

Can Perioperative Computed Tomography Hounsfield Units Predict Failure of Femoral Neck Fracture Fixation?

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Purpose: Global hip fracture incidence in 2050 may reach 6 million. Failure after fixation occurs in 10-30%. The purpose of our study was to determine whether Hounsfield Units (HU) on perioperative CT, a surrogate for bone density, correlated with radiographic outcomes. We hypothesized that lower HU correlates with shortening, screw cutout, and revision surgery.

Methods: We performed a single-center retrospective review from 2004 to 2015 in patients with a femoral neck fracture and perioperative CT. We included 131 patients ≥ 18 years of age treated with closed/open reduction internal fixation with screws or a sliding hip screw. We recorded demographic data, fracture type, and associated injuries. We recorded 2 HU in PACS (picture archiving and communication system) software: an axial femoral head (AH) slice at the foveal level, and a middle coronal neck (CN) slice. We reviewed charts and imaging for outcomes: femoral neck shortening >5 mm, screw cutout, and revision surgery.

Results: At a mean 31 months follow-up, we measured significant shortening in 50 patients. Screw cutout occurred in 16, and 37 required revision surgery (including HWR [hardware failure], revision ORIF [open reduction and internal fixation], or arthroplasty). The shortening group had significantly lower HU in the AH and CN versus non-shortening (AH: 202 vs 249.3, $P = 0.002$; CN: 78.2 vs 131.7, $P = 0.003$). The cutout group had significantly lower HU in the AH and CN than non-cutout (AH: 174.3 vs 239.3, $P = 0.018$; CN: 56.8 vs 119, $P = 0.013$). Multivariate analysis revealed 16.58 odds ratio (OR) of cutout with AH HU <146.06 (4.30-73.73), $P = 0.001$; CN OR 5.80, $P = \text{NS}$. The OR of shortening was 6.59 with CN HU <141.42 (1.99-26.80), $P = 0.019$; AH OR 2.90, $P = \text{NS}$. The OR of any shortening, revision, or cutout was 6.37 with CN HU <150.65 (2.20-20.61), $P = 0.006$; AH OR 2.24, $P = \text{NS}$. The non-shortening group had a younger mean age than shortening (53.2 vs 66.0, $P = 0.006$). Fixation device showed no difference. Displaced fractures shortened more often than nondisplaced (52% vs 48%, $P = 0.046$). No significance was seen for revision surgery or a composite outcome.

Conclusion: Our study revealed significant outcome differences for screw cutout and femoral neck shortening related to lower HU in the femoral head and neck. Logically, screw cutout more closely correlates to femoral head density, while shortening correlates with femoral neck density. HU measurement can aid surgical decision making regarding fixation or arthroplasty. Additional research is needed to better define clinical guidelines.