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Burns in the Elderly

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Abstract **Original Research Article**

Burns in elderly subjects are of paramount importance and occupy a major place in current scientific research. The ultimate goal of our work is the study of epidemiological profiles, the circumstances of burns, clinical characteristics, prognostic factors as well as therapeutic means and the evolution of burn patients aged 60 and over. The analysis of this data will allow us to improve therapeutic care in this vulnerable population. With this in mind, we conducted a retrospective descriptive study spanning from January 2016 to December 2019, identifying 11 cases of elderly burn victims, having been hospitalized in the national burn center of Meknes. Burned seniors require early, multidisciplinary care by a highly experienced team. However, therapeutic ECP has only marginal effectiveness in reducing the rate of morbidity and mortality. So, the best way to treat a burn is to prevent it from happening.

Keywords: Burns, Elderly People, Thermal Burn, the Parkland Formula.

INTRODUCTION

Burn is defined by tissue destruction secondary to attack on the skin covering, or even underlying structures, following the action of thermal, chemical, electrical or radiological agents [1].

Burns are frequent accidents, both in Morocco and in the rest of the world, which constitute a major public health problem, given that they are responsible for approximately 265,000 deaths per year [2], thermal mechanism is incriminated in more than 85% of all burns.

The majority of these accidents occur at home, and the elderly (defined as individuals aged 60 and over, according to the United Nations), are among those most predisposed to burns; advanced age is considered a major prognosis factor of the burn patient.

The objective of this work is to collect demographic, clinical, therapeutic and evolutionary data concerning burns; affecting this vulnerable age category and to report a treatment approach in light of the latest recommendations from learned societies.

METHODS

This is a retrospective descriptive study, carried out in the burns and plastic surgery department at the Mohammed V provincial hospital in Meknes. Spanning from January 2016 to December 2019.

The choice of our patients meets the following criteria:
Inclusion Criteria: we included in this work all patients hospitalized for burns, whose age is 60 years and over:

- Regardless of their gender;
- Whatever their status: civil or military;
- Regardless of the body surface burned
- Whatever their geographical origin.

Exclusion Criteria

- Patients whose age is less than 60 years;
- Patients with incomplete files on initial care.

An exploitation sheet was established, thus allowing the collection of the data necessary for statistical analysis in order to meet the objectives of our study.

Fiche d'exploitation

❖ **Identité :**

- Nom et prénom :
- Age :
- Sexe : Masculin ☐ Féminin ☐
- Date d'admission :
- Saison :
- Mois lunaire :
- Habitat :
- Origine : Urbaine ☐ Rurale ☐
- Mutualiste : Non ☐ Oui ☐ : FAR ☐ RAMED ☐ CNOPS ☐ CNSS ☐
- Niveau socio-économique : Bas ☐ Moyen ☐ Elevé ☐

❖ **ATCDS pathologiques :**

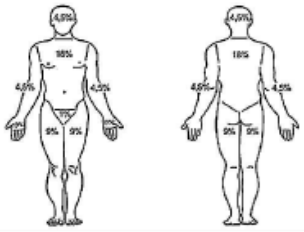
Médicaux	Chirurgicaux

❖ **Circonstances de l'accident :**

- **Heure de survenue de la brûlure :** .....h.....
- **Lieu de l'accident :**
  - À domicile : ☐ si oui, préciser : Cuisine ☐ Salle de bain ☐ Autre :
  - Professionnel : ☐ si oui, préciser :
  - AVP : ☐
  - Bain maure : ☐
  - Autres : ☐ si oui, préciser :
- **Délai entre l'accident et l'admission aux urgences de l'hôpital provincial Mohammed V de Meknès :**
- **Type d'accident :** Individuel ☐ Collectif ☐
- **Mode de transport :**
  - Ambulance : ☐
  - Véhicule personnel : ☐
  - Autres : ☐
- **Agent causal :**
  - Thermique : ☐ si oui, préciser :
    - ✓ Ébouillantement : ☐ si oui, préciser :
    - ✓ Flamme : ☐ si oui, préciser :
    - ✓ Autres : ☐
  - Électrique : ☐ si oui, préciser : Haut voltage ☐ Bas voltage ☐
  - Chimique : ☐ si oui, préciser : Acide ☐ Base ☐
  - Radiologique : ☐

❖ **Caractéristiques cliniques à l'admission :**

- **État hémodynamique :** Stable ☐ Instable ☐
- **État neurologique :** Conscient ☐ Obnubilé ☐ Comateux ☐
- **Profondeur :**
  - 1er degré ☐
  - 2ème degré superficiel ☐
  - 2ème degré profond ☐
  - 3ème degré ☐
- **Surface corporelle brûlée (SCB) :** %
- **Localisation de la brûlure :**
  - Tête : ☐
  - Cou : ☐
  - Tronc : ☐ si oui, préciser : Face antérieure ☐ Face postérieur ☐
  - Périnée : ☐
  - Fesses : ☐



- Membre supérieur : ☐ si oui, préciser : Droit ☐ Gauche ☐
- Membre inférieur : ☐ si oui, préciser : Droit ☐ Gauche ☐

➢ **Lésions associées :**

- Inhalation de fumées : Oui ☐ Non ☐
- Traumatismes associés : Oui ☐ Non ☐, si oui, préciser :
- Autres :

❖ **Prise en charge :**

➢ **Pré-hospitalière :**

- Rien ☐
- Extraction de la source ☐
- Refroidissement à l'eau ☐
- Autres :

➢ **Hospitalière :**

- **Traitement général :**
  - ✓ Voies d'abord veineux :
    - VVP : Oui ☐ Non ☐
    - VVC : Oui ☐ Non ☐ si oui, préciser quelle voie:
  - ✓ Sondage vésical : Oui ☐ Non ☐
  - ✓ sondage naso-gastrique : Oui ☐ Non ☐
  - ✓ Réanimation volémique :
    - Remplissage : Oui☐ Non☐, si oui préciser : Cristalloïdes☐ Colloïdes☐
  - ✓ Réanimation respiratoire :
    - Oxygénothérapie : ☐
    - Intubation : ☐
    - Trachéotomie : ☐

  - ✓ Analgésie : Oui ☐ Non ☐, si oui préciser :
  - ✓ Réchauffement : ☐
  - ✓ Alimentation :
    - Entérale ☐, si oui préciser :
    - Parentérale ☐, si oui préciser :
  - ✓ Thérapeutiques associées :
    - Vitamines et Oligo-éléments : ☐, si oui préciser :
    - Protection gastrique : ☐, si oui préciser :
    - Thromboprophylaxie : ☐, si oui préciser :
  - ✓ Rééducation et physiothérapie :
    - Kinésithérapie respiratoire : ☐
    - Rééducation orthopédique : ☐
    - Rééducation cicatricielle : ☐
    - Rééducation fonctionnelle (autonomie) : ☐
- **Traitement local :**
  - ✓ Nettoyage au sérum salé : ☐
  - ✓ Pansement occlusif : ☐, si oui préciser :
  - ✓ Incision de décharge : ☐
  - ✓ Greffe cutanée : ☐ si oui, préciser le type :

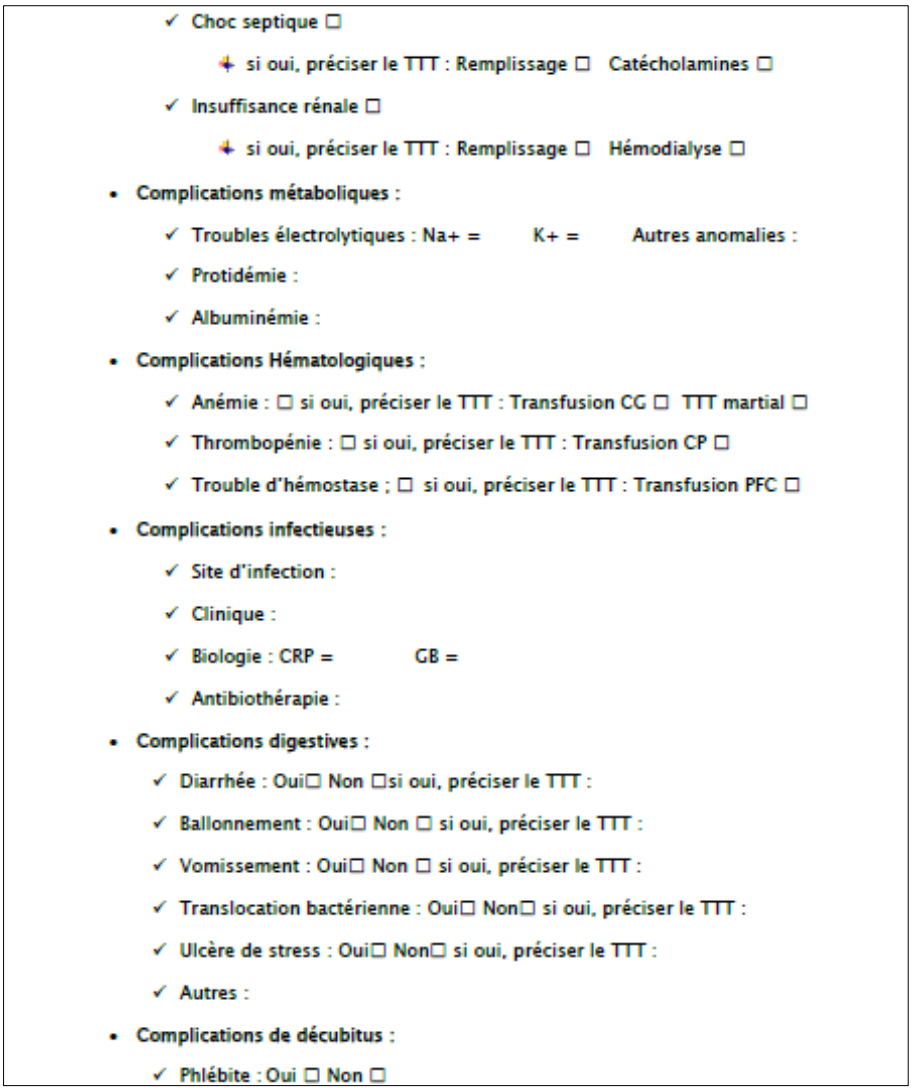
❖ **Évolution et complications :**

➢ **Décès :** Oui ☐ Non ☐ si oui, préciser à quel jour :

➢ **Transfert :** Oui ☐ Non ☐ si oui, préciser :

➢ **Complications générales :**

- **Complications hémodynamiques :**
  - ✓ Choc hypovolémique ☐
    - si oui, préciser le TTT : Remplissage ☐ Catécholamines ☐



- ✓ Choc septique ☐
  - si oui, préciser le TTT : Remplissage ☐ Catécholamines ☐
- ✓ Insuffisance rénale ☐
  - si oui, préciser le TTT : Remplissage ☐ Hémodialyse ☐

- **Complications métaboliques :**
  - ✓ Troubles électrolytiques : Na+ = K+ = Autres anomalies :
  - ✓ Protidémie :
  - ✓ Albuminémie :
- **Complications Hématologiques :**
  - ✓ Anémie : ☐ si oui, préciser le TTT : Transfusion CG ☐ TTT martial ☐
  - ✓ Thrombopénie : ☐ si oui, préciser le TTT : Transfusion CP ☐
  - ✓ Trouble d'hémostase ; ☐ si oui, préciser le TTT : Transfusion PFC ☐
- **Complications infectieuses :**
  - ✓ Site d'infection :
  - ✓ Clinique :
  - ✓ Biologie : CRP = GB =
  - ✓ Antibiothérapie :
- **Complications digestives :**
  - ✓ Diarrhée : Oui☐ Non ☐si oui, préciser le TTT :
  - ✓ Ballonnement : Oui☐ Non ☐ si oui, préciser le TTT :
  - ✓ Vomissement : Oui☐ Non ☐ si oui, préciser le TTT :
  - ✓ Translocation bactérienne : Oui☐ Non☐ si oui, préciser le TTT :
  - ✓ Ulcère de stress : Oui☐ Non☐ si oui, préciser le TTT :
  - ✓ Autres :
- **Complications de décubitus :**
  - ✓ Phlébite : Oui ☐ Non ☐
  - ✓ Escarres : Oui ☐ Non ☐
  - ✓ Autres :
- **Complications psychologiques :**
  - ✓ Dépression : ☐ si oui, préciser le TTT :
  - ✓ Trouble anxieux : ☐ si oui, préciser le TTT :
  - ✓ État de stress post traumatique : ☐ si oui, préciser le TTT :
  - ✓ Confusion mentale : ☐ si oui, préciser le TTT :
  - ✓ Agitation : ☐ si oui, préciser le TTT :
  - ✓ Autres :

❖ **Durée d'hospitalisation :**

Operating sheet

RESULTS

It should be announced that during our study, the number of hospitalizations for burns in the burns and plastic surgery department of the Mohammed V provincial hospital in Meknes was 211 patients.

According to our inclusion criteria, we retained 11 patients, whose age is greater than or equal to 60

years, over a period of 4 years, i.e. an incidence of 5% of all patients hospitalized for burns.

The female gender represents 7 cases of the study population, while 4 cases are male and the average age of our patients is 67.9 years, with extremes ranging from 60 to 82 years.

It should be noted that the majority of patients come from urban areas with a rate of 73%, compared to only 27% who come from rural areas.

The distribution of patients studied according to socio-economic status shows that 73% live in unfavorable socio-economic conditions.

The seasonal distribution of hospitalizations over the four years of our study reveals an increased recruitment of elderly burn patients during the summer period, which represents approximately a little more than half (55%) of the overall recruitment of the target population.

The number of elderly burn patients admitted to the service remained stable and constant between 2016 and 2017, at 27%. On the other hand, we recorded a peak during 2018, with a prevalence of 36%. Furthermore, the hospitalization rate experienced a remarkable decrease during 2019, with an incidence of 9%.

It is important to mention that 64% of the population studied had a pathological history. It is important to note that burns can occur at any time of the day. However, we revealed that more than half (55%) of burns in elderly subjects occurred during the afternoon.

Most burns in subjects aged 60 and over were domestic accidents, with a percentage of 64% of our sample. we noticed that the burn mechanisms were exclusively thermal.

Only 4 patients (i.e. 36%) benefited from medical transport. On the other hand, the remaining 7 cases were taken to the hospital by their relatives using various means of transport.

It is important to specify that the most predominant injured areas in the geriatric population studied were in the upper limbs, in 55% of cases. In second place in terms of the seat, we find the lower limbs as well as the posterior aspect of the trunk, with a percentage of approximately 45%. Furthermore, cervico-facial localization was observed in 3 patients, i.e. a prevalence of 27%. The average body surface area burned in our patients is 22.8%.

We noted a predominance of deep 2nd degree burns in 45% of cases, followed by superficial/deep 2nd degree mosaic burns in 27% of our sample. Furthermore, third-degree burns occupy third place with a prevalence of 18%.

In our series, 9 patients (82%) had a stable hemodynamic state, compared to 2 patients (18%) admitted in a state of hypovolemic shock, treated by the usual vascular filling protocols.

We noticed that 6 patients (55%) were conscious, while 4 subjects were obtunded, a prevalence of 36%. On the other hand, we recorded only one case of coma, or a percentage of 9%.

4 cases (36%) used cooling of the lesions with tap water. However, 5 subjects (45%) of our study population had not undergone any intervention.

All elderly subjects in our sample benefited from a peripheral venous approach. However, the central venous line was necessary in 9 patients, an incidence of 82%. In fact, all of the central routes were made at the femoral level.

All our patients received vascular filling to prevent hypovolemic shock and its consequences. The amount of fluids infused was estimated using the Parkland Hospital Baxter formula as follows: 4CC/kg/percentage of body surface area burned. Indeed, the solute used for the filling was 0.9% isotonic saline. 73% of patients received respiratory assistance.

Paracetamol was the protagonist of the analgesics used in the population, the subject of study. it was given in combination with nefopam in 27% of cases (3/11). Furthermore, morphine was used in 18% of our elderly population.

8 subjects underwent bladder catheterization and 3 patients underwent gastric catheterization. The transfusion was carried out in 8 of our patients (blood and/or albumin)

Nutrition constitutes a challenge in burn patients and more particularly in the elderly, given the major risk of hypoproteinemia. As a result, all our patients benefited from early nutrition. It should be noted that only 5 subjects had benefited from a transplant cutaneous to thin skin.

All our patients had benefited from cleaning the burned areas with isotonic saline as well as flattening the blisters, with a change of dressings every two days. It should be noted that we used a moisturizer for superficial burns. On the other hand, we applied an antiseptic cream based on silver sulfadiazine combined with an occlusive dressing for deep and extensive burns. Furthermore, the discharge incision was made in only one patient (9%) for a deep circular burn on the right lower limb.

It is important to specify that 7 patients were placed on antibiotic therapy, representing a prevalence of 64% of the population studied. In fact, more than half (55%) received amikacin in combination with another molecule

All our patients had benefited from:

- Gastric protection with omeprazole 20 mg per day
- Thromboprophylaxis with LMWH (LOVENOX®) 0.4 ml per day
- Administration of oral iron
- Supplementation with vitamins and trace elements, namely vitamin C, Cu, Zn, Mg and selenium

It should be noted that a little more than half (55%) were declared out after a good improvement.

Furthermore, 2 patients (18%) were transferred; one case of which was transferred to the national burn center in Casablanca, while the second was sent to the dermatology department CHU Hassan II Fez. Finally, 3 subjects died, for a mortality rate of 27%.

It should be noted that the average length of stay of the patients studied was 22.45 days, with extremes ranging from one week to 52 days.

DISCUSSION

A burn is defined as destruction of the skin covering, or even underlying tissues, following the action of thermal, chemical, electrical, or radiological agents [1]. It is important to emphasize that this trauma not only has a local impact, but also a general one, sometimes putting the patient's vital prognosis at risk due to its extent [3].

Furthermore, it is extremely important to describe the physiopathological mechanisms at the level of the different organs and the clinical particularities in order to better understand the consequences of the burn, namely inflammatory, cardiovascular, respiratory, metabolic, digestive, hepatic, neurological, renal, hematological and infectious consequences.

Aging is a physiological, multifactorial and heterogeneous process whose understanding of the mechanisms has become a current phenomenon, especially with the longevity of the population [4]. This phenomenon is accompanied by numerous physiological modifications of the various systems linked to advancing age, which will alter the normal functioning of the individual, regardless of any pathology [5]. Many of these changes begin to manifest gradually from the age of 40 and continue until the person's death [4]. Indeed, these alterations vary both according to the organ and the function considered and also according to individuals of the same chronological age (interindividual aging) [6].

Older adults are a rapidly growing segment of the global population and are at high risk of permanent disability and premature death due to traumatic injuries, such as burns [7]. Indeed, several factors make this particular population prone to burns. Furthermore, a systematic review of data published from 1985 to 2009 showed that the three main factors for poor prognosis were advanced age, pre-existing comorbidities as well as extensive burns [8]. Similarly, current reports reveal that mortality in elderly patients suffering from burns ranges from 7.4 to 66% [9].

Aging is associated with changes in many physiological systems. These changes in association with pre-existing comorbidities (related to advanced age) make the geriatric population prone to burns. These elements also play a potential and determining role in the severity of this trauma. Similarly, a certain incidence of burns in the elderly has been attributed to abuse and neglect [10].

Indeed, the decrease in physical strength and the cognitive disorders linked to senescence, alter the cerebral processing of the early warning signs of gas and fire, on the one hand, on the other hand, the latter slow down the capacity of elderly people to quickly escape from the fire scene, which further predisposes seniors to burns [7-10]. Additionally, reduced mobility and poor coordination also contribute to the severity of thermal burns [7].

As is the case for any burn patient, first aid actions must be initiated by witnesses to the accident, after alerting the SAMU or firefighters. First, the priority is represented in the extraction of the subject from the place of danger, respecting the conditions required by possible trauma and taking care to protect themselves [11]. Then, it is obligatory to stop the thermal process by removing loose clothing and metal objects, in order to avoid the deepening of the lesions. Fashion accessories (especially rings and watches) should also be removed, as they can cause a tourniquet effect, interrupting the underlying circulation when the onset of edema [12].

In addition, the risk of infection is particularly high in the geriatric population [13]. Thus, we can limit the latter and benefit from an analgesic effect by covering the burns with a sterile field or a clean cloth [12].

Furthermore, cooling should be avoided in elderly subjects due to the risk of severe hypothermia [12]. Indeed, hypothermia is associated with an increase in morbidity and mortality [14, 15]. This increases blood loss, amplifies the risk of infection and also increases the risk of cardiovascular events [14]. It is for all these reasons that it is so important to warm the patient with a survival blanket and to increase the temperature of the cabin of the transport vehicle, as well as to elevate the

burned extremities in order to limit the formation of edema.

Early fluid resuscitation is a crucial element in the management of burn patients, particularly the elderly [7]. This aims to prevent tissue hypoperfusion, multiorgan failure, sepsis and mortality [13]. There are several formulas that allow the volume needs of the burn patient to be evaluated. However, the formula described by Baxter (also known as Parkland; 4 ml/kg per percentage of body surface area burned) remains the most used [7-12]. Half the volume is generally administered during the first eight hours, and the other half over the next 16 hours [12]. On the second day, the volumes infused represent approximately half of those administered during the first 24 hours. As for infusion solutions, Ringer Lactate must be used.

It should be noted that whatever the circumstances, one of the essential and indispensable elements in the therapeutic management of burns is oxygen therapy [11]. However, in case of exposure to fire smoke, treatment consists of high-flow oxygenation or mechanical ventilation with 100% FiO2, if the patient's condition required intubation [12].

As described in previous sections, aging is accompanied by impaired wound healing, immunosenescence and involuntary weight loss. Additionally, protein-energy malnutrition is a very common problem among older people [13-16]. These geriatric particularities are increased during burns, largely explaining why the risk of infection and the mortality rate are higher in elderly burns compared to young adults. Thus, nutritional support is essential and important to ensure better care of elderly burn patients [7]. The latter makes it possible, on the one hand, to meet the energy and nutritional needs of the patient, and on the other hand, to control protein metabolism, to maintain lean mass, and thus to promote wound healing and also strengthen the immunity [17]. It is recommended to initiate feeding in the first 24 hours following the burn, or earlier from the 12th hour [7]. A combination of carbohydrates and amino acids is recommended. Carbohydrates promote wound healing and confer a protein-sparing effect [7], whereas amino acids (especially glutamine, alanine and arginine) promote protein synthesis, accelerate wound healing and reduce the risk of infection by strengthening the immune system [7-17].

Meticulous post-burn wound care is extremely important to establish a good prognosis, especially in the elderly [16]. Considering the structural and physiological changes associated with skin aging, such as thinning of the dermis, decreased epidermal renewal and cutaneous vascularization, the healing rate of post-burn wounds appears to be lower in the geriatric population compared to to young adults [16].

In addition, burned skin tissues provide an ideal environment for bacterial colonization and a gateway for germs to enter the bloodstream [18, 19]. In addition, immunosuppression, loss of the skin barrier and hypermetabolism predispose burn patients to infections [20, 21].

This risk is increased in elderly subjects, due to the anatomical and functional changes which accompany the phenomenon of aging, in particular immunosenescence and skin thinning.

Silver sulfadiazine is the product used in most burn centers [11]. However, more recent in vivo studies, one on rats [22], and another on pigs [23], (pig skin is the best model because it has a structure close to that of humans), have showed that silver nanoparticles enjoy higher efficacy than sulfadiazine, with shorter healing time and strong antimicrobial activity.

However, there is currently no clear consensus in favor of a specific type of dressing [24].

For some time, rehabilitation has been neglected or even ignored in the management of burn patients, and only recently have we learned the importance and value of long-term outcomes after burn injury [24]. Indeed, with the decline in overall burn-related mortality thanks to medicosurgical approaches, an emphasis on the role of rehabilitation has been adopted, so that surviving burn patients, particularly the elderly, can have a good quality of life with intact neurological and cognitive functions [7]. Likewise, rehabilitation can improve not only physical and mental health, but also autonomy and can reduce the length of hospital stay.

CONCLUSION

Elderly adults are a rapidly growing segment globally and are at high risk of permanent disability and premature death due to traumatic injuries, including burns.

In fact, seniors are more vulnerable to burns than other populations. This is due, on the one hand, to physiological and structural changes linked to the aging process and, on the other hand, to pre-existing comorbidities as well as polypharmacy. It is extremely important to emphasize that therapeutic treatment has only marginal effectiveness in reducing the rate of morbidity and mortality. Thus, prevention remains the best weapon to fight against this scourge. To do this, burn prevention programs and educational and safety measures, both nationally and internationally, must be put in place and implemented.

Although a large number of elderly people are affected by burns, few studies have been carried out on this subject in developing countries. Additional studies in this area, in these regions, including our country, are

necessary and necessary to better understand the particularities of burned seniors and thus optimize therapeutic care.

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