ORIGINAL ARTICLE

OUTCOMES IN CLOSED REAMED INTERLOCKING NAIL IN FRACTURES OF SHAFT OF FEMUR

Taj Mohammad, Alamzeb Sawati, Ashfaq Ahmed, Abdus Saboor, Siddique
Department of Orthopaedics, Ayub Medical College, Abbottabad-Pakistan

Background: Femoral shaft fracture is one of the common fractures seen in accident and emergency department of our hospital. Violent forces are required to break this and strongest of human bones. There are various treatment modalities for femoral shaft fractures in adults like traction, brace, platting, intramedullary nail (IMN), external fixators and inter locking nails. The study was done with an objective to evaluate the results of closed reamed interlocking nail in fractures of shaft of femur. **Methods:** A prospective study of 114 cases of femoral shaft fractures was carried out at orthopaedic unit of Ayub Teaching Hospital Abbottabad during 1 year. All these cases were treated with statically locked nails under spinal or general anaesthesia. These cases were followed up for up to one year and Results of the interlocking nail were observed in terms of union and complications. **Results:** Out of 114 patients, 95 underwent union in 90–150 days with a mean of 110.68 days. Ten patients had dynamization within six weeks because of obvious fracture gap in radiograph. There were 3 patients who had non-union, and 6 patients had delayed union which was treated with dynamization. **Conclusion:** Close reamed interlocking intramedullary nail in femoral shaft fractures is the treatment of choice. Patient rehabilitation is early, hospitalization is short, and fracture healing response is good.

Keywords: Close reamed interlocking nail, Femoral shaft fractures, Delayed Union, Dynamization
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INTRODUCTION

Femoral shaft fracture is one of the common fractures seen in accident and emergency department of our hospital. Violent forces are required to break this and strongest of human bones. The frequency of this fracture has been greatly increased over the past few years due to increasing number of road traffic accidents and sometime natural disasters like earth quake. Closed femoral fractures are classified by Winquest and Hanson on the basis of communition.[1] Treatment of femoral shaft fracture has long been a subject of controversaries and discussions and various methods of its treatment have been adapted at various times.[2,3]

There are various treatment modalities for femoral shaft fractures in adults like traction, brace, platting, intramedullary nail (IMN), external fixators and inter locking nails. External fixator has been used for open femoral shaft fractures in Gustilo type II and type III fractures and it remained the method of choice during and after World War II. It is still used for some of the open fractures.[4,5,6]

Internal fixation of femoral shaft gained popularity in the 4th decade of 19th century after World War II; when open intramedullary nailing was introduced resulting in short hospital stay early mobilization of patient and relatively short total disability time. Infection and non-union remained two important drawbacks along with rotational deformity closed nailing of the femoral shaft fractures was introduced earlier but could not gain acceptance in the early days.[23]

Kuntscher designed interlocking nail in late sixties (60's) when he found drawbacks in ordinary intramedullary nail. This nail gained acceptance in clinical practice when Klem modified it. Klem's nail was also modified by Grosse (& Kemf) in 1976 that published his first report on interlocking nail in the same year.

Today various types of interlocking nail are available in the market and are widely used in clinical practice for femoral shaft fracture. Interlocking nail, today is the treatment of choice for all kinds of femoral shaft fractures and it has revolutionized the management of femoral shaft fractures. Surgical Implant Generation Network nail was introduced in august 2003 by Professor Lewis G. Zirkle Jr. MD. This important modality for fixation of femoral shaft fracture by open inter locking nail (SIGN Nail).[7] There is a need for understanding the use, results and complications of this important method of fixation for all kind of femoral shaft fracture, which reduces hospital stay, with less chances of infection and early rehabilitation of the patient.

Most intra-medulary nailing is done by closed techniques with minimal soft tissue damage either in antigrade or retrograde fashion depending upon fracture side[5,8–11] close antigrade intra-medulary nailing is done with introducing of guide wire through piriformis fossa into the medullary canal followed by reaming with flexible reamers and then introducing of a nail. The procedure is performed with the help of intra-operative fluoroscopic guidance. Close interlocking Nailing is the treatment

of choice for comminuted fracture shaft of femur Image intensifier has profound effects on orthopaedics trauma surgery, but image intensifier is not a benign aid and the tradition exposure may become significant over a surgeon‘s carriers. A part from the side effects it is an expensive machine and not available at DHQ Hospitals and even in some teaching hospitals.

Dr. Lewis G. Zirkle has introduced another treatment modality of open intramedullary inter locking nail known as (SIGN Nail) which can be carried out without the use of image intensifier with less expensive equipment and comparatively less expertise. The study was done with an objective to evaluate the results of closed reamed interlocking nail in fractures of shaft of femur.

MATERIAL AND METHODS

During 1 year, 114 patients of close femoral shaft fracture were studied in orthopaedics unit of ATH Abbottabad. This is a tertiary care hospital with one thousand beds. Orthopaedics Department has two units each with 31 beds, providing health care faculties to Hazara Northern areas and Azad Jumu Kashmir having alternate days OPD & OT. We provide round the clock emergency cover to all the trauma cases.

The annual admission to the main ward is more than 1200 patients in each, of which, 10-20% are admitted as cold cases while the rest of them come through emergency.

This study comprises 114 close diaphyseal femoral fractures. The majority of fractures were fixed in the first week of their arrival. All the patients were explained about treatment plan, costs of operation, hospital stay after surgery, complications of anesthesia and follow up till the time of union.

Preoperative antibiotics were used in all the fractures and the antibiotics used were first generation cephalosprins, post operatively one gram of first generation cephalosporins (cephazoline) 8 hourly in combination with amino glycoside for 72 hours were used.

The patient’s age range was between 15 and 60 years with an average age of 36 years. Both males and females were included in the study and most of the patients were young males between 20 & 40 years of age (60%). Only fractures of the femoral shaft were included in the study.

Fractures were classified according to Winquest and Hansen Classification according to which only 18 patients had stables fractures while all other 96 patients had unstable fractures.

We used the left lateral or right lateral position on simple operating table for fracture fixation. All the nails were inserted in anti-grade manner and no retrograde nailing was done during the study. Through lateral incision fracture side is opened bone ends are exposed and hand reaming is done through both bone ends and the fracture is then reduced. Curved awl is used to make entrance hole in the posterior half of the tip of greater trochanter. The canal was reamed with the help of hand reamers in increment of 1mm. Over reaming of the canal in all cases for 1 to 2mm was done Nail length and width was determined by pre-operative radiograph and pre-operative measuring length of femur.

Data was collected on two separate *pro formas*. One *pro forma* was used for history and preoperative evaluation of the patient while the other *pro forma* was used for postoperative follow up of the patients.

Follow up was carried out at two, four and twelve weeks and then at six months. Full weight bearing was allowed when the clinical and radiological signs of union were seen.

Most of our patients belong to far flung areas and usually do not turn up on advised follow up dates, patients from urban areas usually come for follow up visits, but majority of patients responded and came for post op. evaluation.

All patients outcome was assessed clinically and radio logically using a criteria regarding union, infection, implant failure and range of movements of joints and were regarded as excellent, good, fair and poor. All X-rays were reviewed.

In follow up visits patients were advised to continue range of movement exercises till the knee can extend and flex fully. In some cases physiotherapy exercises are advised to be cared out at hospital physiotherapy department. Patients were allowed partial weight bearing on first post op visit and then subsequently as tolerated.

After collection the data was compiled in a tabulated form and was evaluated for results and complications of SIGN interlocking interamedullary nail in our setup.

Criteria for Outcome Measures

Excellent	Union in 04 months, no infection, no implant failure and full ROM of joints
Good	Union in six months no infection and no joint stiffness
Fair	Union after six months superficial infection or knee stiffness
Poor	Non-union after 08 months or infection, infection joint stiffness or implant failure

RESULTS

There were 68 (59.65%) males and 46 (40.35%) female out of 114 patients. Patients’ age was distributed in groups, 15–40 were 88 (77.19%), 41–60 were 15 (13.16%) and 61 & above were 11 (9.65%) out of 114 patients

Patients presented with side of fractures, left side were 64 (56.14%) right side 50(43.86%).Out of 114 patients. Patients presented with type (Winquest & Hansen), Type-1=40 (35.09%), type-II=38(33.33%), type-III=20 (17.54%) and type-IV=16 (14.04%) out 114 patients.

Patients presented with history of fall were 66 (57.89%) and RTA 48 (42.11%) out of 114 patients. Sixty-five (76.67%) patients were discharged after three days. Twenty-seven (23.33 %) with associated injuries stayed for about 7 days after surgery. Twenty-two (19.29%) patients got infected with sixteen superficial and six deep infections were discharged at 10 and 14 post op days mean hospital stay was 8 days (3–14 days).

The final bone and functional results were evaluated by the criteria (previously mentioned) for outcome of sign (open) inter locking nail.

Out of 114 patients, 95 underwent union in 90–150 days with a mean of 110.68 days. Ten patients had dynamization within six weeks because of obvious fracture gap in radiograph. There were 3 patients who had non-union, and 6 patients had delayed union which was treated with dynamization.

Sixty-one of our patients (53.50%) got there fractures united within 16 weeks. In 28 patients (24.56%) union was archived within 20 weeks while in 22 patients (19.29%) union accrued between 21–24 weeks. There were three elderly patients whose fracture was not united even after 24 weeks (2.63%). (Table-1).

We had full range of movements (from 0–130“) in 102 patients (89.47%). Seven patients (6.14%) had range of movements from 0 to 90. Five patients (4.38 %) had knee range of movements 0–60. (Table-2).

We obtained excellent results in sixty-one patients (53.51%) good in twenty two (19.30%), fair in twenty six (22.81%) and poor in five (4.38 %).

Majority of the patients complained of pain at the fracture site and knee this was treated with analgesia.

Overall there were 19 complications and we divided them into per-operative and postoperative complication

We were unable to put the distal screw properly in eleven of our patients (9.64 %) and in post-operative radiograph it was detected that the screws were not passing through the nail it was found out it were because of play in the assembly and also due to loosening of locking bolt. We had to replace and put the screws in proper position in all the three patients.

We had complicated procedure due to more anteromedial located portal of entry due to which the proximal femur had a longitudinal split. Ultimately we were able to pass small diameter nail and statically locking it. Breakage of Small (3.5 mm) and Large (6.3mm) Drill bits

In five of the patient the small 3.5mm bits were broken during drilling which were replace and in one of the patient the large 6.3mm bit was broken.

A total of twenty two patients got infected, 16 of them had superficial infection. i.e., superficial to fascia lata. Six patients had deep infection, C/S were taken after stopping the Antibiotic for 28 hours and were started on Antibiotics according to C/S report were ultimately able to treat the infection successfully.

There were three patients with breakage of distal screw, as the fracture was in proximal 3rd of shaft the screw was left as such and the fracture got united uneventfully.

Majority of the patient complained of knee pain. All the patients were allowed lib exercises in the bed on the first day of their operation and were mobilized on crutches or Zimmer frame on the very next day. Majority of the patient were able to flax the knee beyond 90” expect twelve patients who had distal 3rd femoral fracture and were extremely un-cooperative. All the patients had knee stiffens seven of them not able to flax the knee beyond 90” and five of them had knee ROM 0 to 60.

There was three elderly patients with sub-trochanteric fracture who ended up with no sign of union both radiological and clinically after six months.

Table-1: Frequency of union of fractures

Weeks	Number	Percent
16	61	53.51
20	28	24.56
21–24	22	19.30
Above 24	3	2.63
Total	114	100.00

Table-2: Frequency of range of movements

Range of Movement	Number	Percent
0–130	102	89.47
0–90	7	6.14
0–60	5	4.39
Total	114	100.00

Table-3: Per-operative complications

Complication	Number	Percent
Anesthesia	0	0
Longitudinal bones split	1	3.33%
Misplaced distal screw	11	9.64 %
Breakage of small (3.5mm) drill bits	2	6.67%
Breakage of large (6.3 mm) drill bit	1	3.33%

Table-4: Post-operative complications

Complication	Number	Percent
Infection superficial	16	3.33%
Infection deep	6	6.67%
Distal screw Breakage	1	3.33 %
Knee stiffness	12	10.52 %

DISCUSSION

While there is no one universally accepted method of management of all femur and tibia fractures, inter locked intramedullary nailing has been recognized as a superior method of internal fixation, particularly for distal and proximal fractures, since 1980.[12,13] For decades; however clinicians and epidemiologists have debated whether or not internal fixation has as place in resource poor settings. This study attempts to determine if, given an unlimited supply of intramedullary nails that not require fluoroscopy to set locking bolts, can supply of intramedullary nails that do not require fluoroscopy to set locking blots, cans internal fixation be performed in resource poor sitting with comparable or optimal results to previous methods.

Interlocking nailing has been increasingly used to treat both acute and chronic injuries to long bones.[14,15,16] These are commonly performed in the developed countries and involve the use of an image intensifier.[17] These image intensifiers are very expensive and are not readily available in most resource-poor countries of the world, such as Pakistan, India, Bangladesh, Nepal, in the West African sub regions, including Nigeria. With SIGN (Surgical Implant Generation Network) interlocking nails, it is now feasible to achieve interlocking nail insertion without the aid of an intra-operative image intensifier, simply by the use of an external jig and slot finder successful interlocking nailing using the method should not only improve the quality of fracture care, but should also lead to reduction of exposure to intra-operative ionizing radiation.[18]

There were 114 cases in this study, most of them young males between 15–40 years of age making 77.19 % of the total. As most of the young people lead an active life and are affected by road traffic accidents and are victim of fall from height. Due to increasing traffic on the roads and hilly areas in northern part of the province the incidence of long bone fracture has increased over the past two decades.

Furthermore the poor socio- economic status and decreased literacy rate has forced our people to do more manual and labourer jobs which have increased the incidence of fall. Only 22 patients 22.80 % were above 40 years of age the age of patients in this study is in accordance with other studies conducted elsewhere in such circumstances.

Males were more effective than females as 59.64% of the patients were males and 40.35 % were females. As mentioned earlier RTA was responsible for most of the femoral shaft fractures followed by fall from height. The majority of victim of fall from height were either labourer working in the under construction building, or, were those working in their farms and had history of fall from hills are from trees.

Most of the patients received first aid in nearby hospitals of far-flung areas of the northern area and then they were brought to our hospital. Only a few cases that were injured and brought directly to the accident and emergency department were given first aid at our emergency department. These were mostly local people of Abbottabad District. Some patients were given first aid at home.

In Western world facilities of operation and proper management are available in every locality and thus the patients reach hospital in time while, we don't have such facilities in our Districts and even in our accident and emergency department early management facilities are scanty.

In our study closed fracture were classified according to Winquest and Hanson classification[1,3] for communition. Eight were type-I, twelve were type-II six were type-III, and four were type-IV. The patient we received were mostly from far away of northern area where no facilities for treatment such injuries are available so they have to travel a long way to Abbottabad for their proper treatment and arranging transport and money for their treatment at this tertiary Hospital. One patient was having chest injury along with femoral shaft fracture that was dealt with by cardiothoracic unit and was then shifted to our unit for fracture treatment. Similarly two patients with head injury were treated in neurosurgical unit before fixation of their fracture. Four patients were having other orthopaedic injuries to the limbs and spins. Twenty three patients had isolated lower limb injuries. None of the patients were operated in the first 24 hours of their injuries because of lack of facilities in our hospital at the A/E department. The other reason for late operation was delay in the arrival of the patients. Majority of the patients twenty three (76.76%) were fixed after three days seven patients (23.33%) with associated injuries were fixed after one weak. Mean Hospital stay was eight days.

In the Western world most of the patients are fixed within first 24 hours because of facilities of early fixation and wound care in every locality.[19,20, 11]

The question of when is the optimum time for operative stabilization of a leg fracture has long been debated. Before 1959, when Smith published evidence in support of a delay in operation to reduce the incidence of non-union, most countries agreed that operative stabilization should be carried out as soon as possible after a fracture occurs. Smith's theory of the value of delayed operation was supported two decades later when Wilber and Evans concluded that when femoral shafts are managed by operative reduction and internal stabilization, a decreased incidence of delayed union and non-union

can be achieved by delaying the operative stabilization five or more days after fracture.[21] Original study. More recent studies, however have found that greater delays to surgery have negatively influenced the incidence of delayed union and non-union as well as infection, weight bearing, and joint ROM.

In most studies the average union period has been identified as four to five months[3,18] original study as our follow up descent extend beyond six months so it not possible to commend exactly on incidence of delayed or non-union as sixteen of our patients (53.33%) got their fracture united within sixteen weeks in six patients (20%) union was achieved in 20 weeks. In seven patients (23.33%) union was achieved in 20–24 weeks there was one elderly lady whose fracture was not united even after 24 weeks (3.33%). This is surprising, given the high rates of delayed and/ non-union observed in other studies specially when cancellous bone grafting is not used [12,22] original study.

All the 30 patients were allowed exercise in the bed on day one. Patients with isolated femoral fracture were mobilized on crutches or Zimmer frame on the very next day. Patient with multiple trauma were mobilized out of the bed in the first week of their operation.

Three of our patients developed knee stiffness, two of them were those with fracture of the distal 3rd of femur and did not came for proper follow up they extremely uncooperative one of them developed deep infection for which we had to open the fracture site and needed repeatedly debridement and wound wash two of them had knee ROM of 0 to 90. “The other had kneed ROM 0–70”

In our patient we had misplacement of three distal screws (10.0%). We had to replace and put the screws in proper position in all the three patients. Distal screws breakage was observed in one patient (3.33%) as the fracture was not proximal 3rd of shaft so the screws was left as such in the fracture united uneventfully.

Per and Postoperative I/V antibiotics were used in all the patients which included 1gm cephalosporin per operatively followed by 1gm cephalosporin, 80 mg Gentacyin 8 hourly X 3 days. Oral antibiotics including cephalosporin and quinolones were given for one week post operatively. The superficial and deep infection rate was 13.33% and 6.67 %.

CONCLUSION

Closed intramedullary interlocking nail for diaphysial fractures of femur is the treatment of choice nowadays. There is early mobilization of patients, short hospital stay, less number of complications ,so causing decrease in morbidity and mortality due to shaft of femur fractures

AUTHOR’S CONTRIBUTION

TM and AS: Supervision, AS, AA: Data Collection and report writing.

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Address for Correspondence:

Dr. Taj Mohammad, Orthopaedic Unit, Ayub Teaching Hospital, Abbottabad-Pakistan
Cell: +92 333 934 6838
Email: drtaj1877@yahoo.com