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A preliminary clinical experience with Polarus nail for proximal humeral fractures. A pilot study on ten patients

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Abstract: The Polarus nail has recently been popularised to fix proximal humeral fractures. In the current pilot study we reviewed the early results obtained using this nail.

Ten patients with proximal humeral fracture (four pathological, 5 traumatic and one non-union) were fixed using a Polarus nail. The fractures were classified according to Neer (7 two-parts and 3 three-part fractures). The mean follow-up was 22 months (6-39) months. The following criteria were assessed: pain, range of shoulder movement and function. Seven patients were satisfied with their operation, their fractures healed in a mean period of 3 months (2-4 months). No postoperative neurovascular complications were encountered; the re-operation rate, was however 30%.

Conclusion: in the authors' brief pilot study in 10 patients, and despite the heterogenous fracture types, we came in to conclusion that the indications for using Polarus nail is limited due to the high complications rate associated with the procedure when used for displaced three or four part surgical neck fracture of humerus.

Key words: Polarus nail - Proximal humerus - Fracture - Complications

The basic concepts, indications and techniques of Interlocking humeral nails are applicable to most other interlocking nail systems used in tibial or femoral fracture fixation [1]. The Polarus nail is a solid nail used for proximal humeral fractures. It differs from other interlocking humeral nails mainly in the following:

1) The presence of 45 degrees proximal locking bolt's orientation, up to 3 screws can be inserted in different angles. 2) the presence of an accurate and easy to handle external guide jig for distal locking bolts.

We pursued this study to assess the value of this implant in the treatment of proximal humeral fracture in our hands.

Material and methods

Ten patients (6 females and 4 males) with a mean age of 57.5 years (range 18 to 88 years), presented with proximal third humeral fracture. The right dominant arm was affected in six patients and the left side was fractured in the remaining four. According to Neer's classification [5], the fracture was two part in seven and three parts in three patients; none of these fractures were associated with dislocation of the shoulder joint. The fracture was pathological in four patients, three of whom had metastasis (in one from breast cancer, in the second from the kidney and in the third one from the lung); the fourth patient had Paget's disease of affected humerus.

Nine patients sustained the humeral fractures as a result of recent trauma (during daily activities in the pathological cases, and following a fall in the rest). In one patient the Polarus nail was used in the treatment of non-union of proximal humeral fracture after a failed open reduction and plate fixation. The proximal humeral fracture was caused following a fall in five and following a minimal trauma in the remaining four (pathological fractures).

Upon examination, the general condition of patients with pathological fracture was poor with associated anaemia and biochemical disturbance. The affected arm was swollen and deformed with associated bruises in all cases; none of these patients however had any neurovascular problems of the limb. An anteroposterior and lateral scapular radiograph of the shoulder was obtained and assessed in all these patients. The adequate size and length of the nail was chosen after assessing these radiographs.

The indications for surgery were failure to maintain the proximal humeral fracture following reduction by manipulation under anaesthesia [5] and in pathological fractures to alleviate pain and encourage early mobilisation. The

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operation was carried out in a mean period of 6 days (1-14 days) of injury.

The operation was carried out under general anaesthesia in all patients. The mean duration of operations was 40 minutes (with a range of 60 minutes early in the series to 25 minutes later in the series). Blood loss was less than 300 ml in all our cases.

Technique

The patient is positioned lateral or supine with the arm on radiolucent table, the humerus should be easily seen using the C-arm.

The Skin incision is started at the acromioclavicular joint and proceeds distally and anterolaterally, to the deltoid fibres. The deltoid is split in-line, exposing underlying supraspintous muscle. A small longitudinal split is created in the insertion of the supraspintous muscle.

Using an awl, the entry point is created near the insertion of supraspintous, using a reamer, the canal is opened, and appropriate sized nail is inserted after reduction of fracture. Proximal and distal guided locking bolts are inserted. Wound closed in layers, a broad arm sling is applied (Fig. 1). During the postoperative rehabilitation period pendulum movements were initiated within forty-eight hours, followed by abduction of the shoulder within a fortnight of the operation.

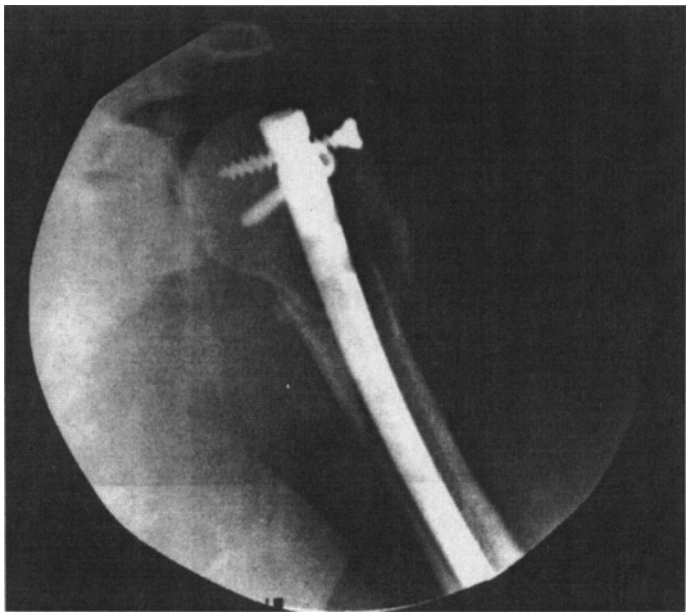

Fig. 1
Early postoperative radiograph showing satisfactory fixation of the proximal humeral fracture using Polarus nail.

Results

The mean follow-up period was of 22.5 months ranging from 6 to 39 months. Within 6-12 months of operation, the 3 patients with metastatic humeral fracture succumbed to malignant spread of their primary tumours. Assessment consisted of:

1. Monitoring pain, both at rest and on daily activities, on a five point scale,
2. Range of shoulder movements,
3. Level of function achieved compared to the pre-injury status,
4. Patient's satisfaction and radiological assessment.

Seven fractures united in a period between 8-15 weeks, the pathological fractures took on average an extra 4 weeks to heal. Healing of the fractures was assessed both on clinical examination and with postoperative radiographs, 4, 8, 12, 15 weeks after operation. The range of shoulder movement in these patients was as follows: 100-150 degrees of shoulder abduction and 30-45 degrees of shoulder rotation. All these patients were satisfied with the operation and were able to do domestic activities soon after the operation.

Complications

No serious general post-operative complications and no postoperative neurovascular deficit or infection was encountered. Local spreads of the tumour throughout the humerus occurred in a patient with metastatic lung cancer patient. This patient underwent forequarter amputation.

The following technical complications required further surgical intervention:

1. Early (within three months of surgery):

In two patients with three parts proximal humeral fracture, the proximal locking bolts cut out and lost purchase on humeral head. Both these cases were revised to a shoulder hemiarthroplasty.

2. Late (three months and onwards):

Subacromial impingement in one case, this responded to removal of the nail after fracture healing.

Discussion

It is still debatable as for which method is the best for internal fixation of proximal humeral fractures. Like humeral shaft fracture, the role of plate and nail fixation for proximal humeral fractures has been studied [2, 3, 4, 6, 7], and preference is still debatable. The complications of open reduction and internal fixation include malunion, non-union and avascular necrosis of head of humerus leading to a painful stiff shoulder [6]. Other complications include arthritis secondary to screw penetration of the joint, varus deformity of the surgical neck and non-union. On the other hand, unsatisfactory shoulder function following locked intramedullary nailing for proximal humeral fracture has been reported [7, 9]. Antegrade humeral nail is introduced through the rotator cuff, this can lead to stiffness of the shoulder and weakness following the rupture of the rotator cuff if the entry point is placed. When left prominent, the proximal part of the nail can impinge in the subacromial space.

We started using the Polarus nail for proximal humeral fracture in our hospital as this nail has recently been enthusiastically advertised for and popularised mainly on the other side of the Atlantic. After analysing our results we feel that this Polarus nail is a good implant to be used for two-part traumatic and pathological fracture fixation. The external jig was found to function well for inserting locking bolts as compared to other systems. We have not experienced any radial nerve complications with Polarus nailing.

Upon analysing our overall results, we were however disappointed for having a re-operation rate of 30% in our series. The Polarus nail has the following disadvantages:

1. Like other antegrade humeral nail, the approach causes an injury to the rotator cuff during the insertion of this nail and the subacromial impingement syndrome (one of our cases) caused by the prominent proximal part of the nail (as compared to retrograde humeral nails),

2. In our series the stability of proximal humeral head fixation was poor when used for three-part proximal humeral fracture and in osteoporotic bone.

The technical problems encountered while inserting the Polarus nail was due to the fact that deep insertion of the nail with the end flush with the humeral head was too low for the proximal bolts of the nail to engage in to the humeral head. On the other hand leaving the end of the nail prominent was associated with impingement in the subacromial space. Our recent paper has the weakness of studying only ten patients, three of which died early in the postoperative period because of metastatic disease. However, the high complication rate we encountered made the nail unpopular and was not possible to recruit more patients for this method of fixation. We highlight our experience and suggest a multi-centre comparative study comparing this nail with other methods of fixation of proximal humerus to be able to draw final conclusions.

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Premiers résultats du clou Polarus dans le traitement des fractures proximales de l'humérus

Résumé : Le clou Polarus a été récemment popularisé pour la fixation des fractures proximales de l'humérus. Dans cette étude, nous analysons les premiers résultats de l'utilisation de cette technique.

10 patients ayant une fracture proximale de l'humérus (4 pathologiques, 5 traumatiques et une pseudarthrose) ont bénéficié de cette osteosynthèse. Les fractures ont été classées selon Neer (7 avec deux fragments et 3 avec troisième fragment). Le recul maximum a été de 22 mois (6-36). Les critères de contrôle ont été : la douleur, l'amplitude des mouvements de l'épaule et la fonction. 7 patients ont été satisfaits de leur intervention, leur fracture avait consolidé dans un délai moyen de 3 mois (2-4 mois). Il n'a été noté aucune ccomplication neuro-vasculaire ; toutefois, la proportion de reprise chirurgicale a été de 30 %.

Conclusion : Après cette courte série d'essai chez 10 patients et malgré le caractère hétérogène des types de fractures, nous arrivons à la conclusion que l'utilisation du clou Polarus doit être limitée, car grevée d'un trop grand pourcentage de complications lorsque l'enclouage est utilisé pour des fractures fragments du col de l'humérus à trois ou quatre fragments.

Mots clés : Clou Polarus – Fracture proximale de l'humérus