

Is Open Reduction and Intramedullary Nailing Deviation from the Standard of Care for Femoral Shaft Fractures? A Systematic Review and Meta-Analysis of Comparative Studies (Closed Versus Open Reduction)

Paul Korytkowski¹, John Panzone, Osama Mohammad Salem Aldahamsheh², Abduljabbar Alhammoud Abdulwahed³
¹SUNY Upstate Medical University, ²Montefiore Medical Center, ³Alraze Hospital

INTRODUCTION:

Femoral shaft fractures are significant injuries with a predominately traumatic etiology. Intramedullary nailing is the preferred surgical intervention and reduction of the fracture can be accomplished through closed or open methods. Closed reduction is often considered the gold standard as it is theorized that an intact fracture hematoma has osteogenic properties that will result in superior healing with fewer complications. Open reduction procedures persist in cases of polytraumatic injury, when the fracture proves difficult to reduce by closed methods, or in geographical areas with limited resources. Studies comparing outcomes between the treatments have conflicting results. The purpose of this systematic review and meta-analysis was to compare the outcomes and complications of intramedullary nailing of femoral shaft fractures between open and closed reduction.

METHODS:

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, PubMed (MEDLINE), Embase, Scopus, and CENTRAL were searched to identify comparative studies up to May 2022. The following search strategy was used in PubMed and modified for subsequent databases and registers: ("Femur*" [Text Word] OR "femoral" [Text Word] OR "Femoral Fractures" [MeSH Terms]) AND ("Intramedullary nail*" [Text Word] OR "fracture fixation, intramedullary" [MeSH Terms] OR "Bone Nails" [MeSH Terms]) AND ("Open Reduction" [Text Word] OR "Closed reduction" [Text Word] OR "Open Fracture Reduction" [MeSH Terms] OR "Closed Fracture Reduction" [MeSH Terms]). Additional studies were identified through hand and citation searching. Exclusion criteria included pediatric patients younger than 17 years of age, studies not published in English, and studies that reported fractures of the proximal or distal femur. The primary outcome was the rate of union. Secondary outcomes included time to union, operative time, and complication rate.

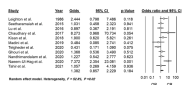
RESULTS:

A total of 11 studies met the inclusion criteria involving 1,481 femoral shaft fractures, 883 (59.6%) in the closed reduction group and 608 (40.4%) in the open reduction group. The union rate was 94.30% in the closed reduction group and 93.15% in the open reduction group with no significant difference between the groups [OR= 1.610 (0.972-2.667), P=.064]. There was no significant difference in the time to union between the two groups [MD = 2.480, 95% CI=-2.167-7.126 P=0.296]. The average operative time was longer in the open reduction group [MD= 17.830, 95% C=15.305-20.522 P<0.05]. There was no statistically significant difference in overall complication rate between groups. The most commonly reported complications were wound infection and delayed union in the closed reduction and open reduction groups respectively.

DISCUSSION AND CONCLUSION:

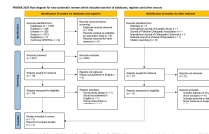
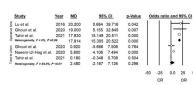
Open reduction and intramedullary nail fixation is a valid option for the treatment of femoral shaft fractures with comparable outcomes and complications to closed reduction.

Complication rate



Study	Total	Open	Closed	OR (95% CI)	P-value
Alraze et al.	100	50	50	1.2 (0.5-3.0)	0.68
Alshaykh et al.	100	50	50	1.1 (0.4-3.2)	0.85
Alshaykh et al.	100	50	50	1.3 (0.5-3.5)	0.62
Alshaykh et al.	100	50	50	1.4 (0.6-3.4)	0.48
Alshaykh et al.	100	50	50	1.5 (0.7-3.3)	0.32
Alshaykh et al.	100	50	50	1.6 (0.8-3.2)	0.18
Alshaykh et al.	100	50	50	1.7 (0.9-3.1)	0.12
Alshaykh et al.	100	50	50	1.8 (1.0-3.3)	0.08
Alshaykh et al.	100	50	50	1.9 (1.1-3.4)	0.04
Alshaykh et al.	100	50	50	2.0 (1.2-3.5)	0.01
Alshaykh et al.	100	50	50	2.1 (1.3-3.6)	<0.001
Overall	1481	608	883	1.61 (0.97-2.67)	0.064

Operative Time and Time to Union



Union rate

