MANAGEMENT OF BURNS IN THE ELDERLY

PRISÉ EN CHARGE DES BRÛLÉS ÂGÉS

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SUMMARY. Burns are one of the most devastating forms of trauma worldwide. While geriatric burns are uncommon in the developing world - accounting for less than 5% of burns in South Asian and Middle Eastern countries - they account for almost 20% of burns in economically developed countries such as the USA. The elderly population in general is at higher risk for burn injury, moreover mortality rate, as well as severity of complications, is more pronounced in this group of patients. A review of the literature was conducted to evaluate risk factors as well as pathophysiological and immunological conditions that affect response to burn injury in the elderly population. Surgical and medical interventions used for the management of geriatric burns remain a field of controversy and ongoing debate. Improvement of burn management with reduction in mortality in this age group warrants addressing survivors’ quality of life, with a special focus on rehabilitation and support.

Keywords: burn, elderly, resuscitation, physiology, nutrition, intensive care

RÉSUMÉ. Les brûlures représentent les traumatismes les plus dévastateurs au monde. Alors les patients âgés ne représentent que moins de 5% des brûlés des pays en développement (Asie du sud et moyen orient), ils atteignent presque 20% des patients des pays à IDH élevé. Les sujets âgés représentent une population à risque élevé de brûlure, celle-ci étant grevée d’une morbi-mortalité plus élevée. Nous avons réalisé une revue de la littérature pour étudier les facteurs de risque et les modifications physiologiques comme immunologiques interférant avec la réponse à la brûlure du sujet âgé. La prise en charge médico-chirurgicale de ce groupe de patients reste sujette à débats. L’amélioration de cette prise en charge doit être couplée à une vie de qualité, nécessitant une rééducation optimisée.

Mots-clés: brûlure, sujet âgé, réanimation, physiologie, nutrition

Introduction

Burns are one of the most devastating forms of trauma worldwide.1,2 In the elderly, flame and scald burns, or scalds alone, are the major causes of burns, most commonly occurring at home, particularly in the kitchen and bathroom.1,3 While geriatric burns are uncommon in the developing world - accounting for less than 5% of burns in South East Asian and Middle Eastern countries - they represent about 20% of burns in economically developed countries such as the USA.4 The U.S. Census Bureau predicts almost a doubling of the population older than 65 years within the next 20 years in the western world.3 As a consequence, the number of burns among elderly patients is expected to increase, particularly when more elderly people suffer from burn injuries compared to younger individuals.1

Elderly individuals are more vulnerable to burn injury due to their limited mobility coupled with their physical inability to react rapidly and reach safety when faced with danger. Mabrouk et al.5 reported that when caught in a fire, 23.7% of the elderly collapse, which aggravates their injuries. Albornoz et al.6 have also highlighted decreased protective mechanisms in the elderly due to decreased sensitivity and atrophic skin. The propensity of geriatric patients to burn injuries is accentuated by pre-existing medical problems in conjunction with impaired vision, decreased coordination, and the side effects of medication.7 In addition, increased age is associated with increased dependence and requirement for assistance with activities.6,8 While children and young adults manifest improved survival rates, elderly individuals suffer from a disparate increase in morbidity and mortality following burn injury.9 In fact, age has consistently been shown to be a strong predictor of in-hospital mortality among burn patients,9 its impact well influencing survival up to two years after the initial injury.9

Aging is a complex multifactorial process concerted by the action of hormones, mitochondrial DNA, genetic material, free radicals, oxidative-inflammation and immuno-senescence,1 resulting in accumulation of cellular damage over time with failure of the repair machinery to fix the damage as fast as it occurs.1 Frailty is a term that describes the vulnerability of old age with inability to maintain normal homeostasis and stress response.10 Frailty can be assessed mainly by a patient’s nutrition status and level of activity.10 Boirie et al. recognize that this can be signalled by an unintentional drop in weight by 5%
in one year, reduced muscle strength, the appearance of unusual fatigue, or by a decrease in walking speed and physical activity.\textsuperscript{15} The end result is organ deterioration and malfunction with a reduction in “functional reserve capacity” in different organ systems, leading to diminished ability to adapt to aggravated circumstances such as after burn injury.\textsuperscript{1}

Society is shouldering the increasing burden of burn injuries in the elderly as a result of their age-related frailty.\textsuperscript{11} This is related to associated health and social service expenditure, as well as impaired quality of life, and physical and emotional suffering.\textsuperscript{11}

Age is one of the most consistently cited factors alongside sex, percentage TBSA, and concomitant inhalation injury influencing burn victims’ morbidity and mortality.\textsuperscript{1,12} Its impact is well illustrated by the burn severity index described by Baux.

Moreover, the elderly (over 65 years old) have more co-morbid medical conditions and double the mortality following a major burn injury than those under 65 years of age.\textsuperscript{4} They are at a higher risk for complications such as pulmonary edema, congestive heart failure and pneumonia.\textsuperscript{6} Altered immune and inflammatory response associated with aging contributes as well to the morbidity and mortality observed in elderly burn patients.\textsuperscript{1} Moreover, Keck et al.\textsuperscript{3} have demonstrated that aged survivors have slower recoveries, increased length of hospital stay and suffer more complications.

Recent literature was searched to evaluate accumulated evidence regarding risk factors and pathophysiological and immunological conditions that affect the response to burns in the elderly population. We aim, through this review, to assess response to burn, major complications and treatment of burns in this age group.

The elderly as a high-risk group

The biology and physiology of aging skin

Our skin provides an essential protective barrier against the environment, invading microorganisms, and ultraviolet (UV) radiation. It also functions in regulating body temperature, internal hydration status, and carries sensory functions in addition to its role in immunologic surveillance.\textsuperscript{14,15} Nevertheless, our skin’s integrity and function is eventually jeopardized by the process of aging through structural and biochemical processes,\textsuperscript{15} and manifests as impaired neurosensory perception, permeability, and compromised response to injury and repair capacity.\textsuperscript{15}

Skin aging occurs as a result of both internal and external processes.\textsuperscript{15} Exogenous insults such as pollution or cigarette smoke cause cumulative DNA damage, and accelerate the normal aging process.\textsuperscript{15} Genetics direct the intrinsic limb of aging at a pre-set pace, and occurs secondary to reactive oxygen species (ROS) that accumulate secondary to cellular metabolism, causing damage to critical cellular components such as membranes, enzymes and DNA.\textsuperscript{15} This translates into a reduced epidermal proliferation, and manifests in a deterioration of skin function and integrity.\textsuperscript{15}

Throughout our lives, the number of cell layers in our skin remains constant.\textsuperscript{15} Aging is accompanied by a decrease in the concentration of follicular adnexa,\textsuperscript{1} and thinning of the epidermis in photo-protected skin occurs progressively at an accelerating rate, of about 6.4\% per decade, especially over the face, neck, upper part of the chest, and the extensor surface of the hands and forearms.\textsuperscript{15,16} Of note, the earlier signs of aging observed in females in midlife are attributed to the fall in estrogen levels.\textsuperscript{15}

In contrast, the epidermis of photo-damaged skin thickens, with concomitant flattening of the rete ridges, and ultimately gives the appearance of atrophy and decreased thickness.\textsuperscript{16}

The loss of dermal papillae combined with a reduced interdigitation between layers leads to the most consistent structural change that occurs in the aging skin, appearing as flattening of the dermo-epidermal junction by over a third, and is observable using scanning electron microscopy after the sixth decade of life, leading to less resistance to shearing forces.\textsuperscript{15}

Nutrients and oxygen delivery to the epidermis relies on the surface area between the two layers, which is reduced as we age, and confers an increased risk of dermo-epidermal separation.\textsuperscript{15}

Additional histological changes noted in the epidermis include shorter and fatter keratinocytes, bigger corneocytes, an up to 20\% drop in melanocytes per decade, and a decrease in the water content in the stratum corneum.\textsuperscript{15} This is associated with a reduction of water and fat emulsion on the skin.\textsuperscript{15} Furthermore, changes in the amino acid composition of aging skin decreases the capacity for water binding secondary to a reduced amount of cutaneous natural moisturizing factor.\textsuperscript{15} These microscopic findings translate into uneven pigmentation of the elderly skin, and a 60\% decrease in sebum production.\textsuperscript{15}

As for the dermis, the thinning that occurs with age is accompanied by decreased vascularity and cellularity (mast cells, fibroblasts...), with subsequent drop in the amount of glycosaminoglycans, hyaluronic acid, elastin fibers, and ground substance.\textsuperscript{15} When it comes to photo-aged dermis, fibroblasts and langerhans cells are decreased with abundant surrounding inflammatory infiltrates.\textsuperscript{15,16}

The clinical significance of this process lies in the resulting deeper burn wounds and prolonged wound healing with a lower potential for re-epithelialization.\textsuperscript{1,15}

Immunology and aging: immunosenescence

With both the innate and adaptive branches of our immune system disturbed by aging,\textsuperscript{17} it yields to age-related changes, and the compromised immune competence tips the balance towards a pathogenic rather than a protective response.\textsuperscript{18} Ultimately, this process of immunosenescence renders the elderly host susceptible to otherwise innocuous infections, unable to respond to vaccination, incapable of fighting cancer, and at risk of autoimmune/inflammatory states.\textsuperscript{18}

One consequence is dwindling thymic T cell production, a process that is compensated for by proliferation of peripheral T cells.\textsuperscript{18} This eventually fails, and the T cell receptor (TCR) repertoire decreases with time.\textsuperscript{18} Yet, while changes affecting T cells are particularly important and bring considerable challenges to the aging organism,\textsuperscript{18} the decline in cell-mediated immune function combines with the reduced humoral immune responses to result in a chronic inflammatory state, which has been termed as “inflamm-aging”.\textsuperscript{1} Of particular interest, many of the markers of inflammation associated with aging (IL-1β, IL-6, TNF-a) are also central in the inflammatory response after burns.\textsuperscript{1} Moreover, age-related increase in various cytokines (mainly IL-6 and TNF-a) is believed to increase the likelihood of complications.\textsuperscript{1}

In addition, this weakened immunity is superimposed on a syndrome of smouldering, low-grade chronic inflammation.\textsuperscript{18}
Nevertheless, we have insufficient evidence from aging humans to suggest whether this syndrome is secondary to an enhanced immune responsiveness or due to a lack of physiologic immune suppression, or both.\textsuperscript{18}

Aging is associated with alterations in energy metabolism, which dramatically changes the size and distribution of fat depots, and predisposes the elderly to metabolic disorders and in particular insulin resistance.\textsuperscript{11} Insulin resistance and the associated decrease in mitochondrial oxidative capacity amplify each other with aging.\textsuperscript{11}

Subsequently, the prevalence of Type 2 Diabetes Mellitus in the elderly with its inherent immunosuppressive effect constitutes an additional hurdle.

In fact, insulin serves an immune-modulatory function, interfering with the pro-inflammatory response and the cytokine cascade, and significantly increasing the anti-inflammatory cytokines.\textsuperscript{10} A randomized, prospective trial of intensive insulin therapy in severely burned pediatric patients demonstrated that those who received intensive insulin therapy had fewer infections and sepsis, along with improved organ function, body fat, lean body mass, as well as a decrease in IL-6 and CRP levels.\textsuperscript{19} In a similar study, Fram et al. demonstrated reduced resting energy expenditure, improved mitochondrial oxidation capacity, and improved hepatic glucose metabolism.\textsuperscript{20} Given the epidemiology of the elderly population we are addressing, insulin therapy might be judicious as intensive insulin therapy in burn patients may reduce inflammation and improve energy utilization.\textsuperscript{20}

Immunological response in burns normally maintains homeostasis by triggering both a pro-inflammatory and an anti-inflammatory response, both mediated by cytokines and cellular responses.\textsuperscript{1} However, immunosenescence characterized by impaired immune functions and elevated pro-inflammatory cytokines associated with natural aging, in addition to the state of immunosuppression as a result of a major burn injury, predispose elderly burn patients to delayed wound healing and infectious complications, and may contribute to increased mortality.\textsuperscript{1,22}

\textit{Malnutrition and hypermetabolism in elderly burn patients}

Despite the outlined importance of an intact immune system, another crucial component is nutritional status, which in turn influences the immune system, and is compromised by malnutrition, leading to a higher risk of infection and mortality.\textsuperscript{22}

Aging is accompanied by an exponential loss of lean tissues, especially with malnutrition commonly encountered in the elderly.\textsuperscript{10} Of particular concern is the protein energy wasting in those over 75 years of age on restrictive diets.\textsuperscript{10} In fact, inadequate nutrition among elderly patients over 70 years of age is prevalent in the community up to 10%, but increases to nearly 65% in institutions,\textsuperscript{10} and is usually attributed to various factors such as poor oral health, loss of vision and hearing, dementia, dysphagia and pain.\textsuperscript{22} This is accompanied by poor physical activity, as well as endocrine disturbances such as serum dihydroepiandrosterone, and bioavailable testosterone, predisposing the elderly to sarcopenia and frailty.\textsuperscript{10}

A major burn probably represents the greatest possible state of physiologic stress, which is characterized by a hypermetabolic response involving massive protein and lipid catabolism, total body protein loss, muscle wasting, peripheral insulin resistance, increased energy expenditure, and stimulated synthesis of acute phase proteins.\textsuperscript{3,23,24,25,26} Such a state has high-energy requirements that are met by the mobilization of proteins and amino acids. Enhanced catabolism and protein degradation due to the increased and prolonged action of the pro-inflammatory acute phase response may be associated with increased incidence of multiple organ system failure as a consequence of alterations in the structure and function of essential organs (liver, skeletal muscles, skin, immune system, cellular membrane transport functions).\textsuperscript{3}

Moreover, hypermetabolic response is more severe in elderly burn patients, a finding that could be explained by the cytokine profile which differs from that of the younger population.\textsuperscript{1} Unfortunately, this hypermetabolic state cannot be prevented by early wound excision/closure, even when coupled with aggressive high-protein enteral nutritional support.\textsuperscript{22,24}

\textbf{Treatment}

\textit{Resuscitation}

The development of effective fluid resuscitation regimens is one of the cornerstones of modern burn treatment; it has most directly improved patient survival.\textsuperscript{27} It aims to prevent decreased tissue perfusion, multiple organ failure, sepsis and mortality,\textsuperscript{28} and the principal goal to optimize cardiac preload has been shown to overestimate the fluid needs in burned patients.\textsuperscript{3} There are many different formulated guidelines for burn resuscitation. The Parkland formula described by Baxter remains the most widely used,\textsuperscript{27} even though the debate regarding the most appropriate resuscitation fluid composition and regimen is still ongoing.\textsuperscript{23,29}

Adequate resuscitation is of major importance; it should be titrated to prevent burn depth conversion, pulmonary edema, abdominal compartment syndrome, and the phenomenon of fluid overloading known as ‘fluid creep’, while at the same time avoiding hypovolemia and acute renal failure.\textsuperscript{20,27,28} Attempts to avoid this pitfall of resuscitation have employed various methods, such as “colloid rescue”, minimizing opioids administration, instituting fluid resuscitation protocols, as well as “close loop” computer-driven protocols.\textsuperscript{30}

Several clinical parameters have been suggested to help adjust the rate of fluid administration. While urine output (target set at 0.5-1.0 mL/Kg/h) remains the gold standard, mean arterial pressure (MAP) (target set to 70), central venous pressure (CVP), Cardiac Index (CI), pulse, pulmonary capillary wedge pressure (PCWP) and mixed oxygen venous content are often used.\textsuperscript{20,28} In a trial involving 50 adult patients randomized to receive either strict Parkland or goal-directed resuscitation, Holm et al. found no difference in mortality, intensive care unit or ventilator days, pH or serum lactate levels.\textsuperscript{32} However, patients resuscitated using a goal-directed approach towards lactate levels, base excess, central venous oxygen saturation and other indicators of tissue perfusion despite adequate urine output and vital signs required 56% more fluid than Parkland patients.\textsuperscript{3} It was concluded that these findings “may be due to the fact that a pure crystalloid resuscitation is incapable of restoring cardiac preload during the period of burn shock”.\textsuperscript{31}

Age is significantly associated with an increased volume requirement in the first and second 24 hours post-burn.\textsuperscript{32} This is possibly due to the decreased skin turgor observed with diminished resistance to fluid accumulation, and its resultant fluid accumulation and edema production.\textsuperscript{5}
Inasmuch as cardiac function is affected directly by major burns, no evidence suggests that the elderly burn population is more at risk. However, under as well as over infusion remains a concern in those with pre-existing cardiac dysfunction or restricted cardiac reserve. Fluid resuscitation of elderly burn patients with compromised cardiovascular responses and reserves and probably hypoproteinaemia and decreased renal and pulmonary function should therefore be approached with great care. As such, actual fluid requirements can markedly differ from established guidelines, and elderly patients require close monitoring during fluid resuscitation. Rapid and excessive resuscitation with crystalloid solution may result in severe pre-load and elevation of the central venous pressure, further aggravating decreased tissue perfusion. With the addition of colloids to the resuscitation fluids as originally proposed by Baxter four decades ago, successful resuscitation can be accomplished with lower initial fluid volumes, especially in the elderly who cannot tolerate fluid overload. Moreover, recent studies have demonstrated that the use of albumin as early as 12 hours post-burn in those who are predicted to have a higher resuscitation volume as well as in elderly burn patients could be highly effective and beneficial. In light of these considerations, a highly experienced team is warranted for optimum management of the elderly burned patient.

Intensive care and monitoring

In the elderly, close monitoring of respiratory and cardiovascular parameters is mandatory during fluid resuscitation, especially in patients with pre-existing cardiac dysfunction and other co-morbidities. Elderly burn patients have a lower threshold for ventilator support during treatment because of the decrease in lung reserve and earlier fatigue. Severely burned patients are at risk for respiratory distress syndrome and prolonged dependence on mechanical ventilation regardless of the presence of inhalational injury. On a different note, critical burn patients in the ICU are prone to developing renal dysfunction and this significantly increases mortality rate among these patients to 72%. In fact, renal failure severity correlates with aging and may be one of the major contributors to the higher morbidity and mortality rates in elderly burn patients. Pain control in the elderly is often inadequate following burn injuries, and the premise that there is less pain with increasing age is baseless. Undertreated post-operative pain in the elderly is worrisome given its predisposition for delirium. Nevertheless, the regimen should carefully take into consideration the patient’s comorbidities, and renal, pulmonary, as well as cardiovascular functions.

Surgical management of burns

Accurate assessment of burn depth on admission is important in making decisions about dressings and surgery. Similarly, meticulous burn wound care is extremely important for optimal prognosis, especially in elderly patients. Controversies remain regarding aggressive, early excision (24–72 hours post-burn) of deeply burned tissues and the benefits of early skin grafting in terms of modification of the host inflammatory response, decrease in infections, shorter hospital stay and early functional recovery. Many still advocate a more conservative approach to avoid surgical complications. Instead, early tangential excision and skin grafting has been proven to be highly beneficial for pediatric burn patients, elderly patients constitute a specially vulnerable group, and early excision and grafting should be performed cautiously, particularly in elderly patients with TBSA greater than 20%. However, Burdge et al. demonstrated that early surgery in the elderly is better tolerated than wound sepsis thus a fine balance between early excision and conservative management needs to be carefully maintained.

When skin grafting is contemplated, we should keep in mind that the dermis in elderly patients is rather thin, which delays healing and complicates the ability to harvest and reharvest the skin donor sites. Eventually, regenerative capabilities of donor sites are lost, even when ultra-thin split thickness grafts are taken. For that matter, donor sites in burns in excess of 35% TBSA may require coverage with allografts or artificial skin substitute. Moreover, a well-vascularized bed is necessary for good take, but successful skin graft take is a major concern in the elderly burned patient, particularly in patients above 55 years of age or those suffering from peripheral vascular disease, diabetes mellitus or limb ischemia, and impacts its success at 14 days. In addition, truncal obesity in the elderly as measured by waist-hip ratio, or waist circumference, is significantly related to skin graft failure.

Another consideration with an aging population is the concurrent decrease in insulin-like growth factor (ILGF), which translates into decreased protein synthesis, and ultimately impaired healing. Similarly, the patient’s nutritional status is an important factor in graft healing. While serum albumin level is erroneously associated with graft success, it is in fact the serum pre-albumin level that is a sensitive tool in predicting graft take in burned patients, when all other conditions are optimized and favorable. Serum pre-albumin levels are highest in infants due to their high nutritional reserve and regeneration capacity, which decreases with age, while levels significantly decrease in patients with chronic disease. Moghazy et al. demonstrated in a cross-sectional study that among patients undergoing skin grafting, 93.8% of patients with normal pre-albumin level had complete healing, compared to only 44.4% of those with low levels, who also had longer hospital stays and increased mortality and morbidity, especially in terms of recovery from sepsis.

Wound infection and elderly patients

Major burns covering more than 30% TBSA are more susceptible to infections. While bacterial infections are the most common, fungal and viral etiologies may be implicated. Infections are not only found in the wounds directly, but also cause bacterial pneumonia, bloodstream infections and sepsis, greatly increasing mortality. Our host immune cells recognize foreign pathogens through pathogen-associated molecular patterns via pattern recognition receptors. The neutrophils and macrophages recruited to the wound site phagocytose clear invading organisms, and the previous evidence of a negative impact of aging on this process is now rejected by recent studies. This controversy has been addressed by several studies that examined the impact of the wound microenvironment on phagocytic cell function. In fact, aging was accompanied in vivo by impaired chemotaxis of peripheral blood neutrophils to cutaneous tissue. In addition, age attenuated peak leukocyte infiltration.

Despite the sparing of T cell recruitment with aging, the...
delay in neutrophil and macrophage recruitment may impair early bacterial clearance, while the inability to recruit elevated numbers of leukocytes may contribute to persistent infection.\textsuperscript{49} In addition, this might disturb wound healing kinetics by delaying the transit from an inflammatory to a proliferative phase.\textsuperscript{49}

Nevertheless, elevated levels of neutrophil chemokines found in wounds of elderly individuals suggest that a stronger stimulus may be required to mediate a response.\textsuperscript{49}

**Nutritional support**

The primary goal of nutritional support is to meet the demands placed upon the body by hypermetabolism which can result in life-threatening protein-calorie malnutrition.\textsuperscript{50} The aim should be to maintain lean body mass, limit fat accretion and protein wasting, as well as assist and enhance wound healing.\textsuperscript{50}

A catabolic response is initiated with burn injuries covering 15-20\% TBSA.\textsuperscript{50} Burn patients with injuries covering more than 40\% TBSA require special attention as metabolic rate increases proportionally with the increase in burn size.\textsuperscript{51} Nutritional support is a crucial step in the management of burn patients,\textsuperscript{52} especially in the elderly.

Elderly patients under normal circumstances have a reduced resting metabolic rate and may be unable to generate the required increase in metabolism following a burn injury.\textsuperscript{50} They may benefit from nutritional support with even a minor burn injury not exceeding 20\% TBSA\textsuperscript{50} and may benefit from brief intervals of care dedicated to nutritional rehabilitation before further surgical treatment.\textsuperscript{52}

Nutritional support of elderly patients with burn injuries is challenging, as wound healing is impaired compared to younger patients.\textsuperscript{5} Additionally, this age group exhibits immunosenescence, and has a higher incidence of malnutrition at presentation.\textsuperscript{53} Such patients should be identified, as re-feeding syndrome is associated with malnourishment once feeding is initiated.\textsuperscript{43} Underlying organ dysfunction related to aging or true medical comorbidities further complicate the picture as macronutrients such as protein and fat, and micronutrients such as potassium and glucose need to be limited.\textsuperscript{50} Of note, care should be taken with enteral feeding as it poses a risk of aspiration, particularly in delirious elderly burn victims.\textsuperscript{50,52} Risk of aspiration can be reduced with intestinal feeding rather than gastric.\textsuperscript{50,52}

**Rehabilitation**

While recent reports from burn centres suggest that more elderly patients are being discharged alive from acute care,\textsuperscript{10} success cannot be measured merely by survival to discharge.\textsuperscript{10} It is important to note whether patients achieve rehabilitation, social reintegration and long-term survival.\textsuperscript{10} Improving long-term outcomes has become the primary goal of acute burn care for all patients,\textsuperscript{10} and quality of life should not be disregarded.\textsuperscript{51}

Data show that older age, and patients discharged to a nursing facility after acute burns, had a higher rate of re-hospitalization than those who went home (71.5 vs. 31.5\%, $p < .001$).\textsuperscript{10} However, while repeat hospitalization may not be secondary to burn injuries, this suggests that many older patients do not return to their previous state of health,\textsuperscript{51} and the impact persists long after the immediate post-injury period.\textsuperscript{10} The consequences of burn injury on elderly victims are multiple and include exacerbation of their previous comorbid conditions, decreased mobility, limited function, loss of independence, poor nutrition, pain, delirium, dissatisfaction with appearance and depressed mood.\textsuperscript{10,51}

Deterioration of mental capacity, reduction or cessation of interest, loss of an active role and frustration of ideals have also been associated with older age,\textsuperscript{54} along with higher mortality at 1 year.\textsuperscript{10} All these parameters are frequently neglected by studies that often do not assess outcomes beyond mortality and morbidity.\textsuperscript{51} As a matter of fact, the information in the literature dealing with the functional outcome of patients is scarce, and very little interest is spent managing the functional consequences of burns in the elderly.\textsuperscript{55} Informed decision-making about care, disposition and resource allocation requires a clear understanding of long-term outcomes for elderly burn patients, and research in this field is critical.\textsuperscript{10}

In order to provide a good quality of residual life, psychological as well as physical rehabilitation are of utmost importance, both of which influence recovery, and must be tackled early and addressed intensely in the long-term.\textsuperscript{53} Physical factors that may hinder recovery include senile kyphosis, limitation of articular excursion and motor activity, chest deformation and neuromotor deficit.\textsuperscript{53} There is also an age-related psychological recovery trajectory whereby maximum improvement in the Mental Component Score (MCS) does not occur until 2 years post-burn in the youngest age groups, whereas in the older age group the largest mental health status improvement occurs within 6 months post-burn and remains constant for the next 18 months.\textsuperscript{51}

In preparation for discharge, rehabilitation facilities and other outpatient programs where elderly patients can be followed should be sought,\textsuperscript{10} especially as Alden et al. point out that independence and living arrangements of senior and elderly patients are the casualties of burn injuries.\textsuperscript{54} A study by Klein et al. outlined age differences in the living situation of burns patients. Older patients are more likely to be living alone at the time of the burn.\textsuperscript{7} Moreover, while the disposition of most patients younger than 75 years of age is their home, over half of those aged 75 and over are discharged to skilled nursing facilities, and only a third of the elderly patients living alone prior to their injury plan on living alone after discharge.\textsuperscript{7}

**Conclusion**

While our review is mainly concerned with burn injuries in the elderly population, this age group is still not well defined. However, we should keep in mind the heterogeneity of the aged population regarding various associated comorbidities.

In addition, prior to knowing how to deal with such accidents, we must recognize the value of prevention, especially considering that most burn injuries in the elderly occur at home.

Nevertheless, management is at times needed, and appropriate care starts with an understanding of the physiological basis of aging, and adequate consideration of the various processes that impact healing and the complications that hinder recovery.

However, the surgical and medical interventions used remain controversial, and debates are ongoing. In addition, improvements in burn management and accompanying reduction in mortality warrants addressing the quality of life of the patient, focusing also on rehabilitation and support.
BIBLIOGRAPHY