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BASIC RESEARCH

Who Is Lost to Followup?

A Study of Patients with Distal Radius Fractures

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Abstract Distal radius fractures are the most common upper extremity fracture, representing one-sixth of all fractures treated in emergency departments nationwide. Beyond the initial reduction and immobilization of these fractures, providing proper followup to ensure maintenance of the reduction and identify complications is necessary for optimal recovery of forearm and wrist functions. We sought to identify the clinical and demographic factors that characterize patients with distal radius fractures who do not return for followup and to assess the underlying causes for their poor followup rates. Compared with patients who were compliant with followup, those lost to followup had lower Physical and Mental Health scores on the SF-36 forms, more often were treated nonoperatively, and more likely had not surpassed secondary education. However, we found no difference between these two groups based on age, gender, mechanism of injury, marital status, or hand dominance. Early identification of patients who potentially are noncompliant can result in additional measures being taken to ensure the patient's return to the treating hospital and physicians. This in turn will prevent complications attributable to lack of followup and allow more accurate assessment of results, thereby improving patient outcomes.

Each author certifies that he or she has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.
Each author certifies that his or her institution has approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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Introduction

Distal radius fractures are the most common upper extremity fracture [3]. Achieving adequate initial reduction and immobilization and receiving proper followup to ensure maintenance of reduction and identify complications are necessary for optimal recovery of forearm and wrist functions [4]. Redisplacement of fractures, caused by deforming forces (such as the brachioradialis and extensor tendons), is common (10%–20%), and although individual patient factors such as age and amount of comminution at the time of initial injury [2, 5] contribute, patient followup can help mitigate its likelihood. Followup can ensure maintenance of the initial reduction. When the reduction is not maintained, early followup also can allow the surgeon to recommend surgery before formation of a soft callus, which would complicate an otherwise straightforward surgery. Complications associated with distal radius fractures can occur at any time during the healing process and include posttraumatic arthritis (7%–65%), loss of reduction (10%–20%), nerve injuries or neurologic complications (0%–17%), infection (4%–9%), tendon rupture (0%–5%), and delayed union, nonunion, and malunion (0.7%–4%) [6, 14].

Loss of patients to followup is common in orthopaedic surgery, particularly in the trauma population. The trauma population exists at a higher risk of societal marginalization and likely does not have the same accessibility to healthcare providers [7]. Patients lost to followup are demographically and clinically different from those who remain involved as reported in a long-term prospective

trauma study [7]. Other studies have found age, income level, type of treatment (operative versus nonoperative), and level of education may play a role in patients lost to followup [7–9, 11]. The underlying characteristics that predispose a patient to become lost to followup are difficult to identify and control [9]. Obtaining this information may allow healthcare providers to understand who these patients are and why they do not return for followup and to target this group and focus on ways to improve their treatment and recovery.

The purposes of our study were to (1) identify the clinical and demographic factors (age, income level, type of treatment, level of education, ethnicity, gender, severity of fracture, mechanism of injury, and marital and employment status) of patients lost to followup compared with those who did return, and (2) assess the underlying causes for their poor followup rates.

Materials and Methods

We reviewed data from 337 medical records of patients with distal radius fractures, unilateral or bilateral, who presented to the emergency room at three of our institution's metropolitan hospitals from November 2003 to December 2006 and agreed to enroll in a database registry. We excluded 44 patients including those younger than 18 years, those with polytrauma, those who sustained concomitant head injuries, and those for whom complete socioeconomic and injury information was not available. This left 293 patients for review. Data collected included mechanism of injury, hand dominance, and patient demographics. Baseline SF-36 [16, 17] and Disabilities of the Arm, Shoulder, and Hand (DASH) [1, 13] scores were recorded at the time of the initial injury. At the time of initial presentation to the emergency department, fracture treatment was categorized as either operative or nonoperative based on the fracture characteristics. The Orthopaedic Trauma Association (AO/OTA) classification, a system based on the degree of intraarticular involvement, was used to grade the degree of comminution and joint involvement on initial injury radiographs [10]. Patients were defined as being "lost to followup" if they consented to treatment and were treated for a distal radius fracture but failed to return for followup or participate in the study beyond the 2-week postinjury time. Of the 293 patients with complete information, 54 (18%) failed to return for followup after their initial injury and were categorized as lost to followup (Table 1). All patients with followup after the initial injury (within 2 weeks) also had followup of at least 6 months. We obtained prior Internal Review Board approval.

Each patient's fracture initially was closed reduced and patients wore a sugar tong splint. The patients then were instructed to return as an outpatient for definitive fracture treatment within 1 week of the initial injury. All patients returned in 1 week for followup. At that time, patients were treated either operatively or nonoperatively based on their fracture pattern. All patients, regardless of management, were scheduled for a 2-week followup to assess maintenance of closed reduction in the nonoperative group or for postoperative radiographs and assessment of open reduction and internal fixation in the operative group.

We obtained SF-36 and DASH scores, and anteroposterior and lateral radiographs, at 2 weeks, 3 months, 6 months, and 1 year postinjury.

We attempted to contact all 54 patients lost to followup; however, we were unable to contact 48 at their last known phone number or address. Six had either disconnected or provided incorrect telephone numbers, 10 had no listed phone numbers, and 32 did not answer on multiple attempts. We were successful in contacting six patients lost to followup, all of whom cited "inconvenience" as the reason for not returning. However, these six patients claimed to seek further care with outside physicians/hospitals for treatment.

All categorical values were analyzed as frequencies. Statistical analysis for differences between patients returning for followup and those lost to followup was performed using a chi square test for categorical values and Fisher's exact test for binary values. Differences in age were compared with a two-sample t test assuming unequal variances. Predictor variables that showed a significant difference in univariate analysis were subjected to logistic regression analysis as covariates. Continuous variables (SF-36 domains, DASH score) were dichotomized with the cut score set at the median. Categorical variables of more than two categories also were collapsed into dichotomous variables. Dichotomous variables then were entered into a stepwise logistic regression model to identify factors that independently predicted loss to followup. The resultant effects on patient followup after distal radius fracture are presented using odds ratios (ORs) with 95% confidence intervals (CIs).

Results

Compared with patients who returned for followup, those lost to followup more often had been treated nonoperatively and more likely had not surpassed secondary education levels. Patients who were compliant with followup had higher Physical and Mental Health scores on the SF-36 compared with those lost to followup (Table 2).

Table 1. Sociodemographic, injury, and treatment information for patients with and without followup

Variable	Lost to followup (n = 54)	Returned for followup (n = 239)	p Value
Fracture (OTA class)			0.387
23.A (extraarticular)	28 (51.9%)	109 (45.6%)	
23.B (partial articular)	11 (20.4%)	40 (16.7%)	
23.C (complete articular)	15 (27.8%)	90 (37.7%)	
Treatment			0.001
Operative	18 (33.3%)	139 (48.2%)	
Nonoperative	36 (66.7%)	100 (41.8%)	
Mechanism of injury			0.862
Low energy	40 (74.1%)	180 (75.3%)	
High energy	14 (25.9%)	59 (24.7%)	
Injury to dominant hand			0.88
Yes	26 (48.1%)	111 (46.4%)	
No	28 (51.9%)	128 (53.6%)	
Education			0.009
No high school diploma	16 (29.6%)	46 (19.2%)	
High school diploma	24 (44.4%)	64 (26.8%)	
Some college	8 (14.8%)	51 (21.3%)	
College degree	5 (9.3%)	51 (21.3%)	
Postgraduate education	1 (1.9%)	23 (9.6%)	
Marital status			0.531
Married/partnership	37 (68.5%)	151 (63.2%)	
Single/divorced/widowed	17 (31.5%)	88 (36.8%)	
Employment status			0.117
Currently working	24 (44.4%)	138 (57.7%)	
Unemployed	7 (13.0%)	22 (9.2%)	
Student	4 (7.4%)	8 (3.3%)	
Retired	18 (33.3%)	66 (27.6%)	
Income			0.001
> $50,000/year	4 (7.4%)	45 (18.9%)	
≤ $50,000/year	13 (24.1%)	52 (21.8%)	
< $25,000/year	24 (44.4%)	49 (20.6%)	
No income	13 (24.1%)	92 (38.7%)	
Workers' Compensation			0.077
Yes	3 (5.6%)	37 (15.5%)	
No	51 (94.4%)	202 (84.5%)	
Ethnicity			0.127
White	18 (33.3%)	111 (46.4%)	
Black	9 (16.7%)	27 (11.3%)	
Hispanic	14 (25.9%)	59 (24.7%)	
Asian	12 (22.2%)	29 (12.1%)	
Other	1 (1.9%)	13 (5.4%)	
Gender			0.531
Male	21 (38.9%)	82 (34.3%)	
Female	33 (61.1%)	157 (65.7%)	
Age (years)			0.709
Average	54.2	55.2	
Range	19–92	18–91	

OTA = Orthopaedic Trauma Association.

Table 2. Baseline self-administered health and functional assessment scores

Assessment tool	Lost to followup			Returned for followup			p Value
	Mean	95% CI		Mean	95% CI		
SF-36 subscales							
Physical function	82.5	75.0	90.0	89.5	86.8	92.1	0.0414
Role physical	86.5	79.8	93.2	91.8	89.1	94.5	0.1230
Bodily pain	86.7	80.7	92.8	92.6	90.3	94.8	0.0426
General health	66.8	60.9	72.8	79.4	76.7	82.2	0.0003
Vitality	72.3	67.0	77.7	75.3	72.7	77.9	0.3557
Social functioning	87.0	82.2	91.7	91.7	89.2	94.2	0.1158
Role emotional	91.8	86.3	97.4	94.4	92.2	96.6	0.3643
Mental health	79.6	74.6	84.6	80.6	78.3	82.9	0.7276
SF-36 component summary							
Physical health	78.5	73.8	83.3	85.7	83.7	87.7	0.0049
Mental health	79.0	74.8	83.2	84.4	82.4	86.4	0.0261
DASH symptom score	9.5	3.8	15.1	5.2	3.4	7.0	0.0746

CI = confidence interval; DASH = Disabilities of the Arm, Shoulder, and Hand.

There were no differences in age, gender, mechanism of injury, marital status, hand dominance, or Workers' Compensation claims between patients lost to followup and those not lost to followup (Table 1). Patients with a distal radius fracture treated operatively were more likely ($p < 0.001$) to return for followup than patients treated nonoperatively. Patients with fractures (complete articular fractures of the distal radius) classified as OTA 23.C were more likely ($p = 0.02$) to return for followup care than those with fractures classified as OTA 23.A (extraarticular fractures) or OTA 23.B (partial articular fractures). Patients with postsecondary education and higher average income level (> $55,000) also were more likely to return for followup. There were no patients with followup greater than 2 weeks but less than 6 months. Patients lost to followup did not return after 2 weeks and patients who were compliant were seen for followups at least through 6 months.

Nonoperative management (OR = 2.4; 95% CI, 1.3–4.6; $p = 0.007$)), lack of postsecondary education (OR = 3.0; 95% CI, 1.5–5.9; $p = 0.002$), and SF-36 General Health subscale score less than 80 (OR = 2.8; 95% CI, 1.5–5.3; $p = 0.002$) predicted loss to followup.

Discussion

Achieving adequate initial reduction and immobilization and receiving proper followup to ensure maintenance of reduction and identify complications are necessary for optimal recovery of forearm and wrist functions [4]. The purposes of our study therefore were to (1) identify the clinical and demographic factors that characterize patients with distal radius fractures who do not return for followup and to (2) assess the underlying causes for their poor followup rates.

The major limitations of this study are (1) its retrospective nature, even though our data were collected prospectively. The information collected here only provides part of the picture, as at the time of the study, we were unable to contact these patients to ascertain their reasons for loss to followup, and therefore there are missing data. (2) Our numbers are limited although we were able to show differences with many of the factors. (3) Factors pertaining to insurance status, including lack of insurance, were not collected as part of the database and therefore we are unable to comment on whether lack of followup may be attributable to inability to pay or other financial reasons. We did find having Workers' Compensation status had no impact on patient followup.

Age was reported as a factor of patients lost to followup [7]. However, we found age as a single factor in patients lost to followup unimportant. Murnaghan and Buckley [7] reported patients lost to followup after sustaining a calcaneus fracture were younger and more likely to be unskilled workers. Our data are similar if we infer from their study the younger, unskilled worker does in fact have a lower education level. Murnaghan and Buckley [7] found overdue followup was more common in patients aged 25 to 34 years. The average age of our patients with a distal radius fracture was 55 years. In another study, living alone and advanced age were independent factors of loss to followup [18]. A reason cited for this is people older than

65 years tend to move when they experience changes that reduce their ability to live independently [11]. We found a SF-36 General Health subscale score less than 80 predicted loss to followup. If we associate poorer health with advanced age, our data are similar to those reported by others [7, 11, 18]. However, age alone was not a factor in predicting patients lost to followup.

Our study showed patients with a high school diploma or higher or an income level greater than $55,000 also were more likely to return for followup. Our findings are similar to those of Zunzunegui et al. [18], who reported less educated, poorer patients are more likely to be lost to followup. Their study, however, may be biased by their patient population, who were selected based on the type of injury predominantly sustained by younger, more active individuals than those in our cohort of patients [7].

Patients in our study treated with operative fixation were more likely to return for followup than patients treated nonoperatively (66.7% versus 48.2%). Data for patients lost to followup after sustaining a rotator cuff tear suggest similar reasons based on initial surveys [9]. The patients lost to followup were less likely to have had an initial surgical procedure in the first place. Surgical care may cause patients to feel as if more time and effort have been invested in their care, thereby increasing their desire to continue their care. Also, those requiring surgery may have worse initial injuries and therefore perceive postoperative followup as an essential part of their recovery. This is consistent with our data showing patients with intraarticular fractures (OTA 23.C) as classified by the OTA classification also were more likely to require surgery and thus return for followup than patients with extraarticular fractures treated with closed manipulation.

Mobility of patients, a factor that often is uncontrollable and difficult to predict, also plays a part in patients lost to followup. According to the US Bureau of the Census, greater than 20% of Americans move each year. Between 1995 and 2000, 80% of the population aged 25 to 39 years were mobile in metropolitan areas [15]. On moving, patients often change their place of employment, choice of insurance carrier, and physician [12]. Patients often do not live and work in the same place, and for this reason, those lost to followup may have sought care somewhere more convenient than where they initially sustained the injury.

Murray et al. [8] studied patients lost to followup after elective total joint arthroplasty and found these patients had worse outcomes than patients who continued to be assessed. A survival analysis that does not account for patients lost to followup is more likely to give falsely optimistic results [8]. Even the loss of a small number of patients can result in statistically significant changes, particularly in studies with small sample sizes [12]. The time-sensitive nature of fracture healing and bone formation makes timely adherence to followup protocol essential. Failure to do so may increase the risk of fracture-associated complications and ultimately necessitate additional surgical interventions that could have been prevented. Identifying factors that lead to loss of followup is important in directing the efforts needed to increase successful followup rates. This is useful in trauma clinics, where loss to followup of 30% to 40% is not unusual.

Our data allow us to target the subgroup of patients more likely to be lost to followup and thereby minimize their numbers and decrease the possible complications that may result from unmonitored recovery. We now are more aggressive in identifying these patients and making an increased effort to maintain contact with them.

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