

Ultrasound-guided reduction of distal radius fractures

Brian Chinnock, MD; Alexander Khaletskiy, MD; Kane Kuo, MD; Gregory W. Hendey, MD
Department of Emergency Medicine, UCSF Fresno and Community Regional Medical Center, Fresno, CA

Background/Objectives

- Appropriate reduction of a distal radius fracture correlates with decreased long-term pain, and increased function and strength.
- Ultrasound (US) may be useful for determining fracture displacement during reduction attempts.
- Our objective was to compare fracture reduction success in US-guided distal radius fracture reduction versus a historical cohort of non-US-guided distal radius fracture reductions.

Methods

Design: Prospective, observational study of patients undergoing US-guided distal radius fracture reduction, compared to a historical cohort without ultrasound.

Setting: Level 1 trauma center ED with an emergency medicine residency program

Patient population: Patients with distal radius fracture were enrolled over a 2-year period.

Measurements

- Fracture characteristics, mechanism of injury, previous reduction attempts prior to enrollment were recorded.
- “Successful reduction” was defined as “no further closed or open manipulation required.” Pre and post-reduction radiographs were reviewed by two blinded orthopedic surgeons.
- Primary outcome measure: Percentage of successful reductions
- ED physicians were also asked post-procedure, but prior to confirmatory radiographs, to rate the adequacy of fracture reduction
- Historical cohort assembled by random selection of ED patients with isolated distal radius fracture

Results

- 46 patients were enrolled in the US-guided fracture reduction group, and 44 in the non-US-guided control group.
- Fracture characteristics, mechanism of injury, and orthopedic surgeon assessment of pre-reduction difficulty were similar. (Table 1)
- More patients in the US group had undergone a prior unsuccessful reduction attempt (24% vs 2%).
- Fracture reduction success rates were similar between the US-guided and control group (83% and 80%, respectively). (Table 2)
- US had high sensitivity for detecting successful fracture reduction. (Table 3)

Table 1. Pre-reduction characteristics of patients having fracture reduction with and without US guidance.

Pre-reduction characteristics	Control Patients (n=44)	US-guided Patients (n=46)
Subject characteristics		
Age in years, mean (range)	30 (3-87)	32 (6-77)
Sex (%)	F: 21 (48)	F: 20 (43)
Fracture characteristics		
Angulation of distal fragment		
Posterior, n (%)	32 (73)	37 (80)
Anterior, n (%)	6 (13.5)	6 (13)
None, n (%)	6 (13.5)	3 (7)
Angulation > 20°, n (%)	24 (55)	22 (48)
AP Displacement		
None, n (%)	19 (43)	17 (37)
Partial, n (%)	9 (20)	11 (24)
Total, n (%)	16 (37)	18 (39)
Shortening, n (%)	26 (59)	28 (61)
Intra-articular, n (%)	4 (9)	9 (20)
Comminution, n (%)	6 (17)	9 (20)
Ulna Fracture, n (%)	25 (57)	25 (54)
Radioulnar dislocation, n (%)	1	1
Mechanism of Injury		
Fall, n (%)	34 (77)	35 (76)
MVA, n (%)	8 (18)	7 (15)
Other, n (%)	2 (5)	4 (9)
Previous Reduction Attempts, n (%)	1 (2)	11 (24)
Pre-reduction assessment of reduction difficulty		
Difficult, n (%)	17 (39)	21 (47)
Inter-rater agreement of reduction difficulty (%)	75	85

MVA = motor vehicle accident; F = female; AP = anterior-posterior

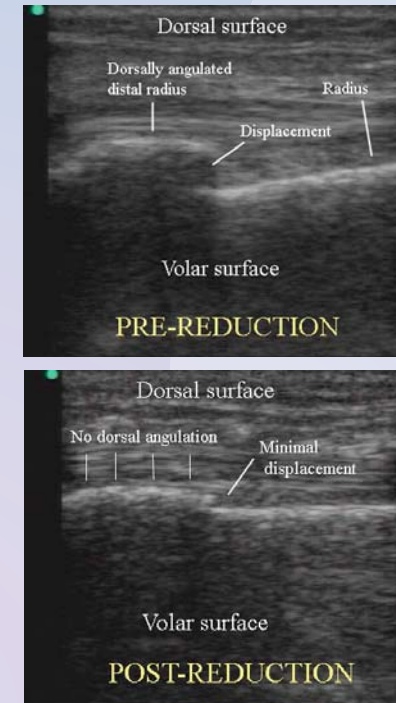


Table 2. Reduction success rates.

Successful Reduction	Control Patients			US-guided Patients		
	N	(%)	(95% CI)	N	(%)	(95% CI)
Overall	35/44	(80%)	(65% - 89%)	38/46	(83%)	(69% - 91%)
First-attempt*	35/43	(81%)	(67% - 91%)	32/35	(91%)	(77% - 98%)
Repeat-attempt**	0/1	(0%)	(0% - 83%)	6/11	(55%)	(28% - 79%)

* patients who were enrolled prior to the initial reduction attempt

**patients in whom one or more reduction attempts occurred prior to study enrollment

Table 3. ED physician assessment of reduction success as seen on US, compared to radiographic assessment of reduction success by orthopedic surgeon

	Radiograph successful reduction	Radiograph unsuccessful reduction
US successful reduction	33	4
US unsuccessful reduction	2	5

Sensitivity 94% (95% CI, 80% to 99%)

Specificity 56% (95% CI, 27% to 81%)

Limitations

- Use of a historical control group
 - Could not compare need for further closed or open repair
 - Unequal groups: US-guided had more patients who had undergone a previous unsuccessful reduction attempt
 - Possibility of other unknown differences between groups
- Reduction success measured with subjective, rather than objective, measure
- May not be applicable to geriatric or pediatric populations, or to other fracture sites.

Conclusions

- Patients who underwent US-guided distal radius fracture reduction had the same success rate as non-US-guided reduction, despite having a larger proportion of patients who had undergone previous unsuccessful reduction
- The ED physicians’ sonographic assessment of reduction was highly sensitive for successful radiographic reduction

