

Hinge Plate Technique for Osteosynthesis of Comminuted Proximal Humeral Fractures at Risk of Avascular Necrosis

Nermine Habib MD; Paolo Fornaciari MD; Jonas Müller MD; Mauro Maniglio MD; GREGOIRE THUERIG MD; Philippe Vial MD

Fribourg Cantonal Hospital, Fribourg, Switzerland

Purpose: Displaced comminuted proximal humeral fractures are often complicated with avascular necrosis of the humeral head. Predictors of ischemia were described by Hertel et al. in 2004. Patients with fractures associated with a high preoperative risk pattern of avascular necrosis often undergo shoulder arthroplasty. Our objective is to retrospectively evaluate the radiological and clinical outcome after application of a novel surgical technique, the hinge plate technique, described by the authors. The aim of this technique is the reconstruction of the original anatomy of the medial metaphysis.

Methods: From January 2016 to January 2019, 41 patients with comminuted proximal humeral fractures (Neer III and IV) were treated. These patients were all treated using the same surgical technique and postoperative protocol. The technique is described as open reduction and osteosynthesis by a Proximal Humerus Internal Locking System (PHILOS) plate associated with a 2.0 hand plate used as a hinge to support the calcar. The preoperative radiographs and, when available, the CT scans are assessed and the different predictors of ischemia for each patient are documented. The follow-up radiographs (minimum after 10 months postoperatively) are assessed for signs of avascular necrosis or pseudarthrosis. The reduction of the fracture is also assessed and evaluated using the above-mentioned criteria. The patients are also clinically assessed by means of the Oxford Shoulder Score.

Results: 41 patients had a follow-up of at least 10 months with radiographs, including 20 males and 21 females, aged 35 to 92 years with an average age of 65 years. 35 cases (85%) did not present any postoperative complications. Four cases of implant removal related to subacromial conflict were not considered a complication. Two cases showed secondary displacement requiring surgery. Four cases (10%) were complicated with pseudarthrosis (2 cases, both requiring revision surgery with consequent consolidation) or necrosis (2 cases, both treated conservatively in the absence of screw perforation). The total rate of reoperation was 10% (4 cases), of which only 1 case underwent conversion to arthroplasty. After reduction, 7 cases (17%) showed persistence of medial hinge disruption, while 3 cases (7%) showed postoperative angular displacement of the head. The clinical outcome, assessed by the Oxford Shoulder Score after the operation, showed an average of 44.7/48.

Conclusion: Proper reconstruction of the anatomy and stable fixation of the fracture is crucial in preventing avascular necrosis. If applied properly, the additional use of a hinge plate allows better realignment and hence a more successful outcome, representing at the moment the only alternative to arthroplasty. In the 10-month follow-up, the complication rate as well as the severity of the complications is lower compared with arthroplasty. However, a follow-up of 5 years is necessary.