**Garden 1 and 2 Femoral Neck Fractures Collapse More Than Expected After CRPP**

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**Background/Purpose:** The outcome of CRPP (closed reduction and percutaneous pinning) of the femoral neck has been widely reported and shortening has been correlated with outcome. However, most reports are of displaced femoral neck fractures and little is known about the degree of shortening seen in minimally displaced and valgus impacted fractures. Most surgeons believe that these fractures are relatively stable and that shortening is not significant. The purpose of this study is to report on the final displacement after CRPP for Garden type 1 and 2 fractures in height, neck shortening, and loss of lever arm.

**Methods**: We reviewed the charts and radiographs of all patients with Garden 1 and 2 fractures seen at two hospitals over an 8-year period based on a prospective database of orthopaedic fractures. All initial radiographs were reclassified by a senior trauma attending prior to inclusion. Fractures with any varus were excluded. Garden 1 fractures were incomplete or valgus impacted with minimal angulation on the lateral radiograph. Fractures were considered Garden 2 if they were not displaced but had some angulation on the lateral radiograph. No fracture was displaced. Only patients with clearly united fractures were included; any patient who failed management or was not followed to unequivocal union was excluded. All fractures were fixed with an inverted triangle with attempts to place a screw close to the calcar and get wide spread, and all cases had screws in 3 quadrants. Screws were either 8.0 mm or 6.5 mm depending on the size of the patient. Radiographs were evaluated using a previously published method (Zlowodzki et al). The amount of displacement in millimeters was determined using the known screw width as a baseline for actual size. The final position at union was evaluated for femoral height, femoral neck shortening, and change in lever arm.

**Results:** A total of 115 patients (72 F, 43 M), average age 75 years, sustained 69 Garden 1 and 46 Garden 2 femoral neck fractures. Maximal shortening occurred in the plane of the femoral neck. Garden 2 fractures demonstrated more shortening than did Garden 1 fractures; however, both averaged ≥1 cm of femoral neck shortening. The results in all three planes are seen in Table 1. The range of displacements was 0 mm to 39 mm as measured along the femoral neck. 28/69 (41%) of Garden 1 and 27/46 (59%) of Garden 2 fractures demonstrated ≥10 mm of neck shortening.

**Table 1. Shortening in Millimeters**

| | Femoral Neck | Femoral Height | Offset |
|---|---|---|---|
| Garden 1 (69) | 10 ± 6 mm | 3 ± 4 mm | 10 ± 7 mm |
| Garden 2 (46) | 13 ± 8 mm | 6 ± 7 mm | 10 ± 9 mm |
| *P* value | 0.032 | 0.026 | 0.97 |

- The FDA has not cleared this drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an "off label" use). For full information, refer to page 600.

**Conclusion:** It has been widely believed that CRPP of minimally displaced or impacted femoral neck fractures heal with minimal displacement. This was not seen in our series, with 41% and 59% of Garden 1 and 2 fractures demonstrating at least 1 cm of neck shortening, which has been linked to worse outcomes in previous trials. In conclusion, Garden 1 fractures shorten less than Garden 2 fractures, but both have high rates of shortening when treated to union with CRPP.



See pages 99 - 147 for financial disclosure information.