

**Proximal Humerus Fracture Fixation with Locking Plate: Screws with a Length of 45 mm or Longer Are Related to Increased Risk of Cutout**

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**Purpose:** The arrival of locking plate systems for the fixation of proximal humerus fractures (PHFs) has changed the treatment for this condition, but also exposed patients and physicians to new complications. One of the complications most often reported in the literature is intra-articular screw perforation (cutout). Factors related to screw cutout are not known. Since there are no clear guidelines regarding the maximal screw length, our study focuses on assessing the screw length associated with postoperative complications. Our hypothesis is that patients sustaining a PHF treated with screws  $P > 45$  mm are subjected to more cutout and reoperations.

**Methods:** We retrospectively analyzed the radiographic and demographic data from cases of PHF treated with the Synthes Philos locking plate. All patients were operated at our institution between 2007 and 2013 with a mean follow-up of 12 months. Charts were reviewed for postoperative complications. A validation study was conducted in which a synthetic humerus fixated with screws of predetermined lengths underwent radiographs at variable angles. This allowed us to identify screws  $> 45$  mm on follow-up images with a level of confidence of 99%. Measurements were made with the SliceOMatic software and adjusted using the size of the plate to calculate a scaling ratio. We also measured the mediolateral head impaction, neck angulation, and height change between the first and last follow-up.

**Results:** We identified 171 cases with a mean age of 62 years (range, 17 to 94) and 116 females. A total of 80 complications were reported in 58 patients. 34 patients had cutout (20%) and of these, 14 (41%) were reoperated due to this complication. 81 patients (46%) had at least one screw  $> 45$  mm. Patients with screws  $> 45$  mm had a 2.5 risk of cutout ( $P = 0.016$ ) and 37% increased risk of reoperation. The presence of cutout was significantly associated with more complex fracture (Neer I-II = 17% vs Neer III-IV = 33%,  $P = 0.017$ ), initial varus deformity (34% vs 15%,  $P = 0.05$ ), osteonecrosis (55% vs 21%,  $P = 0.003$ ) and longer OR (operating room) time ( $P = 0.019$ ). Age, gender, diabetes and smoking did not correlate with cutout.

**Conclusion:** Incidence of screw cutout is associated with the length of screws and the fracture characteristics rather than patient's demographics or past-medical history. Our study points out the dramatic aspect of screw cutout and the subsequent risk of reoperation. It highlights the importance of avoiding the use of locking screws  $> 45$  mm when treating PHF.