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Second generation locked plating for complex proximal humerus fractures in very elderly patients

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ABSTRACT

Objectives: Humeral head sacrificing procedures are more favored in elderly patients with complex proximal humerus fractures because of high incidence of failures and complications with osteosynthesis. The purpose of this study is to assess the outcome of second generation locked plating techniques in 3 and 4 part fractures in active elderly patients >70 years with an emphasis on function and complications.
Materials and methods: 29 patients with displaced 3 and 4 part proximal humerus fractures were treated using the principles of second-generation proximal humerus locked plating. Fixed angle locked plating (PHILOS) using the anterolateral deltoid spilt approach augmented with traction cuff sutures was performed. Minimum of 7 locking head screws including 2 calcar screws were used. In cases with a comminuted medial calcar, an endosteal fibular strut was used. Subchondral metaphyseal bone voids were filled with injectable calcium phosphate cement. Radiological outcome (union, head – shaft angle, tuberosity reduction), functional outcome assessment (Constant and ASES scores) and complications (loss of reduction, nonunion and osteonecrosis) were assessed.
Results: The fracture united in 24 of the 26 patients available for follow up at a mean of 27 months (12–40 months). 3 patients developed complications that required arthroplasty (fixation failure in 2 patients and osteonecrosis in 1 patient). Follow up age adjusted Constant (63.1 ± 11.9) and ASES scores (62.58 ± 7.5) showed the extent of functional improvement post surgery. Patients with fractures having a non-comminuted medial calcar and valgus displacement of the humeral head had better functional scores and fewer complications.
Conclusion: Osteosynthesis with second generation locked plating techniques provide satisfactory outcome in very elderly patients with complex proximal humerus fractures with minimal complications.

Introduction

Proximal humerus fractures have a bimodal distribution. The fractures in the elderly are usually osteoporotic low velocity fractures. Majority of these osteoporotic fractures can be treated conservatively with emphasis on early mobilization [1]. Complex fractures with displaced tuberosities, impacted articular segments and fracture dislocations will benefit from surgical management even in elderly patients [2]. While arthroplasty is a good treatment option in elderly patients with complex fractures, osteosynthesis have been reported with poor results and a higher reoperation rate [3]. Locked plating has been reported to achieve reproducibly good results in younger patients with complex fractures but the results

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have been variable in elderly patients. The technique of proximal humerus locked plating has undergone significant progress over the last decade. Second generation locked plating principles for proximal humerus fractures [4] advocate the use of anterolateral deltoid split approach, stress the importance of medial column support, avoiding varus reduction, use of traction cuff sutures and endosteal support in cases with a non-supportive medial column (Fig. 1). These techniques may help overcome the problems of osteoporosis, chances of humeral head osteonecrosis with the deltopectoral approach and presence of medial comminution, that commonly complicate outcome after locked plating in elderly patients. The purpose of this prospective study is to analyse the outcome of second generation locked plating techniques in complex proximal humerus fractures in patients >70 years of age.

Patients and methods

Records of 29 elderly patients operated for a displaced 3 and 4 part proximal humerus fractures with locked plating between 2012 (Feb) – 2014 (Nov) were prospectively collected and assessed. Our institutional review board approved the study and informed consent was obtained from all patients. Patients >70 years leading an active lifestyle with unrestricted use of the injured shoulder and limb were included. Pathological fractures, homebound patients, patients with previous history of rotator cuff problems, anatomical neck fractures, head splitting fractures and fracture dislocations were excluded. Preoperatively, patients were evaluated with an AP view of the injured shoulder and a CT scan as part of the hospital's protocol.

Surgical technique

A single surgeon through an anterolateral deltoid split operated all patients. Four non-absorbable sutures (no. 2 fiberwire: Arthrex – India) were placed in the cuff – tuberosity junction to help reduction of the head and tuberosity fragments. After securing the tuberosities, the articular fragment was gently manipulated using Schantz pins as joysticks or disimpacted with blunt elevators. The reduced head fragment was fixed provisionally using 1.8 mm K wires to the shaft followed by reduction of the tuberosities. The reduced tuberosity fragments were secured to each other using a fiberwire suture going around the tuberosities. A standard construct with a minimum of 7 locking head screws was used to fix the proximal segment including 2 kickstand screws in the PHILOS (Synthes – India). Remaining three rotator cuff sutures were secured to the plate holes after completing fixation.

In varus-displaced fractures with a comminuted medial column, an autologous fibular graft was used as an endosteal strut for stabilization of the osteoporotic humeral head. Metaphyseal bone voids if present after reduction were filled with injectable calcium phosphate in cases with a supportive medial column to provide subchondral support to the humeral head and maintain the head tuberosity relationship.

Technique of fibular graft harvest and usage

A 6–9 cm mid-segment autograft fibula was harvested from the ipsilateral lower limb. The graft was beveled on one side. The graft was introduced into the humeral canal through the lateral fracture lines with the beveled side facing proximal. The graft was pushed to the medial side of the shaft and then levered up using a 2.5 mm K wire joystick to prop up the humeral head and reconstruct the medial column. The reduced humeral head position was then provisionally secured by fixing the graft to the humeral shaft using 2 K wires. The screws from the plate help secure the graft in its final position (Fig. 2).

Passive range of motion exercises was started from day 1. A graduated supervised home physiotherapy was instituted for a period of 6 weeks followed by strengthening exercises. Patients were seen at the outpatient clinic every 3 weeks till union then at 6 and 12 months and at the final follow up.

Follow up assessment

Immediate postoperative and final follow up radiographs were assessed to measure head shaft angle, loss of head height (as described by Hettrich et al. [5]), tuberosity reduction (unsatisfactory if >5 mm initial displacement in any plane, and further loss of reduction in millimeters was recorded), loss of reduction and fixation, avascular necrosis and appearance of degenerative

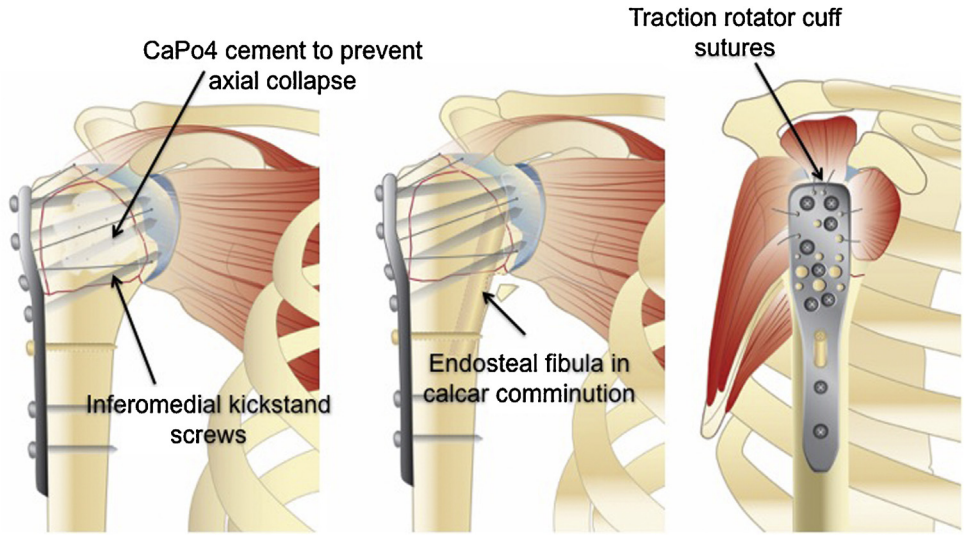

Fig. 1. Summary of surgical techniques used in second generation locked plating of proximal humerus fractures.