Internal Fixation, Parallel Plating, and Selective Supracondylar Shortening for Distal Humerus Nonunions: Results of the Supracondylar Ostectomy and Shortening Procedure

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INTRODUCTION: Despite improvements in surgical techniques and implants, nonunion continues to complicate distal humerus fractures whether treated surgically or conservatively. Many distal humerus nonunions are associated with bone loss and rigid internal fixation is difficult to obtain, especially for low transcondylar nonunions and those with severe intraarticular comminution. The purpose of this study was to analyze the results of a strategy to address this challenge utilizing internal fixation using the Supracondylar Ostectomy + Shortening (i.e., S.O.S.) procedure for distal humerus nonunions. The goals of this procedure are to 1) optimize bony contact and compression through reshaping the nonunited fragments at the supracondylar level with selective humeral shortening, 2) maximize fixation using parallel-plating, and 3) provide biologic and structural augmentation with bone graft.

METHODS: Between 1995 and 2019, 28 distal humerus nonunions underwent internal fixation using the S.O.S. procedure at a single Institution. There were 14 males and 14 females with mean age of 47 (range 14-78) years at the time of the S.O.S procedure and an average of 1.7 prior surgeries. Medical records and radiographs were reviewed to determine rates of union, reoperations, complications, and Mayo Elbow Performance Scores (MEPS). Patients were also prospectively contacted to update their MEPS and gather additional information on complications and reoperations. Mean clinical exam follow up was 17 months, mean clinical contact follow up was 19 months, and mean radiographic follow-up was 32 months.

RESULTS:

Four patients did not have adequate follow up to determine union. Of the remaining 24 elbows, 22 (92%) achieved union; one of these 22 elbows required an additional bone grafting surgery prior to union. Two elbows developed collapse of the articular surface and were converted to a total elbow arthroplasty (TEA) at 14 months and 18 months. There were complications in 10 elbows: contracture (5 elbows), superficial infection (2), ulnar neuropathy (1), deep infection (1), and hematoma (1). Twelve elbows underwent reoperation: 4 for contracture release, 3 for hardware removal (2 for symptomatic hardware, 1 for deep infection), 1 for bone grafting, 1 for hematoma evacuation, and 1 for ulnar nerve neurolysis. Compared to preoperative data, there was a significant improvement in postoperative flexion, extension, and pronation ($p<0.01$). At most recent follow up, the mean range of motion was 20° of extension, 120° of flexion, 79° of pronation, and 78° of supination. At most recent follow up, the Mayo Elbow Performance Score could be calculated for 25 elbows, with a mean of 80 points (range, 25 to 100 points) and 19 elbows (76%) rated as excellent or good.

DISCUSSION AND CONCLUSION:

Stable fixation and high union rates are possible in distal humerus nonunions with bone loss using a technique that combines supracondylar humeral shortening, parallel plating, and bone grafting. Secondary procedures are commonly needed to restore function in this challenging patient population. At most recent follow up, one fourth of the elbows were rated unsatisfactory despite successful union or had required conversion to TEA. Despite these results, the S.O.S. procedure allows for union which remains preferable to nonunion or elbow arthroplasty in this group of patients.

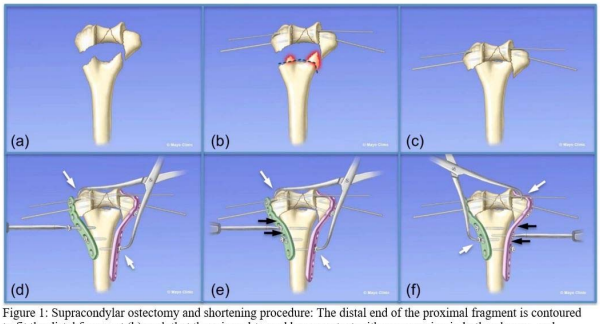

Figure 1: Supracondylar ostectomy and shortening procedure: The distal end of the proximal fragment is contoured to fit the distal fragment (b) such that there is end-to-end bony contact with compression in both columns, and usually side-to-side compression medially and/or laterally (c). Interfragmentary compression is obtained through the use of large bone clamps that provide compression during the insertion of the screws (d). Additional compression at the metaphyseal level results from slight under contouring of the plates and the use of dynamic compression holes in the plates (e - f).

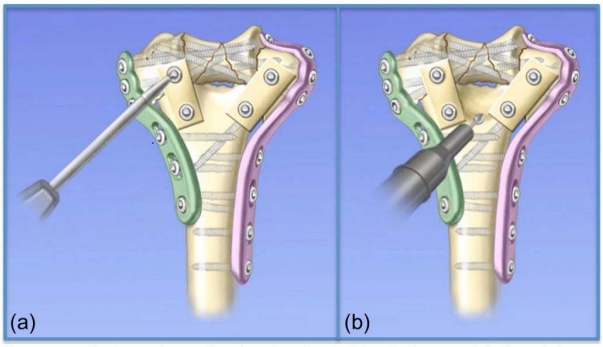

Figure 2a: Example of two corticocancellous "bone plates" harvested from the iliac crest and fixed posteriorly across the nonunion site, one on each column, with one screw above and one below the nonunion. Fig 2b: A new olecranon fossa is excavated using a burr at the posterior cortex of the distal humerus.