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Burns in the Elderly: Causes and Prevention

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Abstract **Original Research Article**

Burns are frequent accidents but vary greatly in severity depending on the general condition of the victim, the affected surface, and the depth of the injuries. In geriatrics, more than age itself, it is the frequency of associated pathologies and the thinness of the skin that worsen the prognosis. Proper and early management should allow for rapid healing in most cases. ***Methods:*** Over a 3-year period (2021-2024), 38 patients over the age of 65 were treated in the Plastic Surgery Department of CHU Mohamed VI in Marrakech. We conducted a retrospective descriptive study, including an epidemiological, clinical, and therapeutic analysis. ***Results:*** These patients represented 12% of all those treated at the center. All patients were injured at home, and the most frequent cause was contact burns in the hammam (Moroccan steam bath). In 53% of cases, burns affected less than or equal to 15% of the body surface area. Over one-third (37%) of patients underwent necrosectomy, and 26% received various types of autografts. Pre-existing conditions were present in 60% of patients, with some having more than one. 65% of patients recovered, while 35% died. The most common cause of death was complications from pre-existing diseases and infection. ***Conclusion:*** This study highlights the specific challenges in managing elderly burn patients, emphasizing the crucial importance of prevention, early and appropriate management, and a multidisciplinary approach.

Keywords: Geriatric burns, Moroccan steam bath burns, Burn management in elderly, Pre-existing conditions in burn patients, Mortality in elderly burn patients.

I. INTRODUCTION

Burns are defined as partial or total destruction of the skin, and sometimes underlying structures, caused by thermal, electrical, chemical, or ionizing radiation agents. They are frequent accidents, but their severity varies greatly depending on the general health of the victim, the affected area, and the depth of the injury. In geriatrics, more than age itself, the prognosis is influenced by the frequency of associated pathologies and the thinness of the skin. Elderly people are particularly vulnerable to burns due to physiological and biological changes inherent in the aging of their skin. Proper and early management should allow for rapid healing in most cases.

The aim of this study is to identify the differences in the management of elderly burn patients and propose a set of preventive measures to reduce mortality.

II. MATERIALS ET METHODS

In this descriptive retrospective study, we defined an elderly person as anyone aged over 65 years, following WHO recommendations. The study period spanned from February 2021 to February 2024, a total of 3 years. 38 patients were included.

III. DATA COLLECTION

Information was collected via a Google Forms survey and processed using Google Sheets. The data included demographic information (gender and age), medical history, admission delay, burn mechanism, accident location, burned skin surface area, depth and location of the injury, duration of hospitalization, blood transfusion, surgical procedures, and patient outcomes.

IV. RESULTS

A. Epidemiological data:

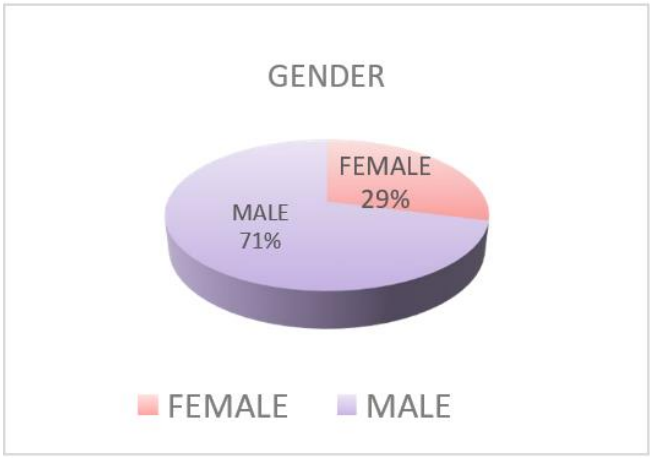
1. Age:

The average age was 76 years, ranging from 65 to 95 years (see Table 1)

Age groups	Pourcentages
65-69 ans	21%
70-74 ans	24%
75-79 ans	24%
80-84 ans	13%
85-89 ans	10%
90-94 ans	5%
95 ans	3%

2. Gender :

71% of patients were men, while 29% were women, with a male-to-female ratio of 3:1 (see Figure 1).



3. Pre-existing conditions:

More than 60% of patients had pre-existing medical conditions, with hypertension being the most common (over 21%), followed by diabetes and COPD.

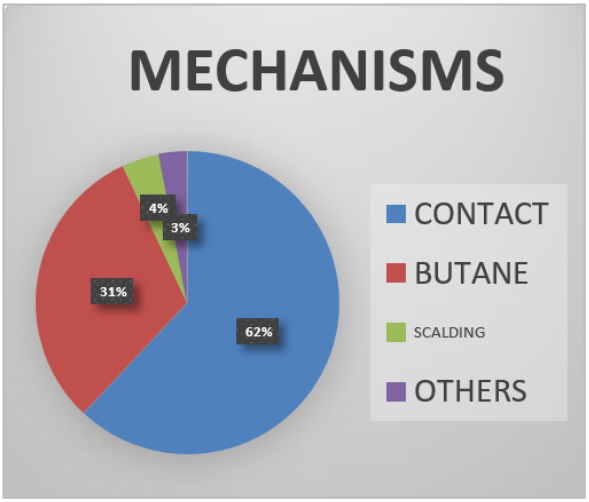
4. Admission delay:

The average admission delay post-burn was 4 days, with a range from the day of the burn (Day 0) to 25 days after.

B. Clinical data :

1. Burn mechanisms :

The most common cause was contact burns from the hammam (62%), followed by burns from butane flames (31%) and scalding burns (4%) (see Figure 2).

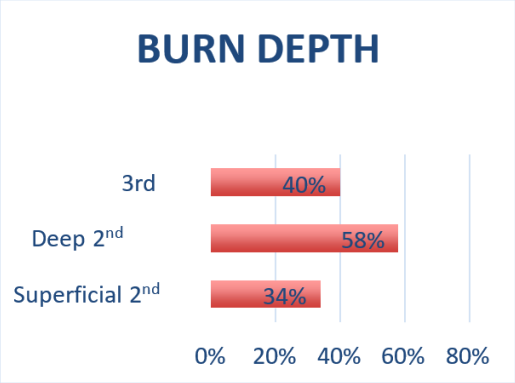


2. Burn characteristics :

All burns were domestic accidents, with 15% reporting prior infections and 24% occurring in enclosed spaces.

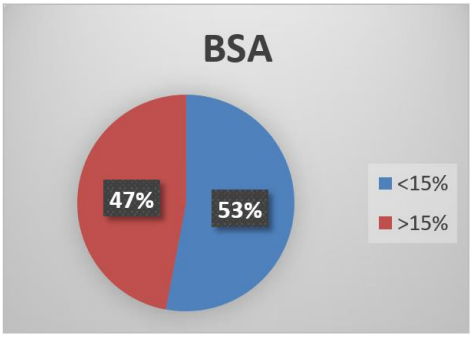
3. Burn depth :

Third-degree burns were present in 40% of cases, deep second-degree burns in 58%, and superficial second-degree burns in 34% (see Figure 3).



4. Burn skin surface area :

The average burned skin surface area was 15%, ranging from 5% to 38%. 53% of patients had burns covering less than 15% of their body surface area, and 47% had burns covering more than 15% (see Figure 4).



5. Burn location :

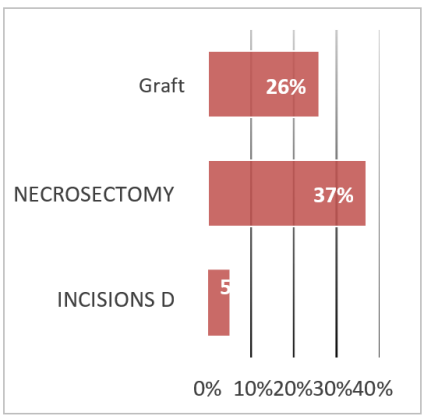
Lesions on the back, buttocks, and the posterior upper limbs were more common in hammam burns, while burns from butane flames affected the face, anterior torso, and hands more frequently.

6. Hospitalization duration :

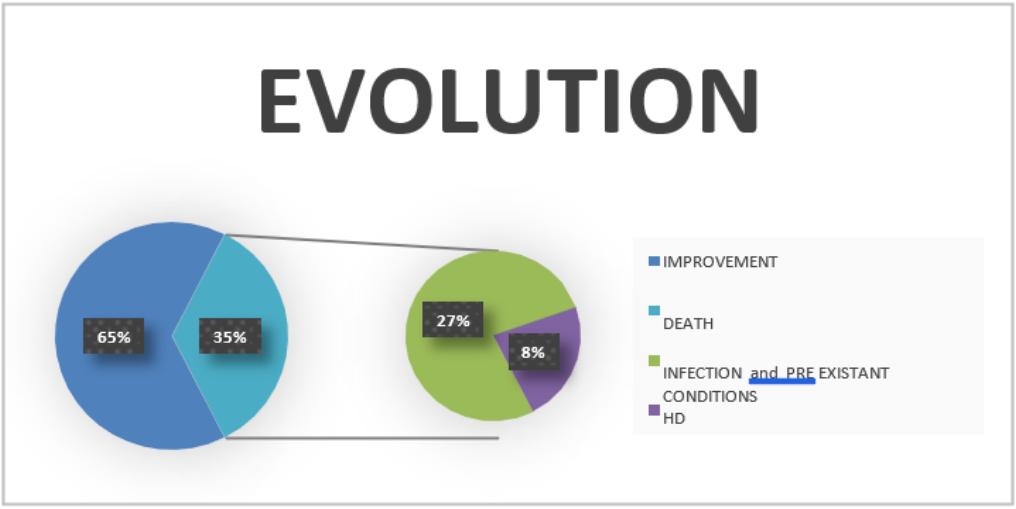
The average hospitalization duration was 21 days, with a range from 1 to 58 days.

7. Evolution :

- 43% of patients required blood transfusions (CG, albumin, PFC).
- 37% of patients underwent necrosectomy, 26% received skin grafts, and 5% had decompression incisions at admission (see Figure 5).



- Mortality : 27% of patients died after the 10th day post-burn, mainly due to decompensation of pre-existing conditions or infection. Another 8% died within the first two days due to poorly controlled hemodynamic instability, especially when burns were accompanied by smoke inhalation and airway burns. One unexplained death occurred on Day 1 (see Figure 6).



The mortality curve is proportional to the burned skin surface area and the age of our patients. It is worth noting that the application of traditional remedies worsened the prognosis of these patients.

V. DISCUSSION

Particularity of elderly patients:

Elderly people are particularly vulnerable to burns due to physiological and biological changes inherent in the aging of their skin. The structural and biochemical degradation of the skin leads to a reduction in its protective function, making individuals more susceptible to injuries and slowing down their healing process (Mason *et al.*, 2015). Environmental exposure and genetic processes accelerate skin aging, reducing epidermal cell proliferation and affecting the overall integrity of the skin (Youn *et al.*, 2019). These alterations result in increased sensitivity and decreased resilience to external aggressions, including burns.

Aging also induces significant changes in the composition of the skin, characterized by thinning of the epidermis and alteration of the dermo-epidermal junction, reducing resistance to shearing forces (Madison *et al.*, 2015). Histological changes, such as reduced melanocyte numbers and decreased water content in the stratum corneum, contribute to uneven pigmentation and increased skin dryness (Ostler *et al.*, 2020). Additionally, the reduction in structural components of the dermis, such as fibroblasts and hyaluronic acid, hinders nutrient and oxygen delivery, compromising wound healing and increasing the risk of dermo-epidermal separation (Zouboulis *et al.*, 2019).

These age-related modifications expose elderly individuals to significant risks in case of burns, leading to deeper lesions and prolonged healing. The reduced capacity of the skin to repair and defend against infections underscores the importance of prevention and tailored treatment strategies for this high-risk group (Kaufman *et al.*, 2018).

Immunosenescence:

Aging of the immunesystem presents significant challenges for elderly individuals, particularly in the event of burns. This condition leads to a reduction in immune capacity, increasing susceptibility to infections, attenuated responses to vaccinations, weakened cancer defense, and heightened risk of autoimmune and inflammatory diseases (Pawelec *et al.*, 2018). Aging especially affects T cells, with a decrease in new thymic cell production and reduced diversity of T-cell receptors. Combined with a weakened humoral response, this leads to a chronic inflammatory state (Bontke *et al.*, 2017). This phenomenon is exacerbated by elevated levels of pro-inflammatory cytokines such as IL-6 and TNF-α, key players in the post-burn inflammatory response, increasing the risk of complications in elderly patients (Ferrucci *et al.*, 2017).

In addition to immunosenescence, aging is also associated with changes in energy metabolism, affecting fat tissue distribution and increasing susceptibility to insulin resistance and type 2 diabetes, which further suppresses immune function (Ruderman *et al.*, 2015). Research has shown that insulin, beyond its metabolic functions, has an immunomodulatory role, potentially positively influencing the inflammatory response and reducing inflammation in burn patients through intensive management (Kohn et al. 2020), highlighting the importance of adjusting treatments for elderly burn patients.

In conclusion, immunosenescence and age-related metabolic changes significantly complicate the healing of burns in elderly patients by delaying tissue repair and increasing the risk of infections and mortality (Wikström *et al.,* 2021). This necessitates special attention in the care of elderly burn patients, emphasizing the need for an adapted therapeutic approach that addresses these unique challenges related to the aging immune system and metabolism.

Malnutrition et hypermetabolism:

Malnutrition in the elderly, exacerbated by various physiological and social factors, poses a significant risk to the immune system, increasing vulnerability to infections and mortality, especially in the presence of severe injuries such as burns (Cederholm *et al.,* 2019). With aging, a decrease in lean muscle mass and energy reserves is common, often worsened by inadequate nutrition (Kumar *et al.,* 2019). This phenomenon is particularly pronounced in elderly individuals living in institutions, where malnutrition rates can reach 65% (Thomas et al. 2020). Nutritional challenges are linked to health issues such as dysphagia, sensory loss, pain, and endocrine changes that promote sarcopenia and frailty, further diminishing the body's ability to recover from injuries (Booth *et al.,* 2019).

Burns induce an extreme hypermetabolic state characterized by increased protein and lipid consumption, loss of structural proteins, and muscle atrophy, requiring significant energy intake for repair and maintenance functions (Jeschke *et al.,* 2017). This intensified catabolism, coupled with a prolonged inflammatory response, can lead to multiple organ failure due to accumulated damage in vital organs like the liver and skeletal muscles (Mlcak *et al.,* 2018). If the increased nutritional needs are not met, the risk of complications increases, hindering wound healing (Wilmore *et al.,* 2018).

In elderly burn patients, this hypermetabolic response is even more pronounced, potentially due to a different cytokine profile than that of younger populations (Morrison *et al.,* 2019). The complexity of managing this hypermetabolic state, combined with the inability to fully prevent adverse outcomes through early surgical and nutritional interventions, underscores the importance of a comprehensive care strategy. This strategy must not only address the immediate burn needs but also proactively manage the nutritional and metabolic status to improve long-term outcomes in elderly patients (Burdge *et al.,* 2017).

Treatment:

Resuscitation:

Fluid resuscitation plays a crucial role in the treatment of burns, significantly improving patient survival (Falk *et al.,* 2018). This practice aims to maintain tissue perfusion and prevent serious complications such as multiple organ failure, sepsis, and mortality (O'Brien *et al.,* 2016). While the Parkland formula is most commonly used to guide fluid resuscitation, the exact approach and composition of fluids remain debated (Schiller *et al.,* 2020). Resuscitation methods must be carefully adjusted to avoid the risk of fluid overload while ensuring optimal replenishment to counter hypovolemia and acute renal failure (Vissers *et al.,* 2019).

Strategies to refine fluid management include the use of various protocols, from colloids to computer-assisted resuscitation systems, to prevent complications from improper fluid administration (Brinkman *et al.,* 2017). Clinicians rely on various clinical indicators such as urine output, mean arterial pressure, and oxygen saturation to adjust the volume administered (Lopes *et al.,* 2018). However, one study revealed that purely crystalloid resuscitation might not be sufficient to effectively restore cardiac preload during the critical post-burn phase (Chung *et al.,* 2021).

Age plays a crucial role in resuscitation volume requirements, with elderly patients needing special attention due to their less elastic skin and reduced ability to tolerate fluid overload (Morris *et al.,* 2019). Challenges in resuscitating elderly patients include managing potential complications from pre-existing conditions like heart or kidney dysfunction and strategies to avoid overhydration (Hewitt *et al.,* 2020).

Nutrition:

Post-burn nutritional management is essential to optimize wound healing and support immune function (Kirkpatrick *et al.,* 2021). Nutritional prescriptions aim to meet increased energy and protein needs, playing a crucial role in reducing complications and promoting recovery (Fossum *et al.,* 2017). Due to burn-induced hypermetabolism, calorie and protein requirements increase significantly, often necessitating supplementation to meet nutritional goals (Miller *et al.,* 2018).

The post-burn nutritional approach should be personalized based on pre-existing nutritional status, burn severity, and the patient's clinical progression (Jeschke *et al.,* 2020). Protocols include early enteral feeding and regular monitoring of biochemical markers to adjust intake according to individual needs (Zhu *et al.,* 2022). Specific challenges in elderly patients, such as metabolic changes and absorption difficulties, require adapted nutritional strategies to ensure optimal care and reduce the risk of malnutrition and complications (Clegg *et al.,* 2016).

Hygiene and wound care:

Proper wound care is essential to prevent infections and promote effective healing (Edwards *et al.,* 2018). This includes rigorous hygiene practices, sterile techniques, and the appropriate selection of debridement agents and dressings (Sibbald *et al.,* 2019). Special

attention is required for wounds in elderly individuals, whose skin is more fragile and prone to infections (Kang *et al.*, 2020). Changes in inflammatory responses and wound metabolism in elderly patients necessitate specific approaches to optimize clinical outcomes (Balestrieri *et al.*, 2019).

Infection management, especially common in severe burn cases, requires close monitoring and early interventions (Moues *et al.*, 2017). Nosocomial infections and complications related to prolonged use of medical devices must be considered in the care plan, with strategies to minimize risk and optimize clinical outcomes (Moriarty *et al.*, 2020).

Prevention Measures: A set of preventive measures should be implemented, especially in our context:

1. **Home Safety:**
   - Install smoke detectors in the home and check them regularly.
   - Eliminate potential heat sources such as candles, cigarettes, or stoves near flammable materials.
   - Use safety devices for gas and electric stoves, such as locks or protective covers.
2. **Education and Awareness:**
   - Inform elderly individuals about the risks associated with heat and burns, as well as the precautions to take.
   - Educate caregivers and family members on burn prevention measures and how to care for elderly individuals to avoid accidents.
3. **Water Temperature Control:**
   - Set the hammam bath temperature to a safe level to prevent burns.
   - Install water temperature regulation devices to prevent accidental burns during bathing or showering.
4. **Precautions with Electrical Appliances:**
   - Avoid allowing elderly individuals to use dangerous or complicated electrical devices, such as electric kettles, irons, etc.
5. **First Aid Training:**
   - Train family members and caregivers in first aid for burns to react quickly and effectively in case of an emergency. Avoid the use of all traditional products.

The discussion of the results and the articles found highlights several key aspects of burn management in elderly patients. Advanced age, the predominance of male patients, the frequent presence of comorbidities, and delays in hospital admission are factors that negatively affect prognosis. The burn mechanisms reflect specific risks associated with the domestic environment, particularly accidents in the hammam and burns from butane flames, emphasizing the importance of targeted preventive measures. The results also show a correlation between burn severity, measured by burned skin surface area, and mortality risk, consistent with previous studies indicating increased mortality in elderly patients with extensive burns and severe comorbidities. Prolonged hospital stays and frequent surgical interventions highlight the complexity of managing these patients.

Literature practices involve early excision and covering excised areas as soon as possible. In cases where the patient's condition does not allow for early excision, or when early excision is not available in our context, we resort to necrosectomy and grafting.

High mortality, especially in the presence of decompensated pre-existing conditions or infections, reiterates the need for a multidisciplinary approach and continuous vigilance. These observations call for improved prevention strategies, initial care, and post-hospitalization follow-up for this vulnerable population.

VI. CONCLUSION

Patients over the age of 65 represent 12% of all burn patients treated at the Center. The most common cause of burns was contact burns in the hammam, and accidents occurred almost exclusively at home. Proper care must take into account age-related specificities at every step. It is entirely possible to save the lives of these patients despite their numerous pre-existing conditions (many had one, and some had several at once), provided that therapeutic measures are appropriate, particularly by considering the specificities of these conditions: they tolerate operations and large-volume transfusions poorly and easily fall into hypovolemic shock and anemia. On the other hand, delays in surgical care expose patients to the risk of complications from pre-existing conditions and sepsis.

We believe that prevention remains the best therapy for these individuals. This highlights the need for caregivers to assist elderly individuals, especially when they have mobility issues or difficulties controlling their behavior.

VII. Conflicts of interest : The authors declare no conflicts of interest.

VIII. Acknowledgments :

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