

Is there a Role for Isolated Closed Reduction in Displaced Proximal Humerus Fractures in Adolescents?

Beltran Torres-Izquierdo, Abhishek Tippabhatla, Keith D Baldwin¹, Rachel Y Goldstein², Julia S Sanders³, Jaime Rice Denning, Pooya Hosseinzadeh

¹Children's Hospital of Philadelphia, ²Children'S Hospital Los Angeles, ³Children's Hospital Colorado

INTRODUCTION:

Pediatric proximal humerus fractures (PHFx) are uncommon and comprise approximately 2% of all pediatric fractures. Displaced PHFx are even less common. Traditionally, most cases are treated nonsurgically with immobilization with no reduction (INR) or closed reduction (CR) with excellent outcomes. Yet, indications for CR without fixation remain unclear since immobilization in the position of reduction (shoulder abduction and external rotation) is not practical. We aim to determine the need for CR among adolescents with displaced proximal humerus fracture who are treated nonsurgically.

METHODS:

We conducted an IRB approved prospective multicenter study involving 42 adolescents aged 10-16 years, treated for a displaced PHFx across 5 institutions between 2018-2022. CR was performed under conscious sedation in the emergency department, with data collected during follow-up visits at 6 weeks and 3 months. Radiographic measurements, range of motion (ROM), and patient-reported outcomes including PROMIS Upper Extremity and Physical Function, SPADI, and QuickDash scores were compared between the INR and CR groups.

RESULTS:

Among 42 fractures, 23 (55%) were treated with INR and 19 (45%) with CR and either casting or sling. In total, 62% of cases were high-energy injuries. Radiographic alignment and ROM were similar between groups at preop, 6 weeks, and 3 months with no significant differences noted. PROMIS Upper Extremity, Physical Function, QuickDash, and SPADI scores at 6 weeks and 3 months showed no significant differences between cohorts. Significant improvement was observed between 6 weeks and 3 months for every PRO.

DISCUSSION AND CONCLUSION:

For displaced proximal humerus fractures treated nonsurgically, our data suggests INR has a similar radiographic and clinical outcome when compared to closed reduction. Our results question the necessity of performing CR in this group of patients.

Table 1. Patient demographics

Category	Value
Total patients	42 (100)
Age - mean(SD)	12.3 (1.5)
Gender	
Male	21 (50)
Female	21 (50)
Treatment	
No reduction and immobilization	23 (54.8)
Closed reduction and sling	12 (28.6)
Closed reduction and casting	7 (16.7)
Mechanism of injury	
High energy	26 (62)
Low energy sports	1 (2.4)
Low energy non-sports	15 (35.7)
Fracture location	
Proximal	10 (23.8)
Metaphyseal	32 (76.2)

Table 2. Immobilization with no reduction vs closed reduction X-ray measurements

Measurement	Immobilization with no reduction	Closed Reduction	P value
Neck	120(40)	108(32)	
Neck angle (SD)	15.1(1.2)	12.5(1.6)	0.384
Internal X-ray measurements			
preop Displacement AP view	25.8(22.3)	26.7(21.7)	0.703
preop Displacement lateral view	17.6(21.6)	20.2(26)	0.783
Angulation AP view (degrees)	24.7(11.7)	24.7(11.7)	0.563
Angulation lateral view (degrees)	24.7(11.7)	24.7(11.7)	0.563
Follow up X-ray measurements			
AP residual angulation at 6 weeks	21.4(11.4)	18.7(11.8)	0.569
lateral residual angulation at 6 weeks	21.7(11.2)	18.7(11.7)	0.269
AP residual angulation at 3 months	20.4(11.4)	18.7(11.1)	0.849
lateral residual angulation at 3 months	20.7(11.5)	18.7(11.1)	0.718

Table 3. Patient X-rays comparing only the patients who had a closed reduction

Measurement	N	Mean (SD)	P value
Pre-reduction AP angulation (degrees)	18	21.7(11.7)	0.433
AP angulation 6 weeks post closed reduction (degrees)	18	18.7(11.4)	
Pre-reduction lateral angulation (degrees)	18	24.7(11.7)	0.07
Lateral angulation 6 weeks post closed reduction (degrees)	18	18.7(11.1)	

Table 4. Range of motion in the no reduction and immobilization vs closed reduction treatment cohorts

Measurement	No reduction and immobilization	Closed reduction	P value
Internal rotation at 6 weeks (%)	81.2(11.1)	80.6(12.7)	0.827
Internal rotation at 3 months (%)	80.4(11.1)	81.5(11.6)	0.286
External rotation at 6 weeks (%)	81.1(11.1)	81.5(11.6)	0.721
External rotation at 3 months (%)	81.1(11.1)	81.5(11.6)	0.721
Flexion at 6 weeks (%)	71.8(22.9)	71.8(22.9)	0.608
Flexion at 3 months (%)	71.8(22.9)	71.8(22.9)	0.608
Abduction at 6 weeks (%)	81.1(11.1)	81.5(11.6)	0.817
Abduction at 3 months (%)	81.1(11.1)	81.5(11.6)	0.817
Extension at 6 weeks (%)	81.1(11.1)	81.5(11.6)	0.817
Extension at 3 months (%)	81.1(11.1)	81.5(11.6)	0.817

Table 5. Patient reported outcome scores comparing immobilization with no reduction vs closed reduction cohorts

Measurement	Immobilization with no reduction	Closed reduction	P value
PROMIS Upper Extremity 6 weeks	15.1(6)	14.2(10)	0.807
PROMIS Upper Extremity 3 months	16.8(6)	17.2(11)	0.102
PROMIS Physical Function 6 weeks	14.1(5)	14.1(11)	0.918
PROMIS Physical Function 3 months	16.1(5)	16.1(11)	0.918
QuickDash 6 weeks	102(15)	102(15)	0.608
QuickDash 3 months	107(15)	107(15)	0.608
SPADI 6 weeks	14.6(12)	15.2(12)	0.408
SPADI 3 months	17.6(12)	18.1(12)	0.408