Humeral Intramedullary Nailing Utilizing the Minimally Invasive Rotator-Interval Technique Improves Shoulder PROMs: Spare the Cuff!

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INTRODUCTION:

Intramedullary nailing (IMN) is an option for treatment of humeral shaft fractures. Most surgeons perform humeral IMN via splitting the rotator cuff (RTCS) in line with the supraspinatus tendon fibers, with shoulder pain reported as a frequent long-term complication. Alternatively, humeral IMN can be performed via the rotator interval with biceps tendon retraction (Minimally Invasive Rotator-Interval Technique, MIR-IT) and spare any incision through the tendinous portion of the RTC. The purpose of this study is to compare outcomes (shoulder PROMs - patient-reported outcome measures; surgical complications) of humeral IMN with the MIR-IT versus a RTCS technique.

METHODS:

A retrospective review of all patients with humeral shaft fractures treated with IMN from 2015 to 2022 at a busy academic Level I trauma center was conducted. Adult patients with radiographic and clinical follow up to union were included. Patients were contacted and validated shoulder PROMs (American Shoulder and Elbow Surgeons- ASES score; Quick DASH (Disability of the Arm, Shoulder and Hand), and Oxford Shoulder Scores -OSS) were obtained. Patients were stratified into MIR-IT and RTCS groups. Patient demographics, comorbidities, American Society of Anesthesiologists class (ASA), associated injuries, open fracture type, and ISS were collected. Primary outcomes were shoulder PROMs. Secondary outcomes were surgical complications including wound dehiscence, superficial and deep infection, nonunion, and iatrogenic nerve palsy. Independent t-tests or Mann-Whitney U tests were used for continuous variables and Chi-Square tests of Independence or Fisher Exact tests were used for categorical variables. A two-tailed post-hoc power analysis with alpha = .05 and a strong effect size (d = .88) yielded an achieved power (1-β) = .79. All analyses were conducted using same software.

RESULTS:

Seventy-one patients underwent humeral IMN (MIR-IT – 39; RTCS – 32). Fifty-five patients had radiographic and clinical follow up to union. Mean follow up was 7.5 months (range: 3.1-16.8 months). Baseline demographics were similar amongst both groups. There were no significant differences in nonunion (7.4% vs. 4.0% p=1.0), superficial infection (3.6% vs. 4% p=1.0), or iatrogenic nerve palsy (3.6% vs. 4.0% p=1.0) between the MIR-IT and RTCS groups. There were no deep infections or wound dehiscences in either group.

Forty-two patients had PROMs (MIR-IT -21; RTCS -21). Average time to PROMs collection was 35.7 months (range: 6.1 to 90.9 months). There were significantly better ASES scores (82.7 vs. 71.6 p=.015), Quick DASH scores (9.7 vs. 21.0 p=.011), and Oxford Shoulder Scores (39.3 vs. 33.9 p=.042) among patients treated with the MIR-IT.

DISCUSSION AND CONCLUSION:

Humeral IMN utilizing the MIR-IT results in better shoulder PROMs compared to a RTCS technique with similarly low surgical complication rates. Surgeons should consider utilizing the MIR-IT for humeral IMN.

Table 1. Humeral Shaft Fractures - Intramedullary Nail Fixation Techniques (MIR-IT vs RTCS): Demographics, Pre-Surgical Comparisons (N = 55)

	MIR-IT IMN n = 30	RTCS IMN n = 25	Statistical Comparison
Age Mean (SD)	54.4 (22.4)	55.1 (18.5)	p = .896
Gender % (n) Male	46.7% (14)	44.0% (11)	p = .843
BMI Mean (SD)	28.5 (7.5)	31.5 (8.9)	p = .181
Medical Comorbidities % (n)			
CAD	10.0% (3)	12.0% (3)	p = 1.000
A/COPD	3.3% (1)	8.0% (2)	p = .585
Diabetes	16.7% (5)	16.0% (4)	p = 1.000
Smoking	23.3% (7)	20.0% (5)	p = .766
Any Medical Comorbidities	30.0% (9)	36.0% (9)	p = .637
Any Mental Health Comorbidities % (n)	3.3% (1)	12.0% (3)	p = .320
Location of Fracture % (n)			
Proximal	43.3% (13)	20.0% (5)	p = .079
Middle	53.3% (16)	76.0% (19)	
Distal	0.0% (0)	4.0% (1)	
Segmental	3.3% (1)	0.0% (0)	
Open Fracture % (n)			
Type 1	13.3% (4)	4.0% (1)	p = .362
Type 3a	4.0% (1)	0% (0)	
Injury Severity Score (ISS) % (n)			
Mild (0-8)	33.3% (10)	48.0% (12)	p = .820
Moderate (9-15)	20.0% (6)	16.0% (4)	
Severe (16-24)	16.7% (5)	12.0% (3)	
Critical (>25)	30.0% (9)	24.0% (6)	