

## Open Reduction Internal Fixation versus Closed Reduction Internal Fixation in Treatment of Young Adults with Femoral Neck Fractures:

### A Multicenter Retrospective Cohort Study

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**Background/Purpose:** Femoral neck fractures in young adult patients often result from high-energy trauma and are associated with a high risk of complications, such as nonunion and osteonecrosis of the femoral head. There is controversy as to whether open reduction and internal fixation (ORIF) or closed reduction and internal fixation (CRIF) leads to better clinical outcomes for this nonelderly age group. The purpose of this study is to compare clinical outcomes and surgical complications between ORIF and CRIF for treatment of nonelderly adult patients with displaced femoral neck fractures.

**Methods:** In this IRB-approved, multicenter retrospective cohort study, young adult patients (18-65 years) with OTA 31-B2 or 31-B3 fractures with minimum 6-month follow-up or with postoperative complication within 6 months were included. Patients with pathologic or nondisplaced fractures, ipsilateral head or neck fractures, or who underwent arthroplasty as primary treatment were excluded. Patients treated by ORIF were compared to those undergoing CRIF. The primary outcome was reoperation. Secondary outcomes included nonunion, malunion, osteonecrosis, infection, osteoarthritis, heterotopic ossification, and fracture fixation failure. Injury and demographic characteristics were compared between treatment groups and those with bivariable association with outcomes ( $P < 0.2$ ) were used to fit a multivariable logistic regression to adjust for and identify predictors of reoperation.

**Results:** Of 239 patients enrolled from 13 academic institutions, 126 were treated with ORIF and 113 with CRIF. CRIF patients were older, had more comorbidities (diabetes mellitus, osteopenia) and more likely to have sustained OTA type B3 (displaced subcapital) injuries, while ORIF patients were more likely to have Pauwels Type III injuries and coincident femoral

shaft fractures. There was no significant difference in total reoperation rate between ORIF (47 [37.3%]) and CRIF (31 [27.4%],  $P = 0.14$ ), although ORIF patients had a significantly higher incidence of reoperation due to nonunion than CRIF patients (16.7% vs 5.3%,  $P = 0.010$ ) (Table 1). A multivariable logistic model that best fit the data included ORIF versus CRIF, age, Pauwels classification, coincidental femoral shaft fractures, and time to surgery (Table 2). Adjusting for other variables in the model, ORIF was associated with a 2-fold increase in the odds of reoperation versus CRIF (odds ratio [OR] 2.13, 95% CI 1.07 to 4.23,  $P = 0.02$ ), while coincident femoral shaft fracture was associated with a decreased odds of reoperation (OR 0.29, 95% CI 0.11 to 0.76,  $P = 0.01$ ).

**Table 1.** Bivariate analyses of reoperation and complications for non-elderly adult patients with displaced femoral neck fractures treated by ORIF vs. CRIF.

	ORIF (n=104)	CRIF (n=108)	P-value
<b>Total Reoperations</b>	35 (33.7%)	31 (28.7%)	0.23
Etiology [number (%)]			
AVN	7 (6.7%)	12 (11.1%)	0.21
Failure	1 (1.0%)	2 (1.9%)	0.89
Malunion	3 (2.9%)	5 (4.6%)	0.53
Nonunion	16 (15.4%)	7 (6.5%)	<b>0.039</b>
OA	2 (1.9%)	3 (2.8%)	0.71
SSI	6 (5.8%)	2 (1.9%)	0.12
<b>Total Complications</b>	45 (43.3%)	58 (53.7%)	0.17
Etiology [number (%)]			
Fracture nonunion	17 (16.3%)	10 (9.3 %)	0.13
AVN of femoral head	9 (8.7%)	20 (18.5%)	<b>0.034</b>
Surgical Site Infection	6 (5.8%)	3 (2.8%)	0.29
Heterotopic ossification	3 (2.9%)	2 (1.9%)	0.63
Osteoarthritis	4 (3.8%)	13 (12.0%)	<b>0.027</b>
Malunion	5 (4.8%)	7 (6.4%)	0.43
Fracture fixation failure	1 (1.0%)	2 (1.9%)	0.87
Death	0 (0%)	1 (0.9%)	0.32

**Conclusion:** In this multicenter retrospective study of open versus closed reduction for repair of femoral neck fractures in nonelderly adults with 6-month follow-up, patients treated with ORIF had significantly higher rates of reoperation after adjustment for patient characteristics and injury severity. A prospective randomized controlled trial is indicated to test whether there is a causal association between open approach to reduction and outcomes.