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# The incidence of the deep veins thrombosis among adult and pediatric Saudi patients with burns. National Guard hospital between 2010-2015

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#### ABSTRACT

**Objectives:** This retrospective study aimed to estimate the incidence of the deep vein thrombosis (DVT) among patients suffering from burn in a tertiary care hospital at Saudi Arabia during the period from January 2010 to January 2016. **Methods:** A chart review study was conducted at National Guard hospital in the Management of Adult and Pediatric Patients with Burns, from 2010-2015. The study included 168 burn cases from 2010 to 2015, of which 109 (64.9%) were children and 59 (35.1%) were adults. Six cases from pediatric had incomplete data were excluded from analysis. **Results:** This study showed that 38.3% of the patients with burns in the study period were adults, 61.7% were children 66.9% were males, and 98% were Saudis. The main cause of burns was the flame in adults (45.7%) and children (66%), with significant difference (p=0.029). Lower limb was the main site of burns among (50.8%) of the adults, while the main site was the abdomen among the children (67.7). DVT (3.1%) and death (1.1%) was higher among children than adults with no significant difference.

**Conclusions:** The rate of the burn was higher among children than adults without significant difference. The main cause for burning was flame. The main risk factors to develop DVT were increased total body surface area, insertion of the central line, and admission to ICU. There is a need for more meaningful evaluation of the patients with burns in order to calculate the incidence of DVT and identify the associated risk factors among them.

Key words: Burn, deep venous thrombosis, Saudi, complication, incidence, death

## Introduction

In a study conducted at the King Khalid University Hospital to define the clinical characteristics and identify the risk factors of pulmonary embolism (PE) in patients received at a Saudi tertiary care center between January 2008 and January 2012, 73.5% of those diagnosed with PE were inpatients [1]. defined the prevalence of deep vein thrombosis (DVT) in admitted traumatized patients, obstetric patients, and patients undergoing general surgery, the prevalence of DVT in subjects exposed to burns still generally unknown [2]. Hence, prophylaxis against DVT in patients suffering from burns still debated [3].

Although there is a marked advance in the intervention and survival of patients exposed to thermal

Despite the plenty of the prospective studies that

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injuries during the last few years, the thromboembolic complications facing patients with burn were not thoroughly investigated. Interestingly, thromboembolism and burns were reported to be associated based on the observation in autopsies for more than thirty years [4]. The occurrence of symptomatic DVT has been noted in (0.9-7%) of the cases, with pulmonary embolism confirmed by clinical examination only in a portion (0 to 0.4%) of these cases [5-7].

A systematic review reported that the incidence of asymptomatic Venous thromboembolism (VTE) in critically ill patients varied from 3.7-26% (median 12.8%) [8]. Furthermore, previous studies have shown that anticoagulant prophylaxis in the intensive care unit (ICU) patients can effectively avoid both fatal pulmonary embolism (PE) and non-fatal VTE [9,10]. However, most of these studies involved a heterogeneous population of critically ill patients with short follow up and variable compliance rates [11].

The prevalence of DVT occurs in unsympathetically ill patients ranged between (3.7-26%) [8]. Moreover, it was stated in the proceeding studies that both fatal PE and non-fatal DVT could be successfully prevented in patients admitted to the ICU by the administration of anticoagulant [9,10] but most of these studies included a diverse subset of patients with marked illness, short monitor periods and inconstant compliance rates [11].

Both DVT and PE persist as prevalent complications in patients suffering from trauma, and both the degree and the site of trauma were determinably important in assessing the risk of the injury [12,13]. In their prospective study, Wibbenmeyer et al., reported that 6.08% of populations exposed to burn at Iowa burn treatment center, and Chicago College of Osteopathic Medicine between 1999 and 2001 were suffering from VTE [3].

It was reported that it is hard to determine whether a positive Homan's sign is symptomatic of pain attributed by burn or DVT except after the use of noninvasive mechanical testing. Wibbenmeyer et al. stated that five out of nine patients suffering from burn were diagnosed to have asymptomatic DVT [3]. Therefore, this retrospective study aimed to estimate the incidence of DVT in patients suffering from burn at one of the tertiary care hospitals at Saudi Arabia during the period from January 2010 to January 2016.

#### Subjects and Methods

Patients suffering from burn frequently satisfy all of Virchow's triad that includes; stasis, local injury, and hypercoagulability with subsequent development of DVT. PE is regarded as a common complication in patients admitted to hospitals. The main risks factors of having DVT in patients suffering from burn included; old age, insertion of a central venous line, and the larger size affected with the burn adding to other risk factors like malignancy, cardiac disease, increased body weight and immobility.

# Patient inclusion characters

All Saudi patients suffering from burn admitted to the National Guard Hospital between 2010-2015 were included in this study. Confirmation of DVT diagnosis was done by using venous ultrasonography and Ddimer testing.

#### Data collection tools

A data collection sheaths were prepared to contain all required data to conduct the study including the age, gender, duration of hospital stays, etc. The primary outcome was the incidence of deep venous thrombosis in patients suffering from burn during the period from January 2010 to January 2016. This study was carried between January 2010 to November 2017.

# Ethical consideration

The approval to perform this retrospective study was taken from the Institutional Review Board at the National Guard Hospital, Jeddah, Saudi Arabia.

## Statistical analysis

The data was collected then analyzed using the Statistical package for social science (SPSS) version 16. The quantitative data was shown in the form of mean and standard deviation. The qualitative data was shown in the form of number and percentage. Chi-square was utilized for qualitative data. Pearson correlation coefficient was utilized to study the correlation between the studied variables. Significance was regarded at a p-value less than 0.05.

# Results

This study showed that there were 168 burn cases from 2010 to 2015, of which 109 (64.9%) were children and 59 (35.1%) were adults. The higher rate was during 2013 (Table 1).

studied cases.

**Table 1.** Admission of cases with burn to the National Guard Hospital during the period from 2011 to 2015.

Year	Adult N (%) N=59	Child N (%) N=109	
2010	7 (11.9)	18 (16.5)	
2011	6 (10.2)	12 (11.1)	
2012	10 (16.9)	15 (11.1)	
2013	19 (32.2)	30 (27.5)	
2014	11 (18.6)	22 (20.2)	
2015	6 (10.2)	12 (11.1)	
Data were expressed as number and percentage.			

The mean age scores were  $39.73\pm18.32$  for adults and  $4.8\pm4.58$  for children. This study showed that 38.3% of the patients with burns in the study period were adults, 61.7% were children 66.9% were males, and 98% were Saudis. The main cause of burns was the flame in adults (45.7%) and children (66%), with significant difference (p=0.029). Lower limb was the main site of burns among (50.8%) of the adults, while the main site was the abdomen among the children (67.7). DVT (3.1%) and death (1.1%) was higher among children than adults with no significant difference (Table 2).

The mean score of hospital stay was  $20.28\pm15.09$  for adults and  $23.59\pm26.07$  for children, without a significant difference and the mean score of total body surface area (TBSA) were 12 for adults and 14 for children, without significant difference (p=0.27)(Table 3).

Surgical treatment and burn wound infection rates were non-significantly higher among adults than children, while the need for the central venous line was higher among children than adults (22 years 1, p<0.0001). On the other hand, the rates of ICU admission need for artificial ventilation, and the need for anticoagulant were higher among children than adults, without significant difference (Table 4).

The results revealed that the rate of DVT and death was higher among children than adults without significant difference, 3 (2.8%) versus 1 (1.6%), p=0.47), and (1 versus 0, p=0.88) respectively. The total incidence of DVT among the studied cases was 2.5%, and the total mortality was 1.3% (Table 5). The relationship between DVT, site, and cause of burn, patient age, and TBSA was shown in Table 6.

N=59		N=95	significance	
Age				
- Mean±SD	39.73±18.32	4.8±4.58		
- (range)	(15-94)	(0.25-14)		
Gender (Number, %)			Chi-square	
- Male	38 (64)	65 (68.4)	test =0.37	
- Female	21 (36)	30 (31.6)	P=0.55	
Nationality (Number,	%)		Chi-square	
- Saudi	58 (98)	95 (100)	test =0.11	
- Non Saudi	1 (2)	-	P=0.90	
Cause of burn (Numb	oer, %)			
- Chemical	11 (18.6)	2 (2.1)	Chi-square	
- Scald	21(35.5)	70 (73.6)	P=0.009*	
- Flame	28(47.3)	23 (24.2)		
*Site of burn (Number, %)				
Face	10 (16.9)	21 (19.2)		
Chest	23 (38.9)	32 (29.3)	Chi-square	
Abdomen	21 (35.5)	40 (67.7)	P=0.043*	
Upper limb	27 (45.7)	21 (19.2)		
Lower limb	30 (50.8)	39 (35.8)		

Table 2. Age, gender, nationality, cause, and site of burn of the

Child

Adult

\*More than one site affected, so the number of sites exceeded the number of both adult and burn. Quantitative data were presented as mean, standard deviation and range. Qualitative data were presented as number and percentage. Chi-square was used as a test of significance.

<b>Table 3.</b> Hospital stay and the total body surface area (TBSA) of the studied cases with the burn.				
	Adult N (%) N=59	Child N (%) N=95	Test of significance	
Hospital stay				
Mean ±SD	20.28±15.09	23.59±26.07		
range	(2-66)	(1-160)		
Hospital stay				
Less 5 day	7 (11.8)	13 (11.9)		
5- 10 day	6 (10.1)	18 (16.5)	Chi-square	
10-15 day	13 (22)	24 (22)	P=0.91	
15-20 day	9 (15.2)	16 (14.6)		
More than 20	24 (40.6)	38 (34.8)		
TBSA				
Mean	12	14	Student t test	
SD	11	4	t=1.04	
Range	(1-36)	(1-80)	p=0.27	
Median	10	9		

Quantitative data were presented as mean, standard deviation and range. Qualitative data were presented as number and percentage. Chi-square was used as a test of significance for qualitative data. Student t-test was used as a test of significance for quantitative data.

Test of

Table 4. Management of adult and pediatric cases with burn.				
	Adult N (%) N=59	Child N (%) N=95	Test of significance	
Surgical treatment			Chi-square	
- Yes	20 (33.8)	30 (31.5)	test =1.2	
– No	38 (66.2)	65 (69.5)	P=0.23	
Admission to ICU			Chi-square	
– Yes	6 (10.1)	15 (15.7)	test =0.68	
– No	53 (89.9)	80 (84.2)	P= 0.40	
Need for artificial venti	Chi-square			
– Yes	5 (8.4)	7 (7.3)	test= 0.06	
– No	54 (91.6)	88 (92.7)	P= 0.80	
Need for central venou	Chi-square			
– Yes	1 (1.6)	12 (12.6)	test=11.07	
– No	58 (98)	83 (87.4)	P<0.001	
Need for anticoagulant	Chi squaro			
– Yes	4 (6.7)	4 (4.2)	test =0.97	
– No	55 (93.3)	91 (95.8)	P=0.37	
Burn wound infection			Chi-square	
– Yes	12 (20.3)	3 (3.1)	test=12.81	
– No	47 (79.7)	92 (96.9)	P<0.001	

Quantitative data were presented as mean, standard deviation and range. Qualitative data were presented as number and percentage. Chi-square was used as a test of significance for qualitative data. Student t-test was used as a test of significance for quantitative data.

#### Discussion

Burn is defined as a complex trauma with variable severity depended upon the size and site of the burn. Severe burns with extending to the large involved area of the body might be fatal. Burn wounds remain a frequent worldwide health problem that attracts the attention of most people due to its negative impact [14-16]. Burns might be induced after exposure to fires, boiling agents, chemicals, electrical energy, and radiation [16]. In the current study most of the burn cases (both adults and children) were significantly due to flame.

VTE, including DVT and PE, causes considerable illness and death among trauma, medical and surgical patients [17,18]. The majority of deaths attributed to PE occur in hours of the embolic phenomenon, frequently after unrecognized DVT [19,20]. VTE might induce mortality as well as marked illness. Patients suffering from burn have many, established risks to have VTE which included increased burned TBSA, prolonged stay in the ICU, insertion of central venous line, old age, overweight, wound infection, and transfusion of extra packed RBCs [21-23]. Regarding the American National Burn Repository (ANBR), the total DVT frequency of 0.48, which rises to 0.92% in patients having TBSA more than 10%, the rates of "sympto-

	Adult N (%) N=59	Child N (%) N=95	Total N (%) N=154	Test of significance	
DVT					
- Yes	1 (1.6)	3 (3.1)	4 (2.5)	Chi-square test= 0.52 p= 0.47	
- No	58 (98.4)	92 (96.9)	150 (97.5)		
Mortality					
- Dead	1 (0)	1 (1.1)	2 (1.3)	Chi-square test= 0.21 p= 0.88	
- Survived	59 (100)	94 (98.9)	152 (98.7)		

Qualitative data were presented as number and percentage. Chi-square was used as a test of significance for qualitative data

#### Table 6. Some clinical and lab characters of the four patients suffering from the burn and developed DVT.

	Age	Cause of burn	Gender	Site of burn	TBSA
Case 1	Child 5 year	Flame	Male	Chest, Abdomen	30
Case 2	Adult 60 years	Flame	Male	Abdomen	12
Case 3	Adult 55 years	Chemical	Female	Abdomen, Upper Limb	16
Case 4	Adult 50 years	Flame	Female	Abdomen, Lower Limb	22

matic pulmonary embolus" in patients having burn are ranged from 0.05% to 1.4%, and the VTE incidence in burned patients is 0.61%. This incidence becomes 1.2% when there is a need to be admitted to the ICU or once the patient's TBSA is larger than 10%. Where the three main risk factors of DVT and PE are multiple surgeries, ICU admission and high TBSA burned [21].

In the current study the prevalence of DVT was 1.6% in adults and 2.8% in children with no significant difference, one case died among children. The prevalence of DVT was higher among children, where both the mean score of TBSA and the rate of ICU admission were higher among children than the adult, as well as was higher without significant difference, (14 versus 12, p=0.24), and (14.6% versus 10.1%, p=0.40) respectively. Similar results were reported in the Michigan study, where the association of necessity to be admitted to the ICU along with enlarged burned TBSA were all intensely predictive of the patients who developed VTE [21]. Fecher et al. reported that ten patients had DVT (0.25%) with TBSA high mean (34.7 + -25.3%), another two patients had non-fatal PE, in addition to 3 died cases were reported [23]. Also, in 2017, Sikora and Papp, reported that among 1549 burn patients, fifty patients (3.2%) had VTE, this was associated with a considerably greater rate of inhalational damage, larger TBSA, lengthier hospitalization period [24]. In an Australian study, from 911 patients, 3 (0.33%) had PE alone, 4 (0.44%) had both DVT and PE and 7 (0.77%) had a DVT alone [25].

Central venous line considered as one of the risk factors to develop VTE [21,26,27]. In the current study children showed a significantly higher rate of central venous line than adults (20.1% versus 1.6%, p=0.016). Similar results were reported in different studies, where the association between the prevalence of VTE and central venues line was demonstrated (84.2 versus 51.4%, P = .016) [21,22,28].

Some contradictions exist in the previous researches about the thromboembolic prophylactic regimens and data reported that complications happen even with the use of chemoprophylaxis [29]. Several studies conducted on patients suffering from burn showed that the incidence of symptomatic DVT in patients does not receive chemoprophylaxis ranges from 2.1% to

Standard VTE prophylactic treatment given to patients with the burn is recommended by the ACCP and multiple institutional authors [3,6,7,12]. Also, "the Joint Commission recently advice the VTE prophylactic treatment as a core measure of hospital quality" [19]. About 24% of centers treating burn was reported not to utilize mechanical or chemoprophylactic drugs against VTE. Among those centers who offer prophylactic treatment, about 22% utilize mechanical prophylaxis alone, and 78% utilize chemoprophylactic drugs [20]. In the current study 4 (6.7%) of adults and 12 (11%) of the children received anticoagulant agents with no significant difference. In 2017 study, the authors reported that out of 26 patients with VTE 12 patients (46%) were on chemoprophylaxis and 14 (54%) without chemoprophylaxis [27].

Limitations of the study: This study has some limitations. It is a single center experience. Being retrospective study could lead to missing important inducing removing some cases.

In conclusion, the prevalence of DVT among burn patients was consistent with previous studies. The rate of the burn was higher among children than adults without significant difference. The main cause for burning was flam. The main risk factors to develop DVT were increased total body surface area, use of central access, and admission to ICU. There is a need for more meaningful evaluation of the patients with burns to calculate the incidence of DVT among them and to determine the associated risk factors. This might necessitate large multinational, well-designed, prospective study. Also, there is a need for national guidelines and a national database, to help in collecting data and improve the management plan.

# **Conflict of interest statement**

The authors have no conflicts of interest to declare. **References** 

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