Outcome of open inter-locking nail for femoral shaft fractures: an effective alternative in a resource restricted environment

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Abstract

Background: Femoralshaft fracture remains one of the commonest fractures in adults arising from high velocity forces. Though closed interlocking nail is the standard of management of closed femoral shaft fractures, however it is not always an obtainable resource in poor settings where ignorance on the part of the patient and absence of required equipment for closed reduction on the part of surgeon makes open interlocking nail popular and the best resort. The aim of the study was to show our experience using open locked intramedullary nail in femoral shaft fractures

Methods: This study is a prospective descriptive study carried out at the Orthopaedic Unit of Barau Dikko Teaching Hospital and Rapha Specialist hospital in Kaduna.

Results: In our study, 75% of patients were aged between 21-40 years with mean age of 32.5±5.7 years. The average time of union both radiological and clinically was 13 – 16 weeks in about 34.4% of cases. 23 (71.9%) of our patients had no post up complications, however 2 patients had superficial wound infection, 3 (9.4%) patients had knee stiffness, 2 (6.3%) patients had a <2cm shortening, 1(3.1%) patient had osteomyelitis and 1 (3.1%) patient had an implant failure.

Conclusion: Our study showed a favorable outcome for open interlocking nail in the treatment of closed diaphyseal fractures even in a resource -restricted environment.

Keywords: Open, Interlocking nail, Femoral Fractures, Resource-Restricted Environment

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Introduction

Diaphyseal femoral fractures are common and can present as isolated injuries or as part of a polytrauma situation.[1] Closed interlocking nail is now the gold standard in the treatment of diaphyseal femoral shaft fractures.[2-4] The global burden of trauma-related death and disability is high, disproportionately affecting low and middle income countries.[5] Trauma-related disability can push the poorest patients deeper into poverty due to associated healthcare costs and decreased economic productivity.[6] Significant injury related disability can be prevented with quality trauma and surgical care.[7] However, surgery remains out of reach for many patients, especially in low and middle income countries. Closed interlocking requires image intensifier with fluoroscopy, mobile X-rays and traction tables. These systems may not be readily available in majority of the hospitals in underdeveloped and developing countries due to the cost of acquiring and maintaining them.[1,8]. The use of Open interlocking nail has grown popular due to limited expertise available to poor routine use of the equipment where they are available; hence the adoption of the easier and more practical open method of fracture reduction and fixation.[9] Delayed presentations, coming from traditional bonesetters equally add to the burden.[10,11]

The femur is the longest, strongest and heaviest tubular bone in the human body and one of the principal load bearing bones in the lower limbs.[12] Fracture of the shaft of femur is one of the most common fractures encountered in orthopaedic practice.[13-15]

Open reduction and internal fixation of long bone fractures has the advantages of being easily learned, producing better reduction and having shorter operation time.[16,17] Several studies carried out on different populations in different climates have suggested higher infection rates and slower rate of union following open intramedullary nailing of long bone fractures compared to closed reduction and internal fixation of fractures which has a steep learning cuff.[18-21]

The objective of the study was to highlight our experience using open locked intra medullary nails in the management of femoral fractures.

Materials and Methods

This study was conducted in the Department of Surgery, Barau Dikko Teaching Hospital and Rapha Specialist Hospital both located in Kaduna State. Barau Dikko Teaching Hospital is a state-owned teaching hospital in Kaduna the capital of Kaduna state and acts as a referral hospital for most parts of Kaduna state. It has a dedicated orthopedic unit which is responsible for the care of

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patients with fractures. Rapha specialist hospital is a privately owned specialist hospital dedicated to providing orthopedic care as well as care for other trauma cases. The inclusion criteria for this study were all patients that had diaphyseal fracture of the femur managed by open locked intra medullary nails. Patient with poly trauma, open fractures, pathological fractures, and those who had other procedures were excluded from the study. At admission patients were resuscitated using the Advanced Trauma Life Support Protocol (ATLS). Patients that were stable and consented to the procedure were prepared for and had Open reduction and internal Fixation using GPC[R] style set. All the patients were counseled about treatment plan, cost of operation and hospital stay after surgery, complications of anesthesia and follow up till the time of union. Pre – operative antibiotics were used in all the fractures, 1 gram of ceftriaxone was given at induction of anesthesia and continued for 72hrs after the surgery.

Operative Technique

The patient was placed on the operating table in the lateral decubitus position, and the femur was exposed through a direct lateral approach.[22] The fracture site was identified and fracture hematoma evacuated. An 8mm manual reamer was passed across the proximal fragment and the guide wire was passed and extracted through the gluteal region: both the proximal and distal segment were reamed with the increment of 1mm to the required size, about 1mm higher than the chosen size of nail. The length of the nail was measured from tip of the greater trochanter to the upper pole of the patella. The interlocking jig was mounted on the proximal end of the selected nail by bolt and tightened.

The rotation and axis of the nail was checked with the position of the jig arm. The assembly was then tightened strongly. The jig arm had holes of different distances from distal locking corresponding to the nail size used. Through the 2cm incision on the distal thigh corresponding to the site determined by the hole, the sleeve was passed up to the bore and drilling done with 4mm drill bit. After confirming correct drill position by striking guide wire + drill bit, screw size was measured through the sleeve and a proper size of 4mm interlocking screws inserted. The position was confirmed by striking guide wire to bolt. External jig removed, wound irrigated with normal saline and Redivac drain inserted; then wound closed in layers and pressure dressing applied. Follow up was carried out at two, six, twelve weeks and at 6 months, 9 months and 1 year post-surgery. Full weight bearing was allowed when the clinical and radiological signs of union were seen. All patients' outcomes were assessed clinically and radiologically using a criteria regarding infection, implant failure and range of movement in the joints and were regarded as either excellent, good, fair or poor. Post-operative X-rays were reviewed and where deemed satisfactory before discharge.

During the follow up, patients were advised to continue range of motion exercises till the knee attained a full range of movement. Patients were allowed partial weight bearing on second post-op visit and then subsequently followed up.

Data collected included demographics, diagnosis, implants used, and time to union, complications and rehabilitation. This data was collected into an Excel sheet from where it was exported into an SPSS version 20 from which it was analyzed.

Results

The total number of patients studied was 32.The mean age of the patient was 32.5±5.7years and the age distribution is as shown in table 1. Majority of the patients were in the age group 21 – 30 and 31 – 40 years there were more males affected in our study accounting for 59.4% of cases and a male: female ratio of 1.5:1.

Road traffic accidents accounted for 96.9% of fractures as shown in Table 1. Majority of the patients (34.4%) presented with a duration of >6 months from time of injury while only 21.9% presented within a month of injury as shown in Table 1. The Left Femur was fractured in18 (56.3%) of the patients while the right femur was fractured in 14 (43.7%) patients.

About half of the patients 50% of the patients spent between 7-14 days on admission, while up to one quarter of patients were admitted for more than 22 days. The average time of union both radiologically and clinically was 13 – 16 weeks in about 34.4% of cases. Twenty three (71.9%) of these patients had no post up complications while 2 patients had superficial wound infection, 3 (9.4%) patients had knee stiffness, 2(6.3%) patients had a <2cm shortening, 1(3.1%) patient had osteomyelitis and 1(3.1%) patient had an implant failure.

Discussion

Our study revealed that males between 20 to 40 years of age were the most commonly affected which may be attributable to their activity and life style[23,24] and these findings were similar to that of other studies carried out in the southern part of Nigeria.[23]

An overwhelming 96.9% of injuries resulted from high energy collision occurring in road traffic accidents which is a recurring popular cause of morbidity and prominent in femoral shaft fractures which is comparable with previous studies.[23,24]This may be a continuing phenomenon due to poor roads, non-adherence to road traffic rules especially speed limits, driving under the influence of alcohol or other illicit drugs with little effort being put in place to curb such. [25,26]

The average duration between injury and surgery in

our study was found to be greater than one month in 71.9 % of patients, and this is similar to other reports.[23, 27] In one study the average duration of stay with traditional bone setters was between 1-6months with a mean of 2.5 months.[28] This in part may account for the delay in presentation, at which point the choice of closed reduction may not be only impracticable but equally more difficult. Economic factors such as cost of treatment may also play a role given that the location of the study is a low income locality.[23, 29]

Table 1: Demographics, Etiology, Surgical outcome and complications of study subjects

Variable	Grouping	Number	%
Age (yrs)	10 - 20	2	6.25
	21 - 30	12	37.5
	31 - 40	12	37.5
	41 - 50	4	12.5
	51 - 60	2	6.3
Mechanism of Injury	Road Traffic Accident	31	96.9
	Assault	0	0
	Falls	0	0
	Others	1	3.1
Duration between Injury	0 -1	7	21.9
and Surgery	1 - 2	5	15.6
(months)	3 - 6	7	21.9
	> 6	11	34.4
Duration of Hospital	7 - 14	16	50
Stay (days)	15 - 21	7	21.9
	22 - 28	5	15.6
	> 31	3	9.4
Time of Union both	< 12	7	21.9
Clinical and	13 - 16	11	34.4
Radiological (weeks)	17 - 20	3	9.4
	20 - 24	10	31.3
	> 24	0	0
	Nonunion	1	3.1
Post Op Complications	Superficial wound Infection	2	6.3
	Osteomyelitis	1	3.1
	Implant failure	1	3.1
	Shortening < 2cm	2	6.3
	Malunion	0	0
	Delayed/ Nonunion	0	0
	Broken nail	0	0
	Failed Distal Locking	0	0
	Screw Breakage	0	0
	Knee Stiffness	3	9.4
	None	23	71.9

The duration of hospital stay following surgery was widely varied in our study though 50% were discharged within 2 weeks only, 72% were discharged by 3 weeks, however more than 90% were discharged by the 4th week following surgery. [27] Most patients live at considerable distances from the hospital and were unsuitable for discharge due to the need for suture removal, hence the mean rate being about 2weeks.[30, 31]

Overall 96.9% of patients showed clinical and radiological evidence of union at 6 months of follow up. Major post-operative complications such as superficial surgical site infection, limb length discrepancy, chronic osteomyelitis, catastrophic implant failure and knee stiffness, was found to be similar in other works,[27, 32] though we recorded a higher infection rate. Various authors have argued that opening the fracture site exposes the fracture hematoma to the exterior and converts a closed fracture to open fracture with a higher risk of infection.[26]

The general outlook of patients who had undergone open interlocking nail for closed femoral shaft fracture showed, good outcomes despite delayed hospital presentation with more than 96.9% reporting clinical and radiological union. Though limited by sample size, this provides evidence of success in the management of closed femoral shaft fractures even in resource poor settings.

Conclusion

Closed interlocking intramedullary nail is now the standard in treatment of diaphyseal fractures. The cost and use of an image intensifier inhibits its common use in a resource poor environment. An open version of this procedure in which the fracture is stabilized by opening the fracture site is more commonly used. This open version has shown a significantly low complication rate as previously anticipated and has shown numerous advantages in being an easy technique, with reduced operating time and equally comparable results. This is in addition to being usable even after some complications of delayed presentation have set in that make close reduction surgically not possible.

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