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Closed inter locking nail for the management of femur in adults

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Abstract

Background and Aim: Casting often leads to malalignment, increased chances of non-union and also stiffness in the joints from prolonged immobilization. Hence the aim of the study was to see the effectiveness of interlocking intramedullary nailing of diaphyseal fracture of femur in adults.

Material & Method: A total of 40 patients were included in the study. All the included patients had fracture of diaphysis of femur. Length of nail was selected by measuring the normal femur from tip of greater trochanter to knee joint line. Results were evaluated using modification of Klaus, W. Klemm *et al* criteria for the results of treatment.

Results: A fair result meant loss of 30% of hip and knee motion, with more than 2 cm of quadriceps atrophy and angulation in any plane between 5 to 10. A poor result was with marked restriction of hip and knee motion and gross muscle atrophy and shortening and deformity greater than 10. Excellent result were obtained in 6 cases, good results were obtained in 24 cases and fair results in 10 cases.

Discussion & Conclusion: Closed interlocking nails achieves strength of femoral diaphyseal fracture shaft in all three planes of loading- bending, compression and torsion. There is no significant change in the union rate when compared with age, sex and level of fracture. The rate of union compared to other modalities of treatment is excellent.

Keywords: femur, fracture, interlocking nail

Introduction

The art and science of fracture management has tremendously advanced over the years. From the use of external splints in the Hippocratic age, to the recent sophisticated instrumentation, treatment of fracture has made an impact in the surgical field ^[1].

Fracture shaft of femur is one of the most common fractures seen in orthopaedic practice. Femur is the longest bone of the body and one of the principal load bearing bones in the lower extremity. Fracture of femoral shaft, often, is the result of high energy trauma like motor vehicle accidents, fall from height, automobile pedestrian accident, and gunshot injury and may be associated with multiple system injury ^[2, 3].

Orthopaedic surgeons often encounter femoral shaft fractures. These fractures most often results from high energy trauma, so one must have a high index of suspicion for complications and associated injuries. In developing countries, femoral shaft fractures are commonly due to increasing incidence of road traffic accident (RTA) ^[4, 5].

Proximal & Distal shaft fractures where one cannot get three point fixations can also be stabilized by use of interlocking nails. Intramedullary nail being close to centre of femur can tolerate bending and torsional loads better than plates and the locking mechanism provides less tensile and shear than plates. IM interlocking nail is a load sharing device and are less loaded than plates causing less cortical osteopenia of stress shielding which is a feature of the load bearing plates ^[6].

Conventional plating necessitates extensile approach and periosteal dissection that leads to complications such as delayed healing. Also stress shielding leads to increased chances of refracture during plate removal and as mentioned earlier most of the femoral shaft fractures are caused by high energy trauma and occurs in younger age group people, who lead more active lives. Thus, the restoration of normal limb and joint function, rotation and length is of utmost importance ^[7].

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Morbidity arises from fracture shortening, malalignment, knee contractures and complications of fracture care. Mortality is infrequent but can result from open wounds, fat embolism, acute respiratory distress syndrome or resultant multiple organ failure [8]. Casting often leads to malalignment, increased chances of non-union and also stiffness in the joints from prolonged immobilization. Hence the aim of the study was to see the effectiveness of interlocking intramedullary nailing of diaphyseal fracture of femur in adults.

Materials & Methods

A total of 40 patients were included in the study. All the included patients had fracture of diaphysis of femur. All the patients were admitted in the medical hospital and were treated with femoral interlocking nail.

The inclusion criteria were as follows: All patients with fracture femur between inferior margin of lesser trochanter and upper border of a square containing the distal end of the femur, Closed and grade I open fracture, ASIF Type A & B fractures, Winquist & Hansen Classification of fractures comminution grade I, II & III. Exclusion criteria were as follows: Age < 18 yrs, Open grade II and III fractures, Pathological fractures, Patients lost in follow up, Selections of these cases were at random. Road traffic accidents were responsible in 18 patients and in 2 patients the cause of fracture was fall. There was one case of open fracture grade-I according to Gustilo Anderson classification, which was treated with interlocking nail. The interval between injury and operative intervention ranged from 2 to 5 days with an average of 2 days.

Once admitted in the hospital, all the patients were assessed for general check up as well as soft tissue and any other injury. Fluid and blood loss were treated with appropriate study and blood replacement. Head injury, pelvic injury, abdominal injuries were given priority treatment. The emergency management for fracture proper included immobilization of fractured limb in a Thomas splint with or without skin traction.

Routine preoperative investigation assessment included.

- Haemoglobin percentage
- CT, BT
- Recording of blood pressure
- RBS, Blood urea, Sr. Creatinine
- E.C.G.
- Radiological assessment.

AP and lateral radiograph of thigh with hip and knee

The routine procedures that were followed in patients who were posted for surgery included:

- Improvement of general condition of the patient and making him / her fit for anaesthesia.
- Shaving and scrubbing of the entire limb on the day before surgery.
- Intravenous generation cephalosporin on the day before surgery and just before incision.
- One bottle of compatible blood was kept ready and used where necessary.

Implant and Instrumentation

The interlocking nails used in the surgery are AO femoral nails. They are universal type nail, used in both right and left side. They were made up of 316L stainless steel. The shaft of the nail is clover leaf in section. The nail is available in diameters 9-13 and length 360 mm to 440 mm.

Locking bolts: 4.5mm diameter, 22 to 60 mm in length.

Locking holes are provided on either ends of these nails. They are usually round in shapes and they are slightly larger than the bolt being used. The proximal locking hole is usually oblong, one which is called dynamic locking hole. This hole allows the bolt to slide over gradually proximally as the fracture collapses but giving adequate rotational stability. Since the locking screws or the bolts are loaded at right angles to their axis they should be stronger for such loads unlike screws. Since in interlocking there is no pull out force but only axial loading force which is acting on these screws. The screws are modified (Called bolts) which have larger core diameter compared to their thread size A 4.5mm bolt will have a 4.3mm core.

Selection of implant

Radiographs of femur with knee in AP and lateral view & hip in AP view taken are used to access comminution. The diameter of nail is selected by measuring the width of medullary canal at level of isthmus.

Length of nail was selected by measuring the normal femur from tip of greater trochanter to knee joint line. Results were evaluated using modification of Klaus, W. Klemm *et al* criteria for the results of treatment.

The criteria were as follows:

Excellent: Full hip and knee motion

No muscle atrophy

Normal radiographic alignment

Good: Slight loss of hip alignment and knee motion Muscle atrophy < 2 cm

Shortening < 2 cm

Angular deformity < 5°

Fair: Moderate (25%) loss of hip and knee motion

Muscle atrophy > 2 cm

Shortening > 2 cm

Angular deformity 5- 10

Poor: Marked loss of hip & knee motion, Marked muscle atrophy, Marked shortening, Angular deformity > 10.

Results

The present study included total of 40 cases of diaphyseal fracture of femur bone that were treated surgically with intermedullary interlocking nails. The age ranges from 15 to 60 years with the mean age found to be 30 years. More number of males was affected as compared to females, because males are more involved in heavy load work as compared to females. Males are the one who are considered as earning member of the family.

Table 1: Age & sex distribution

Age in years	Males	Females	Total
15 – 20	8	3	11
21 – 30	7	2	9
31 – 40	10	1	11
41 – 50	2	3	5
51 – 60	3	1	4
Total	30	10	40

Most of the fractures were of road side accident and any were due to fall at their work site and also because of four wheeler injury. Maximum fractures were located in the middle third area, other areas involved were distal third and the least number of fractures were found in proximal third. Majority of fractures were oblique- 18 cases, spiral fractures were seen in 10 cases, comminution seen in about 6 cases, and transverse in case of 6 of ractures.

Table 2: Types of fractures

Pattern	No. of fractures
Comminuted Fracture	6
Oblique fracture	18
Spiral fracture	10
Transverse fracture	6

An excellent result was defined as full hip and knee motion, no muscular atrophy of thigh and normal anatomical alignment of fracture Radiographically. In good result, only slight loss of hip or knee motion, with less than 2 cm of muscle atrophy and angular deformity less than 4. A fair result meant loss of 30% of hip and knee motion, with more than 2 cm of quadriceps atrophy and angulation in any plane between 5 to 10. A poor result was with marked restriction of hip and knee motion and gross muscle atrophy and shortening and deformity greater than 10. Excellent result were obtained in 6 cases, good results were obtained in 24 cases and fair results in 10 cases.

Discussion

The treatment of fracture diaphysis of femur has evolved from the old conservative management to the most recent methods of interlocking nails. This is the era of biological fixation. Interlocking nails have greatly expanded the indications for closed IM nailing of femoral fractures.^{9, 10} Early mobilization following fractures of the femoral diaphysis has been shown to have a significant advantage in terms of both joint mobility and economic impact which has very well attained by the use of interlocking nails^[11].

Majority of our patients were in the age group 17-39 years which is the prime earning group in the Indian families. Most of the patients were manual laborers and agriculturist whose early return to work was important.

In our series, 65% of fractures were located in the middle third, while in reported series of conventional nailing, this figure ranged from 60-80% and 50% in the series of Thoresen *et al* where G.K. interlocking nail was used. Even the distribution of both comminution and type of fracture is similar to those in other series; where in interlocking nails were used.

Majority of the patients of our series returned to their functional pre-fracture state and return to work by the end of 3 months.

Conclusion

Closed interlocking nails achieve strength of femoral diaphyseal fracture shaft in all three planes of loading-bending, compression and torsion. There is no significant change in the union rate when compared with age, sex and level of fracture. The rate of union compared to other modalities of treatment is excellent.

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