

Exchange Nailing for Delayed or Non Union of Diaphyseal Femoral Fractures

Irfaullah Ansari, Badaruddin Sahito, Faheem Ahmed Memon, Ghulam Mehboob

ABSTRACT

- Objective* To determine the effectiveness of exchange nailing for delayed or nonunion of diaphyseal femur fractures.
- Study design* Descriptive case series.
- Place & Duration of study* Department of Orthopaedics Jinnah Postgraduate Medical Center Karachi, from March 2009 to February 2012.
- Methodology* 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. Exchange nailing was performed.
- Results* A total of 36 patients were managed which included 27 males and 9 females. Twenty-four (66%) patients were between 30 – 40 year of age. Left femur was predominantly involved (56%). The non union involved middle third in 61% cases. Following surgery union was achieved in 33 (92%) cases. In 14 patients union occurred between 4 to 6 months. Superficial infection occurred in 2 patients.
- Conclusion* Exchange nailing is the one of best options for delayed or nonunion of femoral diaphyseal fractures.
- Key words* Delayed union, Diaphyseal femur fracture, Exchange nailing.

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. 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.³ Aseptic nonunion and less complicated cases respond well to an Ilizarov treatment.⁴

Exchange nailing for the treatment of an ununited long-bone fracture includes removal of the current intramedullary nail, reaming of the medullary canal, and placement of an intramedullary nail that is larger in diameter than the removed nail.⁵ In 1972, Olerud and Karlström reported an exchange of an intramedullary nail for a larger-diameter nail in the treatment of a nonunion of the tibia.⁶ The incidence of non-union following post traumatic fractures is reported to be between 5% and 10%.⁷

Correspondence:

Dr. Badaruddin Sahito
Department of Orthopedics
Jinnah Postgraduate Medical Centre
Karachi
E mail: sahitobadar@hotmail.com

Exchange nailing is most appropriate for a nonunion without substantial bone loss. The objective of this study was to assess the effectiveness of exchange nailing in delayed or nonunion of diaphyseal fractures.

METHODOLOGY:

This was a descriptive case series of patients with delayed or nonunion fractures femur treated by exchange nailing. It was conducted in the Department of Orthopaedics, Jinnah Postgraduate Medical Center Karachi from March 2009 to February 2012. Patients were included in this study through non probability convenience sampling technique.

All patients above the age above 18 year with aseptic non-union femur fracture treated with nail were enrolled. Those with hypertrophic nonunion following fixation and non-union associated with implant failure (K-nail or interlocking nail) were also included. Patients with infective non-union, segmental fractures or fractures with bone loss and open fractures were excluded.

Detailed history and examination were done. Radiographs, anteroposterior 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. At surgery prophylactic parenteral antibiotic was given which was switched to oral route after change of dressing 48 hours post-surgery. Oral antibiotics were continued for 5 days.

Patients underwent spinal or general anesthesia. Previously placed nail was removed. Reaming was carried till flutes of reamer cutting the cortex. Static interlocking nail of 1 or 2 mm more in diameter size and same length than previous, placed. In broken implants, fracture site was opened and nails removed. After reaming and fixing with nail, cancellous autogenous bone graft from iliac crest placed.

On first postoperative day patient mobilized with partial weight bearing and discharged after three days on antibiotics. Full weight bearing was started after 4 weeks. Follow ups carried at 2 weeks for 2months, then monthly for 7 months to assess the progression of union radiologically.

RESULTS:

A total of 36 patients were managed. There were 27 males and 9 females in this series. Most (n=24 - 66%) of the patients were between 30 – 40 year of age. Left femur was involved in 56% patients. The non union involved middle third in 61% cases, upper third in 22% and lower third in 17% patients. Previous implant used were K nail in 41%, open dynamic interlocking in 28%, open static nail in 17% and close static interlocking nail in 14%.

Following surgery union was achieved in 33 (92%)

patient, while in three (8%) non-union persisted. In 14 patients union occurred between 4 to 6 months while 19 fractures united after exchange nailing in 6- 9 months. In this study superficial infection was observed in 2 patients. No other problem was noticed.

DISCUSSION:

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%.⁶ 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.⁸ A large portion of the cortex loses perfusion immediately after reaming because the endosteal circulation is destroyed and bone marrow blocks the intercortical canals.⁹ In response to these effects, periosteal blood flow increases in order to maintain circulation in the cortical bed.¹⁰ The periosteum reacts to the increased blood flow by forming new bone which in turn aids in healing of the nonunion.¹⁰ Blood flow in the cortex returns to normal or supranormal levels within days after medullary reaming.¹¹

A nail that has a larger diameter than the intramedullary nail removed at surgery, provides greater bending rigidity and strength than the original nail.¹² Reaming also widens and lengthens the isthmus portion of the medullary canal. This increases the cortical contact area of the nail, which enhances mechanical stability. Mechanical stability can also be improved by increasing the length of the nail when the original nail was too short in one of the fragments.¹³ Furthermore, mechanical stability can be improved either by increasing the number of interlocking screws or by using a nail that allows placement of interlocking screws that are not purely parallel to one another.¹⁴

In our study after exchange nailing union was achieved in 92% patients. In one study fractures in fifty-five (49%) patients with non-union healed and 56 (51%) did not.² This study included open fractures as well as infected cases which were excluded in our series. This may be one of the reasons for good result in our study.

In another study thirty-three non-unions healed with a union rate of 91.7% (33/36) and a union period of median 4 months (range 3-8 months) with

three aseptic nonunions (8.3%).¹⁵ A study spanned over 10 years quoted fair results.¹⁶ Furlong reviewed their success with exchange nailing in 25 patients. Almost in half of the cases autologous bone grafting was used at the same time. Healing was observed in all but one patient at an average of 30 weeks. Union occurred more rapidly in patients undergoing a simultaneous bone grafting procedure.¹⁷ In our bone graft was also used thus results were more ideal.

Hak treated 23 patients with reamed intramedullary nails who had a lack of progression to healing for at least 4 months. The patients were treated with exchange nailing using an implant with a diameter 1 to 3 mm larger. All eight of the nonsmokers healed after exchange reamed nailing, whereas only 10 of 15 patients who smoked healed. Their overall success rate was 78%.¹⁸

CONCLUSIONS:

High frequency of union was observed following exchange nailing in this series. Exchange nailing is a simple, less time consuming procedure with excellent results. We recommend static intramedullary exchange nailing in aseptic hypertrophic non-unions.

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