

Acute Compartment Syndrome Prevalence and Outcome in Aseer Central Hospital

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ABSTRACT

Background: Acute compartment syndrome is a painful condition caused by the increased interstitial pressure, itone of the most critical emergencies cases in both trauma cases and orthopedics. The leg is themost common site, but forearms, hands, feet, and buttocks are also places of occurrence. There are several risk factors for this syndrome and its outcome is depending on time of diagnosis.

Aim: To assess the risk factors and outcomes of acute compartment syndrome.

Methods: This retrospective study was conducted in Aseer central hospital, Abha, Saudi Arabia. The study included 77 patients who suffered acute compartment syndrome.

Results:The mean age of patients was 28.31 ± 14.68 years old, males represented 92.2%, and females represented 7.8%. The fracturewas presented in 79.2%; the most common cause was RTA representing 57.1%, 53.2% of patients had no injuries. Mostpatients had no complications (63.6%), the only significant factor between patients with and without complication was open fixation (P-value=0.001).

Conclusion: Acute compartment syndrome was more common in males, and themost common site was in theleg, the most important cause was RTA and the more dominant associated injury was avascular injury.

Keywords: ACS, Complication of ACS, ACS risk factors.

INTRODUCTION

Acute compartment syndrome (ACS) is one of the most serious emergencies cases in orthopedics and trauma cases. It is a painful condition caused by the increase interstitial pressure (intracompartmental pressure - ICP) within a closed oste fascial compartment which impairs local circulation^[1]. The leg is themost common site for ACS, but it can occur in the forearms, hands, feet, and buttocks. In one case series of 164 patients with ACS, fracture was the cause in (69 percent) of cases. Fractures of the tibial diaphysis (36 percent) and the distal radial fracture (9.8 percent) and diaphyseal fracture of the radius and ulna (7.9 percent) and after femoral fracture (3 percent), and (3 percent) after tibial plateau fracture .Soft tissue injury without a fracture was the cause in(23 percent) of patients^[2].DeLee and Stiehl found that 6% of patients with open tibial fractures developed compartment syndrome, compared with only 1.2% of patients with closed tibial fracture^[3]. The incidence of compartment syndrome is much higher in patients who have an associated vascular injury. Feliciano et al. reported that 19% of patients with vascular injury required fasciotomy^[4].

It occurs more in male than female,andthe mean age is also different, about 30 years for men and 44 years for women. A lot of unknown causes can create this problem thatsuggests surgeons pay great attention to this serious complication. There was study by Schwartz et al.^[5]reported a mortality rate of 47% after ACS of the thigh .The outcome of ACS depends on the time of diagnosis from injury to

intervention. Rorabeck and Macnab reported almost complete recovery of limb function if fasciotomy was performed within first six hours^[6].Matsen found necrosis after first six hours of ischemia, which currently is the accepted upper limit of viability^[7].When fasciotomy was performed within 12 hours^[7] after the onset of ACS, Sheridan and Matsen reported that normal limb function was regained in 68% of patients^[8]. However, when fasciotomy was delayed 12 hours or longer, only 8% of patients had normal function. Thus, little or no return of function can be expected when the diagnosis and treatment are delayed. Tendon transfers and stabilization may be indicated as a late treatment for CS.Infection is a dangerous complication of compartment syndrome. Matsenet al.,reported in retrospective study 11 of 24 extremities that had late surgical decompression developed infections, and 5 of these infections led to an amputation^[9].

Up to our knowledge, NO studies describes the acute compartment syndrome among traumatic patient in Aseer Central Hospital.The rationale of our study is to estimate theprevalence of ACS and outcome of the patient in Aseer central hospital.

METHODS

It is a retrospective case series study using medical records of the patients admitted on Operating Room (OR) as a case of ACS(FASCIOTOMY) at Aseer Central Hospital (ACH), Abha, Saudi Arabia.The inclusion

Criteria were Patients who admitted on OR as a case of ACS, Both male, and females. The exclusion criteria were other patients without ACS. This study included 77 patients with acute compartment syndrome. The data were verified manually, entered in the computer and IBM-SPSS software statistical program version 20 was utilized for data entry and analysis. Categorical variables were presented as frequencies and percentages. Chi-square was used to measure the correlation between two variables. P-value of less than 0.05 was considered significant.

RESULTS

The present study included 77 patients with acute compartment syndrome, 6(7.8%) of them were females and 71 (92.2%) were males.

The mean age of patients was 28.31 ± 14.68 years old, participants with age less than 20 years old represented 27.3%, while those with age range 20-39 years represented 55.8%, patients with age range 40-59 years and ≥ 60 years represented 11.7% and 5.2%

respectively. 57 (74%) of patients were Saudi, and 20 (26%) were non-Saudi. There were 4 (5.2%), and 5(6.5%) only suffered diabetes mellitus and hypertension respectively, while the large majority 68 (88.3%) were free. There were 61 (79.2%) of patients had fractures, whereas 16 (20.8%) had no fracture. The most common site of compartment syndrome was leg 35 (45.5%), while there were 5(6.5%) in foot, 18(23.4%) in forearm, 9(11.7%) in thigh, 5(6.5%) in hand, 3(3.9%) in leg and feet and 2(2.6%) in arm.

Among the types of injuries, there were 44 (57.1%) RTA, 8 (10.4%) crush, 7(9.1%) gunshot, 13(16.9%) fall, 3(3.9%) burn and 2(2.6%) other types including sports injuries. Regarding associated injuries, there were 41(53.2%) had no associated injuries, 22(28.6%) had vascular injuries, 5(6.5%) had nerve injuries, 5(6.5%), 3(3.9%) and 1(1.3%) had neurovascular, femur and hand injuries respectively, table 1.

Table 1: Characteristics of patients

Characteristics	N	%
Sex	Male	71 92.2
	Females	6 7.8
Age in years	< 20	21 27.3
	20-39	43 55.8
	40-59	9 11.7
	≥ 60	4 5.2
	Mean \pm SD	28.31 \pm 14.68
Nationality	Saudi	57 74.0
	Non-Saudi	20 26.0
Medical condition	Free	68 88.3
	DM	4 5.2
	HTN	5 6.5
Presence of fracture	Yes	61 79.2
	No	16 20.8
Site of lesion	Leg	35 45.5
	Foot	5 6.5
	Forearm	18 23.4
	Thigh	9 11.7
	Hand	5 6.5
	Leg & feet	3 3.9
	Arm	2 2.6
Causes	RTA	44 57.1
	Crush	8 10.4
	Gun shot	7 9.1
	Fall	13 16.9
	Burn	3 3.9
	Others(sport)	2 2.6
Associated injuries	None	41 53.2
	Vascular	22 28.6
	Nerve	5 6.5
	neurovascular	5 6.5

Among patients, there were 43 (55.8%) had open fracture, the management strategy involved fasciotomy only for 16(20.8%) patients, fasciotomy and plate for 28(36.4%), fasciotomy and external fixation for 14(18.2%), fasciotomy and IMN, K-wire or close red for 11(14.3%), 7(9.1%) and 1(1.3%) respectively.56 (72.7%) of patients didn't recurrence, so duration between injury and intervention wasn't calculated, 6(7.8%) spent 6 hours between injury and

intervention, while 6(7.8%) and 8(10.4%) spent 12 hours and more than 24 hours respectively.

The types and percent of complications between patients are shown in figure1. Most of patients 49(63.9%) had no complication, but the most common complication the patients suffered was infection 11(14.3%), followed by amputation 7(9.1%), the loss of motion 5(6.5%), contractures represented 2(2.6%) of complications and other complications represented 3(3.9%).

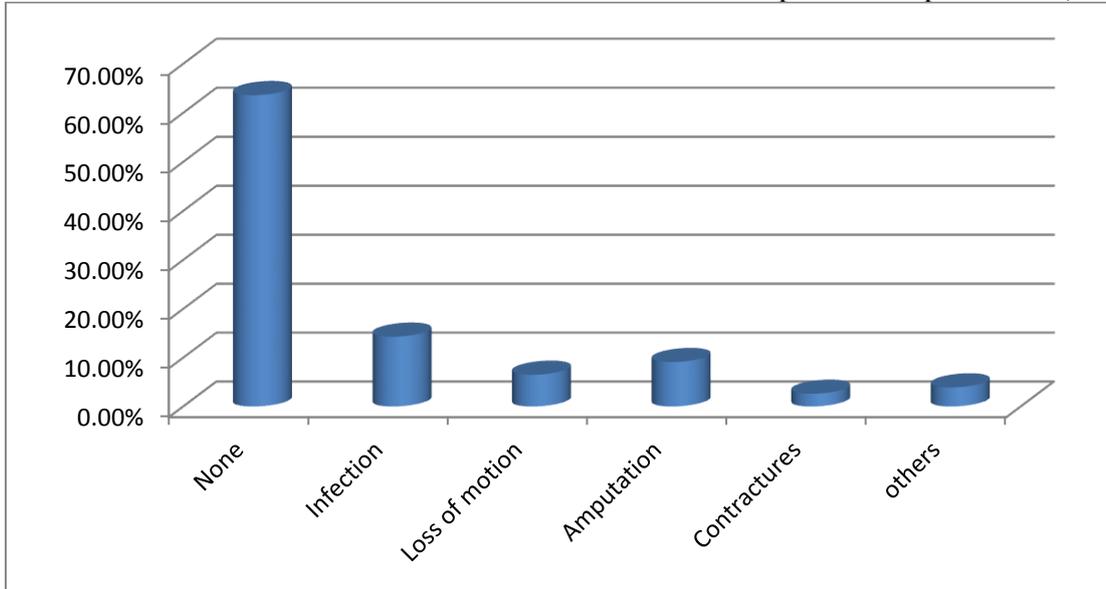


Fig 1: Types and percent of complications of participants

By comparing patients without complications and those with complications, there was a significant difference regarding open fracture (P-value=0.001), where more patients who had no open fracture tended to suffer no complications 29(85.3%), while those who had open fracture tended to suffer complications 23(53.5%), table3.

Table3: Comparison between complicated and uncomplicated cases

Variables		Un-Complicated cases (49)	complicated (28)	P value
Fracture	Yes	37	24	0.288
		60.7%	39.3%	
	No	12	4	0.063
		75.0%	25.0%	
Associated injuries	Yes	19	17	0.063
		52.8%	47.2%	
	No	30	11	<0.001*
		73.2%	26.8%	
Open fracture	Yes	20	23	<0.001*
		46.5%	53.5%	
	No	29	5	0.056
		85.3%	14.7%	
Time to intervention	No rec	38	18	0.056
		67.9%	32.1%	
	6-12	9	4	0.056
		69.2%	30.8%	
	>24 h	2	6	0.056
		25.0%	75.0%	

The frequency of compartment syndrome site between patients with and without complications is shown in figure2; there was no significant difference between the site of syndrome and suffering complication or not (P-value>0.05).

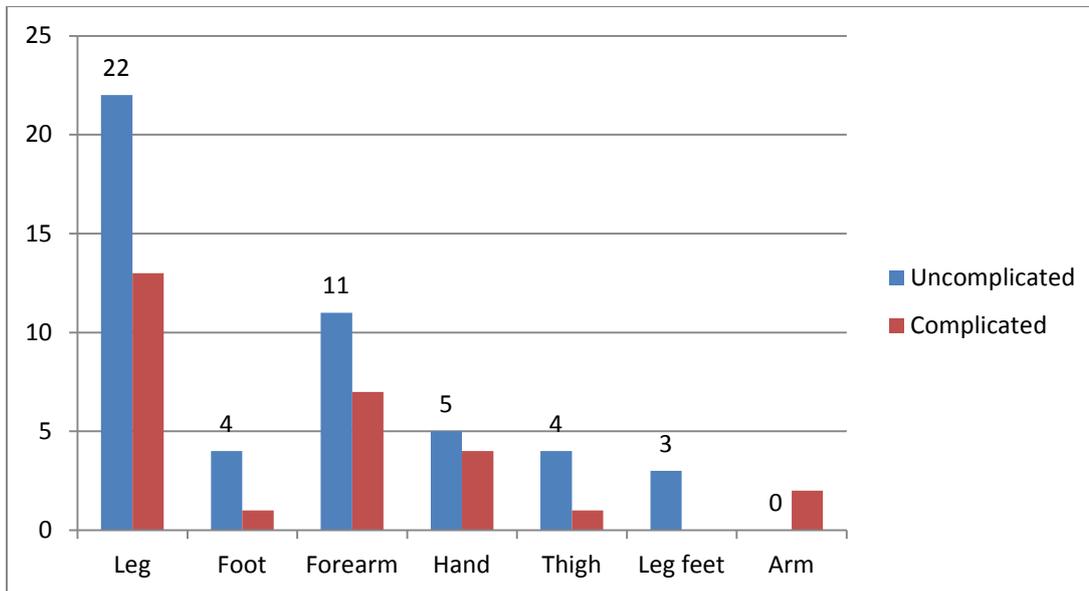


Fig 2: Distribution of syndrome site between patients with and without complications

DISCUSSION

Acute compartment syndrome (ACS) is a condition that occurs in abdomen and limbs ^[10]. The most common site of ACS is leg then forearm which is followed by arm, thigh, foot, gluteal region, hand, and finally abdomen ^[11]. In the present study, the most common site for ACS was leg (45.5%) followed by forearm (23.4%), there were 11.7% suffered ACS in thigh, 6.5% in the foot, 6.5% in hand, 3.9% in leg and feet and 2.6% in arm, there was no patient suffered ACS in abdomen. The incidence of ACS was thought to be $3.1/10^5$ of population and it is more prevalent in males than females by ten times ^[9,12]. ACS was more prevalent in males (92.2%) than in females (7.8%) in this study and the most affected individuals were those in the age range of 20-39 years (55.8%), with a mean age of 28.31 years. One of the strongest predictors for ACS is age, the average age for diagnosis of ACS is 32-years-old ^[13]. Presence of increased frequency of high energy trauma, stronger fascia and increased muscle volumes among younger patients are thought to be the reasons for making ACS more common in younger patients ^[14]. Acute compartment syndrome can result from non accidental causes such as diabetes mellitus ^[15], however most of our patients didn't suffer DM or HTN (88.3%), whereas only 5.2% and 6.5% suffered DM and HTN respectively. It was mentioned that the common causes of ACS included burns, crush injuries, bleeding disorders, infection injuries and fracture

^[16]. The most prevalent cause of ACS in this study was RTA representing 57.1% of causes, followed by fall (16.9%), crush represented 10.4% of causes, while burn represented 3.9% only. In the current study, there were 79.2% of ACS patients had fractures. Fractures are the most common cause of ACS, they result in 69% of all ACS cases ^[13]. The second most common cause of ACS is soft tissue injury which accounts for 23% of all ACS cases ^[17]. Most of patients in this study (53.2%) didn't have associated injuries, while 28.6% had vascular injuries and 6.5% had nerve injuries. It was stated that vascular injuries can cause ACS secondary to compartmental ischemia ^[1]. Regarding the time between injury and intervention, there were 10.4% spent more than 12 hours, while the most of patient didn't recurrence 72.7% and an equal percent of patients spent 6 and 12 hours (7.8%). The large majority of patients in the current study (36.4%) were performed fasciotomy and plate for management, 20.8% performed fasciotomy only, whereas 1.3% only performed close red. High complication rate was associated with fasciotomy as it transforms closed lesion into an open wound ^[18]. Early fasciotomy in case of symptom diagnosis within six hours can allow for complete limb recovery ^[19]. Fasciotomy is controversial after 8 hours in cases of ACS as in this case myoneural damage is irreversible and risks exceed any potential benefit ^[16]. Delayed fasciotomy may cause an increased risk of amputation, infection, sepsis, renal

failure and death^[19]. It was reported in one study^[20] that one of 5 patients died after performing fasciotomy, where there was an average of 56 hours delay from the diagnosis for those patients, the other 4 patients required a later amputation. The open wound can be healed by second intention such as after fasciotomy the skin is left open and then allow the granulation from the outside in, or close skin within four days by either flap coverage or skin grafting^[10]. This combination of an open wound and necrotic muscle can result in development of infection and other complications which are life-threatening^[10]. In the current study, 63.6% of patients had no complications, while 14.3% suffered infection and least percent 2.6% suffered contractures. Although most of our patients performed fasciotomy with palate (36.4%) and 20.8% performed fasciotomy, the complications were present in only 36.7% and 14.3% of them suffered infection. By comparing patients with and without complications, the only significant factor found was open fixation, where open fixation was more common in patient with complications (53.5%) than those without complications. The site of syndrome wasn't a significant factor between patients with or without complications.

CONCLUSION

ACS was more prevalent in males than in females and those with age range of 20-39 years old. The fracture was more prevalent in ACS patients, the most common site of ACS was leg, the most common cause was RTA, and most of them had no associated injuries. The complications were not associated with the fasciotomy, and the most common complication was an infection. However, most of the patients didn't suffer any complications. Open fracture was the only significant factor that differed between patients with and without complications.

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