



## **The principles of resuscitation aimed at burns and electrical trauma** *The principles of resuscitation for burns and electrical trauma*

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### Summary

Burns represent the main determinants of death in Brazil. These are injuries to organic tissues arising from agents (chemical, electrical and chemicals) that can develop excessive heat, deteriorating body tissues and generating cell death. Burns can be classified according to the causative agent and the depth of the lesions, whether they include burns of the type (chemical, thermal, electrical, ionizing, biological, friction or friction). The level of a burn reached, that is, the depth, is determined by clinical examination, based on observation of the pathological aspects of the lesions and palpation. The assessment of injuries resulting from burns is crucial for the clinical management to be established, prioritizing the victim's survival and good prognosis by avoiding worsening of existing injuries. Keywords: Burns, Ventilation, Hypovolemia.

### Abstract

Burns represents the main determinants of death in Brazil. These are injuries to organic tissues arising from agents (chemical, electrical and chemical) that have the potential to develop excessive heat, deteriorating body tissues and causing cell death. Burns can be classified according to the causative agent and the depth of the lesions, there are burns of the type (chemical, thermal, electrical, ionizing, biological, by attrition or friction). The reached level of a burn, that is, the depth, is determined by the clinical examination, based on the observation of the pathological aspects of the lesions and on palpation. The assessment of injuries resulting from

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burns is crucial for the clinical management to be established, prioritizing the victim's survival and a good prognosis by avoiding damage to existing injuries.

Keywords: Burns, Ventilation, Hypovolemia.

### Introduction

From a clinical perspective, thermal injuries are classified as emergencies, due to the high potential for morbidity and mortality. However, it is important to apply protocols for managing trauma victims and reducing their repercussions on the body<sup>1</sup>.

Burns are injuries resulting from heat, which can be caused by contact with a fire flame, boiling water or other liquids and abrasive objects. However, it could be the product of electric shock or chemical elements. It is estimated that the difference between a burn and other injuries is based on the repercussions of which are respectively consistent with the amplification of the inflammatory reaction to the injury, that is, the more ascending and intense it is, the more serious the inflammatory condition will be<sup>5</sup>. In this context, patients urge essential measures to stop the burn, offering patency of the airways and ventilation and imposing intravenous access<sup>3</sup>. The following article aimed to describe, through a literature review, the principles of resuscitation aimed at burns and electrical traumas and the determinants for the patient's good prognosis.

### Methodology

This is a qualitative narrative review study, suitable for discussing the principles of aspects of spinal cord injury. It consists of a comprehensive analysis of the literature, which the method was based on as it is a bibliographical analysis regarding spinal cord trauma and its respective repercussions. Articles indexed in the databases of PubMed, Lilacs, SciELO, Latindex and others were retrieved. Literature relevant to the topic, during the month of January 2023, with the last 5 years as a reference period. The indexing terms or descriptors, spinal trauma, clinical management, neurological deficits, isolated or in combination, were used. The criterion chosen for inclusion of publications was to have the expressions used in the searches in the title or keywords, or to have it explicit in the abstract that the text relates to aspects linked to spinal cord trauma and its repercussions on organic regularity. The excluded articles did not meet the established inclusion criteria and/or were duplicated, that is, publications restored in more than one of the databases. Dissertations and studies were also excluded. After the target information was retrieved, the titles and abstracts were initially read. Subsequently, the complete reading of the 20 texts was carried out. As axes of analysis, we initially sought to classify the studies according to sampling particularities, delimiting those whose samples are from the pathophysiological aspects of the injuries and those whose samples are from the types of injuries that address each classification and clinical impairments. From there, the analysis of the theoretical foundation of the studies continued, as well as the observation of the general characteristics of the articles, such as year of publication and language, followed by their objectives. Finally, the methodology used, results obtained and discussion were assessed.

### Results and discussion

The search for scientific publications that supported this study identified 70 references on burns and emergency management protocols in the aforementioned databases, of which 25 publications were included in the review. Among the selected studies, 28 articles have a theoretical approach, the others have a cross-sectional design and case study. The prevalence of publications in English was observed, representing 84% of the total, when compared to Spanish (9.6%) and Portuguese (6.4%).

The burn interferes with the functional integrity of the skin, responsible for hydroelectrolyte homeostasis, control of internal temperature, flexibility and lubrication of the body surface. Therefore, the magnitude of the repercussions of these functions varies depending on the extent and depth of the burn<sup>9</sup>.

Thermal aggression causes a local reaction in the body, resulting in tissue coagulation necrosis and progressive thrombosis of adjacent vessels in approximately 12 to 48 hours. The burn wound is initially sterile, but the necrotic tissue quickly becomes colonized by endogenous and exogenous bacteria, which produce proteases, which lead to liquefaction and separation of the eschar, ascending to the granulation tissue responsible for wound healing, based on the potential suitability of retraction and fibrosis in third-degree burns<sup>10</sup>.

The initial approach in a burn patient is to avoid the perpetuation of the process, which requires exposing the body. patient, because artificial tissues are susceptible to inflammation and burning at high temperatures. tures, consequently forming residual products that perpetuate the burn event, however, in situations where clothing is adhered to the skin, it is not recommended to remove it. Emphasizing that it is essential to avoid hypothermia and be careful with the recommended conduct to mitigate the fire, which can infect the burned portion with remains and even contaminated water<sup>3</sup>.

Airway patency is a priority, as it is susceptible to occlusion through direct aggression, exemplified by the inoculation of carbon dioxide during the event, being proven by elevations above 10% of carboxyhemoglobin, in addition to impacts arising from this, such as the extension and the level of the burn, adjacent trauma, the location in portions of the face, head and inside the mouth, culminating in edema



massive, although it does not develop consecutively and signs of obstruction are not evident, make the initial examination essential to assess the need for endotracheal intubation<sup>6</sup>.

The protocols that make the imposition of a definitive airway mandatory, that is, early intubation, are: the condition suggestive of airway occlusion such as hoarseness, stridor, use of accessory respiratory muscles, sternal retraction; size greater than 40% to 50%; dysphagia; respiratory difficulty, represented by the inability to eliminate secretions; bronchial; respiratory fatigue, oxygenation and ventilation deficits; lowering of the level of consciousness; transfer accuracy of the large burned patient<sup>8</sup>.

Aeration must be guaranteed in a burn patient, since direct damage to the airway, although uncommon, is proportional to the inhalation of superheated steam or flammable gases. Ventilation is clinically significant, due to the clinical triad represented by hypoxia, carbon monoxide poisoning and injury from smoke exposure. The reduction in oxygen supply is compatible with inhalation damage, ventilation deficit due to circumferential burns to the chest or traumathoracic injuries not associated with burns, requiring oxygen supplementation through a non-rebreathing mask with or without intubation. . Justified by the high affinity of CO for hemoglobin<sup>11</sup>.

In cases of burn patients in confined situations, it is highly favorable to consider subjection to carbon monoxide. The identification of this event is based on the previous history and direct extension of carboxyhemoglobin (HbCO), with measurements below 20% occurring asymptotically, whereas at higher levels the appearance of coma, confusion, headache, nausea and even death is common<sup>13</sup>.

Aspiration of cyanide through combustion elements in burns arising from confined spaces is common. The finding is continuous, unfounded and intense metabolic acidosis. Furthermore, combustion subsidies, such as carbon particles and toxigenic vapors, are decisive in the outcome of inhalation injury. These become lodged in the distal bronchioles, resulting in deterioration and cellular death of the mucosa, resulting in an exacerbated inflammatory reaction and high capillary leakage, making it essential to lack fluid infusion and obstacles to the diffusion of oxygen. Associated with the event of dead cells becoming an obstacle due to the possible occlusion of the airways, together with the abrupt drop in airway clearance, resulting in a greater propensity for pneumonia, in addition to having more challenging therapeutic management and a greater chance of death<sup>15</sup>.

When managing a patient suspected of suffering from smoke inhalation injury, the responsible professional must request a chest x-ray and arterial blood gas analysis, however the absence of abnormalities in these tests does not exclude an inhalation injury.

Patients who are in severe stages of burns are a challenge in terms of blood volume parameters and also due to the risk of being affected by other disorders that culminate in hypovolemic shock, which is managed in accordance with the principles of resuscitation. It is noteworthy that fluid resuscitation for burn therapy must be carried out, as there is high and continuous fluid depletion resulting from capillary leakage resulting from inflammation. It is necessary to impose a permanent urinary catheter to evaluate urinary excretion by estimating the level of perfusion, that is, in cases of failure of this it is necessary to exponentiate until the objective is achieved<sup>16</sup>.

However, it is essential to regulate compliance to avoid exaggerations during resuscitation. Justified by the fact that the deficit generates hypoperfusion and final organic deterioration, while the excess leads to a greater chance of edema<sup>12</sup>.

In case of smoke inhalation injury, corresponding to an injury resulting from a considerable burn, intubation is highly recommended. Situations based on hemodynamic stability and absence of injuries to the spine require elevation of the thoracic and headrest by approximately 30 degrees, helping to prevent edema in the wall of the neck and chest. However, in cases where a total burn in the anterior and lateral thoracic region causes aggravating mobility limitations, regardless of a circumferential burn, escharotomy (surgical incision through the eschar to free the constriction, restoring circulation and optimal ventilation) a viable option

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The clinical profile of the burned patient is the main guide for management, that is, gastric catheterization is recommended in situations involving nausea, emesis, abdominal distension. It is necessary to cover the burned area with a clean cloth, under no circumstances breaking the blisters or administering antiseptic agents. Antibiotics are not indicated for the initial stages after burns, but rather for the treatment of infections<sup>15</sup>.

The recommendations for transferring patients to burn centers were imposed by the American Burn Association and are based on: partial thickness reaching more than 10%, involvement (face, hands, feet, genitals, perineum, main joints), third degree burns,



incidents (electrical, chemical), inhalation injuries, burns due to previous pathologies potentially aggravating the care, the existence of concomitant trauma, the structural deficit of the care hospitals<sup>7</sup>.

### Conclusion

According to the information analyzed in this study, it can be elucidated that a detailed clinical history associated with the size of the affected body surface area and the depth of the injury resulting from the burn. However, there are cases in which it is essential to transfer the victim to the burn center, making it essential to collect records on exams, temperature, pulse, infused liquids and output.

### References

1. Barret JP, Herndon, DN. Effects of burn wound excision on bacterial colonization and invasion. *Plast Reconstr Surg.* 2003;111:744-50; discussion 751-2.
2. Ramos-e-Silva M, Ribeiro de Castro MC. New dressings, including tissue-engineered living skin. *Clin Dermatol.* 2002;20:715-23.
3. Sheridan RL, Hinson MI, Liang MH, Nackel AF, Schoenfeld DA, Ryan CM, et al. Long-term outcome of children surviving massive burns. *JAMA.* 2000;283:69-73.
4. Barillo DJ, Paulsen SM. Management of burns to the hand. *Wounds.* 2003;15:4-9.
5. Wassermann D. Évaluation et premiers soins d'une brûlure thermique. *See Prat.* 2002;52:2228-33.
6. Lion CEG. Burns. In: Fonseca FP, Rocha PRS, editors. *Outpatient surgery.* 3rd ed. Rio de Janeiro: Guanabara Koogan; 1999. P.122-8.
7. Costa DM, Abrantes MM, Lamounier JÁ, Lemos ATO. Descriptive study of burns in children and adolescents. *J Pediatr.* 1999;75:181-6.
8. Rossi LA, Barruffini RCP, Garcia TR, Chianca TCM. Burns: characteristics of cases treated at a teaching hospital in Ribeirão Preto (SP), Brazil. *See Panam Salud Publica.* 1998; 4:401-4.
9. Hettiaratchy S, Dziewulski P. ABC of burns: pathophysiology and types of burns. *BMJ.* 2004;328:1427-9.
10. Hettiaratchy S, Dziewulski P. ABC of burns. Introduction. *BMJ.* 2004;328:1366-8.