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Case Report

Foot drop in patients with extensive 3rd and 4th degree burn, case series study

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Abstract: Burn injuries can lead to a variety of short- and long-term complications, peripheral neuropathy has been known as the most common neuromuscular complication. 29% of the burn-related peripheral neuropathy has been found in both the upper and lower limbs. Moreover, literature failed to find the causative factors for specific presentations like foot drop in burn patients. This study reports a series of 10 patients who developed foot drop after burn injury and required occupational therapy follow up at King Abdulaziz Medical City in Riyadh. To assess the effect of different risk factors in the outcome of foot drop. 10 case records were reviewed, 70% among the patients were men and 30% were women with a mean age of 39 and a mean BMI of 28. Most of the patients 70% were burned by flame. The mean Total Body Surface Area (TBSA) was 62%. 4 of the cases (40%) were having comorbidities. There was a significant association between death and high TBSA. All cases were managed without surgical intervention, physiotherapy started immediately after the diagnosis of foot drop. Seventy percent of our patients improved while 3 cases have expired. Higher TBSA showed to be significantly associated with death.

Keywords: Foot drop, burn, neuropathy

Introduction

Burn injuries expose the patient to a wide array of short and long-term complications. These complications range from minor manageable ones to more severe complications that might lead to mortality. One of these complications is the peripheral neuropathy, the most frequent neuromuscular complication of burns [1].

Burn related peripheral neuropathy has been observed for both upper and lower limbs with an incidence of 29% [2]. Thermal and electrical burns are the most common etiologies, some studies reported chemical burns as a cause of acute peripheral neuropathy too [3, 4].

Studies have shown that peripheral neuropathy may also be due to vascular occlusion of vasa nervorum, inflammation, neurotoxin production leading to apoptosis, and direct destruction of nerves from the burn injury. Axonotemsis injuries are more common than demyelinating ones, and polyneuropathies are more common than mononeuropathies [5-9].

Burn related neuropathy is difficult to recognize due to the various time of presentation and different symptoms. Weakness, chronic pain, paresthesia, dysesthesia and foot drop in the lower limb injuries are all reported symptoms for burn related neuropathy [3, 6-9].

Despite the current evidence, the literature failed to find the causative factors for specific presentations like foot drop in burn patients [1-12]. Reported cases of patients with foot drop after sustaining burn injury to the lower limb didn't identify the exact cause of this issue. A couple of cases have been identified through occupational therapy clinic of patients developing foot drop after burn injury in our hospital. Performing a case series study to look and examine the cases closely would help us build a hypothesis about the exact mechanism of foot drop in this context, and how to prevent future incidents. Conducting the study will enrich the

Table 1. Demographic characteristics of the studied sample (n = 10)

Variables		Mean ± SD/N (%)
Age		39±13.5
BMI		28±6.17
TBSA		62±19.2
Length of Stay		53±26.6
Length of Casting		42±23.8
Gender	Male	7 (70%)
	Female	3 (30%)
Burn Type	Electrical	2 (20%)
	Flame	8 (80%)
Outcome	Improved	7 (70%)
	Expired	3 (30%)
Comorbidity	Yes	4 (40%)
	No	6 (60%)
Inhalation Injury	Yes	5 (50%)
	No	5 (50%)

literature with a simple yet very informative study.

Objectives

- To assess foot drop cases in burn patients.

- To assess the effect of different risk factors in the outcome of foot drop.

- Extensive debridement role in foot drop.

Methodology

Type of study

A descriptive case series for a group of patients who developed foot drop after burn injury and required ocuppational therapy follow up.

Research setting and participants

The study was conducted in the burn unit at King Abdul-Aziz medical city in Riyadh (KAMC), Kingdom of Saudi Arabia. Approval was obtained from IRB of King Abdullah International Medical Research Center (KAIMRC).

Selection criteria

All patients with 3rd & 4th degree burn who developed foot drop.

Methods and procedure of data collection

A group of identified cases with similar diagnosis and same standardized management and developed the same issue "foot drop" was involved in this study. A total of 10 cases have been identified for burn patients who had foot drop and following up in the occupational therapy clinic. Demographic data (age, gender) and related variables (type of burn, TBSA, date of admission, date of discharge, inhalation injury and number of surgeries) was taken.

Methods and procedure of data analysis

Analysis was performed using Stata Version. 17. Frequency tables were used to describe categorical data of the patients; continuous variables were summarized using means and standard deviations. Independent t test was used to test the statistical differences between the mean of TBSA among categorical variables, Chi-square to test the association between categorical variables. Survival analysis was estimated using the Kaplan-Meier method and the log-rank test, survival time was calculated from the date of admission until the date of death or last clinical follow-up visit. A value of $P<0.05$ (95% confidence interval) was reported as statistically significant.

Ethical issues

Informed consent (written and verbal) was obtained from the studied patient.

Results

Demographics

Table 1 represents the demographic characteristics of studied sample (n = 10) showing that, the mean age is 39±13.5, mean length of the stay in hospital is 53±26.6, and mean length of casting is 42±23.8. Out of 10 sample size, 7 (70%) are male and 3 (30%) are female. Most of burned cases were flame 80%, and the rest is electrical. Majority of our cases were improved 70%, and 30% of them expired. About 40% of the cases were having comorbidities. The inhalation injury was found in about 50% of our cases.

Outcome in relation to TBSA

Table 2 shows a significant association between outcome & total body surface area (TBSA) (*P* value = 0.0441), which indicate that the higher the TBSA involved the higher chances of bad outcomes. Moreover, there is a significant relation between comorbidities & TBSA (*P* value = 0.0427).

Table 2. Independent sample t test by TBSA

		N	TBSA (Mean)	SE	*P* value
Outcome	Expired	3	80	5.7	0.0441
	Improved	7	54	6.4	
Comorbidity	Yes	6	71	7.9	0.0427
	No	4	47	2.1	

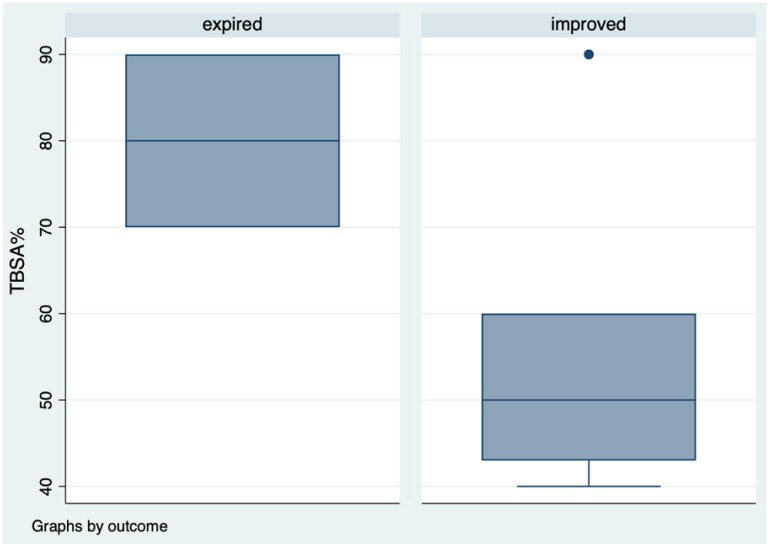

Figure 1. Mean of TBSA by outcome.

Table 3. Independent sample t test by age

		N	Age (Mean)	SE	*P* value
Outcome	Expired	3	41	6.009	0.82
	Improved	7	39	5.8	

Figure 1 is illustrating the mean of TBSA by outcome, it showed that patients who have lower TBSA had a better outcome.

Outcome in relation to age

Table 3 demonstrates the association between outcome & age, it showed that age is not significantly associated with death or improvement (*P* value = 0.82).

Outcome in relation to inhalation injury

Figure 2 represents the frequency of inhalation injury by the outcome, it shows that 5 patients had an inhalation injury while 2 of them have expired.

Survival estimates by comorbidity

Figure 3 demonstrates the Kaplan-Meier Survival Curves of patients with foot drop according to length of stay in the hospital. Comorbidity was consistently associated with mortality as 3 of the expired patients were having comorbidities.

Discussion

Evaluating of overall burn patients with peripheral neuropathy is quite difficult

Judgment between peripheral neuropathy related to burn itself or related to prolong casting is difficult to untrained. However, establishment of EMG is helpful for diagnostic study and incidence of injury. While we expect and predict some cases with peripheral neuropathy related to casting, early physiotherapy and occupational therapy will be keyword in prevention of nerve injury and further damage.

In this case series 10 admitted patients to our burn unit was diagnosed clinically as case of foot drop. The severity of nerve damage usually related to the depth of the thermal injury and incidence of neuropathy is higher with more TBSA [1, 5], the average TBSA in this case series is 62%. Another related predisposing factor is the length of stay in the burn intensive care unit, as observed in our cases their mean duration of stay was 53 days, in a cohort review of neuropathy in major burn patients, the incidence of neuropathy was found to be more common in patient who stayed in the ICU for more than 20 days [1].

Neuropathy is more associated with electrical and flame types of burn [11, 12], similar finding in our study to the literature as eight of the

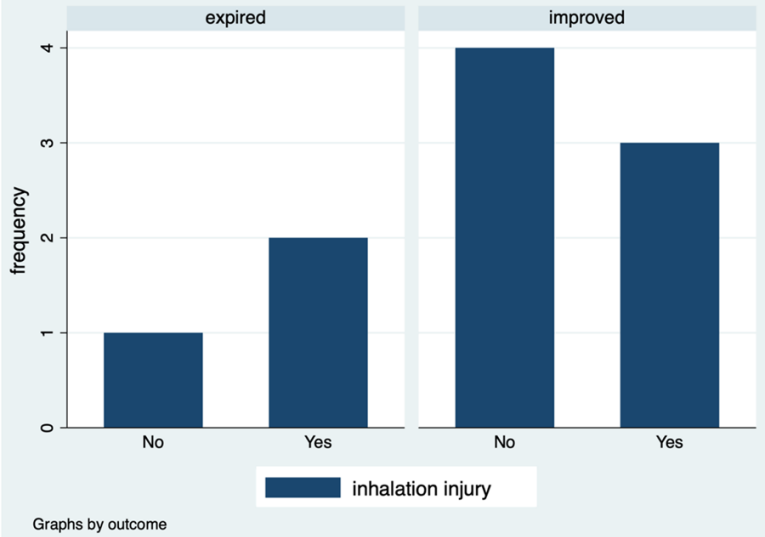

Figure 2. Inhalation injury by outcome (n = 10).

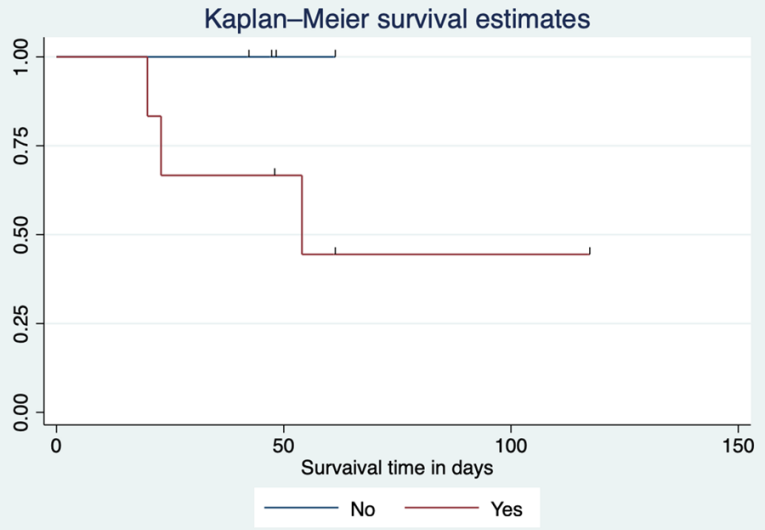

Figure 3. Kaplan-Meier survival estimates by comorbidity (n = 10).

cases were flame burn victim and two had electrical burn injury.

The orthotic splints that patients wear in the lower limbs in acute state after fasciotomy or other surgical intervention that require immobilization of the limb, along with edema both might cause a peroneal nerve compression and subsequent foot drop [3], all of our patients in this series were casted for an average period of 42 days, which might cause some sort of compression over the peroneal nerve. Screening of the casted limbs for peripheral neuropathy would be of great value as identifying and managing these consequences early can be of great value in the functioning and quality of life in the burn patients.

In our series the diagnosis of neuropathy was made clinically based on the signs and symptoms in all cases, no further nerve conduction studies were carried out, in review of the literature axonotmesis was found to be more frequent than myelin sheath involvement as the cause of neuropathy [1, 10]. These clinical findings necessitate the frequent follow up assessment of post burn patients in which some overlook non-life threating complications can be discovered and managed. Also, observed in our sample that further investigations may not be indicated until a trial of physiotherapy management offered to the patients, this approach is supported by the noticed improvement in all of our patients that survived the acute burn sequelae.

Conclusion

All of our patients were managed conservatively with no surgical intervention, physiotherapy was initiated immediately after the diagnosis of foot drop, 70% showed improvement during their follow up post discharge, only 3 patients of our series showed no improvement as they expired during their hospitalization, secondary to severity of the initial burn injuries and high TBSA 70%, 80% and 90%. The recovery of the patients was assessed by clinical examination and subjective improvement of the symptoms with no further tests.

The limitation of this study is that patients did not underwent electrodiagnostic study for objective evaluation of their neuropathy.

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Disclosure of conflict of interest

None.

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