Early Experience with Titanium Elastic Nails in a Trauma Unit

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Abstract

The Titanium Elastic Nail (TEN) offers a number of potential advantages over traditional ways of treating long bone fractures particularly in the paediatric population. These advantages include earlier mobilisation and shorter hospital stay and less risk of loss of fracture position. These advantages are most apparent and significant when treating femoral fractures in children where the length of hospital stay is reduced from several weeks to a typical period of 3 to 8 days. We have reviewed our early experience of using these implants over the past 2 years. Patients were assessed clinically and radiologically. 13 patients were treated using the TEN during this period. There were 2 femoral fractures, 4 humeral fractures, 1 tibial and 6 forearm fractures treated using the Titanium Elastic Nail. All fractures united during the study period. However 1 humeral fracture required a secondary bone grafting and plating for delayed union and 1 fracture lost position during follow-up. Insertion point pain was a problem in 4 patients but this resolved after nail removal in all. There was 1 superficial wound infection which resolved with antibiotics and 1 superficial wound infection of an open fracture wound which resolved following nail removal and antibiotics. There were no cases of deep infection. There were no limb length discrepancy or rotational or angular malalignment problems. Biomechanical principles and technical aspects of this type of fixation are discussed.

Introduction

The Titanium Elastic Nail (TEN) used in this hospital was introduced by Synthes (Failli, PA, USA) in 1997. Other flexible nails have been used in Europe over the past 2 decades. This is the first report of usage of this type of nail in Ireland.

The Titanium Elastic Nail (TEN) is a system of minimally invasive biological fixation. It is based on the symmetrical bracing action of two elastic nails. Each nail is pre-bent and makes contact against the inner cortex at three points. This provides resistance to flexion, translation, angulation and rotation. This type of elastic stable intramedullary nail is widely used in France and Germany and was first introduced in Nancy, France. This nail became licensed and available in the United States in June 1998.

The main indications for TEN use are diaphyseal fractures especially femoral fractures in children between the ages of 4 to 15 years. Adult humerus and forearm fractures fall into relative indications. The nailing system is versatile and can be used for metaphyseal fractures also.

The operative technique involves reduction of fracture, selection of entry point for antegrade or retrograde nail insertion. The recommended nail diameter is a third of the medullary canal as measured on x-ray. The nail is pre-bent to 3 times the diameter of the canal prior to insertion. The nail is advanced across the fracture. 1 cm of the nail is left proud at the entry point for ease of removal.

The standard method of treating most femoral fractures in children has been a period of bed rest, in traction followed by casting when early callus appears on x-ray. This typically involves 2 to 3 weeks of hospitalisation in a hospital which has social, psychological and economic costs. Other methods of treating this fracture include early casting which has a high incidence of loss of position or external fixation which has a high incidence of pin tract infection and late re-fracture after implant removal and solid IM nails which have a high risk of angular necrosis and growth plate injury. The TEN may be used for other long bone diaphyseal and metaphyseal fractures also.

Patients and methods

13 patients were treated using the TEN during the period from April 2001 to May 2002. There were 2 femoral fractures, 4 humeral fractures, 1 tibial and 6 forearm fractures treated using the Titanium Elastic Nail. Average age of the patients was 24.5 years (range 4 to 69 years). There were 9 males and 4 females. There were 12 closed fractures and one open fracture (humerus). All were treated using the standard techniques and recommendations as to nail length and diameter. Patients were assessed clinically and radiologically.

Results

All fractures united during the study period. However 1 humeral fracture required a secondary bone grafting and plating for delayed union and 1 fracture lost position during follow-up. Insertion point pain was a problem in 4 patients but this resolved after nail removal in all. There was 1 superficial wound infection which resolved with antibiotics. There was 1 superficial wound infection of an open fracture wound which resolved following nail removal and antibiotics. There were no cases of deep infection. There were no limb length discrepancy or rotational or angular malalignment problems.

Discussion

Our early experience with TENs for paediatric long bone fractures has been good. Use of this system for adult fractures in other centres has shown satisfactory results also.

Operative treatment of paediatric fractures in general is often looked at critically and performed only when conservative options have been clearly shown to be unsatisfactory. The main indications for surgery in paediatric fractures are displaced distal humeral and epiphyseal fractures. Osteosynthesis is rarely indicated for paediatric diaphyseal fractures due to excellent results of conservative treatment.

Internal fixation may be carried out in children with open fractures, head injuries, multiple injuries, and in unstable fractures. This is an accepted closed reduction. Internal fixation can be beneficial to reduce major complications such as premature epiphyseal closure (12%) and malunion (18%) in displaced forearm fractures.

In our study group internal fixation was carried out with flexible titanium nails by a closed procedure for a variety of paediatric and adult fractures. Overall our results were excellent in the paediatric group with no complications, however in the adult group we had one non union, one superficial insertion point infection, one
insertion point skin irritation and one open wound infection. There were shorter periods of splintage for upper limb fractures. The TEN was associated with much shorter periods of bed rest and hospital stay for paediatric lower limb fractures which has significant potential economic, social and psychological benefits.

We have successfully treated unstable adult and paediatric forearm fractures using the TEN system. The adults treated in our centre with this nailing system were informed of the treatment modality being used. This has allowed us to treat these fractures with a minimally invasive procedure. The principle alternative method of treating these forearm fractures involves plating the radius and ulna. Forearm plating involves a much more extensive surgical dissection with documented risk of nerve or vessel both at the time of plating and also at the time of metal removal.

Early experience with the TEN system on a relatively small number of patients has been satisfactory. The TEN system has been associated with a high union rate and relatively low rate of complications. Fixation of one distal radial fracture was associated with loss of position and along with other authors we would advise frequent and close follow-up.