

Evidence-Based Orthopaedic Trauma

Ipsilateral Femoral Neck and Shaft Fractures

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Background

Ipsilateral fractures of the femoral neck and femoral shaft are the result of high-energy injuries and have a guarded prognosis. Anatomic reduction of the femoral neck is considered a priority. Controversy exists whether a single implant or two separate implants provide the optimal fixation and outcomes following this fracture pattern.

Objective

To determine the effect of alternate devices in the management of ipsilateral femoral neck and shaft fractures in young patients on reoperation, deep infection, malunion, nonunion, and avascular necrosis.

Highest Available Evidence

1. Ipsilateral femoral neck and shaft fractures: systematic review of case series (level IV)* (1)
2. Femoral neck fractures only: meta-analysis of randomized trials (level II)** (2)
3. Femoral shaft fractures:
 - a. Meta-analysis of randomized trials—reamed versus nonreamed (level II)*** (3)
 - b. Randomized trial: antegrade versus retrograde (level II)**** (4)

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This manuscript does not contain information about medical devices.

Study Identification

1. Computerized database searches from 1969 to 2002
 Cochrane Database register of systematic reviews**
 PubMed:
 clinical query—systematic review engine***
 clinical query—therapy review engine****
2. Reviews of bibliographies of eligible articles*

Are the results of these studies valid?

	Strengths	Weaknesses
1. Ipsilateral femoral neck and shaft fractures meta-analysis	Comprehensive literature search Hypothesis generating information	Lack of direct, randomized comparisons between implants Possible bias in study selection No formal assessment of study validity
2. Femoral shaft fracture meta-analysis	Comprehensive literature search Eligibility criteria reported Study validity (quality) assessed Independent assessments of eligibility and validity No between-study heterogeneity Sensitivity analysis conducted	Randomized trials included suffered methodological limitations such as nonconcealed randomization, no blinding of outcomes, and incomplete followup
3. Femoral neck fracture meta-analysis	Same as 2	Same as 2
4. Antegrade vs. retrograde randomized clinical trial	Random patient allocation	Randomization unconcealed

RESULTS

Study	Age (yrs)	NU	ReOP	MU	IF	Hip AVN
Ipsilateral femoral neck and shaft (N = 659 patients)						
Screws in neck/shaft plated	34 (median)	H: N/R S: 8/82 (10%)	H: 0/82 (0) S: 5/82 (6%)	H: 1/82 (1.2%) S: 3/82 (4%)		H: 1/82 (1.2%)
Screws, pins in neck/shaft IMN	34	H: N/R S: 2/73 (3%)	H: 5/72 (7%) S: 1/73 (1.3%)	H: 1/72 (1.4%) S: 6/73 (8%)		H: 2/72 (3%)
Reconstruction nail (single implant)	34	H: N/R S: 0/38 (0%)	H: 6/38 (16%) S: 2/38 (5%)	H: 2/38 (5%) S: 1/38 (3%)		H: 2/38 (5%)
Femoral shaft only						
Reamed vs. nonreamed (N = 310)	35 (mean)	RRR: 76% (18–92%)	N/R	No difference RR: 1.04 (0.32–3.57)	RRR: 70% (42–84%)	
Antegrade vs. retrograde (N = 69)	32	None	N/R	No difference RR: 0.63 (0.16–1.45)	None	
Femoral Neck only	21–100 (range)					
Sliding hip screw/plate vs. 3 screws (N = 246)		RR = 0.60* (0.28–1.27)	RR = 0.51 (0.16–1.59)	N/R	N/R	RR = 0.61 (0.15–2.43)

NU, nonunion; ReOP, reoperation; MU, malunion; INFN, infection; IF, implant failure; AVN, avascular necrosis; H, hip; S, shaft; RRR, relative risk reduction; RR, relative risk.

*Relative risk of fracture healing complications with sliding hip screws vs. multiple screws (3 or more).

Evidence-based Pearl

Level of evidence		Grade of recommendations
Level I	Large randomized trials with clear-cut results and low risk of error, or meta-analyses of randomized trials with homogenous (similar) study results and narrow confidence intervals	A
Level II	Randomized trials with uncertain results and/or moderate to high risk of error; prospective cohort studies of high quality	B
Level III	Case-control studies or meta-analyses of case-control studies	B
Level IV	Case series with no controls	C
Level V	Expert opinion without explicit critical appraisal, or based upon physiology or bench research	D

Evidence-Based Bottom Line

Based upon the current available evidence, we report the following:

- Single implant versus separate femoral neck and shaft implants
 - Weak evidence (grade D)
 - Evidence from case series suggests separate femoral neck and shaft implants may result in fewer reoperations (1)
 - Prospective cohorts and randomized trials are needed

- Internal fixation of femoral neck—multiple screws versus screw and side plate
 - Moderate evidence (grade B)
 - Evidence from a meta-analysis of multiple randomized trials with heterogeneous study results suggests no difference between type of implant on fracture healing complications; however, the point estimate of relative risk favors sliding hip screws (2); larger, higher quality randomized trials are needed to resolve this issue
- Femoral shaft fracture: reamed versus nonreamed intramedullary nail
 - Strong evidence (grade A)
 - Evidence from a meta-analysis of multiple randomized trials with homogeneous study results suggests that reamed nails reduce the risk of nonunion by 76% (95% confidence interval, 18%–92%) (3)
 - Additional trials of femoral reaming may not be warranted
- Femoral shaft fracture: antegrade versus retrograde intramedullary nails
 - Moderate evidence (grade B) (4)
 - Evidence from a small randomized trial suggests a 47% reduction in malunion risk with antegrade nailing; however, the confidence interval is wide and crosses equivalence; larger trials are needed

Supplement: Glossary of Evidence-Based Orthopaedic Trauma (EBOT) Terminology

Let us assume that in a study of 200 patients, 100 patients receive a particular treatment, and 100 patients

serve as controls. The 2×2 table below illustrates the number of patients in each group that develop an infection. The following terminology can be used to describe the results:

	Infection	No infection
Treatment group	10 (A)	90 (B)
Control group	50 (C)	50 (D)

Treatment Event Rate (TER): $A/A + B = 10/100 = 10\%$

The incidence of infection in the treatment group.

Control Event Rate (CER): $C/C + D = 50/100 = 50\%$

The incidence of infection in the control group.

Relative Risk (RR): $TER/CER = 10/50 = 0.2$

The relative risk of infection in the treatment group relative to the control group.

Relative Risk Reduction (RRR): $1 - RR = 1 - 0.2 = 0.8$ or 80%

Treatment reduces the risk of infection by 80 percent compared to controls.

Absolute Risk Reduction (ARR) = $CER - TER = 50\% - 10\% = 40\%$

The actual numerical difference in infection rates between treatment and controls.

Number Needed to Treat (NNT): $1/ARR = 1/0.40 = 2.5$

For every 2.5 patients who received the treatment, one infection can be prevented.

Odds Ratio (OR) = $AD/BC = (10)(50)/(90)(50) = 500/4500 = 0.11$

The odds of infection in treatment compared to controls is 0.11.

95% confidence interval: One can consider the 95% confidence interval as defining the range that includes the true relative risk reduction 95% of the time. In other words, if the investigators repeated their study 100 times, it would be expected that the point estimate of their result would lie within the confidence interval 95 of those 100 times. In the current example, the 95% confidence interval around the point estimate of RRR (80%) is 63% to 90%.

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