Nutritional supplementation in hip fracture sarcopenic patients: a narrative review

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Summary

In light of the progressive aging of the population the number of hip fractures is expected to be higher with resulting increased mortality, disability and medical costs. Nutritional interventions and supplementation in hip fractured patients, and in particular in sarcopenic ones, might have a positive effect, but the few evidences in literature and the heterogeneity of the studies make a controversial topic in the aging research field. The aim of this narrative review is to summarize the state of the art regarding the role of nutritional supplementation in hip fracture sarcopenic patients. Several studies provide evidences about the positive role of adequate nutritional approaches and supplementation, in particular with amino acids regarding safety and muscle strength and mass increase and functioning in hip fracture sarcopenic patients. Further evidences are mandatory to confirm the potential therapeutic role of specific macro/micronutrients in this condition and to develop specific recommendations regarding the correct posology required to obtain the best outcome improvements. Thus, future research should be focused on assessing the better response to nutritional approaches and the role of supplementation combined with multidisciplinary treatments in hip fractured sarcopenic patients management.

KEY WORDS: sarcopenia; aging; osteoporosis; hip fractures; dietary supplements; nutrition therapy.

Introduction

Hip fractures are the most common fragility fractures requiring hospitalization (1), with major morbidity (2, 3) and a high mortality (33% at 1 year) (4). Fragility fractures are defined as fractures associated with a low bone mineral density occurring spontaneously or due to low-energy trauma (fall from the standing position or less) (5); they often require a surgical approach (6-8) with a subsequent rehabilitative treatment (9-11).

Previous studies showed a high prevalence of sarcopenia (12, 13) in osteoporotic hip fractured patients. Sarcopenia, a condition characterized by low muscle mass and a reduced muscle function in terms of strength or physical performance (14, 15), share several pathogenic mechanisms with osteoporosis and their coexistence, recently defined as “osteosarcopenia”, negatively affects functional recovery after osteoporotic hip fracture in terms of disability, length of stay and social and health care costs (12, 16-20). According to the European Working Group on Sarcopenia in Older People 2, primary sarcopenia is related to aging while secondary is due to other pathological causes (15, 21). Among these reduced intake of proteins, malabsorption, anorexia, dysphagia or inability to eat are included (15). Moreover, a high prevalence of malnutrition was recognized even in hospitalized patients with hip fracture showing a strong correlation with worse outcomes and poor recovery in these patients (22, 23). Furthermore, aging is also associated with the loss of muscle and bone mass, and several studies have suggested that nutritional interventions could determine positive effects on bone and skeletal muscle health (24, 25). These evidences suggested that an adequate nutritional approach and supplementation combined with physical exercise (in particular muscle strengthening) might be considered crucial interventions in the treatment of sarcopenia (26).

In light of these considerations the aim of this narrative review is to summarize the state of the art regarding the role of nutritional approach and supplementation in hip fracture sarcopenic patients.

Supplementation in elderly

One of the main goal of nutritional supplementation worldwide is the achievement of “active aging”, as confirmed by the increasing sales of dietary supplements and nutraceuticals, containing vitamins and minerals (27). A recent
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In 2006 Miller et al. (49) analyzed energy and protein intake in hip or leg fractured older adults. They estimated the ideal caloric intake based on age, activity level, gender and disease-related metabolic stress and a protein intake of 1g/kg of body weight/day. Patients were able to meet only 50% of energy and 80% of target protein intake with diet alone. Therefore, considering the high prevalence of malnutrition in hip fracture patients, it is important to evaluate the role of supplementation and its effects are crucial aspects for both research and clinical purposes.

The PROT-AGE Study Group (50) recently showed in older patients hospitalized for hip fracture that a nutritional supplementation with an increased protein intake (1.2 to 1.5 g/kg body weight/day) might improve bone mineral density, reduce rehabilitation time and the risk of complications. The risk of complications has been also evaluated in a recent review performed by Meesters et al. (51), assessing the role of amino acid deficiencies in the clinical development of hip fracture non-union. The arginine-citrulline-nitric oxide metabolism plays a key role in fracture healing, and might also require appropriate serum concentrations of amino acids for an adequate bone consolidation. However, there are still few evidences to provide adequate recommendations on amino acids role in fracture healing process.

Lastly a recent Cochrane Systematic Review (52), including 41 trials with 3881 overall hip fracture patients, found low-quality evidences that oral multinationals prevent complications 12 months after hip fracture without any clear effect on mortality. Low quality evidences suggested likewise that nutritional supplementation might reduce unfavourable outcomes without increasing incidence of adverse effects like vomiting and diarrhoea.

Amino acids in hip fracture older patients

The role of amino acid supplementation in older people is still unclear, especially in hip fracture patients. Rondanelli et al. (53) recently investigated the role of essential amino acids supplementation in elderly patients with sequelae of coronary artery disease or hip fracture. The patients after a supplementation with essential amino acids (4 g, 2 times/day for 8 weeks) had an improvement in terms of nutritional outcomes without increasing incidence of adverse effects like vomiting and diarrhoea.

In 2008 Meesters et al. (54) performed a randomized controlled trial in hip fracture patients to study the impact of amino acid supplementation on body composition and muscle strength. Patients were divided into 2 groups, both undergoing a rehabilitative treatment, based on five sessions of 40 min/week for 2 weeks, followed by a home-based exercise protocol and nutritional counselling. Only the study group received supplementation with two sachets of 4 g/day of amino acids (1,250 mg of L-Leucine, 650 mg of L-Lysine; 625 mg of L-Isoleucine, 625 mg of L-Valine, 350 mg of L-Threonine, 150 mg of L-Cystine, 150 mg of L-Histidine, 100 mg of L-Phenylalanine, 50 mg of L-Methionine, 30 mg of L-Tyrosine, 20 mg of L-Tryptophan; 0.15 mg of vitamin B6, and 0.15 mg of vitamin B1). All the patients showed significant improvements in muscle strength, physical performance and level of assistance.

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after 2 months of intervention (T). Sarcopenic patients in the study group (n=10) showed statistically significant differences in all the primary outcomes at T (p<0.017), whereas in non-sarcopenic patients we found no differences at T, in all outcome measures. These findings suggested a greater positive effect of the intervention in the sarcopenic sub-population with important implications in the rehabilitation management and healthcare.

Conclusions

In this narrative review we showed that an adequate nutritional approach and supplementation in particular with amino acids might be considered a safe therapeutic option showing significant improvements on muscle mass, strength and function in hip fracture sarcopenic patients. However, long-term follow-up studies are lacking hindering any possible indication about a carry over effect of nutritional supplementation after discharge. Further studies are mandatory to confirm the potential role of specific macro/micronutrients and to develop and provide specific recommendation regarding the correct posology, in particular for amino acids supplementation. Studies might be focused on assessing the predictive characteristics of better response to a nutritional approach and the role of multidisciplinary approaches combining nutritional supplementation and physical exercise in hip fracture sarcopenic patients.

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