

# Serious Burn by Sulfuric Acid: Case Report of Particular Therapeutic Strategy in a Non-Specialized ICU at Hôpital Principal de Dakar (HPD) Sénégal

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## Abstract

Managing severe burns remains problematic due to the lack of specialized units, but also because of the delay in implementing emergency care. The aim is to show that an adapted strategy, can lead to satisfying management of chemical burns. The authors report retrospectively the case of a patient admitted for chemical burns, and treated in a non-specialized intensive care unit; a 38 years old male, referred for burns by sulfuric acid at his workplace. On admission to H15, the clinic did not reveal any vital organs failure. Burns were localized on two legs and soles of the two feet (18% TBSA). Treatment combined daily dressings with silver sulfadiazine. On day 14, the wound healing associated occlusive gauze dressing, iodine cream application, and mechanical debridement. On day 47, a 5% dermal autograft performed on right foot favored with good attachment grafts. On day 58, the patient was released after complete skin recovery. Then, in a non-specialized burn unit and without early surgery access, our wound healing adapted strategy was successful. In Senegal, chemical burns represent about 2.5% of burn cases. They are often from accidents on occupation job, while generally in Africa chemical burns result from criminal attacks. Patients with severe lesions are admitted in non-specialized environments after an extended time of transfer, and don't have efficient initial care. This may explain the high morbidity and mortality after burns in our country. The lack of surgical facilities such as skin substitutes, in non-specialized unit on low or median income countries (LMICs), explains this long period of wound healing. The treatment of severe burn in LMICs is hazardous.

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## Keywords

Chemical Burns, Sulfuric Acid, Adapted Strategy, Senegal

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### 1. Introduction

Skin burn lesions have a diversity of causes including the action of heat, electricity, corrosive chemicals, or various radiations. Chemical burns in Senegal, most often occur by accident in the workplace. In some countries in West Africa, chemical burns are a real public health problem as arising out of assaults or attempted autolysis [1]-[3]. The management of severe chemical burns in our facility settings is problematic. The incriminated products are either acids or bases, with a caustic and sometimes systemic risk. The lack of specialized centers associated with the frequent delay in the implementation of emergency care exposes patients to a high morbidity and mortality. Sulfuric acid is a corrosive liquid, colorless, odorless; its skin penetration is very fast. It is often the cause of skin lesions, sometimes eyes and respiratory or digestive injuries [4]. With the opportunity of a suitable observation, we argue the efficacy of an adapted medico-surgical management in an intensive care unit environment.

### 2. Patient and Method

We report a case of a patient admitted for skin lesions resulting from chemical burns, which was supported in a non-specialized Intensive Care Unit, hospital level III, HPD. This Army Military Teaching Hospital has a Burn Treatment Room (BTR) with 3 beds, within an intensive care unit of 13 beds.

### 3. Observation

MFS is a 38 years old male employee of The Chemical Industries of Senegal (ICS) located in Mboro (100 km from the capital city Dakar). He was referred to us for chemical burn injury sustained with an accident on Sept. 4, 2013 at 9:30 p.m.

**Mechanism:** He walked into a tank with sulfuric acid at 98°. After immediate removal and washing with water followed by a brief dressing on the scene of the accident, he was transported to the regional hospital nearby. The first debridement of the lesions associated with a topical dressing, was performed in a local hospital, before transfer to the HPD.

**On admission:** 15 hours after the accident, the clinical examination showed a conscious patient, painfully, and oliguric. The blood pressure was at 130/90 mmHg, Cuff frequency to 102 beats/min, and his temperature at 37.2°C. The burn injury essentially set on both legs to the feet, and was estimated at almost 12% of the total skin surface (TBSA), according to the table of Lund and Browder, 8% second degree and 4% third degree (**Figure 1**).

Laboratory tests found hemoconcentration with on blood gave those results:



**Figure 1.** Deep injury burgeoning on the right foot associated with eschar at the end of first week and after 3 dressings.

- Hemoglobin: 18.5 g/dL;
- Hematocrit: 53.5%;
- Leukocytes:  $11,763 \times 10^9/L$ ;
- CRP (C Reactive Protein): 204.11 mg/L;
- Urea: 3.05 mmol/L;
- Creatinine: 10.7mg/L;
- Glycemia: 9.07 mmol/L;
- Sodium ( $Na^+$ ): 138 mmol/L;
- Potassium ( $K^+$ ): 3.9 mmol/L;
- Protidemia: 68 g/L.

A fluid resuscitation was made according to Parkland Hospital (Baxter) formula, combined with daily dressings under general anesthesia. He received a morphine-based analgesia and Ampicillin, Gentamicin, and Metronidazole by intravenous injections. This antibiotherapy was preceded by a skin swab, and a Urine culture (urinalysis), and a blood culture. Prevention of thromboembolism was provided by 4000 IU/day of enoxaparin. A hyper-calorie protein diet (more than 3500 calories/day) involving enteral nutrients was given early from admission.

**Evolution:** Despite the severity of lesions of legs, need of escharotomy was rejected by the surgical team. Then, from day 1 to day 5, the silver sulfadiazine dressings were made daily. From day 6 to day 12 (**Figure 2**), dressings were performed by 48 hours.

From day 16, the wound healing, was done by dressing that combined gauze and iodine cream (**Figure 3**). A reasonable mechanical debridement, using a scalpel blade was made and obtained a cleavage of deep skin lesions.

Meanwhile, our patient was receiving a daily physiotherapy at bed, supporting the mobility of the ankles and toes.

Day 47, the left leg is fully healed. Unlike the left leg, the right one presented a clean base budding (**Figure 4**).



**Figure 2.** At the end of 2nd week, the budding phase delayed by a very purulent clostridial revamped at each food. At this time the autograft was an indication.



**Figure 3.** From 3rd to 4th week, a budding and own base resulting from the controlled wound healing, based on the chemical debridement with silver sulfadiazine.



**Figure 4.** At 5th week, this figure shows the limits of controlled wound healing, with the presence of superinfected and up budding homes, which can delay skin recovery or autograft.

The surgeon indicated autograft skin at the front side of the lower third of the leg, the back of the extended right foot (**Figure 5**). Engraftment made on the front side of the right side, allowed to autograph about 5 % of skin surface.

All bacteriological samples and thick films came back negative.

The outcome was favorable with a good grasp of transplants, and completes healing of donor sites. A few pathological scarring (hypertrophic or retractable) was found during evolution (**Figure 6**).

On day 58, this patient fit for strolling and enjoying a full skin covering. Thereafter, he was released and sent to functional rehabilitation service for outpatient care.



**Figure 5.** Satisfactory result in nearly 8 weeks with full skin recovery combining some discoloration and hypertrophic scars.



**Figure 6.** After 10 weeks, autonomous patient without functional sequelae during his first external medical visit.

#### 4. Discussion

Chemical burns are rare in Senegal (2.5%) where the causes of burns are dominated by thermal and electrical mechanisms [2] [5]. They are most often related to accidents in the workplace. In contrast, these chemical burns constitute a public health problem in some West African countries in (Niger, Nigeria), and Asia, and they are most often due to attacks [1] [3] [6]-[8].

The severity of chemical burns from sulfuric acid is linked to its irritant or corrosive threat. In severe cases, there is a strong exothermic reaction with lesions that evolve into deep ulceration, black and painless. The risk of systemic absorption remains high, although it has rarely been described [4].

Emergency treatment at the scene of the accident by extensive washing with water is essential, given its impact on the changing profile of the lesions. The use of washing Diphotérine® in the initial phase has profoundly reduced the severity of mucocutaneous lesions by chemical reach [4]. Unfortunately, in our conditions of care, patients rarely benefit from effective water washing, and amphoteric solutions such as Diphoterine are not available in this exposed professional community. With absence of emergency care, we have to manage patients with chemical burns, usually after a long transfer period [3] [5] [9]. This explains the severity of the depth of their skin burn and the severity of the

sustained injuries, while being admitted, in most cases, in non-specialized centers.

In the absence of surgical means, our patient received a step by step strategy of healing, using chemical and mechanical debridement. The wound healing is a surgical method itself, it may be indicated whenever a defect is not sutured but its basement is properly vascularized without exposure of noble body [10]. Spontaneous healing is called “guided” by the surgeon, who must regularly monitor the wound to ensure the absence of infection. This may be accelerated by surgical excision stage debridement. It can flatten hypertrophic bud and can shorten the evolution of epidermization stage by a skin graft [4] [10]. Some areas of the body are better suited than others to spontaneous healing. They Have the advantage of reducing the surface loss to the initial skin substance and repair the wound without additional scarring. Wound healing can be used exclusively or as preparatory to a graft or a flap. If the soil is healthy, healing occurs in all cases, regardless of the nature of the dressing, which has very little impact on the surgery [4] [10].

In case of persistence of deep clean and budding lesions, an extended skin autograph is possible: otherwise, the lack of protective and surgical means such as allograft skin, the dermal-epidermal graft, and skin substitutes, explain our minimal surgical strategy. Indeed, the risk of bone and tendon exposure after surgical excision was our major issue (Table 1).

In our environment, it will precede precociously dressings sulfadiazine by a spa combining an antiseptic solution (Hexomedine or diluted bleach), with the main objective of a good epidermization, or failing to have a good base for autograft. The management of such lesions in our environment can be challenging, and probably explains the prolonged and costly [3] [8] [10] hospitalization stay. This highlights the need for increased policies of active and passive preventive methods to care for chemical burns, especially in the workplaces [4] [10].

## 5. Conclusion

The treatment of severe burns in non-specialized environment is similar to riding on a bumpy road. Proximity to other ICU patients often increases the risk of infection. Nevertheless, the implementation of a thoughtful medical-surgical strategy and implemented on a case by case basis, can achieve satisfactory functional and esthetic results.

**Table 1.** Evaluation indicators of injury recovery during wound healing.

Indicators of injury recovery	Local	General
Complete epithelialisation		
Painless scar		
Quality of the scar		
Clinic inflammatory syndrome		(1)
Biologic inflammatory syndrome		(1)

(1): Eliminate any other source of inflammatory syndrome.

In this context, chemical burns with increasing occurrence, should be better taken care by:

- Better policy of passive and active prevention;
- A medical emergency training in case of chemical burn care;
- The provision antagonist products in high risk areas;
- The creation of specialized centers for resuscitation and effective surgery.

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