Original Article
Orthopaedics

RESULTS OF EXCHANGE NAILING IN ASEPTIC NON-UNION/DELAYED UNION OF FEMORAL SHAFT FRACTURES

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Article submitted on: 28 July 2017
Article Accepted on: 03 August 2016

Abstract:

Background: Fractures of femoral shaft are among the most common fractures encountered in orthopedic practice. Intramedullary nailing is the method of choice in the treatment of acute femoral shaft fractures in adults. It is associated with a high fracture union rate and a low complication rate. Aspetic Nonunion/delayed union as well as its other rare complications are treated by exchange femoral nailing.

Objective: To assess results of exchange nailing for aseptic non-union/ delayed union in the management of femoral shaft fractures.

Design: This was a Descriptive case series study.

Patients and methods: Twenty five patients of non-union/delayed union fractures shaft of femur were admitted to the Department of Trauma and Orthopaedics, Sri Guru Ram das Institute of Medical Sciences and Research, Vallah, Sri Amritsar from January 2012 to September 2014, and their informed consent obtained for the procedure. All patients with delayed or hypertrophic nonunion of diaphyseal femur fractures diagnosed on clinical and radiological examination, were included. Patients with infective nonunion, segmental fractures or fractures with bone loss and open fractures were excluded. Patients were treated with exchange nailing.

Results: A total of 25 patients were managed. The type of non-union of femur and its correlation with bone healing using pre- and postoperative x-rays of the femur was analysed. The analysis shows better healing in hypertrophic non-union than in atrophic ones. Twenty-three out of 25 cases (92%) healed uneventfully. Except for 2 out of 25 cases (8%) of persistent non-union, no significant complications occurred.

Conclusions: Exchange femoral interlocking intra-medullary nailing is a simple technique with minimal complications. This operative treatment option appears to have a high success rate and should be considered as the treatment of choice for aseptic, non-comminuted diaphyseal femoral non-unions.

Key words: *Femoral shaft fractures, Aseptic non-union, Delayed union.*

Introduction:

Fractures of femoral shaft are among the most common fractures encountered in orthopedic practice.[1] In spite of increased understanding of biomechanics and implant design, nonunion of femoral shaft fractures continues to hinder the treatment of these injuries.[2] Closed interlocking IM nailing of these fractures necessitates use of image intensifier and costlier fracture table which are not ready to hand in many hospitals in the developing countries.[3]

Under the circumstances many orthopaedic surgeons from these countries still carry out open IM nailing for these fractures with resultant increase in the rate of nonunion.[3] This complication presents a difficult treatment challenge for the surgeons.[2] There are several methods of treatment for femoral diaphyseal nonunions that were initially treated with an intramedullary nail. This includes nail dynamization, exchange nailing, plate fixations, bone grafting, and combinations of these.[4] Aseptic nonunion and less complicated cases respond well to an Ilizarov treatment.[5] Exchange closed interlocking nailing provides biological and mechanical effects that promote osseous healing. Reaming of the medullary canal leads to increased periosteal blood flow, stimulates periosteal new-bone formation, and delivers internal bone graft to the non-union site, all in turn aid in healing of the nonunion.[6]Likewise improved mechanical stability due to use of larger size IM nail also leads to accelerated healing at the non-union site.[6,7]

High incidence of femoral shaft fractures and their non-union plus paucity of research study on the issue has prompted us to carry out a prospective study on exchange interlocking IM nailing on the perplexing issue of aseptic non-union fractures shaft of femur which have failed to heal by the prior IM nails. The aim of this study was to determine the management outcome of non-union femoral shaft fractures with exchange interlocking nailing in term of radiological bone healing.

Material And Methods:

Twenty five consecutive cases of non-union fractures shaft of femur were admitted to the Department of Trauma and Orthopaedics, Sri Guru Ram das Institute of Medical Sciences and Research, Vallah, Sri Amritsar from January 2012 to September 2014, and their informed consent obtained for the procedure. This was a hospital-based descriptive case series of patients with delayed or nonunion fractures femur treated by exchange nailing. Patients were included in this study through non probability convenience sampling technique.

Inclusion criteria

1. All male and female patients who were aged 15 years and above.
2. All patients who had initially closed post traumatic fractures of the shaft femur.
3. All patients with delayed or hypertrophic nonunion of diaphyseal femur fractures diagnosed on clinical and radiological examination.
4. All patients had less than 1 Cm shortening and no bone comminution or bone loss at the time of study.

Exclusion criteria

1. Patients with infective nonunion, segmental fractures or fractures with bone loss and open fractures were excluded.

Detailed history and examination were done. Radiographs, anterio-posterior and lateral views, were taken to confirm radiological delayed or nonunion. Base line investigations and chest x-rays, electrocardiography were also done. Informed written consent was taken. Patients were given prophylactic intravenous antibiotics at induction of anaesthesia. These antibiotics were continued for five to seven days postoperatively. Patients were given either general anaesthetic (GA) or spinal anaesthetic, positioned supine on fracture table. Both lower limbs were put in traction in a way to allow use of image intensifier for the procedure. A small incision was given extending five cm up from the tip of greater trochanter. A guide wire inserted into the medullary canal of femur antegrade way, previous IM nail was removed, and medullary canal of the femur reamed in gradual increments up to 2 mm above the previous nail size using flexible reamers. Lastly a proper size interlocking IM nail, one mm smaller diameter than the last reamer used, was inserted over the guide wire using interlocking nail assembly. Proximal locking was done using the jig and distal screws for locking were inserted free hand way under image intensifier. We used static interlocking for all the cases in our study in order to provide added stability to the construct.

Check x-ray of the operated site for all patients were done on the 1st postoperative day to reconfirm fracture reduction and nail locking, counselling of and showing it to patients, and as guideline for comparison with later x-rays during follow-up period. Postoperatively, all patients were permitted to ambulate with protected weight bearing as soon as possible. Quadriceps as well as

knee range of motion exercise was encouraged. Patients were discharged home on 5th to 6th post-operative day. All operated patients were followed-up in the outpatient department at 2 weeks for suture removal and wounds examination. Patients were followed up subsequently for clinical and/or radiological check up at one month intervals for minimum period of one year after the surgery or till time when bone healing at non-union site has occurred. The fracture showing radiological evidence of healing, as confirmed by independent radiologist, was considered healed.

Observations and Results:

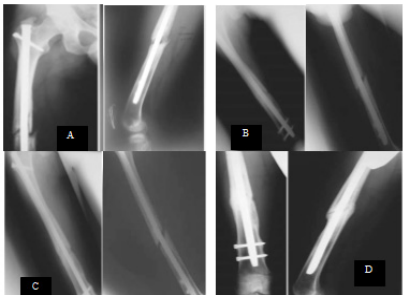
Table 1: Location of femur fracture site

Location	Frequency	Percent
Left	14	56
Right	11	44
Total	25	100

Table 2: Non-union type and its correlation with healing

Non-union Type	Healing after exchange interlocking nailing Non-union	United	Total
Hypertrophic	0	10	10
Atrophic	2	13	15
Total	2	23	25

A total of 25 patients were managed. There were 15 males and 10 females in this series. Most of the patients were between 25 – 45 year of age. Left femur was involved in 56% patients (Table-1).The type of non-union of femur and its correlation with bone healing using pre- and postoperative x-rays of the femur was analysed. The analysis shows better healing in hypertrophic non-union than in atrophic ones (Table-2). Twenty-three out of 25 cases (92%) healed uneventfully. Except for 2 out of 25 cases (8%) of persistent non-union, no significant complications occurred.



Figures 1A to 1D.

A) Atrophic nonunion after intramedullary nailing of a midshaft fracture of the femur (6 months postoperative).
B) No signs of healing and nail breakage 20 months postoperative.
C) Exchange nailing (1 month postoperative).
D) Solid union with excellent functional outcome postoperative.

Discussion:

A non-union of long bones including that of shaft femur is a difficult proposition for orthopaedic surgeons. Femur being the strongest and the longest bone in the body, it not only takes the brunt of loads during everyday life, its fracture has serious morbidity like non-union. Based on vascularity and osteogenic potential of fracture fragments' ends, Non-union has been classically classified into two types, i.e., hypertrophic (hyper-vascular) type and atrophic (avascular) type. This classification has both prognostic and treatment significance. The hypertrophic type has good healing potential and is often the result of poor fixation or loss of stability at fracture site. It benefits from stable fixation. The avascular type of non-union lacks osteogenic potential beside loss or lack of stability at the fracture site and requires bone grafting in addition to stable fixation.[8] Exchange nailing is an excellent choice for aseptic non-unions of non-comminuted diaphyseal femoral fractures, with union rates reported to range from 72% to 100%.[9]

Our data shows a healing rate of 92% for non-union of shaft femur fractures. Exchange nailing provides biological and mechanical effects that promote osseous healing. The biological effects result from reaming of the medullary canal, and the mechanical effects result from the use of a larger-diameter intramedullary nail. Reaming of the medullary canal increases periosteal blood flow and stimulates periosteal new-bone formation.[6] A large portion of the cortex loses perfusion immediately after reaming because the endosteal circulation is destroyed and bone marrow blocks the intercortical canals.[10] A nail that has a larger diameter than the intramedullary nail removed at surgery, provides greater bending rigidity and strength than the original nail.[11] Reaming also widens and lengthens the isthmic portion of the medullary canal. This increases the cortical contact area of the nail, which enhances mechanical stability.[12] Factors favouring fracture healing are minimal gap at non-union site, provision of adequate stability, and blood supply to the fracture fragments' ends.[13] The size of bone defects can affect the union rate.[14-15]

Though our study has focused only on aseptic non-union exchange nailing but literature review showed that many authors have used exchange nailing to treat infected non-union and have shown success.[16] In principle, exchange nailing should not be used in patients with acute infections. For those with acute infections, staged

operations with conversion to external fixation may be more suitable.[17-19]

Conclusions:

Exchange femoral interlocking intra-medullary nailing is a simple technique with minimal complications. This operative treatment option appears to have a high success rate and should be considered as the treatment of choice for aseptic, non-comminuted diaphyseal femoral non-unions which have bone gap of less than 1 Cm. We recommend static intramedullary exchange nailing in aseptic hypertrophic non-unions.

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