

# Pectoralis Major Reference Technique for Restoration of Humeral Length in Fracture Hemiarthroplasty

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**Background:** While hemiarthroplasty for complex proximal humerus fractures remains a viable option, numerous studies have reported poor functional outcomes despite satisfactory pain relief after surgery. The key reasons are incorrect positioning of the humeral stem and subsequent loss of tuberosity reduction. Therefore, restoration of the patient's native humeral head height is crucial for regaining function after this procedure. We present a simple and effective technique to restore humeral height using the numeric value of the distance from the insertion of the pectoralis major tendon to the superior aspect of the humeral head (PMHD).

**Description:** With the patient in beach chair position, a standard deltopectoral approach is used. The upper border of the pectoralis major insertion is identified and marked. With arm extension and external rotation, the trial stem is then inserted into the humerus with 20° of retroversion. According to the calculated value by PMHD formula [ $23 + (\text{height (cm)} \times 0.17) + 3.45$  (for men)], the patient's native humeral height is established by controlling the level of stem depth. After reduction into the glenoid, the proper alignment of the tuberosities around the prosthesis is confirmed. Three or four drill holes are created in the humeral shaft to pass #5 non-absorbable braided sutures for tuberosity fixation. The real stem is implanted using a cementing technique, with the stem height set according to the pre-measured value. Before assembly of the replicator plate and head implant, sutures are passed for horizontal and vertical fixation of the tuberosities. After fixing the head implant, the humeral height is finally confirmed. After reducing the head into the glenoid, suture fixations are completed with cancellous bone grafting.

**Alternatives:** Several techniques have been attempted to restore humeral height during hemiarthroplasty, including preoperative templating with a full-length radiograph of the uninjured humerus, specially designed jigs, tension of the long head of the biceps, and calculation by medial diaphyseal calcar. However, these methods have shown limitations, with errors resulting in shortening or over-lengthening of the humerus.

**Rationale:** The PMHD has been advocated to determine the height of the humeral stem. Because the upper border of the pectoralis major tendon is easy to identify, no further radiologic exposure or equipment is necessary. Previous studies advocated the use of PMHD as a reliable guide in restoration of proper humeral length with fixed PMHD values of 56-58mm. However, Kim et al. proposed a calculation formula through statistical analysis using 260 shoulder magnetic resonance images because a value of PMHD may vary with height and gender.

**Expected Outcomes:** Valenti et al. reported on 51 cases with fracture hemiarthroplasty using PMHD technique. Thirty-eight patients (74.5%) had satisfactory clinical outcomes, and 47 patients (92.1%) had proper position of the humeral stem. Greiner et al. reported better clinical and radiological outcomes including restoration of humeral length, and tuberosity positioning and healing in a group using PMHD technique compared to a control group.

**Important Tips:** Preoperatively, the patient's native humeral height is determined through the calculation formula [ $23 + (\text{height (cm)} \times 0.17) + 3.45$  (for men)].

After identification of the upper border of the pectoralis major insertion, the estimated humeral height is adjusted by controlling the depth of the stem.

The order of tuberosity fixation is as follows: interfragmentary sutures between the greater tuberosity and the humeral shaft, horizontal cerclage sutures for the tuberosities, and vertical sutures between the tuberosities and the humeral shaft.

**Conclusion:** Restoration of the patient's own humeral head height and anatomical healing of the tuberosities are crucial for regaining function after hemiarthroplasty for proximal humerus fractures. Pectoralis major reference technique is easy and useful for restoring humeral height and enhancing clinical and radiological outcomes after this procedure.