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ESPEN endorsed recommendations: Nutritional therapy in major burns☆

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SUMMARY

Background & aims: Nutrition therapy is a cornerstone of burn care from the early resuscitation phase until the end of rehabilitation. While several aspects of nutrition therapy are similar in major burns and other critical care conditions, the patho-physiology of burn injury with its major endocrine, inflammatory, metabolic and immune alterations requires some specific nutritional interventions. The present text developed by the French speaking societies, is updated to provide evidenced-based recommendations for clinical practice.
Methods: A group of burn specialists used the GRADE methodology (Grade of Recommendation, Assessment, Development and Evaluation) to evaluate human burn clinical trials between 1979 and 2011. The resulting recommendations, strong suggestions or suggestions were then rated by the non-burn specialized experts according to their agreement (strong, moderate or weak).
Results: Eight major recommendations were made. Strong recommendations were made regarding, 1) early enteral feeding, 2) the elevated protein requirements (1.5–2 g/kg in adults, 3 g/kg in children), 3) the limitation of glucose delivery to a maximum of 55% of energy and 5 mg/kg/h associated with moderate blood glucose (target $\leq$ 8 mmol/l) control by means of continuous infusion, 4) to associated trace element and vitamin substitution early on, and 5) to use non-nutritional strategies to attenuate hypermetabolism by pharmacological (propranolol, oxandrolone) and physical tools (early surgery and thermo-neutral room) during the first weeks after injury. Suggestion were made in absence of indirect calorimetry, to use of the Toronto equation (Schoffield in children) for energy requirement determination (risk of overfeeding), and to maintain fat administration $\leq$ 30% of total energy delivery.
Conclusion: The nutritional therapy in major burns has evidence-based specificities that contribute to improve clinical outcome.

1. Introduction

Severe burn injuries remain a major health care problem through the World. There are good news though: the first is that the vast majority of injuries are small "bagatelle" injuries that can be treated as outpatient, with a little less than 10% of the victims requiring hospital admission, and only a few requiring intensive care (ICU) treatment[1,2]; the second is that burn care has improved tremendously over the last 3 decades, resulting in a reduction of both mortality and of sequelae. Major burn injuries, i.e. those affecting more than 20% total burn surface area (TBSA) with or without inhalation injury, represent a specific condition when compared to the general intensive care pathologies. Critically ill burned patients are characterized by a strong oxidative stress, an intense inflammatory response, and a prolonged months-long hypermetabolic and catabolic response, all of which are proportional to the severity of injury (depth and extent). Nutrition therapy constitutes an integral part of the treatment, from the early start of the initial resuscitation.

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The body of literature concerning burns' nutrition has increased over the 3 last decades, while some important trials should be completed during 2013. The American Burn Association (ABA) published guidelines for the management of burn injuries in 2001,[3] based on a Medline search including years 1966 through 1998. As many aspects of management have evolved since that date, and particularly those concerning energy requirements, the French speaking societies included a revision of nutritional therapy in major burns in their upcoming global nutrition guidelines.

2. Material and methods

Experts in charge of burns' nutrition were nominated based on their experience by delegates of three scientific societies: Société Française d'Anesthésie-Réanimation (SFAR), Société de Réanimation de Langue Française (SRLF) and Société Francophone de Nutrition Clinique et Métabolisme (SFNEP).

Based on a PUBMED search including human studies 1979 through 2011, the experts produced a review of the literature and elaborated a French version of recommendations using the GRADE methodology (Grade of Recommendation, Assessment, Development and Evaluation),[4] that was validated by the widened non-burn specialized expert group. This method takes into account the quality of evidence study limitations, inconsistency of results, indirectness of evidence, Imprecision, reporting bias, the balance between benefits versus harms, and endpoint relevance.

The quality of evidence of each study used to support the recommendations was systematically specified (the supplemental online Table provides the list of the studies included in the analysis). The global evidence quality was therefore up- or down-modulated by the weight of these three additional factors. Each recommendation was thus allocated a final level of evidence which determined its wording: "we recommend" (or "we do not recommend") for a strong recommendation, "we strongly suggest" (or "we strongly do not suggest") for a moderate recommendation, "we suggest" (or "we do not suggest") for a weak recommendation. Each recommendation was then rated by all experts on a scale from 1 to 9 (1 = disagreement, 9 = agreement). A median score was calculated (after exclusion of the highest or lowest ratings, if necessary) that could fall into one of 3 zones: [1–3] = disagreement; [4–6] = indecision; [7–9] = agreement. If the confidence interval of the median was within the first or last zone, the strength of the recommendation was considered to be weak or strong, respectively. With this methodology, strength of recommendation has to be distinguished from the level of agreement (or disagreement) obtained from the vote of the experts: for example, it is possible to propose a weak recommendation with a strong agreement, or inversely a strong recommendation with weak agreement (e.g. for the use of rhGH in children).

3. Recommendations

Major burn patients are first of all critically ill. By default general ICU recommendations apply. Many high quality human studies, i.e. randomized and placebo controlled with reasonable number of patients, were published during the period, investigating major burn specific issues, enabling a reasonable GRADE rating (Table 1).

3.1. Route of feeding

The gastrointestinal tract is particularly at risk during the early burn resuscitation phase due to the major stress resulting from burn injuries and from the treatment required to maintain life. As a result of the early massive capillary leak causing an hypovolemic shock, large amounts of crystalloids are required during the first 24–48 h to maintain blood pressure. The fluid resuscitation causes generalized edema, including in the gut, contributing to the development of a paralytic ileus in case the gastrointestinal tract is not used early on. Intestinal permeability is also significantly increased shortly after injury compared to other ICU conditions.[5] Very early enteral feeding, i.e. initiated within the first 6–12 h after injury by the gastric route is associated with numerous clinical and biological advantages, such as attenuation of the stress hormone levels, of the hypermetabolic response,[6] results in increased immunoglobulin production,[7] reduction of stress ulcers, while reducing the risk of malnutrition and of energy deficit.[8,9]

The gastric route should be attempted first, keeping the post-pyloric access option or even percutaneous endoscopic gastrostomy (PEG) as backup in case of pyloric dysfunction in the most severely burned patients.

The choice of the feeding solution does not differ from other critically ill patients with preference of polymeric, high energy, high nitrogen solutions.[10] Fibers are recommended from the start as these patients are exposed to a high risk of constipation due to the important fluid movements and high doses of sedatives and opioids frequently required for analgesia. Parenteral nutrition (PN) is an alternative that is indicated only in case of enteral feeding

Table 1
Summary of statements.

Topic		Grade	Agreement
Indication	Nutritional therapy should be initiated early within 12 h of injury, preferentially by the enteral route.	B	strong
Route	We recommend to give priority to the enteral route, parenteral administration being rarely indicated	C	strong
Energy requirements & predictive Equations	We recommend considering indirect calorimetry as a gold standard to assess energy requirements. If not available or not suitable, we recommend using the Toronto equation for burn adults. For burn children, we suggest to use Schoffield formula	D	weak
Proteins	Protein requirements, are higher than in other categories of patients, and should be set around 1.5–2.0 g/kg in adults and 1.5–3 g/kg/day in children.	D	strong
	We strongly suggest to consider glutamine supplementation (or ornithine alpha-ketoglutarate) but not arginine	C	weak
Glucose and glycemia control	We strongly suggest to limit carbohydrate delivery (prescribed for nutritional and drug dilution purpose to 60% of total energy intake, and not to exceed 5 mg/kg/min in both adults and children.	D	strong
	We strongly suggest to keep glucose levels under 8 mmol/l (and over 4.5 mmol/l), using continuous intravenous infusion of insulin	D	strong
Lipids	We suggest to monitor total fat delivery, and to keep energy from fat <35% of total energy intake	C	weak
Micronutrients	We strongly suggest associating, in both adults and children, a substitution of zinc, copper and selenium, as well as of vitamin B1, C, D and E.	C	strong
Metabolic modulation	We strongly recommend using non-nutritional strategies to attenuate hypermetabolism and hypercatabolism in both adults and children (warm ambient temperature, early excision surgery, non-selective beta-blockers, and oxandrolone).	B	strong
	Unlike adults, we recommend to administer rhGH to burn children with burns TBSA >60%	B	weak