

Outcome of Femoral Fractures Treated with External Fixators in the Douala General Hospital: A Referral Hospital in a Poor Resource Setting in Africa

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Abstract

Background: The femur is the most robust and the longest bone in the body. It is a weight bearing bone and when fractured requires a strong and stable fixation. Intramedullary nailing is the best treatment option however other options also give successful results. External fixator has been used as temporary method especially in polytraumatised patients and open fractures. In our environment where secondary procedure is not very feasible because of limited resources, external fixators have been used as a definitive treatment with satisfactory outcome.

Objective: To study the outcome of patients with femoral fractures treated with external fixator.

Materials and Methods: Files of patients with femoral fractures treated with external fixators within a period of 10 years (January 2008 - December 2017) were retrieved from the surgical unit of Douala General Hospital. Standard definition of operational terms like fracture union, nonunion and malunion were used. The data obtained were age, gender, cause and type of fracture, associated injuries and complications. This data was analyzed using the statistical package for social sciences (SPSS) version 20.0. Pearson's chi square test was used with a confidence interval (CI) of 95% at a p-value of < 0.05.

Results: We reviewed 97 files and exploited 86 with 87 fractures since there was a bilateral case. There were 62 (71.3%) open and 25 (28.7%) closed fractures. Most of the open fractures were Gustillo type II and IIIB (27.4%) each. Associated injuries included head injuries 23 (26%), radius/ulna fractures 12 (14.0%) and pelvic fractures 6 (7.0%). Average duration of surgery was 61 mins and average union time was 30 weeks. A total of 26 (30%) fractures consolidated uneventfully. Pin tract infection was the commonest complication with 37%. Most of it healed satisfactorily with dressings and antibiotics.

Conclusion: External fixators which are indicated for temporary fixation of femoral fractures have been found to be suitable in the definitive management of these fractures in low income settings and with favourable outcome. It is cost effective, fast to apply and with minimal soft tissue damage.

Keywords: Femur; Fracture; External Fixator; Outcome

Introduction

Femoral fractures commonly result from high energy mechanisms and are often associated with polytrauma and other serious injuries [1].

Intramedullary nailing is considered to be the treatment of choice for fixation of most femoral shaft fractures because of the benefits of early weight-bearing that helps maintain muscle mass, function, strength, and mobility [2].

External fixators can be applied with minimal effect on the trauma patient's disease burden and should be placed with objective of obtaining a stable construct, relative restoration of the length, alignment and rotation of the femoral bone.

Primary External fixation of femoral shaft fractures is indicated in situations where primary intramedullary nailing cannot be performed [3].

These may include severe open fractures, vascular injuries, polytrauma, those needing stabilization for transfer, and patients who are unstable for early definitive care. Conversion from external fixation to intramedullary nailing within one to two weeks of the injury is considered the standard practice [4]. However, due to financial constraints in many low- and middle-income countries, external fixation of femoral shaft fractures often serves as definitive treatment [5,6].

Aim of the Study

The aim of this study was to evaluate the outcome of the use of external fixation as definitive treatment of femoral shaft fractures in the surgical Department of the Douala General Hospital.

Materials and Methods

This was a hospital based retrospective analysis of clinical files of patients with femoral shaft fractures managed by external fixation from January 2008 to December 2017. The study was carried out at the department of surgery of the Douala General Hospital. Approval was sought from the hospital authorities and was granted.

Files of patients with femoral fractures who were managed with external fixator were sorted out from the records unit. Files of patients who did not attend follow-ups, incomplete files and those who died for reasons unrelated to the fracture, were ruled out. Further search for information about their presentation was carried out in the operating theatre records, emergency unit and x-ray department. Information on the fractures characteristics was gotten from x-rays of some of the patients retrieved from the radiology department.

The data obtained from these records were the age at surgery, gender, the cause of the fracture, the injured side, location and type of fracture, AO classification and associated injuries. Follow-ups were carried out for a minimum period of 39 weeks (9 months), or until bone union. During clinical assessment, fractures were considered to be united clinically in the absence of movement and pain on stress at the fracture site. Radiographic union was achieved in the presence of uniform and continuous ossification of callus, with consolidation and development of trabeculae across the fracture site. Complications and secondary surgical procedures following external fixation of femoral fractures were noted.

The data was analyzed using the statistical for social sciences (SPSS) version 20.0. Pearson's chi square test was used with statistical confidence interval (CI) of 95% at a p-value of < 0.05.

Results

Patient's characteristics

From the records 383 patients presented with femoral fractures during the study period out of which 97 fractures were managed with external fixators. We however exploited 86 files with 87 fractures (one bilateral case). The main age group affected was between 20 - 40 years with 37 (43%) patient involved between 30 - 39 year (Table 1). There were 70 (81.3%) males and 16 (18.7%) females, giving a male to female ratio of 4.4:1. Three had a history of a malignancy (prostate cancer with metastasis) and three had a history of osteoporosis. Eight of the cases were diabetics. Twenty nine cases had a positive history of heavy alcohol consumption while eight had a history of chronic smoking.

Age group (years)	Total (n = 86) n (%)	p-value
< 20	4 (4.7)	
20 - 29	18 (20.9)	
30 - 39	37 (43.0)	0.528
40 - 49	15 (17.4)	
50 - 59	5 (9.3)	
> 60	4 (4.7)	

Table 1: Age distribution.

Causes of injury

A vast majority 68 (79%) of cases were caused by road traffic crashes. Most of these cases were due to motorbike accidents. Falls and gunshot injuries constituted a very small number (Table 2).

Variables (causes)	Frequency (N)	Percentage (%)
Road traffic crash	68	79
Falls	5	5.8
Pathological fracture	5	5.8
Gunshot injuries	4	4.7
Assault	4	4.7

Table 2: Causes of injury.

Fracture types

Most of the cases were open femoral fractures 62 (71.3%) and 25 (28.8%) were closed (Figure 1). A majority of these fractures were Gustillo type II and IIIB constituting 27.4% each (Table 3).

Types	Frequency (N)	Percentage (%)
Open	62	71.3
Closed	25	28.5
GUSTILLO		
GA I	7	11.3
GA II	17	27.4
GA IIIa	13	21
GA IIIB	17	27.4
GA IIIC	8	12.9

Table 3: Types of fracture.

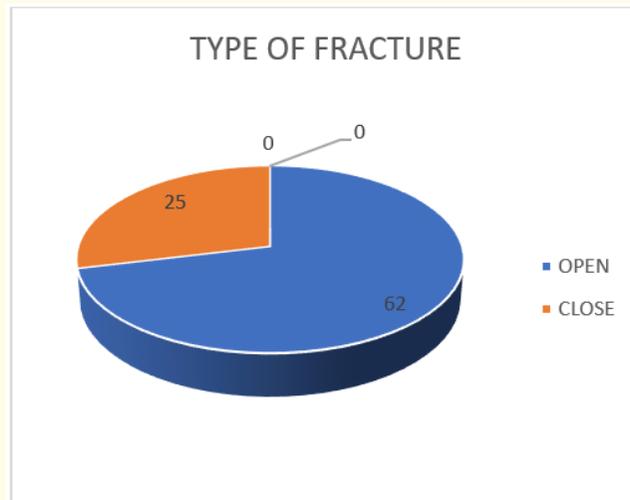


Figure 1: Fracture type.

A total of 32 x rays were reviewed from January 2016 to April 2018. Majority of the cases received managed with external fixation were AO 32 B3 fractures.

Associated injuries

Head injury was the most associated injury among adults with femoral fractures in 23 (26.7%), followed by radius/ulna fractures 12 (14.0%) and pelvic fracture 6 (7.0%). Other associated injuries were chest injuries 4 (4.7%), and abdominal injuries 3 (3.7%) (Table 4).

Associated Injury	Frequency	Percentage (%)
Head Injury	23	26.7
Radius/Ulna fracture	12	14.0
Pelvic fracture	6	7.0
Tibia /Fibular fracture	5	5.8
Patella fracture	5	5.8
Chest Injuries	4	4.7
Abdomen	3	3.5
Others	3	3.5
No associated injury	43	51.2

Table 4: Presentation of associated injuries for adults with femoral fractures.

Outcome evaluation

The average duration of surgery was 61.2 ± 12.4 minutes (range 45 - 120). The average duration of hospital stay was 28.62 ± 14.6 days. The average follow-up time was 66 ± 30.7 weeks (ranging from 26 to 160). The mean duration for fixator removal was 31 ± 12.2 weeks (Table 5).

Variable	Time (mean ± sd)
Duration of surgery (minutes)	61.2 ±12.4 (range 45 - 120)
Duration of Hospital stay (days)	28.62 ± 14.6 days (range 5 - 90)
Union time (weeks)	30 ± 11.48 (range 14 - 102)
Follow up (weeks)	66 ± 30.7 weeks (range 26 - 160)
Fixator removal time (weeks)	31 ± 12.2 weeks (range 20 - 108)

Table 5: Results of patient details that were recorded.

A total of 26 (30.2%) healed satisfactorily with no complications during treatment and follow up. However, pin tract infections occurred in 32 (37.2%) cases and were managed with improvement of hygiene, dressing and antibiotic therapy. There were 3 cases of chronic osteomyelitis which were managed by debridement and sequestrectomy. There were no reported cases of deep vein thrombosis, fat embolism syndrome or decubitus ulceration (Table 6).

Outcome	Open	Closed	OR	CI	P value
Normal	31 (50.0)	14 (58.3)	0.714	0.276	0.650
Delayed union	4 (6.5)	6 (25.0)	0.207	0.053 - 0.815	0.025
Malunion	8 (12.9)	1 (4.2)	3.407	0.403 - 28.827	0.434
Nonunion	6 (9.7)	1 (4.2)	2.464	0.281 - 21.625	0.668
Decrease range of motion	16 (25.8)	7 (29.2)	0.845	0.296 - 2.409	0.965
Refracture	3 (4.8)	0 (0.0)	1.407	1.226 - 1.614	0.557

Table 6: Out come in relation to fracture type.

Other complications were delayed union 10 (11.6%), non-union 7 (8.1%), malunion 9 (10.5%), secondary fracture displacement 3 (3.5%), chronic bone infection 3 (3.5%) and decreased range of motion of the knee 23 (26.7%).



Figure 2: Consolidated of the midshaft and distal third of the femur.

Majority of the cases of delayed union were closed fractures (6 cases). Majority of the malunion cases were associated with open fracture (8 of the 9 cases). Six of the seven non-union cases were open fractures. Decrease range of motion of the knee joint and refracture were also commoner in patients with open fractures.

The proportion of patients with malunion, nonunion, decrease range of motion at the knee joint and refracture of the already treated fracture increased with an increase in the Gustillo Anderson type.

	G I-II	GIII	OR	CI	p-value
Normal	17 (73.9)	13 (34.2)	5.449	1.731 - 17.155	0.006
Delayed union	2 (8.7)	2 (5.3)	1.714	0.225 - 13.086	0.628
Malunion	2 (8.7)	6 (15.8)	0.508	0.094 - 2.759	0.698
Nonunion	1 (4.3)	5 (13.2)	0.300	0.033 - 2.745	0.395
Decrease range of motion	2 (8.7)	14 (36.8)	0.163	0.033 - 0.803	0.034
Refracture	1 (4.3)	2 (5.3)	0.818	0.070 - 9.561	1.000

Table 7: Out come in relation to open fracture classification.

Discussion

Intramedullary nailing (IMN) is the gold standard of treatment for femoral shaft fractures. Early definitive treatment in systemically stable patients within 24 to 48 hours reduces the incidence of pulmonary complications, infection rates, and mortality [7,8]. External fixation is not widely used for femoral shaft fractures, except for temporary fixation for patients with open fractures, vascular injuries, polytrauma, stabilization for transfer, and those unstable for early definitive care [9].

The aim of this study was to evaluate the outcome of femoral shaft fractures which were treated definitively with external fixator in a low-middle income environment.

In this study, the mean duration of surgery was 61.2 ± 12.4 minutes (range 45 - 120) which is comparable to the mean duration of 55 minutes by Testa., *et al* [3]. This is because more time was needed to treat associated soft tissue and skin injuries. The short duration of the surgery was particularly beneficial to patients who were in critical condition, and in cases of severe open fractures with extensive soft tissue damage.

Primary external fixation was the treatment of choice in patients with open fractures of the femur (71.3%) of which 62.3% were Gustillo-Anderson III. The use of external fixation allows daily wound care. unlike internal fixation devices, external fixation spares uninjured tissue planes and the periosteal circulation, allowing adequate healing of injured soft tissue [9,10].

The treatment of such open fractures was associated with increased risk of malunion (OR 3.407) and non-union (OR 2.464). This finding is similar to other studies [3,11]. Open fractures are associated with periosteal stripping and bone void of soft tissue envelop. This devascularises the bone making healing difficult.

Mean healing time in our study of femoral fractures treated by external fixation was 30 ± 11.48 weeks (range 14 - 102), In our series, removal of external fixation was performed at an average time 31 ± 12.2 weeks (range 20 - 108), with application of brace until clinical stability of fracture or the use of crutches with weight bearing for two weeks. These durations are similar to other studies [12-14].

Main complications reported in other studies are pin-tract infections and decrease range of motion of the knee joint [12,15]. We had similar findings in our study where 32 (37.2%) cases had pin tract infection and 23 cases (26.7%) had a decrease range of motion at the knee joint. Decrease range of motion was a common complication in our study and this was a common finding in patients with open fractures and particularly those with distal femoral fractures where the external fixator was spanning across the knee joint or when the most distal pin interferes with the insertion of the collateral ligament thereby causes fibrosis around the knee. Our study revealed a delayed union rate of 11.6% which was similar to findings of other studies [3,16,17]. Six out of 11 cases with delayed union were closed fractures and could be explained by the fact that the closed fractures that were managed via external fixation were complex fractures and most of them were managed via open reduction and external fixation.

The non-union rate in our series was 8.1% which was relatively higher than findings in other studies [3,18]. However, this was similar to findings by Zlowodzki, *et al.* where they had a non-union rate of 8.5% [9].

Non-union was found to be higher in patients with open fractures and particularly those with a higher Gustillo Anderson score. This could be explained by the fact that higher energy impact fractures turn to have a higher degree of bone and soft tissue ischemia. Revascularization of ischemic bone fragments in fractures is derived from the soft tissue. If the soft tissue (skin, muscle, adipose) is ischemic, it must first recover prior to revascularizing the bone. Complications such as delayed union, non-union and re-fractures were managed with secondary surgical procedures such as internal fixation.

Conclusion

Although external fixation is considered a safe procedure to achieve temporary rigid stabilization in patients with multiple injuries at risk of an adverse outcome, in view of conversion to solid definitive internal fixation, we performed external fixation as definitive management, because the patients were not financially viable to afford conversion to internal fixation. Satisfactory outcomes were obtained with stable external fixation of an adequately reduced fracture. A strict postoperative protocol, including early weight-bearing, intensive physical therapy and protection of the bone after complete removal, needs to be followed.

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