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Prognostic factors for amputation in severe burn patients

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ABSTRACT

Introduction: Amputation is a rare procedure among burned patients. However, it has significant physical and psychological consequences which impact quality of life.
Objective: To study the incidence, etiology and prognostic factors associated with amputation among burned patients in Chile.
Methods: Cohort study of patients admitted to the Reference Burn Center of Chile from 2006 to 2011. Association of demographic, event and injury variables with the likelihood of amputation were evaluated by using multivariable analysis.
Results: Amputation incidence was 5.8% in 1090 admitted patients. Male amputee patients were significantly more frequent ($p = 0.01$), with more electrical and high voltage burns ($p < 0.01$) and had greater frequency of impaired consciousness ($p = 0.03$). Multivariable analysis identified electrical burns (OR 13.7; 95% CI 6.7–28.1) and impaired consciousness (OR 2.8; 95% CI 1.4–5.7) as prognostic factors for amputation.
Conclusion: Amputation is a low incidence procedure among burned patients. Patients who underwent amputations are frequently at working age. Patients with high-voltage electrical burns and impaired consciousness are more likely to undergo amputation. Since these are highly incapacitating injuries, it is very important to implement preventive measures.

1. Introduction

With the exception of death, amputation is the consequence with major impact in the life of a severe burned patient. Although this is a very uncommon procedure, the physical and psychological sequelae result in greater complexity for the rehabilitation, psychosocial reintegration and impaired quality of life [1,2].

The reported incidence of amputation in burned patients, regardless of the mechanism of injury is close to 2% [3]. This incidence increases to 20–50% in electrical burns [4,5]. The incidence of amputation in burned patients and the factors associated with them in our country are unknown.

In Chile, since 2006, severe burned patients are covered by the Guarantee Explicit System (GES program), which ensures opportune attention, standardized treatment and financial protection. Approximately 80% of severe burns patients, beneficiaries of public health (which is 75% of the population) are treated in the National Reference Center. Since there are no national records of illnesses, the information gathered in this center it is considered as an estimate of the national situation [6].

This is a preliminary study aimed to determine the incidence, etiology, prognostic factors and lethality associated with amputation in burn patients hospitalized in the National Reference Center for severe burns in Chile. This study aims to provide a basis for planning actions in prevention, treatment and rehabilitation fields to ensure proper monitoring and less deterioration of the quality of life.

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2. Materials and methods

We conducted a retrospective cohort study of patients admitted to the Burn Service at the Public Assistance Hospital (HUAP) between January 2006 and August 2011. Amputations due to reasons different than burns were excluded (e.g.: acute trauma, major vascular or bone injury of the limb).

2.1. Management strategy

In our center severe burns were initially treated according to the Algorithms of the Advanced Trauma Life Support (ATLS) and Advanced Cardiac Life Support (ACLS). Volume replacement was performed according to the Parkland formula (4 cm^3 Lactated Ringer's solution × weight (kg) × % burned TBSA), replacing half the volume during the first 8 h and the other half the next 16 h. Volume reposition was increased to 5.6 cm^3 × weight (kg) × % burned TBSA when inhalation injury is associated or late resuscitation. In patients with high voltage electrical burns, an urine output of 100 ml/h drove the fluid resuscitation.

The final diagnosis of the depth and extent of the burns were done during the first surgical procedure, within 24–48 h after the accident. If compartment syndrome was suspected, compartment pressure measurements and fasciotomies were performed. Amputation was not performed as an emergency procedure. The therapeutic protocol followed two lines: local and systemic protection of viable epithelial cells in partial-thickness burns, early escharectomy in addition to temporary or permanent immediate coverage in full-thickness burns.

Amputation indication was determined by the extent of local necrosis and systemic involvement caused primarily by rhabdomyolysis. Amputation level was defined in terms of tissue viability and rehabilitation prospects. It is intended to preserve as much viable tissue to facilitate the use of prosthetics in the future.

2.2. Analysis of factors associated with amputation

The information was obtained from clinical records and surgical protocols. Demographic variables such as, gender, age, morbid history and habits were analyzed.

Mechanism of injury was identified and burns were classified in thermal, chemical and electrical. Thermal burns were categorized into fire, scald and contact. Electrical burns were classified as high voltage (≥1000 V) and low voltage (<1000 V). Presence of impaired consciousness at the time of the accident was recorded.

In relation to the burn, total burned body surface area (% TBSA) was described and percentage of deep burn TBSA. Amputation was considered minor if included fingers and toes, and major if amputation was performed above or below the infratrochlear, supratrochlear, supracondylar or infracondylar levels. Decompression procedures prior to amputation were registered, as well as the necessity to raise the level of amputation (more proximal) and time between injury and amputation.

Univariate analysis was performed on variables that could be associated with amputation. Chi square test was used to compare categorical variables and Mann–Whitney test for continuous variables (age). The variables found significantly associated were included in a multivariable analysis; a positive association was considered with odds ratio (OR) greater than 1.00, confidence interval 95% which do not include the null value or p-value <0.05. Statistical analysis was performed using Stata®, version 11.

3. Results

During the study period, between January 2006 and August 2011, 1090 patients were admitted in the National Burn Reference Center. From these patients, 69% were fire burns, 16% scalds and 6% electrical burns. Ninety-eight amputations were performed in 64 patients, with an incidence of 5.8%. Seventy-nine percent of the amputees were male, with an average age of 43.7 years (range 16–94 years). Among the amputee patients, the most common agent was fire (53%). Twenty percent of patients had impaired consciousness at the time of the burn, 9.3% were diabetic and 6.2% epileptic (Table 1).

Fig. 1 shows the mechanism of injury in amputee patients. Fifty-three percent of patients experienced fire burns (n = 34), 36% had electrical burns (n = 23) and 11% (7 patients) from scalding. Table 2 shows amputee patients' characteristics by burn agent, classified as thermal or electrical. It was noted that amputation was significantly more frequent in patients with electrical than thermal burns ($p < 0.01$). Amputee patients

Table 1 – Summary of main characteristic comparing amputee and non-amputee patients. Univariate analysis.

		Amputees (n = 64)	No amputees (n = 1.023)	p
Age (years)	(ds)	43.7 (18.8)	47.4 (20.2)	NS
Male gender	n (%)	51 (79.6)	675 (65.9)	0.02
Agent				
Fire	n (%)	34 (53.1)	782 (76.4)	<0.01
Scald	n (%)	7 (11.0)	169 (16.5)	NS
Electric	n (%)	23 (35.9)	48 (4.6)	<0.01
High voltage	n (%)	17 (26.5)	28 (2.7)	<0.01
Chemical	n (%)	0 (0)	14 (1.3)	NS
Impaired consciousness	n (%)	13 (20.3)	127 (12.4)	0.04
Diabetes mellitus	n (%)	6 (9.3)	80 (7.8)	NS
Epilepsy	n (%)	4 (6.2)	47 (4.5)	NS