refeeding syndrome risk within the adult hospital settings across Australia and New Zealand.

AUTHOR CONTRIBUTIONS

All authors contributed to the literature reviews and drafting content and recommendations. KMR, KB, and DL drafted the manuscript. This project was supported by the clinical practice committee from the Australasian Society of Parenteral and Enteral Nutrition. All authors are in agreement with the manuscript and declare that the content has not been published elsewhere.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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