SAS Journal of Surgery
Abbreviated Key Title: SAS J Surg
ISSN 2454-5104
Journal homepage: https://www.saspublishers.com

OPEN ACCESS

Orthopaedic Surgery

Pattern and Treatment of Femoral Shaft Fracture in a Tertiary Hospital: One Year Retrospective Review

Diamond T. E[1*], Echem R. C[1], Aaron F. E[1]

[1]Department of Orthopaedic Surgery, University of Port Harcourt Teaching Hospital, East-West Road, Port Harcourt, Nigeria

DOI: 10.36347/sasjs.2022.v08i05.010 | **Received:** 26.02.2022 | **Accepted:** 02.04.2022 | **Published:** 13.05.2022

***Corresponding author:** Diamond T. E
Department of Orthopaedic Surgery, University of Port Harcourt Teaching Hospital, East-West Road, Port Harcourt, Nigeria

Abstract **Original Research Article**

Femoral shaft fractures are common orthopaedic problems with interesting treatment evolution based on evolving clinical evidence. Though closed reduction and locked intramedullary nailing is the gold standard in adults, this requisite tools and skills for this option may be unavailable in some low income countries necessitating other treatment options. We retrospectively review the presentation pattern and treatment outcomes of 71 femoral shaft fractures in a tertiary center. Records of these patients who meet the inclusion criteria were recruited into the study. Relevant data was extracted for the patients' folders and supplemented with calls to the patients where needed information was unavailable. Data was presented in frequency table and charts. Femoral shaft fractures represents 7.6% of the total number of patients with musculo-skeletal conditions seen at the studycentre within the study period with a male preponderance. Open reduction and locked Intramedullary nailing and hip Spica cast were was the treatment of choice in adults (62%,n=44/71) and children respectively (11.3%, n=8/71). Bone union rate at 12 weeks post intervention was (57.7%). This increased to 90.1% by the end of the eighteenth post-operative week. The most common complication was wound infection in open fractures (4.2%, n=3/71).

Keywords: Femoral shaft fractures, orthopaedic, treatment, musculo-skeletal.

BACKGROUND

A break in the continuity of a portion of the femur, from a point just distal to the lesser trochanter to just above the supra-condylar region is regarded as a femoral shaft fracture [1].

These fractures usually result from high energy forces in a previously normal bone[5] or from trivial force on a previously diseased bone [6]. Most of these high energy forces also cause multi-systemic injuries making patient's management more difficult [2].

Although most femoral shaft fractures are closed fractures, open fracture pose significant risk of contamination, soft tissue and bone infection, poorer bone healing outcomes and longer hospital stay.

Tscherne and Gotzen [3] have also noted that closed fractures, though with minimal risk of contamination, still cause considerable and devastating soft tissue injury even with an intact skin envelope.

Associated injuries are frequent, ranging from fractures of contiguous bones to severe traumatic brain injuries. Frequently, these injuries dictate the treatment modality and influence the treatment outcome [4-6].

Road traffic accidents (RTA) are the commonest causes of femoral shaft fractures[7,8,]. Most of these fractures from RTAs are usually associated with high degree of life threatening injuries which in many cases could result in mortalities [9-11].

Clinical diagnosis of femoral fractures is usually obvious with symptoms of pain, deformity, swelling and shortening of the thigh in a trauma patient. Definitive management depends on factors such as the site and type of fracture, age of the patient, aetiologic factors, presence of associated injuries, pre-fracture bone state, affordability of care and the level of surgical skills and resources available [1, 2].

Intramedullary nailing provides a stable osteosynthesis through impingement of the nail in the bone and represents the ideal treatment of suitable fractures, as it permits early weight bearing, joint movement and minimal post-operative care [12, 13].

Several workers [14-16] have reported numerous advantages of intramedullary nailing when compared with other treatment methods. These include; fewer cases of mal-union and limb-shortening, good post-operative function, shorter hospitalization, earlier return to work and rapid fracture healing (since interference with fracture hematoma is minimal).

Titanium elastic nails are flexible nail used in the treatment of diaphyseal fractures in older children, their popularity breeds on the unacceptable axial and rotational mal-unions, the prolonged period of bed stay (with it attendant cost on the heath system and on family dynamics) the long absenteeism from school and delay return to sports/play associated with conservative treatment methods in children.

The dynamic compression plate (DCP) facilitates rigid fixation and is said to permit early joint movement [17]. These plates had wide acceptance and use in femoral diaphyseal fractures, up until the 1980s when the interlocking nail concept became popular, revealing some disadvantages of the rigid plate which include, marked invasion of fracture hematoma, profound soft tissue dissection, damage to periosteal blood supply and stress shielding of bone with consequent localized osteopaenia [17, 18].

This modality of treatment is mostly indicated when equipment and skills are unavailable for interlocking nailing, in the management of peri-prosthetic fractures and where nailing has resulted in fracture non-union or mal-alignment (especially after an initial exchange nailing).

External fixation may also be useful in the initial stabilization of fractures in multiply injured patients, for limb lengthening procedures, correction of post traumatic deformities and for infected as well as mal-united fractures.

The disadvantages of this mode of treatment include pin tract infections, axial, and occasionally, angular mal-alignment of fracture fragments and its unappealing and cumbersome appearance [19, 20].

Non –operative treatment modalities include the use of traction and hip Spica (cast bracing). Hip Spica is currently reserved for the treatment of diaphysealfractures in smaller children. Cast bracing was a modification of these, with the advantage of facilitating knee movement and allowing for early weight bearing.

The usefulness of non-operative methods currently is only limited to femoral fractures in young children, pre- operative management of femoral fractures, (in centres with delays in initiating operative treatment), frail in-operable patients and occasionally in adults especially in resource-poor countries where the cost of operative treatment is unaffordable or the operating skill is unavailable.

The disadvantages with this treatment option include; prolonged immobilization, knee stiffness, unacceptable axial, angular, and occasionally, rotational mal-unions, limb inequalities, prolonged hospitalization and their general unsuitability for certain femoral fractures [16].

The pain, deformities, disabilities, and prolonged immobilization that are associated with these fractures, result in absenteeism from school/ work, and thus may reduce the man hours of any nation, if early and appropriate management measures are not instituted.

Also the duration of hospital stay and overall cost of care poses a serious challenge to weak health systems and could have negative impact on the economy of populations grossly skewed to the young age group.

An evaluation of the pattern and management of such injuries will no doubt be relevant in adopting more appropriate and effective treatment options, contributing to effective health planning and improving on the nation's health and economic indices.

AIM

To evaluate, using clinical and radiological parameters the pattern and management of fractures involving the femoral shaft in the university of Port Harcourt teaching hospital, Rivers state, Nigeria.

PATIENTS AND METHODS

STUDY DESIGN

This study was a retrospective study of patients with femoral shaft fractures who presented to the University of Port Harcourt Teaching Hospital (UPTH) via the Accident and Emergency, Orthopaedic Out-patient clinic or the children emergency units, from the 1st of January 2018 to the 31st of December 2019.

SAMPLING

The hospital records ofsixty-nine (69) patients with femoral shaft fractures who presented to the orthopaedic clinic, the accident and emergency department and thechildren emergency unit of the hospital were consecutively sampled and recruited into the study.

EXCLUSION CRITERIA: The records of the following patients were excluded from the study

a. Patients who are unable to do simple radiological investigations like plain radiographs of the affected limb.

b. Patients with incomplete records i.e. where relevant information cannot be retrieved from the records and involved patients either cannot be contacted or cannot provide such information when contacted.
c. Patients presenting with fracture complications involving the femoral shaft i.e. where primary treatment was received outside the study centre.
d. Patients with pathologic femoral shaft fractures.
e. Patients whose records did not show evidence of at least a six-month follow-up period.

LIMITATIONS OF THE STUDY

1. Records of 26 patients were not complete. These patients couldn't provide needed information when contacted or couldn't be contacted.
2. The decision on treatment modalities was made by orthopaedic surgeons with varying level of training and experience. Though guided by sound clinical judgment. This created unstandardized treatment variability.
3. Follow-up period was widely variable from the records. The study protocol could only accept patients followed up for at least six months.
4. Twenty three patients were either not treated or treated and followed-up for only six weeks.

METHODOLOGY

Records of Patients who met the inclusion criteria were recruited into the study. Initial records were retrieved from the ward admission books, theatre records and the accident and emergency records. Relevant information on patient's bio-data, time interval between onset of symptoms and presentation at UPTH, possible aetiology, severity of trauma involved, presence or absence of open wound and initial treatment at trauma scene. Other aspects of clinical history obtained include; patients previous medical condition, history of long term medications, occupational history and other relevant aspects of history.

Records of initial primary survey and detailed secondary survey was also retrieved. Relevant radiographs of the affected limb which adequately revealed the fracture site, as well as, adjoining joints was retrieved and reviewed. This aided clinical diagnosis of femoral shaft fracture, described the fracture pattern, and revealed injuries to contiguous portions of the femur. Where available Radiographs of the contra-lateral limb and other areas of suspected injury were also retrieved.

Treatment decisions were made by consultant orthopaedic surgeons guided by standard accepted variables and sound clinical judgment. Treatment options offered were as follows:

1. Immobilization by skeletal traction
2. Immobilization by hip Spica
3. External fixation
4. Plating
5. Open reduction and locked intramedullary nailing.
6. Closed reduction and locked intramedullary nailing.

Records from follow-up visits done at 2weeks, 4weeks and 6weeks post intervention as well as Subsequently, visits done at 12weeks, 18weeks, and 24 weeks post intervention were analyzed.

Post-operative radiographs done on the immediate post-operative period, six weeks later, twelve weeks later and 18 weeks later were also reviewed.

A fracture was considered to have united if no tenderness was elicited on palpation or attempted motion at the fracture site, attainment of full painless weight-bearing status as well as radiologic evidence of union across the fracture site.

Outcomes measured include; length of hospital stay, duration of time from commencement of treatment to radiologic evidence of fracture union, functional range of motion in the ipsilateral hip and knee at the point of radiologic union, wound healing, return to work and school and the weight bearing status at 12 weeks post- intervention.

DATA ANALYSIS

Frequencies and cross tabulations were used to create two- way and multi-way tables. Charts and graphs were used to display appropriate variables. Certain results were also expressed in mean, median (inter-quantile range), proportion and standard deviation. Where appropriate, P values were determined using standard chi- square test. A p-value of less than or equal to 0.05 was considered statistically significant. Statistical methods were carried out using the statistical package for social sciences (SPSS) 17 for windows.

CONFIDENTIALITY OF DATA

The hospital number of the patient was used, instead of the name, for data collection.

RESULTS

Records of a total of nine hundred and twenty-six (926) patients with musculo-skeletal conditions were seen at the accident and emergency department, orthopaedic outpatient clinic and the children emergency department of the hospital within the study period. Ninety-six patients (96) had fractures and fracture complications involving the femur. Sixty-nine (69) patients had seventy-one (71) fresh femoral shaft fractures and constituted the study population. This represents 7.6% of the total number of patients with musculo-skeletal conditions seen at the study centre within the study period.

GENDER AND AGE DISTRIBUTION OF PATIENTS

Fifty-two (75.4%) were male while 17 (24.6%) were female patients giving a male to female ratio of 3.2: 1. Patients' ages ranged from 10 days to 86 years. Mean age was 29.2± 13.8years.

Table 1: Age Distribution

Age Groups (Years)	Frequency	Percentage (%)
0-10	5	7.2%
11-20	5	7.2%
21-30	20	29.0%
31-40	23	33.3%
41-50	10	14.4%
51-60	3	4.3%
61-70	1	1.4%
71-80	1	1.4%
81-90	1	1.4%
TOTAL	69	100%

DISTRIBUTION BY OCCUPATION

Most of the study population were students (21; 30.4%) followed closely by traders (19; 27.5%).

Table 2: Patients' Occupation

OCCUPATION	FREQUENCY	PERCENTAGE
ARTISANS	4	5.8%
CIVIL SERVANTS	5	7.2%
FARMERS	3	4.3%
FISHERMEN	3	4.3%
HEALTH WORKERS	1	1.4%
MILITARY PERSONNEL	3	4.3%
PROFESSIONALS	2	2.9%
STUDENTS	21	30.4%
TEACHERS	3	4.3%
TRADERS	19	27.5%
RETIREES	2	2.8%
UNEMPLOYED	3	4.3%
TOTAL	69	100%

MECHANISM OF INJURY

The most common injury mechanism was road traffic accidents (31; 70.3%) either as motor vehicular accidents or motor cycle accidents. Gunshot injury and assaults also made significant contributions.

Table 3: Distribution of Injury Mechanisms

Mechanisms Of Injury	Frequency	Percentage %
ASSAULTS	11	15.5%
BIRTH TRAUMA	2	2.8%
FALLS	10	14.1%
GUNSHOT	6	8.5%
ROAD TRAFFIC ACCIDENTS	41	57.7%
OTHERS	1	1.4%
TOTAL	71	100

PATIENT'S STATUS AT TRAUMA SITE

Thirty-three (26; 63.4%) of the patient's involved in RTA were passengers, 10; 24.4% were pedestrians while 7; 17.1% were drivers.

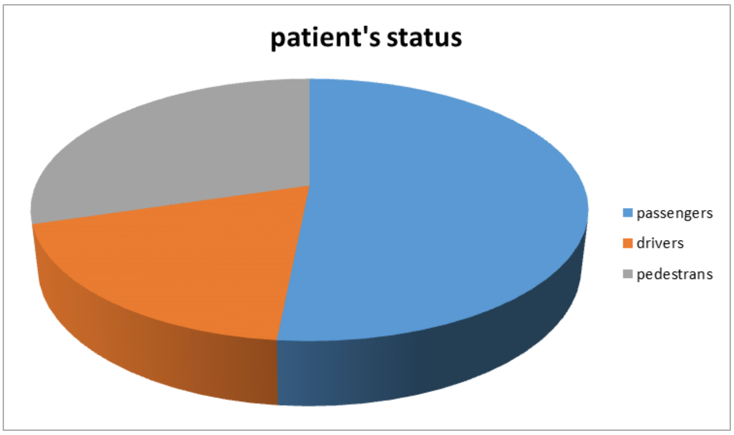

Figure 1: Patients' Status at Trauma Site

LATERALITY OF INJURY

Thirty-seven (32; 45.1%) of the patients had left femoral shaft fractures, 37; (52.1%) had right femoral shaft fractures while 2; (2.8%) had bilateral femoral shaft fractures.

ASSOCIATED SOFT INJURIES

Non osseous injuries found in this study include urethral injuries, splenic injuries, vascular injuries, traumatic brain injuries and others as shown in Table 4.

Table 4: Distribution of Associated Soft Tissue Injuries

INJURIES	FREQUENCY	PERCENTAGE
TRAUMATIC BRAIN INJURIES	7	13.0%
MAXILLO-FACIAL SOFT TISSUE INJURIES	4	7.4%
VASCULAR INJURIES	2	3.7%
SPLENIC INJURIES	2	3.7%
URETHRAL INJURIES	4	7.4%
ABRASIONS AND CONTUSION	35	64.8%
TOTAL	54	100

FRACTURE TYPE

Most femoral shaft fractures found in this study were closed fractures (64; 90.1%). There were however 7 (9.9%) open fractures giving an open: closed fractures ratio of 1: 9.1) Type IIIb fractures were the most common type of open fractures seen accounting for four; 57.1% of all open fractures. Others were IIIc fractures (2; 28.6%) and IIIa fractures (1; 14.3%).

ASSOCIATED FRACTURES

Associated bone injuries are as shown in Figure 2.

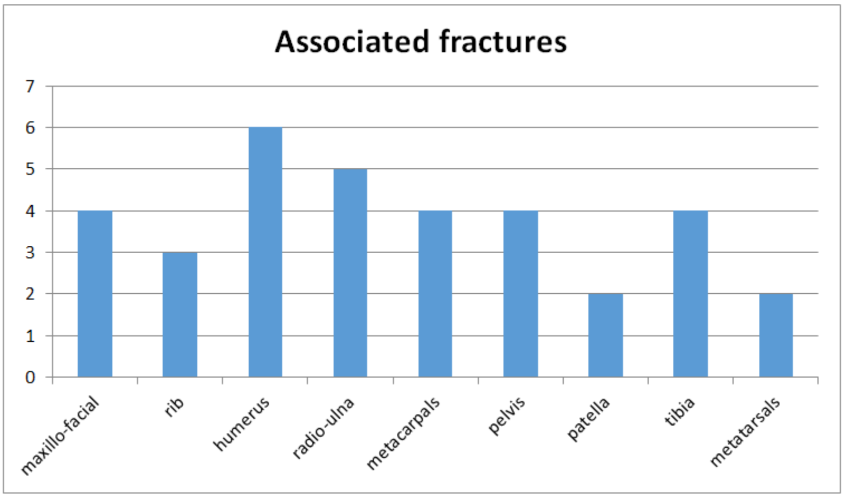

Figure 2: Associated Fractures

RADIOGRAPHIC PATTERN

On radiographic evaluation, the commonest fracture pattern was transverse fracture (49; 69.0%).

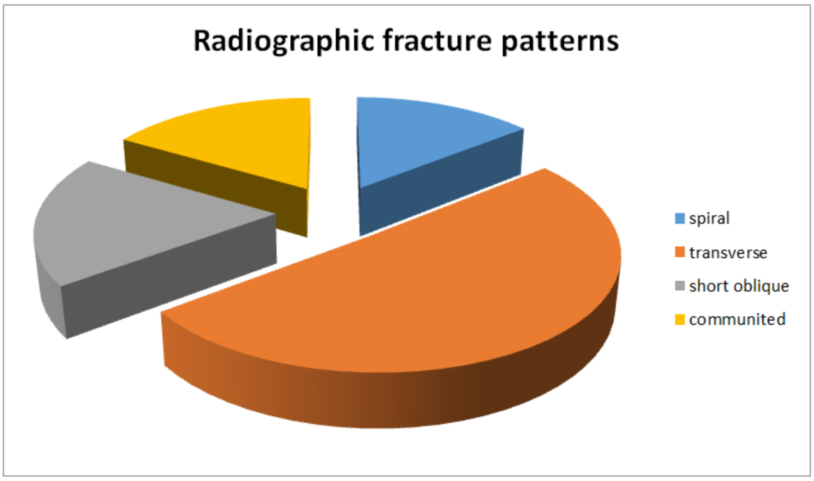

Figure 3: Radiographic Fracture Patterns

INITIAL CARE AT INJURY SCENE

None of the patients in the study population had care provided by trained medical and paramedical personnel at the scene of accident. Twelve (17.0%) of the patients had their limbs splinted by untrained passers-by and co-accident victims using improvised materials. Fifty- four (54; 76.1%) had no form of care at the injury scene.

INJURY-PRESENTATION INTERVAL AND PRESENTATION- INTERVENTION INTERVAL

Table 5 shows the intervals between injury and presentation at the study center and that between presentation and definitive intervention.

Table 5: Interval between Injury/Presentation and Presentation /Intervention

DURATION	FREQUENCY	
	INJURY-PRESENTATION	PRESENTATION-INTERVENTION
≤1HOUR	4 (5.6%)	0(0%)
>1-6HOURS	17(24.0%)	3(4.2%)
>6-24HOURS	25(35.2%)	17(23.9%)
>24HOURS-1WEEK	18 (25.4%)	23 (32.4%)
>1WEEK.	7 (9.9%)	28 (39.4%)
TOTAL	71 (100)	71 (100)

METHODS OF TREATMENT

The treatment methods are as shown in Table 6.

Table 6: Treatment Methods

TREATMENT	**FREQUENCY**	**PERCENTAGE**
NON-OPERATIVE		
SKELETAL TRACTION	1	1.4%
HIP SPICA	8	11.3%
OPERATIVE		
CRIF WITH INETRLOCKING NAIL	4	5.6%
ORIF WITH INTERLOCKING NAIL	44	62.0%
ORIF WITH PLATE AND SCREWS	8	11.3%
EXTERNAL FIXATION	4	5.6%
ABOVE KNEE AMPUTATION	2	2.8%
TOTAL	71	100

OUTCOME MEASURES

A. HOSPITAL STAY

The duration of hospital stay is as shown in figure 5. All nine (9) patients that were treated non-operatively stayed in hospital for greater than 4 weeks. Patients who had spica cast were initially placed on skin traction for two-three weeks before spica cast application.

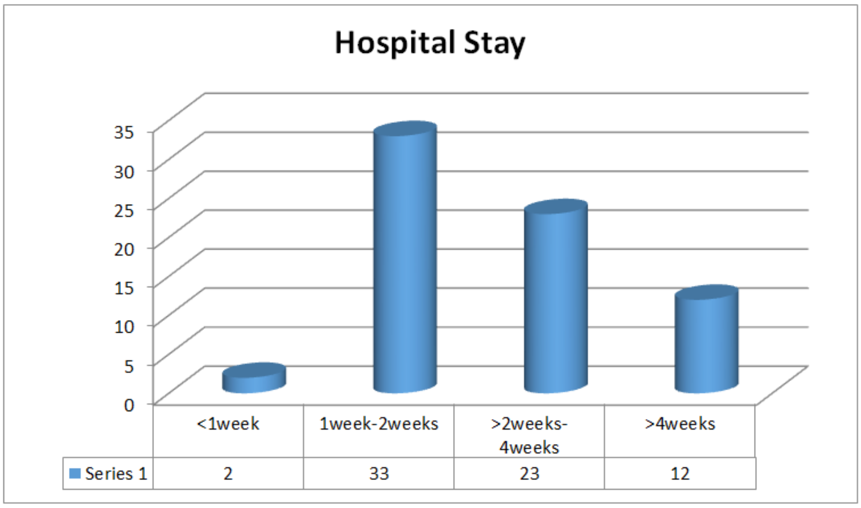

Figure 4: Duration of Hospital Stay

B. CLINICAL AND RADIOGRAPHIC EVIDENCE ON BONE UNION

Union was considered to have occurred in the absence of tenderness on palpation or attempted motion at the fracture site, attainment of full painless weight-bearing status as well as radiologic evidence of union across the fracture site. The bone union profile from records of patients is as shown in Table 7.

Table 7: Duration for Union with Radiographic Evidence

	HIP SPICA	SKELETAL TRACTION	CRIF WITH LOCKED NAILING	ORIF WITH INTERLOCKING NAIL	ORIF WITH PLATE AND SCREWS	EXTERNAL FIXATION	TOTAL
≤6 WEEKS	8	0	0	0	0	0	8
6WEEKS TO 12WEEKS	0	0	4	27	2	0	33
12WEEKS TO 18WEEKS	0	1	O	15	4	3	23
>18WEEKS	0	0	0	2	2	1	5
TOTAL	8	1		32	14	8	71

C: COMPLICATIONS

There were a total of four (4) wound infections. Three of the infected cases were from open fractures while the other was from a closed fracture treated with locked intramedullary nail. Infection was established by clinical evidence of pain and purulent suppuration in the wound as well as microbiologic evidence.

Bony complications observed include non-union (2; 2.8%), unacceptable mal-union (1, 1.4%), and bone infection (1; 1.4%).

Table 8: Distribution of Early and Late Complications

COMPLICATIONS		FREQUENCY	PERCENTAGE
WOUND INFECTION			
	CLOSED FRACTURES	1	1.4%
	OPEN FRACTURES	3	4.2%
MALUNION			
	SKELETAL TRACTION	1	1.4%
NON UNION			
	SEPTIC	1	1.4%
	ASEPTIC	1	1.4%
BONE INFECTION			
	OPEN FRACTURE	1	1.4%
JOINT STIFFNESS			
	SKELETAL TRACTION	1	1.4%
MORTALITY		0	0%
TOTAL		9	12.6%

D: ACTIVE RANGE OF MOTION IN THE HIP AND KNEE AT FRACTURE UNION

Table 9 shows the active ranges of motion (ROM) in the ipsi-lateral hip and knee at fracture union.

Table 9: Range Of Motion in Ipsilateral Hip and Knee

	ROM (DEGREES)	FREQUENCY	PERECNTAGE
HIP	FLEXION		
	120-140	68	95.8%
	90-120	3	4.2%
	<90	0	0%
	EXTENSION		
	10-0	71	100%
	<0	0	0%
KNEE	FLEXION		
	110-90	69	97.2%
	<90	2	2.8%
	EXTENSION		
	0	71	100%
	>0	0	0%
TOTAL		71	100%

E: WEIGHT BEARING STATUS AT TWELFTH POST-OPERATIVE WEEK.

By the end of the twelfth post-operative week, 41 patients (57.7%) were bearing full weight on the affected limb. This number increased to 64 (90.1%) by the end of the eighteenth post-operative week.

PATIENT'S LEVEL OF SATISFACTION WITH CARE RECEIVED.

At the end of treatment, all patients were asked about their level of satisfaction with the quality of care they received at the study. Their responses were as outlined in Table 10.

Table 10: Patients' Level of Satisfaction

RESPONSES	FREQUENCY	PERCENTAGE
YES	65	91.5%
NO	4	5.6%
NO COMMENT	2	2.8%
TOTAL	71	100%

.

DISCUSSION

The evaluation of seventy-one femoral shaft fractures presenting at the University of Port Harcourt Teaching Hospital showed that it contributed to 7.3% ofmusculo-skeletal injuries at the study centre.

Demographic results show that males were more commonly affected (m:f = 3.2:1) while the 31-40 years age group was the most involved constituting 33.3% of the study population. Douglas *et al.*, [22] also showed a male predominance in their study and gave a median age of 30years. Mbamali [23] in a similar study in Zaria, Nigeria also reported peak incidence among the 20-55years age group.

This group constitutes the economic work force of any nation and as such requires the least level of limb morbidity especially in low income economies of Africa.

Students and traders cumulatively constitute 57.9% of the population. The high mobility associated with this group probably explains their proneness to road traffic accidents and femoral fractures consequently.

The commonest fracture mechanism in this study was Road traffic accidents (RTA), followed closely be falls. Jensen *et al.*, [24] and Dencker [25] have all shown road traffic accident as the commonest mechanism of injury accounting for 68% and 70% of femoral fractures in their studies respectively. Falls however made more contributions in the work by Wong [10] in Singapore. Road traffic accidents (RTA) accounted for 57.7% while falls accounted for 14.1% of fractures in this study. All patients whose fractures were caused by falls were either below 10years or above 70 years.

This study did not show any marked difference in the laterality of femoral shaft fractures (L: R = 45.1%:52.1%). Both Dencker's [25] and Koostra's [5] study corroborate this finding (46.9%:53.1% and 45.6%: 54.4% respectively). There were however 2 (2.8%) bilateral fractures in this study.

The ratio of open to closed fractures in this study was 1: 9.1. Three decades earlier, Roberts [26] in his study on management of fractures and fracture complications of the femoral shaft showed a ratio of 1:26.8. The discrepancy between his finding and the finding from this study may be a product of higher degree of energy implicated in the aetiology of fractures resulting from increasing utilization of vehicular modes of transportation and rising gun violence rates over time.

Transverse fractures were the most common fracture pattern on radiographic evaluation accounting for 69.0% of all fractures. This is similar to findings by Hansen and Winquist [27] (38.3%). Magerl *et al.,* [28] however showed more comminuted fractures (63%) than all other patterns put together. Their study however was specifically for patients who had plate osteosynthesis.

Following injuries, most patients 66.0% presented to the study center more than 6 hours later. This may be a reflection of an interaction of factors including the non-existence of pre-hospital services, reluctance by passers-by and relatives to convey patient to the hospital and the initial visit to the traditional bone setters. All patients with type IIIc open fractures presented 24hours after injury. More disturbing however is the large fraction of patients whose definitive intervention (fracture fixation) was commenced more than six hours after presentation. These delay resulted from administrative bottlenecks, delays in payment for surgeries and incessant service disruptions by health workers strike action. Such delays may impact negatively on the outcome of treatment.

Open reduction and internal fixation using locked intramedullary nails was the most common treatment modality in this study (44; 60.2%). The study center only recently acquired a functional intra-operative fracture table and image intensifier making open reduction the most popular treatment modality as at the time of the study. Panti *et al.*, [29] in a similar study in the Philippines showed good outcome in the treatment of 48 patients with isolated femoral shaft fractures using the S.I.G.N (Surgical Implant Generation Network Inc.) interlocking nails. Gosselin *et al.*, [30] in Cambodia have also shown better clinical outcome in patients with femoral shaft fractures treated with interlocked SIGN nails with more cost effectiveness compared to matched cohort treated with Perkin's traction.

The SIGN nails were used for 76.2% of the 44 patients treated with open reduction andintra-medullary interlocked nailing. Ikem *et al.,* [31] had also earlier reported such treatment modality of 85% of forty (40) shaft fractures using the SIGN nail without image intensifier. They concluded that with the aid of external jigs and slot finders, interlocking nailing can be achieved without image intensifier.

Spica cast was the principal mode of treatment for 8paediatric femoral shaft fractures in this study. On five of these occasions however, hip spica cast was applied after 21-28 days on skin traction (just before discharge from hospital). Two patients however had immediate fracture reduction and hip spica application. These two had decreased duration of hospital stay, reduced cost of treatment and earlier return to school than the patients who had earlier by traction. D'ollonne *et al.,* [32] found similar results in their study on 35 children aged below 6years. They observed that immediate hip spica casting led to significant reductions in weight-bearing delay, hospitalization duration, complications and cost, while having similar clinical results as traction.

Open fractures in this study were either treated by external fixation (type IIIB fractures) or above –knee amputation (type IIIC fractures). The failure of vascular repairs necessitated the choice of amputation in all open type IIIC fractures. This contrasts findings by Rosental *et al.*, [33] on twenty-one (21) patients with vascular injuries associated with femoral fractures. They reported successful vascular repair in seventeen (81.0%) of the patients with 19% amputation rate.

In the multiply injured patient, External fixators are quite useful in the initial stabilization of the fractures (most of which are usually high energy open fractures) Fredl *et al.*, [20] reported a clear advantage of primary external fixation followed by intramedullary nailing in multiply injured patients with an Injury Severity score (ISS) of 40 and above. This allows for the immediate fracture stabilization and gives enough time for the patient's status to improve before a more prolonged surgery is carried out.

Findings by Nowotarski *et al.*, [34] corroborate this report. They studied 54 multiply- injured patients (with a mean ISS of 29) with 59 femoral fractures, who were initially treated by unilateral external fixation. Fifty-five fractures were later treated with intramedullary nailing in a one-stage procedure on the eighth post-operative day. Their result showed an overall infection rate of 1.7% and an average functional knee motion of 107^0 with satisfactory fracture union.

The duration of hospital stay, radiographic union, range of motion in the knee and hip joints, weight bearing status at twelfth week visit, and post-operative complications were the outcome measures analyzed.

Twelve patients stayed in the hospital for more than 4weeks. This long period of hospitalization mainly involved patients treated with non-operative modes, long pre –operative waiting period and patients that had repeat surgeries either as planned staged management or treatment of complications.

Bone union rate at 12 weeks post intervention was (57.7%). This increased to 90.1% by the end of the eighteenth post-operative week.

Generally, wound infection rate from this study was 5.6 %. (n=4/71) this was less for closed fractures (1.4%, n=1/71). Deepak *et al.*, [35] in India and Bohler [36] reported higher rates of 16.7% and 9% respectively among patients with mostly closed fractures treated with intramedullary nailing. Mbamali [23] in Zaria had also reported an overall infection rate of 13% in 74 femoral fractures treated by open intramedullary nailing or plating. Strict adherence to standard aseptic protocol, mechanical washing of the affected limb prior to surgical skin preparation and prophylactic antibiotics administration could be responsible for the lower rates seen in this study. Bothkatchy *et al.*, [37] and Salawu [38] reported similar wound infection rates of 5.2% and 6.5% respectively.

Thus study showed a 1.4% Bone infection rate comparable with results from other workers [36, 37]. The predominant infective organism in all infected cases was *stappyloccocus aureus.*

Non-union and mal-union rates from this study were 2.4% (n=2) and 6.1% (n=5) respectively. Most mal-unions occurred in fractures treated by non-operative modes (skin traction (n=1) and skeletal traction (n=2). Ruedi *et al.*, [39] and Magerl *et al.*, [28] had higher non-union rates (5% each) for femoral shaft fractures treated by plate osteosynthesis although there were more patients in both series compared to this study.

Although most patients had good range of active motion in the ipsi-lateral hip and knee, 1.4% (n=2) of patients could not achieve up to 90^0 ofipsi-lateral knee flexion. This patient had communited fractures and was treated with skeletal traction for up to 12weeks. Bezabeh *et al.*, [40] in Addis Ababa, Ethiopia showed higher knee stiffness rates (10.3%, n=7/69) in their series on the use of Perkin's traction for the treatment of adult femoral shaft fractures.

The findings from this study could contribute to discussions and could potentially stimulate further related research for appropriate clinical decision – making and good health policy formulation.

REFERENCES

1. Bucholz, R. W., & Jones, A. L. A. N. (1991). Fractures of the shaft of the femur. *JBJS*, *73*(10), 1561-1566.
2. Bucholz, R. W., & Brumback, R. J. (1996). Fractures of the shaft of the femur. In: Rockwood, C. A. Jnr, Green, D. P., Bucholz, R. W., & Heckman, J. D., (eds). Rockwood and Green's fractures in adult, 4th ed. Philadelphia: Lippincott-Raven, 1827-1918.
3. Tscherne, H., & Gotzen, L. (1984). Closed fractures. In: Tscherne, H., Gotzen, L. Fractures with soft tissue injuries New York: Springer – Verlag, 4, 34-42.
4. Kootstra, G. (1973). Femoral shaft fractures in adults: A study of 329 consecutive cases with a statistical analysis of different methods of treatment. *Assen: van Gorcum*.
5. Isaacson, J. O. S. E. P. H., Louis, D. S., & Costenbader, J. M. (1975). Arterial injury associated with closed femoral-shaft fracture. Report of five cases. *JBJS*, *57*(8), 1147-1150.
6. Barr, H., Santer, G. J., & Stevenson, I. M. (1987). Occult femoral artery injury in relation to fracture of the femoral shaft. *The Journal of cardiovascular surgery*, *28*(2), 193-195.
7. Blichert-Toft, M., & Hammer, A. (1970). Treatment of fractures of the femoral shaft. *Acta Orthopaedica Scandinavica*, *41*(3), 341-353.
8. Keel, M., & Trentz, O. (2005). Pathophysiology of polytrauma. *Injury*, *36*(6), 691-709.
9. Bener, A., Justham, D., Azhar, A., Rysavy, M., & Al-Mulla, F. H. (2007). Femoral fractures in children related to motor vehicle injuries. *Journal of Orthopaedic Nursing*, *11*(3-4), 146-150.
10. Wong, P. C. (1967). An epidemiological appraisal of femoral shaft fractures in a mixed Asian population--Singapore. *Singapore medical journal*, *7*(4), 236-239.
11. Smith, R. M., & Gopal, S. (1999). Tibial fractures - Open fracture, principle of management: Curr Orthop, 13, 87-91.
12. Riska, E. B., von Bonsdorff, H. E. N. R. I. K., Hakkinen, S. I. R. K. K. A., Jaroma, H. E. I. K. K. I., Kiviluoto, O. L. L. I., & Paavilainen, T. I. M. O. (1977). Primary operative fixation of long bone fractures in patients with multiple injuries. *The Journal of Trauma*, *17*(2), 111-121.
13. Iwegbu, C. G. (1984). Preliminary results of treatment of fractures of the femur by cast-bracing using the Zaria metal hinge. *Injury*, *15*(4), 250-254.
14. Carr, C. R., & Wingo, C. H. (1973). Fractures of the femoral diaphysis: a retrospective study of the results and costs of treatment by intramedullary nailing and by traction and a spica cast. *JBJS*, *55*(4), 690-700.
15. Johnson, K. D., Johnston, D. W., & Parker, B. (1984). Comminuted femoral-shaft fractures: treatment by roller traction, cerclage wires and an intramedullary nail, or an interlocking intramedullary nail. *The Journal of Bone and Joint surgery. American Volume*, *66*(8), 1222-1235.
16. Künstscher, G. B. (1958). The Küntscher method of intramedullary fixation. *JBJS*, *40*(1), 17-26.
17. Muller, M. E., Allgower, M., Schneider, R., & Willenegger, H. (Editors). (1999). Manual of internal fixation- Techniques recommended by the AO group. 3rd ed. Berlin: Springer – Verlag, 138-139.
18. Lindahl, O. (1967). The rigidity of fracture immobilization with plates. *Acta Orthopaedica Scandinavica*, *38*(1-4), 101-114.
19. Mohr, V. D., Eickhoff, U., Haaker, R., & Klammer, H. L. (1995). External fixation of open femoral

shaft fractures. *Journal of Trauma and Acute Care Surgery*, *38*(4), 648-652.
20. Fredl HP, Stocker R ,Czermak B, Schmal H, Trentz O. Primary fixation and delayed nailing of long bone fractures in severe trauma. TechnOrthop 1996; 11: 59-66
21. GB, K. (1948, January). Recent advances in the field of medullary nailing. In *Annales chirurgiae et gynaecologiae Fenniae* (Vol. 37, No. 2, pp. 115-136).
22. Douglas, F. A., John, R. D., & Janos, P. E. (2012). Femur injuries and fractures. Emedicine.medscape.com/article/90779. Accessed on Dec. 5th 2012.
23. Mbamali, E. I. (1981). Internal Fixation of Femoral Shaft Fractures at the Ahmadu Bello University Teaching Hospital, Zaria. *Nigerian Medical Practitioner*, *2*, 81-85.
24. Jensen, J. S., Johansen, J., & Mørch, A. (1977). Middle third femoral fractures treated with medullary nailing or AO compression plates. *Injury*, *8*(3), 174-181.
25. Dencker, H. M. (1963). Fractures of the shaft of the femur. A clinical study based on 1003 fractures treated in Swedish Hospitals during the three-year period 1952 to 1954. Thesis. University of Gothenburg, Gothenburg, 1-135.
26. Roberts, J. B. (1977). Management of fractures and fracture complications of femoral shaft using the ASIF compression plate. *The Journal of Trauma*, *17*(1), 20-28.
27. Hansen, S. T., & Winquist, R. A. (1979). Closed intramedullary nailing of the femur. Küntscher technique with reaming. *Clinical orthopaedics and related research*, (138), 56-61.
28. Magerl, F., Wyss, A., Brunner, C. H., & Binder, W. (1979). Plate osteosynthesis of femoral shaft fractures in adults. A follow-up study. *Clinical Orthopaedics and Related Research*, (138), 62-73.
29. Panti, J. P. L., Geronilla, M., & Arada, E. C. (2013). Clinical outcomes of patients with isolated femoral shaft fractures treated with SIGN interlock nails versus Cannulated Interlock Intramedullary nails. *Journal of orthopaedics*, *10*(4), 182-187.
30. Gosselin, R. A., Heitto, M., & Zirkle, L. (2009). Cost-effectiveness of replacing skeletal traction by interlocked intramedullary nailing for femoral shaft fractures in a provincial trauma hospital in Cambodia. *International orthopaedics*, *33*(5), 1445-1448.
31. Ikem, I. C., Ogunlusi, J. D., & Ine, H. R. (2007). Achieving interlocking nails without using an image intensifier. *International orthopaedics*, *31*(4), 487-490.
32. d'Ollonne, T., Rubio, A., Leroux, J., Lusakisimo, S., Hayek, T., & Griffet, J. (2009). Early reduction versus skin traction in the orthopaedic treatment of femoral shaft fractures in children under 6 years old. *Journal of children's orthopaedics*, *3*(3), 209-215.
33. Rosental, J. J., Gaspar, M. R., Gjerdrum, T. C., & Newman, J. (1975). Vascular injuries associated with fractures of the femur. *Archives of Surgery*, *110*(5), 494-499.
34. Nowotarski, P. J., Turen, C. H., Brumback, R. J., & Scarboro, J. M. (2000). Conversion of external fixation to intramedullary nailing for fractures of the shaft of the femur in multiply injured patients. *JBJS*, *82*(6), 781-788.
35. Deepak, M. K., Jain, K., Rajamanya, K. A., Gandhi, P. R., Rupakumar, C. S., & Ravishankar, R. (2012). Functional outcome of diaphyseal fractures of femur managed by closed intramedullary interlocking nailing in adults. *Annals of African medicine*, *11*(1), 52-57.
36. Böhler, J. (1951). Results in medullary nailing of ninety-five fresh fractures of the femur. *JBJS*, *33*(3), 670-678.
37. Katchy, A. U., Agu, T. C., & Nwankwo, O. E. (2000). Femoral shaft fractures in a regional setting. *Nig J of Med*, 9(4), 138-140.
38. Salawu, S. A. I. (1985). Comparative study of the methods of treating fractures of the middle third of the adult femur in Zaria. FMCS part II dissertation. *National Post graduate Medical College of Nigeria*.
39. Rüedi, T. P., & Lüscher, J. N. (1979). Results after internal fixation of comminuted fractures of the femoral shaft with DC plates. *Clinical Orthopaedics and Related Research*, (138), 74-76.
40. Bezabeh, B., Wamisho, B. L., & Coles, M. J. (2012). Treatment of adult femoral shaft fractures using the Perkins traction at Addis Ababa Tikur Anbessa University Hospital: the Ethiopian experience. *International surgery*, *97*(1), 78-85.