

CHARACTERISTICS AND OUTCOMES OF MILITARY BURN PATIENTS IN PEACE TIME

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SUMMARY

Objectives: To evaluate characteristics and outcomes of military burn patients admitted to the National burns hospital during 5 years (2015 - 2019). **Subjects and methods:** A retrospective study was conducted on 4,799 adult burn patients (18 - 60 years old) with health insurance admitted to the National Burn Hospital from 01/01/2015 to 31/12/2019. Patients were divided into two groups: Military and civilian burn patients. Demographic data, burn features, manifestation, cost, and outcome of military and civilian groups were compared. **Results:** Amongst 4,799 patients admitted, 158 were military, accounting for 3.29%. Military patients were younger (33.3 vs. 36.6 year old; $p = 0.001$) and healthier with a lower rate of comorbidity (2.53% vs. 9.76%; $p = 0.002$). Proportion of male and scald injury were significantly higher (87.34% vs. 70.52%; $p = 0.001$ and 27.22% vs. 17.45%; $p = 0.001$) amongst military group. Military patients suffered significantly lower burn extent, deep burn, and deep burn area ($p < 0.01$) compared with the civilian group. However, the treatment time for 1% deep burn injury was remarkably longer ($p = 0.03$). **Conclusion:** In peacetime, the incidence of military burn patients is low. The manifestation and outcomes do not differ from civilian burn patients.

* **Keywords:** Soldiers; Burn; Outcomes.

INTRODUCTION

Burns are a common trauma in military operations, both in wartime and in peacetime. During the war, the percentage of burn wounded soldiers is about 5 - 20%, depending largely on the tactical situation. Main causal agents are explosive devices with high temperatures such as fuel-air bombs, napalms, phosphorus, or chemical burns from blistering warfare agents or leakage of chemicals and more serious burns from nuclear weapons [1, 2]. Military burn accidents can happen in peacetime related to training, production, living, handling activities related to explosives. The rate, structure, manifestation,

and outcome of burns may be different from civilian burn patients. In this study, we compared and evaluated characteristics and outcomes between military and civilian burn patients who were admitted to the National Burn Hospital in the period 2015 - 2019.

SUBJECTS AND METHODS

1. Subjects

4,799 adult burn patients (18 - 60 years old) with health insurance were admitted to the National Burn Hospital from 01/01/2015 to 31/12/2019. Patients were divided into two groups: Military and civilian burn patients.

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2. Methods

* *Study design:* A retrospective study.

- Recorded parameters included patient demographics (age, gender), burn features (time of admission after-burn accident, causal agents, burn extent, deep burn area, inhalation injury, eye injuries, comorbidity, combined injury, location of

burns on the body according to anatomical regions including head, face, neck, body, limb, genital) and outcomes (hospitalization, complication, death, costs paid by insurance).

- Data were analyzed using Intercooled Stata version 14.0 software, and $p < 0.05$ was considered significant

RESULTS

Table 1: Patient characteristics.

Criteria	Subgroup	Civilian patients (n = 4,641)	Military patients (n = 158)	p
Age, year		36.6 ± 0.2	33.3 ± 0.8	0.001
Gender, n (%)	Male	3,273 (70.52)	138 (87.34)	0.001
	Female	1,368 (29.48)	20 (12.66)	
Causal agents, n (%)	Scald	810 (17.45)	43 (27.22)	0.001
	Flame/heat surface contact	2,859 (61.6)	98 (62.03)	
	Electricity	856 (18.44)	16 (10.13)	
	Chemical agent	116 (2.5)	1 (0.63)	
Season, n (%)	Spring	1,021 (22.0)	35 (22.15)	0.50
	Summer	1,350 (29.02)	54 (34.18)	
	Autumn	1,222 (26.33)	39 (24.68)	
	Winter	1,048 (22.58)	30 (18.99)	
Admission time post burn, n (%)	< 24h	4,064 (87.57)	145 (91.77)	0.11
	≥ 24h	577 (12.43)	13 (8.23)	
Comorbidity, n (%)	No	4,188 (90.24)	154 (97.47)	0.002
	Yes	453 (9.76)	4 (2.53)	
Combined injury, n (%)	No	4,533 (97.67)	156 (98.73)	0.38
	Yes	108 (2.33)	2 (1.27)	

Of the 4,799 adult patients admitted to our hospital over five years, 158 were military patients, accounting for 3.29%. Military patients were significantly younger (33.3

vs.36.6 years; $p = 0.001$) and healthier with a remarkably lower rate of combined disease (2.53% vs. 9.76%; $p = 0.002$); however, male and scald injury were significantly higher (87.34% vs. 70.52%; $p = 0.001$ and 27.22% vs. 17.45%; $p = 0.001$). Whereas, the difference did not significantly between the two groups about the season, combined injury, and admission time post-burn ($p > 0.05$).

Table 2: Distribution of burn features by the group.

Criteria		Civilian patients (n = 4,641)	Military patients (n = 158)	p
Burn extent, median, % TBSA		9 (3 - 20)	6 (2 - 13)	0.001
Deep burn, n (%)		2,618 (56.41)	45 (28.48)	0.001
Deep burn area, median,% TBSA		0.25 (0 - 4)	0 (0 - 0.125)	0.0001
Inhalation injury, n (%)		131 (2.82)	2 (1.27)	0.24
Eye injuries, n (%)		73 (1.57)	1 (0.63)	0.35
Burn sites, n (%)	Face	1,649 (35.53)	57 (36.08)	0.89
	Head	229 (4.93)	5 (3.16)	0.31
	Neck	1,097 (23.64)	29 (18.35)	0.12
	Anterior trunk	2,024 (43.61)	66 (41.77)	0.65
	Posterior trunk	1,527 (32.9)	49 (31.01)	0.62
	Upper extremity	3,407 (73.41)	117 (74.05)	0.86
	Lower extremity	3,198 (68.91)	95 (60.13)	0.30
	Genital	167 (3.6)	5 (3.16)	0.77
<i>TBSA: body surface area: total body surface area</i>				

Compared with civilian patients, military patients suffered significantly lower burn extent (6% vs.3% TBSA respectively; $p = 0,01$). Incidence of deep burn injury was remarkable lower amongst military patients (28,48% vs. 56,41% respectively; $p = 001$). In addition, the deep burn area was also lower in the military group ($p < 0.01$). Meanwhile, the incidence of inhalation injury, eye injury, as well as burn sites was not significantly different between the two groups ($p > 0.05$).

Table 3: Manifestation and outcome.

Criteria	Civilian patients (n = 4,641)	Military patients (n = 158)	p
Mechanical ventilation, n (%)	123 (2.65)	2 (1.27)	0.28
Complication, n (%)	175 (3.77)	2 (1.27)	0.1
Treatment time/1% deep burn area, median, days	8 (3.2 - 25)	14.3 (4.8 - 40)	0.03
Number of surgical intervention, median, times	0.66 (0.33 - 2)	1 (0.36 - 2)	0.33
Cost/1% deep burn area median, million Dong	11.3 (6.0 - 25.9)	12.1 (5.8 - 23.4)	0.75
Mortality, n (%)	179 (3.86)	2 (1.27)	0.09

The rate of patients who underwent mechanical ventilation, complication, overall mortality rate, and treatment cost were not remarkably different between the two groups ($p > 0.05$). However, the treatment time for 1% deep burn injury was significantly longer in military patients (14.3 vs. 8 days; $p = 0.03$).

DISCUSSION

In peacetime, the military burn wounds mainly due to accidents in daily life or in the process of training and military operations [3]. Rizzo J. A et al. conducted a retrospective analysis of the data of 3814 burn patients admitted to the army burn center in the United States from 2003 to 2014 found that 28% of patients were military. The authors also indicate that the most common etiology of burn injury in military patients was blast injury; however, civilians experienced more fire/flame, scald, chemical, and electrical burns than military patients ($p < 0.001$). Military patients had a higher percentage of full-thickness burn injury (7.5% vs. 3%; $p < 0.0001$) and higher incidence of inhalation injury than civilians (14.1% vs. 10%; $p < 0.001$) [5]. In 2006, Wolf S.E. et al. analyzed 751 burn patients indicated that

36% was military patients and as compared to civilian burn group, the military patient had the same burn extent but significantly higher of the deep burn area and incidence of inhalation injury ($p < 0,05$) [4].

Comparing to burns in civilian groups, it is also noted from other studies about the characteristics of military burn-in peace time included: Burn extent was usually smaller with about 80% of patients suffered less than 20% of TBSA, full-thickness burn injury often occurred in open sites such as the face, neck, forearms, and hands, burn injuries were usually associated with other injuries, resulting in higher rates of infection and longer hospital stays [5, 6].

In our study, burn injuries of military force were all due to accidents occurring during training, production, logistics activity,

or daily life. So the causal agents and severity were similar to other reports about burn characteristics in peacetime. Our study showed that the patients with scald burns were significantly higher (27.22% vs. 17.45%; $p = 0.001$), there was no difference in burn season and combined injury ($p > 0.05$). In addition, civilian patients suffered significantly higher rates of chemical and electrical injuries (2.5% vs. 0.63% and 18.44% vs. 10.13%; $p = 0.001$). Moreover, compared with the civilian group, military patients had significantly less burn extent, rate of deep burn, and deep burn area ($p < 0.01$), and there was no difference in the rate of inhalation injury. In this study, the treatment time for 1% deep burn injury was remarkably longer in military patients ($p = 0.03$). The reason could be that military patients had to undergo longer rehabilitation treatment to healthy enough soldiers when they were returning to the unit to perform the task immediately.

CONCLUSION

Military burn patients accounted for 3.29% of total adult burn patients with health insurance. Compared with civilian patients, military patients were younger 33.3 vs. 36.6 year old; $p = 0.001$),

healthier with higher proportion of male (87.34% vs. 70.52%; $p = 0.001$) and less extensive burn. Except for higher scald burns (27.22% vs. 17.45%; $p = 0.001$) and treatment time for a deep burn injury, the manifestation and outcomes do not differ between the two groups.

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