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Nail versus Plate in Proximally Displaced Humeral Fractures

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Proximal humeral fractures are the third most common in elderly people after hip and distal radius fractures. The majority of these fractures are non displaced and are treated conservatively (Hodgson et al. 2003). In some patients displaced fractures require operative fixation. A low but persistent rate of complications continue to appear in the treatment of these fractures independent of the method of fixation used (Nho et al. 2007). The use of an intramedullary device allows for a minimally invasive procedure with early mobilization and little pain. The introduction of new locking plates with angular stability has obtained also good results in different studies.

The goal of this study is to compare a series of patients treated with an intramedullary device and a group of patients treated with locked plate for the treatment of 2-part and 3-part fractures of the proximal humerus.

Patients and Methods

All patients that were included in this study were treated in the Trauma Department of Hospital La Paz in Madrid and operated by an experienced trauma surgeon. From year 2003 to year 2007 106 patients were treated operatively for fractures of the proximal humerus. 60 patients were treated with methods other than locked angular plate or intramedullary rod (49 patients with

hemiarthroplasty and 11 with screws and or Kirschner wires). Of the 46 patients, 3 patients died from other causes, 6 patients were operated for four part impacted valgus fractures and were excluded from this study, so finally 28 patients were available for follow-up. 16 patients were treated with an intramedullary rod (Group 1) and 12 patients with a locked angular plate (Group 2). Their clinical records and x-rays were reviewed.

Their mean age was 67,8 years (range, 47-89) for Group 1 and 59,2 (range, 30-75) for Group 2. In Group 1 there were 4 3-part fractures and 12 2-part fractures and in group 2 there were 4 2-part fractures and 8 three part fractures.

All patients in the intramedullary rod group were operated through a deltoid splitting approach following a technique as described by Sosef et al. (2007). The patients in the plate group were operated through a deltoid splitting approach with a radiotransparent device jig that permits insertion of the screws percutaneously. 5 patients were operated through a standard deltopectoral approach. Postoperatively all patients were placed on a sling. Passive motion in flexion was permitted from day 1 and advanced to active assisted motion at 4 weeks. External rotation was allowed at 6 weeks.

Radiographic assessment was made at 6 weeks to assess bony union and to grade the reduction obtained. Malunion was considered, arbitrarily, for fractures with malalignment of more than 5 mm or angulation of more than 20 °. Constant scores were obtained at 1 year. Complications were recorded for each group.

Results

All patients had achieved bony union at 6 weeks. Malreduction or loss of reduction after initial reduction was seen in 4 patients in group 1 (25%) and 2 patients in group 2 (16 %). Active elevation higher than 120° was achieved in 10 patients in group 1 (62,5 %) and in 9 patients in group 2 (66 %). Constant scores had a mean of 68 (42-100) in Group 1 and 72 (49-100) in Group 2.

3 patients in group 1 were reoperated due to complications derived from hardware. There were migration of 2 screws proximally and 1 nail protrusion. In group 2 there was one reoperations due to hardware complications. Penetration of the screws was observed in one case that required removal. Impingement due to a high placed plate was observed in one case but the patient declined further treatment. There were no avascular necrosis in either group. One patient sustained a fracture distal to the tip of the nail and was reoperated with introduction of a longer distally locked nail.

Although statistical correlations were not included in this study due to the low number of patients there is a trend towards poorer results in patients with increased age, with malreduction (especially the greater tuberosity), with

fracture configuration (medial calcar comminution) and with complications related to hardware

Discussion

There is almost unanimous agreement in the conservative management of proximal humeral fractures, although good functional results are not always obtained (Koval et al. 1997). Surgical treatment of proximal humeral fractures can be treated nonoperatively, or with shoulder reconstruction with either osteosynthesis or prosthetic replacement. There are not current evidence-based criteria to decide upon treatment of these complex injuries (Nho et al. 2007). Displaced four-part fractures have poor results with nonoperative management and should be handled with shoulder replacement, excluding the four-part valgus impacted fracture. Displaced three-part and two-part fractures are amenable to operative fixation.

Many methods of osteosynthesis have been described to treat these fractures ranging from K-wires, screws, sutures, plates, intramedullary devices or a combination of both (Jaberg et al. 1992, Frankhauser et al. 2005, Dimakopoulos et al. 2007, Sosef et al. 2007). The approach has been varied also, including a percutaneous approach, a deltoid lateral split or a formal deltopectoral approach and occasionally a combination of these. The advantage of less invasive approaches include less dissection and a possible lower rate of avascular necrosis (Resch et al. 2001, Smith et al. 2007). In our study, almost 50 % of the fractures were three-part fractures and at one year no avascular necrosis was seen. Other advantages include less pain postoperatively and less scarring. Tuberosity reduction is possible and easy and placement of traction sutures in the cuff tendons can aid in reduction. These sutures can then be incorporated through the plate or around the proximal screws of the intramedullary rod. The disadvantages include those of a limited approach. Calcar reconstruction is not possible through a lateral deltoid split. In our study all except 5 cases were treated through a limited lateral deltoid split and no complications were observed due to this specific approach. No need to converse or change the approach was needed but fractures with comminuted and not reconstructed calcars had a tendency to collapse into varus malalignment.

The functional results were comparable to other reported in the literature. Due to the elderly population absolute Constant scores may not be a true representation of their clinical picture at final follow-up. Patients were generally satisfied with the procedure and could manage their daily routines. Although no former statistic analysis was made it is a personal observation of the authors that a bad reduction or malunion and increased age increased the likelihood of a worse clinical result. Malreduction of the head in a varus position due to calcar comminution decreased range of motion but otherwise was not associated with pain (Gardner et al. 2007). Malreduction of the greater tuberosity had a

tendency to show pain on overhead activities (if they could) and limited overhead function.

Problems related to hardware are avoidable problems that can hinder our results. Meticulous technique should be followed to allow for proper depth and height of the intramedullary rod or the locking plate, respectively. Use of fluoroscopy should aid in prevent intrarticular penetration. Due to collapse of some of these fractures is sometimes expected a 5-10 mm of subchondral bone window should be allowed between the screws and the joint (Frankhauser et al 2005). Repair of the cuff and augmentation of the fixation through nonabsorbable sutures passed through the cuff can enhance the fixation and improve the repair.

Literature

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Figures.

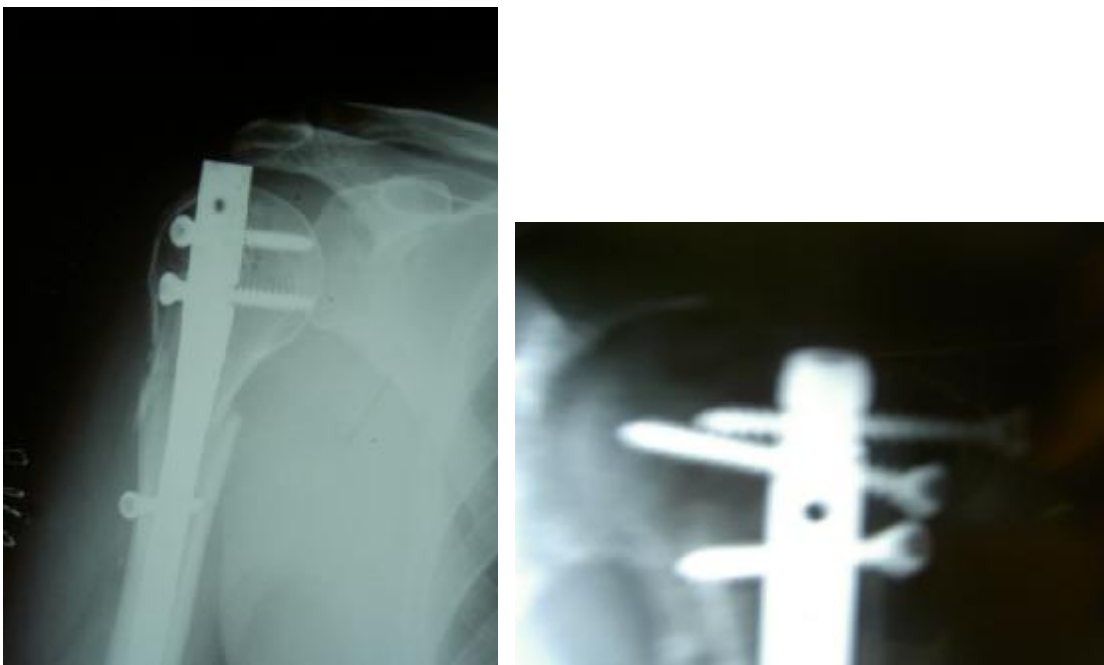


Figure 1. Complications following intramedullary rod fixation. Rod protrusion can be avoided by attention to proper surgical technique. Screw backout has been diminished with new design of proximal cap that locks the most proximal screw.

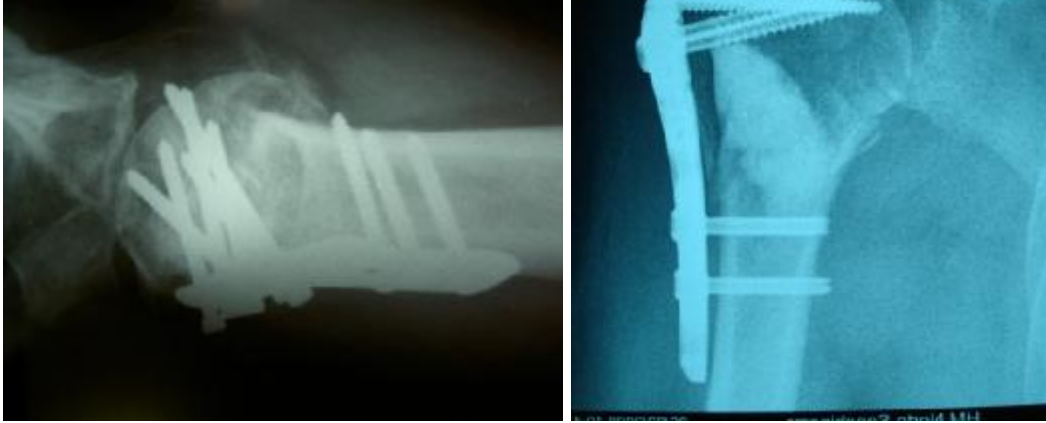


Figure 2. Complications after use of an angular stability plate. Collapse of the fracture with screw penetration into the joint is seen. Plate impingement because of superior placement. Hydro-set (Stryker) was used to aid in support of the humeral head.

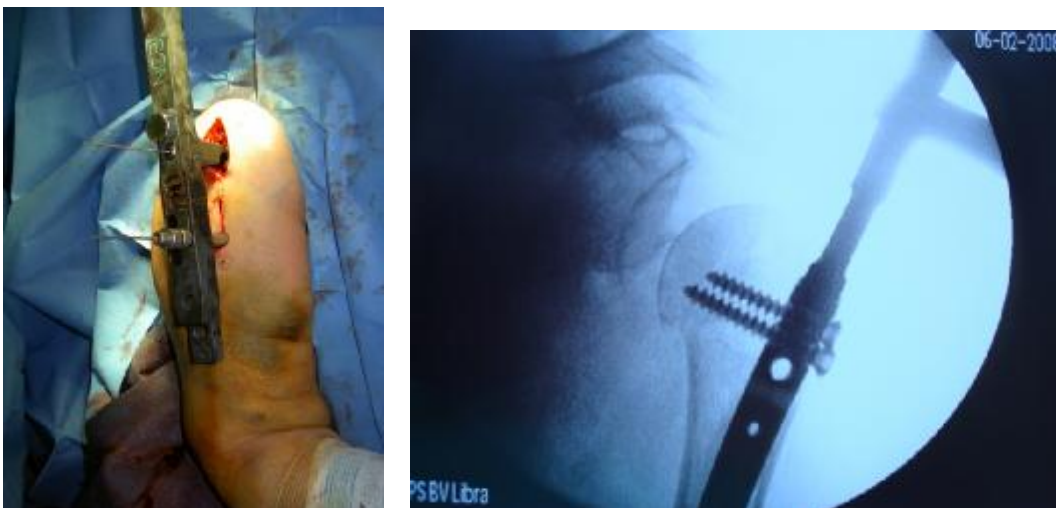


Figure 3. Percutaneous approach using the IM rod and the plate.

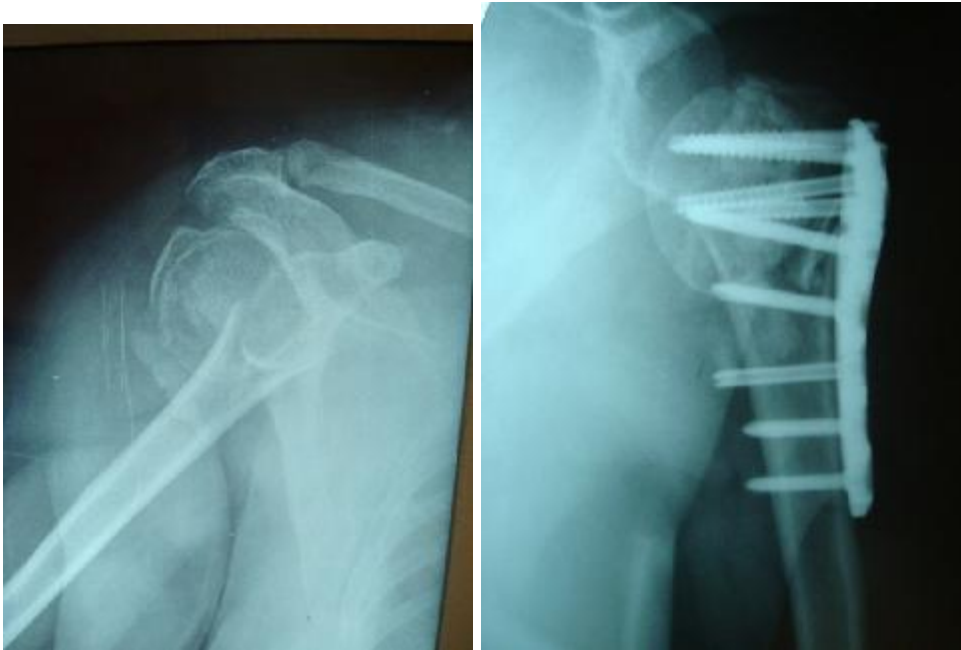


Figure 4. Calcar reconstruction is difficult through a limited lateral deltoid exposure but is critical to prevent varus malposition of the humeral head.