Teshale Lodamo, Abiy Worku, Tilahun Desta, Tariku Shimelis, Natan Wondwossen Elssa.
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ORIGINAL ARTICLE

PATTERN OF PEDIATRIC FEMUR SHAFT FRACTURES IN A TERTIARY HOSPITAL, ADDIS ABABA, ETHIOPIA

Teshale Lodamo, MD[1], Abiy Worku, MD[1], Tilahun Desta, MD[1], Tariku Shimelis, BA, Msc[2], Natan Wondwossen Elssa, MD[3]

ABSTRACT

Introduction: *Femoral shaft fractures represent the most common pediatric orthopedic injury that requires admission to the hospital. The epidemiology of femur shaft fractures is well described in literature from developed countries. However, abundant studies are not available on pediatric femur shaft fractures in resource-limited areas like the sub-Saharan Africa.*
Objective: *To determine pattern of pediatric femur shaft fractures at Addis Ababa Burn Emergency and Trauma Hospital.*
Methods: *Institution-based retrospective cross-sectional study was used. All medical records of pediatric patients with femur shaft fractures, who were treated between September, 2015 and August, 2018 were reviewed. Medical records with incomplete data were excluded. Data abstraction format was applied to collect data. The data was then entered and analyzed using SPSS version 20.0.*
Result: *Ninety-one patients who had femur shaft fractures were reviewed in the study. Males were 67 (73.6%). The most commonly affected age group was 6-12 years in 40(44%); the mean age being 8.8 years. Majority of the fracture were due to fall (41.8%). Most fractures occurred in June to August (36.3%). Left side was involved in 45(49.5%) cases. Eighteen patients (19.8%) had associated injury; head injury being the commonest, 7(38.9%). Closed fracture was the commonest type 84(92.3%). Traction followed by spica was the commonest treatment modality (28.6%). The mean length of hospitalization was 15.3 days.*
Conclusion: *The most affected age group was 6-12 years. Fall accidents predominated as the etiology. Most of the fractures were closed type. Conservative management was mostly used.*
Key Words: *Pediatric, femur shaft, fracture, pattern*

INTRODUCTION

The Arbeitsgemeinschaft fur Osteosynthesefragen (AO) definition of pediatric femur shaft is the area between the greater trochanter and the distal metaphyseal area (1). Femoral shaft fractures represent the commonest pediatric orthopedic injury that requires admission to the hospital (2, 3). The impact of pediatric femur shaft fracture is substantial physically, socially and psychologically to the affected children as well as the parents (4, 5).

Study findings in a Cameroonian tertiary center shows that 20% of pediatric fractures came across at surgical department are femoral fractures (6). Pediatric femoral fractures involve the shaft in 70% of cases (7). They are common amongst male (3, 8-12). In an English epidemiologic study done between 1991 and 2001, the fracture rate in boys was greater than that of girls, ranging from a ratio of 1.6:1 at the age of 11 to a ratio of 4.7:1 at the age of 14 (10).

In another study done in Israel, boys to girl's ratio were 2.4: 1 (11). The incidence of the pediatric femoral shaft fractures is bimodal; the first peak is between the age of 2 and 4, the second peak is throughout adolescence (3, 8).

Causes of pediatric femoral fractures differ for different age groups of children. In sixty to eighty percent of cases the etiology of infants' and toddlers' femur fracture is abuse (13-15). Whereas, in school age children and adolescents, femoral fractures are mostly caused by road traffic injuries – ranging from 26% to 90% – and fall down injuries – ranging from 33% to 49%. (10, 12, 16-18) Stress fractures of pediatric femoral shaft are rare (19). So are pathologic pediatric femur fractures (20). An analysis of seasonal variation in many studies shows pediatric fractures are frequent during the summer; the time when schools are closed and children are involved in various physical activities (21).

[1]Department of Orthopedic Surgery, St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia. [2]St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia. [3]Department of Orthopedic Surgery, School of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia.
*Corresponding Author E-mail: tilahundesta84@yahoo.com

A study done in Sweden showed that the incidence of pediatric femur shaft fractures is highest in March and August. In March sports accidents are responsible for the increase in incidence and in August the increase is caused by traffic accident (9).Multiple factors contribute to determine the best treatment modality: including the age of the child, the weight, the available resources, the fracture pattern and the presence of other life threatening trauma (22).

A panel of surgeons, from the American Academy of Orthopedic Surgeons, critically evaluated existing literature and attempted to devise treatment recommendations based on current best evidence (23).In a retrospective cross sectional study done in Brazil, non -operative management was choice of treatment for children below 6 years of age and operative management for those above 6 years of age (3). In a prospective cohort study done in Cameroon, conservative treatment was used in 87% of the cases (6).

Regarding Ethiopia, there is limited published data. A prospective study was done on treatment of adult (older than 16 years) femur shaft fracture using Perkins traction at Addis Ababa Tikur Anbesa Hospital (24).

Abundant studies are not available on pediatric femur shaft fractures in resource-limited areas such as the sub-Saharan African region (25). The authors' could not manage to find any published research on epidemiology of pediatric femur shaft fracture in Ethiopia.

PATIENTS AND METHODS

The study was done at St. Paul's Hospital Millenium Medical College (SPHMMC), Addis Ababa Burn Emergency and Trauma (AaBET) hospital, Addis Ababa, Ethiopia. It was institution-based retrospective cross-sectional study. All children treated in the hospital for femur shaft fractures in the three year period from September, 2015 to August, 2018 were eligible for recruitment into study. Patients' age should be between birth and 14 years. Patients with isolated hip fractures or physeal injuries were not included in this study.

Fracture is said to be closed when there is no physical contact between the fracture or the fracture hematoma and the outside environment. When the fracture was not described whether it was closed or open in a patients' medical record, it was considered as closed fracture. The data was collected using data collection templates. Five age groups were created to categorize the patients. Little modification of the categories proposed by Kasser and Beaty was used. Group I: Birth to 6 months, group II: >6 months to 2 years, group III: >2 years to 6 years, group IV: >6years to 12 years, group V: >12 years to 14 years.

The following data was collected using the template: socio-demographic data, causes of fracture, fracture type (Closed vs. Open), season in which fracture occurred, mode of treatment, duration of hospitalization. Data collection was done by trained orthopedic residents.

The collected data was checked for completeness. Then it was fed to SPSS version 20.0 and analysis was made. Data entry was conducted by a trained data clerk. Afterwards, the patterns of the femur shaft fracture were described using descriptive statistics.

The template was tested before the actual data collection in order to avoid any ambiguity. There was daily supervision. Patient medical records with unclear, incomplete data were not included in the study.

Ethical approval was attained from Institutional Review Board (IRB) of SPHMMC. Administration of Aabet Hospital asked to get permission to retrieve and review patients' medical records. Patients' medical data were kept confidential.

RESULTS

Ninety one patients with a total of 94 fractures met the inclusion criteria. The mean age of patients with pediatric femoral shaft fracture was found to be 8.8 years, with SD of 3.82 years and the median was 9 years. The age of patients ranged from 6 months to 14 years. Majority of the patients i.e. 40 (44%) were in >6 years to 12 years age group, followed by 29(31.9%) patients in >12 years to 14 years group.

There was male predominance with 67(73.6%) males and 24(26.4) females. The male to female sex ratio was 2.8: 1. Most of the patients 50 (54.9%) came from Oromia region. (Table 1).

Mechanism of injury: The commonest mechanism was fall 38(41.8%), followed by RTA 35(38.5%). RTA was leading cause fracture in >6 years of age (44.9%). Eight patients (8.8%) were found to have pathologic fracture as an etiologic factor. Six of them were caused by chronic osteomyelitis and two were due to bone tumor (Table 2).

Table 1: Sociodemography of Pediatrics patients with femur shaft fracture in SPHMMC, AaBET Hospital, Addis Ababa, Ethiopia (2015 - 2018)

Characteristics	Frequency	Percent (%)
Sex		
Male	67	73.6
Female	24	26.4
Total	91	100
Age Group		
Birth to 6 Months	1	1.1
>6 Months to 2 Years	2	2.2
>2 Years to 6 Years	19	20.9
>6 Years to 12 Years	40	44.0
>12 Years to 14 Years	29	31.9
Total	91	100
Address : Region		
Addis Ababa	26	28.6
Oromiya	50	54.9
Amhara	8	8.8
SNNPR	3	3.3
Somali	2	2.2
Afar	1	1.1
Benshangul-Gumuz	1	1.1
Total	91	100

Table 2: Mechanism of injury of Pediatrics patients with femur shaft fracture in SPHMMC, AaBET Hospital, Addis Ababa, Ethiopia (2015 - 2018)

Mechanism of Injury	Frequency	Percent (%)
Road Traffic Injury	35	38.5
Fall down Injury	38	41.8
Bullet Injury	2	2.2
Struck by falling object	4	4.4
Pathologic Fractures	8	8.8
Hit by stone	2	2.2
Other	2	2.2
Total	91	100

Seasonal distribution: Majority of the fractures 33 (36.3%) occurred in a season of Sene-Nehassie/ Pagume (June to August: this is a season in Ethiopia when children are out of school). Number of patients with femur shaft fractures seen annually increased from 19 in 2008 E.C to 46 in 2010 E.C.

Side affected: Left femur was involved in 45 (49.5%) patients and right femur in 43(47.3%) patients. Three patients had bilateral femur shaft fracture.

Associated injury: In addition to femur shaft fracture 18(19.8%) patients had another injury. Majority, 7(38.9%) had head injury. (Table 3)

Table 3: Associated injury of Pediatrics patients with femur shaft fracture in SPHMMC, AaBET Hospital, Addis Ababa, Ethiopia (2015 - 2018)

Associated Injury	Frequency	Percent (%)
Head	7	38.9
Pelvis, acetabulum	1	5.6
Upper limb	4	22.2
Lower limb	6	33.3
Total	18	100

Type of fracture: Most of the fractures 84(92.3%) were closed. (Figure 1)

Mode of definitive treatment: Overall, traction followed by hip spica was the most frequently 26 (28.6%) used treatment method. The second was Rush rod 25(27.5%). (Figure 2)

All patients in age group I and II were treated conservatively (hip spica). In age group III traction followed by hip spica was the commonest method. SIGN intramedullary nail was the most frequently (41.4%) used treatment method in age group V. (Table 4)

Length of hospitalization: Duration of hospitalization ranges from 3 days to 90 days. The mean was 15.3.

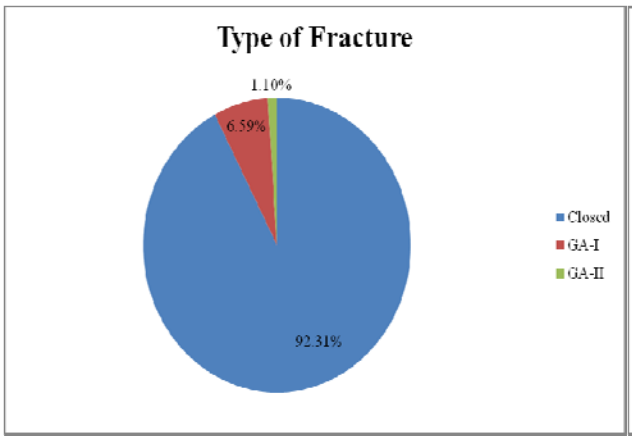

Figure 1: Type of fracture of Pediatrics patients with femur shaft fracture in SPHMMC, AaBET Hospital, Addis Ababa, Ethiopia (2015 - 2018).

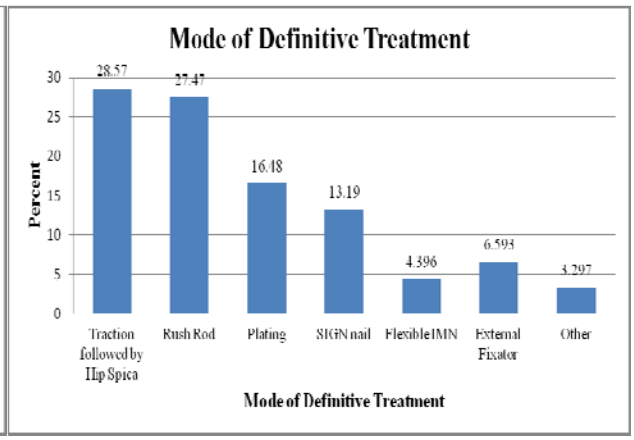

Figure 2: Mode of treatment of Pediatrics patients with femur shaft fracture in SPHMMC, AaBET Hospital, Addis Ababa, Ethiopia (2015 - 2018).

Table 4: Therapeutic pattern by age category of Pediatrics patients with femur shaft fracture in SPHMMC, AaBET Hospital, Addis Ababa, Ethiopia (2015 - 2018)

	Mode of Treatment (%)							
	Traction followed by Hip Spica	Rush Rod	Plating	SIGN nail	Flexible IMN	External Fixator	Other	Total
Group I: Birth to 6 Months	100							100
Group II: >6 Months to 2 Years	100							100
Group III: >2 Years to 6 Years	84.2				5.3	10.5		100
Group IV: >6 Years to 12 Years	15	42.5	30		2.5	5	5	100
Group V: >12 Years to 14 Years	3.4	27.6	10.3	41.4	6.9	6.9	3.4	100

DISCUSSION

The study involved a total of 91 patients and the result showed that male to female ratio was 2.8: 1. Other similar studies have also shown male preponderance in pediatric femur shaft fractures (3, 9, 10, 11). The mean age for pediatric femur shaft fracture in this study was 8.8 years and it is within the range that other studies have found (3, 11). The commonest age group for pediatric femur shaft fracture was 6 years to 12 years. However, other studies showed bimodal age distribution (12).

The main mechanism of injury was fall (41.8%), consistent with findings obtained in Cameroon (2, 6). The study done in England also reported that falls accounted for majority of femur shaft fractures (10).
The study result showed that incidence of pediatrics femur shaft fracture has its peaks in Sene-Nehassie/ Pagume(June to August).

This may be explained by Sene- Nehassiebeing a season in Ethiopia when students are out of school. Children during this season (particularly July and August) are frequently involved in different sport activities, play different games. This probably increases risk of fracture. The study done in Sweden found that fracture peaks in March and August. In March sports accidents are responsible for the increase in incidence and in August the increase is caused by traffic accident. (9).

The annual number of pediatric patients with femur shaft fractures seen in our hospital increased from 19 in 2008 E.C (2015 / 2016) to 46 in 2010 E.C (2017 / 2018). This could be due to increased awareness of the community and local health facility to refer to our hospital, which was opened recently in August 2015. The other explanation could be relative advancement of the hospital service over the last three to four years.

In this study 18 patients had associated injuries, in addition to the femoral fracture. Head injury was the commonest 7 (38.9%). Six patients had lower limb injuries. The study done by Rajesh K et.al. showed similar finding: head injury was the commonest associated injury, followed by tibial fracture (26). Similarly head trauma was the commonest injury (16%) associated with femur shaft fractures in Saudi Arabian trauma center (27).

This study result indicated that majority of femur shaft fractures 84(92.3%) were closed. The proportion of open fracture (7.7%) was comparable with similar studies (3).

Non operative treatment was the most commonly applied method of treatment (28.6%) in this study. This could be lack of adequate appropriate instruments. Similar study from Cameroon showed that non-operative treatments are the commonest choice of treatment (6). Whereas, a study in Brazil revealed that the choice of treatment varies depending on the age of patients (3).

In our study duration of hospitalization was long. The mean was 15.3 days. This could be due to multiple reasons; including lack of operating time and table, lack of standard fixation method, lack of active disposal of patients from the emergency OPD to the ward or to the OR. A study from Sweden reported that duration of hospitalization has decreased from 26 days to 5 days in 18 years period as operative treatment became rampant (9).

Limitation of the study: The study was retrospective by reviewing patients' medical records. Incomplete data from chart was a problem in obtaining information. There was no report of child abuse as a cause of pediatric femur shaft fracture in this study; however, in literatures it is not uncommon to get fractures secondary to child abuse (13-15).

Conclusion: The pediatric patients with femur shaft fracture at AaBET hospital were mainly males. The mostly affected age group was between 6 years and 12 years. Majority were from Oromia region. The commonest etiology was fall down injury. Closed type of femoral shaft fractures is predominant.

The season with most incidences was June to August. The number of patients seen annually was increasing. Head injury was the most common associated injury. The treatment most used was conservative.

Recommendations: Development of safety guidelines: safe playing ground for children at home and school to prevent fall accidents. Implement road traffic policies which can decrease road traffic injuries. We recommend increasing surgical treatment option, establishing orthopedic services in other hospitals to reduce duration of hospitalization. We also recommend deployment of Electronic Health Record System to prevent losses of important health information.

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