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## ENHANCED RECOVERY AFTER SURGERY: THE ROLE OF NUTRITION

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***'Failing to prepare is preparing to fail', a statement which is all too true when considering patient outcomes post-surgery. For any patient undergoing surgery, recovery and avoidance of complications are key objectives. The pre-and post-operative health and diet of the patient is an integral part of this . . .***

While there are numerous factors which will influence recovery post-surgery (i.e. underlying disease, extent of surgery, age and psychological well-being), nutritional intervention can play an integral role, with the correct nutrition an essential part of the recovery process.

Malnutrition can negatively affect wound healing by prolonging inflammatory pathways, and in patients with undernutrition who present for surgery, there is a higher risk of post-operative complications including morbidity and mortality.<sup>1,2</sup> More than three million people in the UK are malnourished at any one time, with an estimated 30% of people admitted to acute hospitals and care homes at risk of malnourishment.<sup>3,4</sup>

A survey by BAPEN (British Association for Parenteral and Enteral Nutrition) of UK hospitals found that adults admitted to hospital were more underweight (<20kg/m<sup>2</sup>) when compared with the general population.<sup>5</sup>

The European Society for Clinical Nutrition and Metabolism (ESPEN) guidance recommends that nutrition support should be used in patients with severe nutritional risk 10-14 days prior to surgery; inadequate oral intake during this period is associated with a higher mortality rate.<sup>6</sup> For those patients at severe nutritional risk, a delay to surgery and administration of tube feeding and/or oral nutritional supplements (ONS) is advised (with exception to intestinal obstruction, severe shock and intestinal

ischemia). Use of tube feeding and/or ONS is also indicated in those patients who cannot maintain oral intake above 60% of recommended intake for more than 10 days and those who will be unable to eat for more than seven days peri-operatively (even if undernutrition is not obvious). Parenteral nutrition (PN) is indicated in patients for whom enteral nutrition (EN) may not be appropriate, such as in intestinal obstruction or failure.<sup>6</sup> PN can also be used to complement EN, in those patients consuming <60% of calorific requirements. In upper GI cancer patients at severe nutritional risk, use of PN, pre-operatively, has been shown to reduce complications.<sup>7</sup>

### PRE-OPERATIVE NUTRITIONAL CONSIDERATIONS

The overall health and nutritional status of the patient prior to surgery will vary significantly. Underweight, malnutrition, sarcopenia, cachexia and atrophy may already be present pre-surgery due to factors such as aging, disease and inactivity.<sup>8</sup> Surgical nutrition studies have identified weight loss (>10%) and low albumin (<30g/l) as risk factors for adverse outcomes.<sup>9</sup> Skeletal muscle plays an essential role in health; loss of aerobic capacity, reduced strength, weakness, fatigue, insulin resistance, falls and fear of falling, frailty disability and mortality are all associated with skeletal muscle loss.<sup>10</sup>

An interruption in nutritional intake can be negatively implicated in

health outcomes; increased metabolic stress, hyperglycaemia and insulin resistance are all indicated in pre-operative fasting.<sup>6,11</sup> Therefore, whilst pre-operative fasting is still common practice, it is now considered unnecessary for most patients (although this is contraindicated in those at risk of aspiration). When an earlier return to gastrointestinal function is facilitated, patients' tolerance to normal food and even enteral feeding can also be improved.<sup>12</sup> In a systematic review of patients who had elective gastrointestinal surgery, septic complications and length of hospital stay were reduced in those who received early EN.<sup>13</sup> It should be noted, however, that risks are associated with both enteral feeding and its early use. BAPEN guidelines provide advice on best practice for the administration of medication via enteral tubes.<sup>14</sup>

Surgery can have a huge impact on the body, resulting in a cascade of metabolic changes. When an injury occurs, afferent neuronal impulses activate an endocrine response.<sup>15</sup> This stress response to surgery results in a rise in stress hormones and inflammatory markers, which present as immune system suppression and increased cortisol secretions which will impact both carbohydrate, fat and protein metabolism. Insulin resistance is a sign of surgical stress, with more extensive surgery associated with greater levels of insulin resistance - an independent risk factor that influences length of stay and poor wound healing.<sup>16</sup> Hormonal changes will lead to increased catabolism (to mobilise energy sources). Once surgery has commenced, blood glucose concentrations will rise: the extent of this varies according to the type and degree of surgery. Potential risks linked to perioperative hyperglycaemia include increased wound infection and impaired wound healing. Post-operative control of blood sugar levels is, therefore, essential to recovery and overall outcomes.

#### POST-OPERATIVE NUTRITIONAL CONSIDERATIONS

During periods of inactivity/immobility, such as post-surgery, a loss of lean body mass is implicated in a reduced ability to recover. This issue is further exacerbated with age. An older cohort subjected to 10 days of inactivity

experienced approximately a three-fold greater loss of lean leg muscle mass when compared to a younger cohort examining protein synthesis and muscle mass in healthy adults who were subjected to bed rest for 28 days.<sup>5,17</sup> From age 40, muscles do not respond to protein from the diet as well as that of younger counterparts.<sup>18</sup> The right nutrition for muscle health and recovery is, therefore, key.

Post-operatively, for the majority of patients a standard whole protein formula is appropriate, which may include immune-modulating substrates (arginine, omega-3 fatty acids and nucleotides) in enteral form.<sup>6</sup> Extensive research exists on the role of ONS in older populations, which has shown to increase both body weight and improve nutritional status.<sup>19</sup> In those older individuals who are malnourished, an ONS high in protein and vitamin D in particular, can have a valuable role to play in improved recovery.

Patients with whole-body protein depletion have been shown to have a marked increase in both major complications and duration of post-operative stay.<sup>20</sup> For both young and elderly individuals it is well researched that moderate-to-large servings of protein or amino acids increases muscle protein synthesis.<sup>21,22</sup> In older adults, high doses of protein (>25g) or essential amino acids (10-15g) have a similar ability to synthesise muscle protein compared to younger ones; lower doses (protein <20g; EAAs <8g) do not achieve the same skeletal muscle response. However, single servings of >30g protein do not stimulate a greater anabolic response between younger and older adults.<sup>23</sup> The American Society for Parenteral and Enteral Nutrition (ASPEN) has suggested 1.2-2.0g protein/kg for those in the critical care setting, including post-operative major surgery.<sup>24</sup>

In a prospective non-randomised study, significant reductions in nosocomial infections and overall complications were shown in high-risk surgery patients (NRS 2002  $\geq 5$ ) who received sufficient pre-operative nutrition therapy (>10kcal/kg/d for seven days) when compared with patients who received insufficient therapy.<sup>25</sup> For low risk patients, no differences were observed between sufficient and insufficient EN.<sup>25</sup> 'Immune modulating nutrition' or 'immunonutrition' (a liquid nutritional supplement enriched with specific nutrients), given by



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the oral/enteral route during the peri-operative period has demonstrated a reduction in post-operative infective complications.<sup>26</sup>

Optimal rehabilitation and wound healing is dependent on the body being in an anabolic state. For the majority of patients undergoing surgery, a pre-operative carbohydrate drink the night before (800ml) and a 400ml drink two hours prior to anaesthesia is generally advised.<sup>6</sup> Reduced post-operative insulin resistance and preservation of skeletal muscle mass has been demonstrated in colorectal patients and those with hip replacement who took a 12.5% hypo-osmolar carbohydrate rich drink pre-operatively.<sup>27,28,29,30</sup>

Additionally, pre-operative carbohydrate loading reduces thirst, hunger and anxiety.<sup>29,30</sup> The correct pre-operative preparation is essential to post-operative recovery; carbohydrate loading reduces insulin resistance and diminishes nitrogen and protein loss.<sup>31,32</sup> Post-operatively it also helps to preserve skeletal muscle.

#### ENHANCED RECOVERY AFTER SURGERY (ERAS) GUIDELINES

Adopted by a number of hospitals, enhanced recovery after surgery (ERAS) protocols have become a widely accepted toolkit.<sup>33</sup> These guidelines provide evidence-based recommendations for ONS and EN in surgical patients. In a systematic review of six trials (3 RCTs and 2 CTs; n=512) use of ERAS resulted in reduced hospital stays and a lower morbidity rate (RR: 0.54 [CI 0.42-1.69]), although there was no difference in readmission and mortality rate.<sup>6</sup>

The ERAS guidelines seek to minimise

surgical stress, maintain nutritional status, reduce complications and optimise recovery rates. The ERAS programme considers key nutritional and metabolic aspects of pre and post-operative care, which integrate nutrition into the overall management of the patient, and include:

- pre-operative nutrition;<sup>34</sup>
- avoidance of long periods of pre-operative fasting;<sup>34</sup>
- fluid intake and carbohydrate loading up to two hours pre-operatively;<sup>34</sup>
- re-establishment of oral feeding as early as possible after surgery (ideally the first post-operative day);<sup>34</sup>
- metabolic control, e.g. of blood glucose;<sup>34</sup>
- reduction of factors which exacerbate stress-related catabolism or impair gastrointestinal function.<sup>6</sup>

Recently published (ESPEN) guidelines on nutrition in cancer patients strongly recommend that all cancer patients undergoing either curative or palliative surgery are managed using an ERAS programme.<sup>34</sup> Successful adoption of an enhanced recovery approach also requires input from the multidisciplinary team; 'enhanced recovery is about the whole team rather than an individual' at a sustained level.<sup>35</sup>

Implementing the most appropriate pre-and post-surgery protocols ensures that patients have the best possible chance of a successful and speedy recovery. Nutritional screening and intervention can play a vital role in this, with ERAS programmes offering a measured clinical impact on overall patient outcomes.