



Lower extremity compartment syndrome in northern Ghana

Kuubiere B. Callistus and Abass Alhassan

Department of Human Biology, School of Medicine and Health Sciences, University for Development Studies, Tamale

ABSTRACT

Compartment syndrome is a condition in which increased pressure within a closed compartment compromises circulation and function of the tissues within that space. This usually occurs in osseofascial compartment of the leg or forearm, but it may occur in the upper arm, thigh, foot, buttock, hand, and abdomen. The general cause of compartment syndrome is trauma, usually after a fracture. The incidence rate of acute compartment syndrome is up to 20% in acutely ischaemic limbs but can vary from one place to the other. Delays in treatment can result in significant disability including neurological deficit, muscle necrosis, amputation, and death. However, very little is known about the prevalence of this condition in the Northern part of Ghana. The aim of the study was to investigate the prevalence of acute lower extremity compartment syndrome and its causes in Northern Ghana over a five year period. The study setting was the Tania specialist orthopaedic hospital, Tamale, Ghana. Data regarding patient's age and sex, extremity involved, cause of injury from January, 2007 to December, 2012 were analysed retrospectively. The prevalence of compartment syndrome over the study period was 20.76%. Majority of the cases were a result of non-infected fractured limb (48.17%), followed by infected fractured wounds, 25.23%, Gun-shot wounds, 15.60%, burns, 7.34% and others 3.67%. Among the non-infected fractured wounds majority (52.38%) were a result of prolong immobility with back slap POP with gauze bandage. In conclusion the prevalence of acute lower extremity compartment syndrome in Northern Ghana is relatively high. High energy injuries such as those sustained from road traffic accidents and gunshots as well as traditional bonesetter splinting are the most predominant precursors for lower extremity compartment syndrome in this part of Ghana. Monitoring of compartment pressure in these patients as wells as early referrals for specialist orthopaedic and trauma management should be considered to allow for early detection and treatment

Keywords: Compartment syndrome, lower limbs, fasciotomy, Fracture, Northern Ghana

INTRODUCTION

Compartment syndrome is said to occur when there is an increased pressure within a closed compartment which compromises the circulation and function of the tissues within that space [1, 2]. The most common occurrence is in an osseofascia compartment of the lower limb or forearm but may occasionally occur in the upper arm, thigh, foot and the abdomen. The causes of compartment syndrome are varied but the most common cause is trauma, usually after a fracture [1, 2]. Other causes included the use of inelastic gauze or bandages, and the use of inappropriate POP. It also occurs in ischaemia, burns and in poor positioning during certain prolonged surgical procedures (in lithiotomy) [1, 2]. Studies have shown that about 4.3% of all adult patients with tibial shaft fractures and 3.1% of diphyseal fracture of the forearm develops acute compartment syndrome. Acute compartment syndrome is said to occur most commonly among male patients under the age of 35 years [3-5].and can cause significant morbidity if not treated early but the diagnosis is often very challenging [6-8]. Delays in diagnosis and treatment can result in significant disability including neurological deficit, muscle necrosis, amputation and death. The diagnosis is very challenging because it requires a high index of suspicion usually by a trauma/orthopaedic specialist and severe pain is thought to be a cardinal feature of compartment syndrome [1, 2, 9].

To the best of our knowledge there is virtually no literature on the prevalence and causes of compartment syndrome in the Northern part of Ghana. The purpose of the present study is to determine the prevalence and causes of lower extremity compartment syndrome in a specialist trauma/orthopaedic hospital which serve the Northern part of Ghana.

MATERIALS AND METHODS

This study was conducted retrospectively over a five year period at the Tania Specialist orthopaedic/Trauma hospital, Tamale from January 2007 to December 2012. This hospital is one of the very few Trauma/Orthopaedic hospitals serving the entire three Northern regions of Ghana with a population of about 5 million people. There were 177 males and 41 females representing 91.2% and 18.8% respectively. Acute compartment syndrome was diagnosed either clinically or by monitoring of compartment pressure. Normal pressure in the muscle compartment is below 10–12 mm Hg [2]. The clinical diagnosis of acute compartment syndrome was made depending on the presence of some or all of the clinical indications (severe pain, stretch pain, sensory deficit, motor deficit), a differential pressure of less than 30 mmHg between the diastolic and compartment pressures [3] or a combination of both clinical and pressure indications. Majority (185 patients) of the patients had either been referred from the regional and district hospitals or they had sought treatment from traditional bonesetters before been admitted to our facility.

RESULTS

There were 218 patients with acute compartment syndrome in the lower extremity out a total of 1050 surgical cases recorded over the study period giving a prevalence rate of 20.76%. The study subjects included 41 females (18.8%) and 177 males (81.2%) with a mean age of 34.1 ± 11.7 years (mean \pm SD). The mean age of the women was 31.8 ± 18.6 and that of the men was 34.5 ± 10.1 . More than 50.0% of the cases occurred among patients within the age so f 31 to 40 years with about 45% of those cases occurring in men as shown in table 1. There was a general decline in the number of case in both males and females above the age of 40 years (Table 1).

Table 1: Prevalence of compartment syndrome stratified by age and sex

Age	Total n (%)	Male n (%)	Female n (%)
10-20	20 (9.17)	13(6.0)	7 (3.21)
21-30	60 (27.52)	50 (22.93)	10 (4.59)
31-40	117 (53.67)	98 (44.95)	19 (8.72)
41-50	11 (5.05)	8 (3.67)	3 (1.38)
>50	10 (4.59)	8 (3.67)	2 (0.92)

The primary condition causing lower extremity compartment syndrome among the patients was fracture occurring in about 73.4%. Non-infected fractures accounted for about 48% (105 patients) of all cases followed by infected fractures with 25.2% (55 patients) as shown in table 2. Penetrating wounds sustained as a result of gun-shot accounted for 15.6% (34 patients) (Table 2).

Table 2: underlying causes of compartment syndrome among the patients

Underlying condition	Number of patients	Percentage
Non-Infected fracture	105	48.2
Infected fracture	55	25.2
Gun-shot wounds	34	15.6
Others	24	11.0

Majority of the non-infected cases were due to improper handling during immobilization of the fractures. Prolonged immobility of the affected part with back slap POP with gauze accounted for about 52.4% of the non-infected cases follow by prolonged immobility with circular POP with 38.1% and the remaining 9.5% was as a result of the application of traditional bonesetter splint (Table 3).

Table 3: Sources of non-infected wounds

Types of non-infected	Number of patients	Percentage
prolong immobility with back slap POP with gauze bandage	55	52.4
prolong immobility with circular POP	40	38.1
traditional bonesetter splint	10	9.5

Figure 1 A show the initial causes of injury among the patients. Road traffic accident was the most common, accounting for over 70% of the cases follow by Gun-shot and fall from height. About 45% of the road traffic accidents involve Motorbike users and about 23% of the road traffic accident victims were passengers of vehicle involved in accidents. The rest of the road traffic accident cases were drivers of vehicles (4.7%) and pedestrian (7.3%). Other initial causes of injury as shown in figure 1 are Gun-shot injury (15.6%) and fall from height (5.1%). Figure 1 B show the laterality of the lower extremities involved. The right limb was the most affected part accounting for about 47.3% of the all the compartment syndrome cases and the left was involve in only 30.7% of the cases.

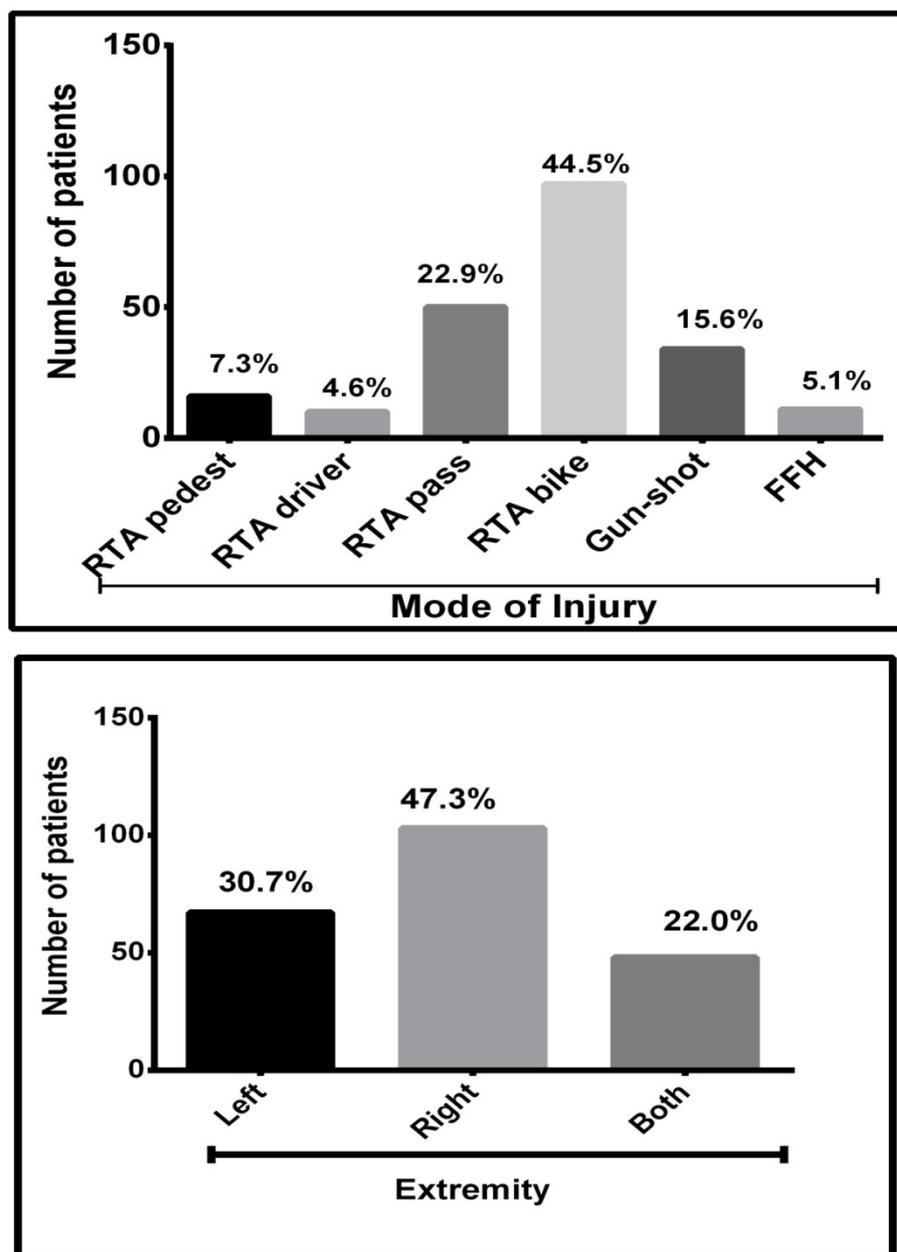


Figure 1: The initial causes of injury among the patients and laterality of the injury. RTA; Road Traffic Accident, Pedest; pedestrian, PASS; passenger, FFT; Fall From Height

DISCUSSION

Compartment syndrome which is a condition in which increased pressure within a limited space compromises the circulation and function of tissues within that space can occur in any part of the body but is most often seen in the lower extremity especially in the lower leg. The lower extremity is frequently expose to trauma and has a typical predisposing anatomy where fascia, membranes, tibia and fibula enclose four compartments generally referred to as the anterior, lateral (or peroneal), deep- and superficial posterior compartment, each with specific muscles, vascular

structures and nerves, supplying the lower leg and foot [1, 9]. The general incidence and prevalence of compartment syndrome varies from one place to another likewise its causes [1, 2, 4]. In the present study the aim was to elicit the causes and general prevalence of lower extremity compartment syndrome in Northern Ghana. The study has shown the prevalence of lower extremity compartment syndrome among the study subjects to be about 20.7%. Studies have shown that the incidence rate of acute compartment syndrome is up to 20% in acutely ischaemic limbs but can vary from one place to the other depending on how prompt diagnosis are made and the early management [1, 2, 4, 10].

The result of the present studies has shown that young people within the ages of 31 to 40 years especially men have the highest incidence of lower extremity compartment syndrome. This finding is similar to the work of McQueen, et al [4] who also found acute compartment syndrome to be highest among this group. It is possible that young men have relatively large muscle volumes, while the compartment size does not change after growth is complete gives less space for swelling muscle in young men after injury. The communities in the catchment area of this study are male dominated in all aspect of their daily life and this could mean that males are more prone to injuries which could lead to the development of compartment syndrome. The area is also conflict prone zone resulting in lots of gunshot wounds as noted in the study. The finding also revealed that the incidence was low in older people. This could be due to the fact that older people have smaller hypotrophic muscles, and a relatively higher blood pressure which may provide tolerance for higher tissue pressure [8]. Despite the fact that there has been disagreement in deciding what pressures constitute an acute compartment syndrome the importance of the difference between perfusion pressure and tissue pressure has been shown both experimentally and clinically [1, 3, 6-8]. Hypertension has also been noted to have a protective effect against compartment syndrome [8]

Our study have shown that while fracture in itself is not a prerequisite for compartment syndrome, its management especially prolonged immobilization with back slap POP, Circular POP and traditional bonesetter splint posses a greater risk of developing compartment syndrome in the lower extremities. Other studies have shown that complications such as avascular necrosis, contractures and ischaemic limbs as a result of fracture management by traditional bonesetter in Northern Ghana is very high [11] and could be responsible for the high incidence of compartment syndrome noted in this study.

The present study has also shown that high-energy injuries such as road traffic accident and gun-shots accounted for majority of the initial caused of fracture and wounds. Previous studies have revealed that road traffic accident is very high in this part of Ghana especially involving motorbikes which the common means of transport for the people [10, 12]. The recent tribal conflicts in this part of the country could have accounted for the high number of gunshot injuries in the present study. During these conflicts young men are usually involve in the fighting and could explain the high number of men in the study.

CONCLUSION

The incidence of acute lower extremity compartment syndrome in Northern Ghana is relatively high. High energy injuries such as those sustained from road traffic accidents and gunshots as well as traditional bonesetter splinting are the most predominant precursors for lower extremity compartment syndrome in this part of Ghana. Monitoring of compartment pressure in these patients as wells as early referrals for specialist orthopaedic and trauma management should be considered to allow for early detection and treatment.

Acknowledgements

The authors will like to thank all the staff and patients of Tania Specialist Hospital in Tamale/Ghana for their support during the study.

REFERENCES

- [1] Mar GJ, Barrington MJ, McGuirk BR: *ABr J Anaesth* **2009**, **102**(1):3-11.
- [2] Tuckey J: *Br J Anaesth* **1996**, **77**(4):546-549.
- [3] McQueen MM, Court-Brown CM: *J Bone Joint Surg Br* **1996**, **78**(1):99-104.
- [4] McQueen MM, Gaston P, Court-Brown CM: *J Bone Joint Surg Br* **2000**, **82**(2):200-203.
- [5] Schwartz JT, Jr., Brumback RJ, Lakatos R, Poka A, Bathon GH, Burgess AR: *J Bone Joint Surg Am* **1989**, **71**(3):392-400.
- [6] Dunwoody JM, Reichert CC, Brown KL: *J Pediatr Orthop* **1997**, **17**(3):285-288.
- [7] Hyder N, Kessler S, Jennings AG, De Boer PG: *J Bone Joint Surg Br* **1996**, **78**(3):499-500.
- [8] McQuillan WM, Nolan B: *J Bone Joint Surg Br* **1968**, **50**(3):482-492.
- [9] McQueen MM, Christie J, Court-Brown CM: *J Bone Joint Surg Br* **1996**, **78**(1):95-98.
- [10] Kuubiere CB, Alhassan A, Majeed SF: *Journal of Medical and Biomedical Sciences* **2013**, **2**(3):17-23.

[11] Alhassan A, Kuubiere BC, Issahaku M: *FAdv Appl Sci Res* **2013**, **4**(6):207-211.

[12] Afukaar FK, Antwi P, Ofosu-Amaah S: *Injuiry Control and Safety Promotion* **2003**, **10**:69-76.