Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/16712
DOI URL: http://dx.doi.org/10.21474/IJAR01/16712

*RESEARCH ARTICLE*

# SEQUELAE OF HAND BURN: EPIDEMIOLOGICAL AND THERAPEUTIC ASPECTS IN MOROCCAN STUDY

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## *Manuscript Info*

***Manuscript History***
Received: 20 February 2023
Final Accepted: 24 March 2023
Published: April 2023

***Key words:-***
Burn, Hand, Sequelae

## *Abstract*

Hand burns can result in both aesthetic and functional sequelae, which are often intertwined, ranging from simple dyschromia to multidigital amputation. They can be minor, requiring medical treatment, or major, requiring surgical treatment consisting of skin grafting or various flaps and plasties. To study the epidemiological, clinical, therapeutic, and evolutionary characteristics of burned hand sequelae, we conducted a retrospective study at the Plastic and Burn Surgery Department of the Mohammed VI University Hospital Center in Marrakech, from January 2013 to December 2017. The study collected 104 cases, including patients with burn sequelae in at least one hand. This work shows that almost one in two patients hospitalized for burns has a burn on at least one hand. The study also shows the frequency of young adult injuries (42%) and children under six years old (33%) in domestic accidents (76%), the frequency of burns to the dorsal surface of the hands from butane flames in the "Hand-Face Syndrome" in adults, and the frequency of burns to the palmar surface in children. Concerning the sequelae phase, our study shows the frequent association of major sequelae (contractures, retraction, pathological scars) and minor sequelae (dyschromia, itching, scar fragility, cutaneous hyperesthesia). The sequelae were dominated by digital and digito-palmar retractions (65.5%). A functional deficit was observed in more than two-thirds of cases. Various means of reconstruction were used depending on the location and type of sequelae; local plasties were performed in 84.6% of cases, and excision-grafts in 76.9% of cases. The most commonly used local plasties were the "Z" plastie (65.5% of cases) and the "trident" plasty (26.5% of cases). 78% of the grafts used to treat sequelae were full-thickness skin grafts. The evolution was marked by a satisfactory result for most treated patients. The management of burned hands is multidisciplinary, requiring cooperation between surgeons, physicians, rehabilitators, physiotherapists, and psychologists.



## Introduction:-

The hand is an extension of the brain and an interface with the world around us. It represents only 2.5% of the body surface, but its social, aesthetic, relational, and professional roles are major. It is a highly exposed area due to the defensive reaction to any injuring agent, which means that the cervicofacial region is affected in 33.4% of cases and the hands in 47.1% (WHO/ISBI survey, February 1989). Hand burns are present in 50% of hospitalized burn patients.

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This percentage can even reach 80% in major burn units. Hand burns do not involve vital prognosis, but they are often serious due to their potential sequelae, both aesthetic and functional. Adequate treatment of the hands is often neglected in the acute phase in favor of the treatment of other parts of the body or intensive care. However, even in this acute phase, the opportunity for successful restoration of hand function is established. In the late 1940s, surgeons noted that failure to mobilize the fingers results in early joint stiffness and thus loss of hand function. To this end, we conducted a five-year retrospective study, gathering 104 cases managed for hand burn sequelae in the Plastic and Burn Surgery Department of the Mohammed VI University Hospital Center in Marrakech..

## Materials and Methods:-

To describe the epidemiological, clinical, and therapeutic profile of hand burns in the sequelae phase, we conducted a retrospective study over a five-year period (January 2013 to December 2017) at the Plastic, Reconstructive, Aesthetic, and Burn Surgery Department of the Mohammed VI University Hospital Center in Marrakech. We collected data on 104 patients who had at least one hand burn sequela and were admitted to our department for management. Among them, 34 patients were hospitalized in our department during the acute phase of the burn, while 70 patients were initially treated elsewhere.

Patients with incomplete or lost medical records during the study, or those who did not receive surgical treatment for their sequelae, were not included. For each patient, we recorded several criteria collected from the department's medical records and intervention registers. A pre-established exploitation form was developed for this purpose, including epidemiological, clinical, and therapeutic information. For patients who presented for treatment of their sequelae and did not receive burn treatment during the initial phase in our department, we only considered the elements collected by patient interviews and mentioned in their medical records. The data was entered and analyzed using SPSS 13.0 for Windows software, while respecting patient anonymity and confidentiality during data collection.

## Results:-

In our series and during the study period, 370 patients were hospitalized for the management of burn sequelae. Among these patients, 104 had hand sequelae, representing 30% of all cases, including 34 cases managed in our service during the acute phase of the burn. The average age for patients consulting for sequelae was 19.7 years with extremes ranging from 1 year to 57 years. Young adults between 19 and 40 years were the most affected (36.50% for the age of sequelae), followed by children under 6 years (31% for the age of sequelae). Of the 104 observed cases, a sex ratio of 1.2 was calculated, indicating a slight male predominance. Thus, we found that 62.5% of the patients lived in unfavorable conditions. Burns were due to a domestic accident in 76% of cases. Regarding the responsible agents, the thermal origin was implicated in 93% of cases. Butane flame injury alone represented 42% of cases. Flame burns mainly affected adults. Among the 64 cases under 6 years of age, 48 cases (75%) were burned by contact with boiling liquid or a hot solid object. We observed 12 cases of electrical burns, two of which were victims of high-voltage electrical shock and 10 by low-voltage current. We noted only one case of chemical burn by hydrochloric acid. Sequelae were localized to the right hand in 42 cases (40.5%) and to the left hand in 38 cases (36.5%). 24 patients had a bilateral location. Our study, therefore, focused on 128 hands. Finger involvement was the most frequent, representing 88 cases (68.7%), followed by the commissures, the dorsal region of the hand (40 cases or 31.2%), then the palmar region of the hand in 34 cases (26.5%), and finally the wrist, which was affected in 8 cases (6.2%) without bone injury. The first commissure was the most affected (59% for the first commissure compared to 41% for all other commissures). Bridles and retractions were the main reason for consultation, encountered in over 95% of cases. Pathological scars (true hypertrophic scars and keloids) were associated with retractions in more than one-third of cases, mainly present on the dorsal surface of the hands. The average time between the burn and the management of sequelae was 57 months, with extremes of 2 months and 25 years. Therapeutic management was multidisciplinary. Therapeutic means were varied, combining drug, physical, and surgical therapies. All hands included in the study underwent surgical repair. Surgery mainly concerned skin retractions and bridles. After debridement and Z-plasty (in 65.5% of cases), a full-thickness skin graft was used in 78% of cases where the defect was large. After fixation of the graft, finger pinning was performed for certain patients (pre-bone or trans-bone). A plaster splint was used to prevent finger deformity in all patients. Physiotherapy was started for all patients. Infectious complications were noted in 6 of our patients. The results were good in 64 cases (61.5%) where there was complete recovery of the functional area involved. The results were fair in 27 cases (26%) and poor in 12 cases (11.5%).

## Discussion:-

Burns are a common type of accident in Morocco, particularly in rural areas, and account for 2% of all emergency department admissions [5]. At the CHU Mohammed VI hospital, approximately 1.2% of all emergency cases are due to burns [6]. In our study, we observed that 47% of hospitalized burn patients (including all types of burns) had

sustained burns on at least one hand. The hand is the second most affected area for burn sequelae (30% of all locations of sequelae), after the cervicocerebral area. Due to the lack of comprehensive national studies, the incidence of hand burns is difficult to estimate and can only be based on fragmentary survey data. At Saint Joseph Hospital in Lyon, 50% of burn patients admitted to the acute care center have hand burns [7]. Similarly, a series of studies conducted in Rabat on 152 hand burn cases between 1997 and 2007 found that these patients accounted for 69% of all burn cases [8]. In cases of severe and extensive burns, a two-year series conducted at a US military hospital reported that hands were affected in 86% of cases [9,10]. Our findings are consistent with the literature, as hand burns are present in 50% of patients hospitalized in burn centers and occur in one in five burned children [2].

In developed countries, there has been a significant decrease in hand burn sequelae over the last 35 years, according to the literature. However, in developing countries, hand burn sequelae are still prevalent, despite the development of current techniques aimed at improving healing quality [11]. In Mali, a study conducted in 2007 by Bakayoko found that 47.1% of burned patients had sequelae [12]. The most affected age groups for sequelae were young adults (36.5%) and children under six years old (31%). These findings are similar to a study of 145 patients treated for hand burn sequelae in Tunisia over a 16-year period (2000-2016), which found that the mean age was 16 years, and two-thirds of the patients were children [13]. A study on hand burn sequelae in Congo reported that 40% of patients were between 1 and 5 years old, and 31% were over 18 years old [14]. This reflects both the demographic characteristics and epidemiological profile of acute burns in Morocco. Poor safety conditions and lack of experience and information contribute to the frequency of burns, whether in a domestic or professional environment [15]. In developing countries, there is generally a predominance of boys among children, while among adults, women are more often burned than men due to the importance of accidents during meal preparation [16,17]. In this study, there was a slight predominance of males (54.6%) regardless of age. The male-to-female ratio was found to be in favor of men in different series of burned hands in the primary or sequela phase, as well as in different hand injuries. In this series, 62.5% were from a low socioeconomic level. Moreover, the significantly higher incidence of burns according to the WHO is in developing countries [18]. For example, in Sweden, the relative risk of being hospitalized due to a burn is 2.3 times higher in children from the poorest socioeconomic group than in children from the wealthiest group [19]. In this study, the accident occurred mainly at home (76% of cases), a similar result was found by K. Kibadi with 72% [14] and S. El Mazouz with 64% [8]. In these patients, the thermal origin was incriminated in 94% of cases, with flame injury found in 59% of cases. Butane flame burn alone accounted for 42% of cases. Flame burns mainly affected adults, which is in line with the results of Sheridan at 70% [20] and Maslauskas at 71.9% [21], who report a predominance of flame burns in adults. Injuries related to a butane flame contained in the "small 3 kg bottle", inexpensive but of poor quality (random sealing), are frequent (34% of cases in Morocco). Among the 64 cases under 6 years of age, 48 cases (75%) were burned by contact with boiling liquid or a hot solid object. In this age group, the flame was responsible for only 16% of burns.This is consistent with literature in developing countries, where hot liquids are the predominant cause of burns in children, flame burns in adults, and there are a limited number of electrical and chemical burns [22,23]. In our series, retractions and scarring were the main reason for consultation, present in 95% of our patients. Scarring and cutaneous retractions represent the major problem of hand burn sequelae, especially on the first commissure, where they affect the essential function of opposition [24]. Finger involvement (digital and digito-palmar scarring) was predominant in our study (65.5%), followed by commissures (50%), the dorsal aspect (35.9%), and isolated palm (15.6%). Studies conducted by Boukind [25] and Yafa [13] also report that digito-palmar scarring is predominant. In his series treating the pediatric population, Coulibaly [26] found 82.5% of digito-palmar retractions compared to 17.5% for dorsal retractions. Other authors report different results, like Afifi [27] in his series of 57 major hand retractions reports that extensions of dorsal scarring account for 66.6%. In fact, the back of the hand is the most exposed to severe burns in adults and therefore more frequently affected [28,29]. The difference in results can be explained by the fact that in a large number of our patients, the burn injury dates back to childhood (palmar burns are very common in young children). The average delay between the burn injury and the management of sequelae was 57 months. Other studies report different delays, such as Kibadi [14] at 11 months and Boukind [25] at 36 months.The study included 104 patients who underwent at least one surgical intervention for scarring and cutaneous retractions. Local flaps, particularly in the form of Z or trident flaps, were the most commonly used method (84.6%), consistent with the findings of Mimoun [30] and A. Benbrahim [31]. These local flaps yielded better results, especially in commissure retractions and digital and digito-palmar scarring. Skin grafting was also frequently used (76.9%), which is in line with S. Ettalbi's series [32]. According to Mimoun [30], A. Benbrahim [31], and M. Afifi [27], the use of skin grafting on the dorsal side of the hand produces good results in most series. Simple techniques such as flap surgeries and skin grafting offer the advantage of low morbidity with short hospital stays and should be used as a first-line treatment. Z and trident flaps are the most effective and least traumatic methods, with the possibility of further intervention, especially in children [13]. On the dorsal side, a total skin graft is used if the substrate is favorable, or a thin skin graft. Skin grafting can also be used for the treatment of hypopigmentation of the hand [30]. On the palmar side, a total skin graft is used. At discharge from the hospital, 62.2% of the patients treated for sequelae had good results, while 26.3% had average results, and 11.5% had poor results. The latter were patients

with major deformities, and the therapeutic choices were limited. Follow-up of patients is difficult in the context of the study since it is challenging to get patients to comply with rehabilitation and follow-up protocols once they are discharged from the hospital and the sequelae of the repaired hand burns are present.

## Conclusion:-

The hand is often impacted by burns, resulting in significant functional, aesthetic, and sensory aftereffects. Proper initial treatment performed in optimal conditions not only minimizes the number of burn sequelae, but also mitigates their severity. Prevention continues to be the best strategy.

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