Factors Associated with Patient Delay in Scaphoid Nonunions

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Abstract Delay in seeking medical attention by patients, —so-called patient delay, contributes to the relative high rate of delayed diagnosis and treatment in scaphoid nonunion cases. In this retrospective study we investigated the incidence of patients with a patient delay exceeding 6 months, thus by definition having an established nonunion. In addition to this, we investigated demographic, injury and patient related factors associated with this patient delay in scaphoid nonunion patients. We included 101 patients with established scaphoid nonunions treated surgically at our specialized hand surgery unit. Information regarding demographic and injury characteristics, and subjective patient related factors was obtained from medical records and a questionnaire-based survey. Sixty-four patients (63 %) responded to our survey. A quarter (25 %) of the patients showed a delay of more than 6 months. Demographic and injury characteristics were not related to this delay. In contrast to this, not attributing post-injury symptoms to a fracture but to e.g. a sprain instead, showed to be an independent predictor of patient delay. We report a high incidence of patients with an established scaphoid nonunion who delayed seeking medical attention. As there appears to be no demographic or injury characteristics associated with this patient delay, future developments of strategies to reduce patient delay should be targeted on all patients with a suspected scaphoid injury.

Keywords Scaphoid · Nonunion · Delay · Medical attention

Introduction

The scaphoid fracture is the most common fracture of the carpal wrist. In the United Kingdom, the annual incidence of scaphoid fractures is 29 per 100.000 [1]. Although the majority of these scaphoid fractures unite with conservative treatment, most case series report an approximate 10 % nonunion rate [2, 3]. The scaphoid bone is relatively prone to nonunion due to its small, complex geometry and poor blood supply [4]. Delay of treatment has shown to be an important predictor in the failure of scaphoid fractures treatment [5]. Nonunion rates of up to 40 % are reported when treatment is delayed by more than 4 weeks [6].

Next to incorrect clinical management —also referred to as doctor delay, patient factors contribute to a delayed diagnosis and treatment of scaphoid fractures. Reigstad et al. noted a high threshold for seeking medical help among the predominantly young men with acute scaphoid fractures [7]. Social deprivation, including lower socioeconomic status and limited education seem to affect patient attendance behavior [8–10]. Also post-injury symptoms are often misinterpreted as a sprain by both patient and doctor [7]. A recent cohort study of scaphoid nonunion cases reported that more than 60 % of these patients did not seek medical attention within 24 h after their wrist injury and almost 50 % of these patients not within four weeks post-injury [11]. We had the impression that many patients with a scaphoid nonunion seek medical attention after a nonunion already has been established, —by definition more than six months after the initial injury [12].

Current research is mainly focused on improving clinical and radiological management in an effort to reduce doctor

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delays, and consequently decrease nonunion rates. We believe that also efforts should be made to reduce patient delay, especially in those patients with scaphoid fractures who are likely to wait more than 6 months and show a declined healing potential. A better understanding of the incidence and factors associated with this delay may help to optimize the management of scaphoid injuries. The aim of this retrospective study was (1) to investigate the incidence of patient delay greater than 6 months (i.e. chronic delay) in a patient cohort with established scaphoid nonunions, and (2) to identify demographic, injury and patient related factors associated with this patient delay.

Methods

Data Acquisition

A database search identified 101 patients treated for scaphoid nonunions at our specialized hand surgery unit between 2000 and 2013. Inclusion criteria included patients who received treatment for a unilateral symptomatic non-united scaphoid fracture. Exclusion criteria included concomitant musculoskeletal injuries. This study was approved by our human research committee.

A questionnaire-based paper survey was mailed to all participants with questions regarding demographic, injury and patient related topics. Demographic and injury characteristics, and date of the initial consultation of a medical professional were also reviewed and extracted from their medical records. Collected data included gender, age, marital status, native language, education, employment status, smoking, co-morbidities, trauma mechanism and dominant hand. Based on related literature, potential relevant patient related factors were inquired. These subjective aspects included if patients had immediate post-injury pain symptoms [13], had the perception they suffered a wrist fracture after their injury [14], expected benefit from consulting a medical professional [15], if they felt to unnecessary burden the health care system if consulting a medical professional [16], had used self-treatment appliances [17] or had previous negative experiences at an emergency department [18]. In case of nonresponse, patients were contacted by telephone, and if required surveys were sent a second or third time. Thirty-seven patients did not respond or sent an incomplete survey and were excluded from the study. The remaining 64 (63 %) patients were included for further analysis.

Statistical Analysis

Statistical analysis of continue variables included determining the mean, standard deviation (SD) and range. Student t-test for continuous variables and Pearson Chi-square test or Fisher's exact test for ordinal variables were used for bivariate analysis

to compare the chronic delay versus no chronic delay patient group. We included variables that were significant or near significant ($P < 0.10$) in a multivariable backward stepwise logistic regression analysis. P value ≤ 0.05 was considered statistically significant.

Results

Incidence of Patient Delay

A total of 16 patients (25 %) consulted a medical professional more than 6 months after the initial scaphoid injury, thus showing chronic delay. Of the patients without chronic delay, 31 patients consulted a medical professional within 24 h, four patients within 24–48 h, nine patients after 48 h up to 4 weeks and four patients after 4 weeks up to 3 months (Fig. 1). No patients attended for medical help in the time period between 3 to 6 months. Overall, the median delay was 1.0 years (range 24 h – 15 years). In the group of patients with chronic delay, the median delay was 3.0 years (1–15 years).

Demographic and Injury Characteristics, and Patient Related Factors

Overall, the cohort's mean age at trauma was 28.1 years (range 14–58) and consisted of predominantly males (86 %) (Table 1). The majority of injuries occurred during sports (45 %), followed by traffic accidents (23 %) and after fall from standing or heights (17 %). Approximately one third of the patients (36 %) were smokers at the time of the injury.

Regarding demographic and injury characteristics, no significant differences were present between the chronic delay versus no chronic delay group (Table 1). As regards to patient related factors (Table 2), 22 patients (34 %) reported to have experienced no immediate post-injury pain symptoms, with significantly more patients being present in the chronic delay group ($P < 0.001$). In addition, 30 patients (47 %) did not suspected they had suffered a wrist fracture at the time of the injury, with significantly more patients being present in the chronic delay group ($P = 0.001$). Of the 11 patients (17 %) who did not expected benefit from consulting a medical professional, significantly more patients were present in the chronic delay group as well ($P = 0.003$). In a multivariable logistic regression model, one variable was found to be independent risk factor for chronic patient delay; patients who did not suspected to have suffered a fracture at the time of the injury had significantly higher odds of having a patient delay (odds ratio: 7.2, 95 % confidence interval 1.695–30.865, $P = 0.008$).

Fig. 1 Number of patients who sought medical attention within the time-interval of <24 h, 24–48 h, 48 h–4 weeks, 4 weeks–3 months, 3–6 months and >6 months (chronic delay) after the initial scaphoid injury

Discussion

Patient delay appears to be a serious problem, contributing to the relative high incidence of nonunion development in scaphoid fractures [7]. In this retrospective study, we investigated the incidence of patients showing a delay of more than 6 months after injury, thus by definition having an established nonunion. Subsequently, we investigated factors that might be associated with this delay.

This present study was limited by several factors. A retrospective survey-based study inevitably leads to a recall bias. For example, pain recall could diminish with time. A prospective study could reduce but not eliminate this recall bias, as patient delay unavoidably causes an incongruity between symptoms as observed at the initial visit and the unobserved symptoms directly post-injury. Moreover, one should realize that prospective enrolment of a similar number of patients with a scaphoid nonunion would take a considerable number of years. However, in this study most objective data regarding demographic and injury characteristics was directly obtainable from medical records and therefore not affected by a recall bias. Secondly, due to absence of validated questionnaires purposed for assessing subjective patient related factors, e.g. pain perception, we were required to use self-compiled questions based on evidence based factors obtained from related peer reviewed studies. We reduced the arbitrariness of self-compiled questions by discussing their relevance and readability in plenary sessions at our department until

consensus was reached. Thirdly, due to the retrospective nature of this study we were not able to further investigate factors that might have influenced the patients' perception of post-injury pain and symptoms, e.g. psychological factors such as depression, or patient activity level and functional demands. Futures prospective studies could investigate this relationship using validated questionnaires such as depression scales [19] taken at the first medical visit. A final limitation is the survey non-respondent rate of 37 %. Nonetheless, our response rate of 63 % was slightly higher compared to the average response rate of 60 % for survey mailings in medical research [20].

Reigstad et al. reported a cohort of 268 scaphoid nonunion patients and found that 46 % of the patients did not seek medical help at the time of the injury. The median delay time was 1.0 year from injury to diagnosis, which is consistent with our present findings. The authors noted that scaphoid fractures were frequently misinterpreted as a sprain of which the symptoms would resolve eventually, by both patients and doctors [7]. In contrast to this present study, the relationship between misinterpretation of symptoms and patient delay was not further evaluated. Wong et al. reported a similar cohort of 96 patients, and found an even higher patient delay rate of approximately 60 %, with an average delay of 7.5 years [11]. Also this latter study did not assess specific factors associated with patient delay. Our study showed that demographic factors and injury characteristics were not distinct from those of patients presenting without delay. On the other hand, patients with chronic delay significantly less often reported post-injury pain symptoms, less often attributed

Table 1 Bivariate analysis of demographic and injury characteristics in relation to chronic patient delay

Time to presentation	Cohort (<i>n</i> = 64)	< 6 months (<i>n</i> = 48)	> 6 months (<i>n</i> = 16)	<i>P</i> -value
Demographics				
Gender				
Male	55 (86 %)	40 (83 %)	15 (94 %)	0.299
Female	9 (14 %)	8 (17 %)	1 (6 %)	
Mean age (range)	28.1 (14–58)	27.7 (14–58)	29.3 (17–43)	0.612
Marital status				
Single	38 (59 %)	29 (60 %)	9 (56 %)	0.769
Partner	26 (41 %)	19 (40 %)	7 (44 %)	
Native speaker				
Yes	56 (88 %)	43 (90 %)	13 (81 %)	0.383
No	8 (13 %)	5 (10 %)	3 (19 %)	
College degree				
Yes	15 (23 %)	13 (27 %)	2 (13 %)	0.233
No	49 (77 %)	35 (73 %)	14 (88 %)	
Employed or student				
Yes	57 (89 %)	44 (92 %)	13 (81 %)	0.248
No	7 (11 %)	4 (8 %)	3 (19 %)	
Heavy manual labour				
Yes	31 (48 %)	24 (50 %)	7 (44 %)	0.965
No	26 (41 %)	20 (42 %)	6 (38 %)	
Missing	7 (11 %)	4 (8 %)	3 (19 %)	
Smoking				
Yes	23 (36 %)	16 (33 %)	7 (44 %)	0.452
No	41 (64 %)	32 (67 %)	9 (56 %)	
Co morbidity*				
Yes	5 (8 %)	3 (6 %)	2 (13 %)	0.420
No	59 (92 %)	45 (94 %)	14 (88 %)	
Sports				
Yes	44 (69 %)	33 (69 %)	11 (69 %)	1.000
No	20 (31 %)	15 (31 %)	5 (31 %)	
Injury factors				
Trauma mechanism				
Sports	29 (45 %)	22 (46 %)	7 (44 %)	0.302
Traffic accident	15 (23 %)	13 (27 %)	2 (13 %)	
Fall from standing/height	11 (17 %)	7 (15 %)	4 (25 %)	
Other cause	9 (14 %)	6 (13 %)	3 (18 %)	
Fracture of dominant hand				
Yes	33 (52 %)	23 (48 %)	10 (63 %)	0.348
No	30 (47 %)	24 (50 %)	6 (38 %)	
Missing	1 (2 %)	1 (2 %)	0 (0 %)	

*Comorbidity includes diabetes mellitus and cardiovascular disease

their post-injury symptoms to a fracture, and less often expected benefit from consulting a medical professional at the time of the injury. Besides patient related factors, also a so-called utilization delay may contribute to patient delay. Utilization delay involves a threshold for seeking medical help due to the costs of a treatment [21]. In this study measures

of social deprivation such as socio-economic status (e.g. single, unemployed) and limited education (e.g. no college degree) were not associated with patient delay. However, the insurance system in The Netherlands guarantees access to healthcare for all its residents and may differ from other countries. A higher level of utilization delay may be present

Table 2 Bivariate analysis of patient related factors in relation to chronic patient delay

Time to presentation	Cohort (<i>n</i> = 64)	< 6 months (<i>n</i> = 48)	> 6 months (<i>n</i> = 16)	<i>P</i> -value
Immediate post-injury pain symptoms				
Yes	42 (66 %)	38 (80 %)	4 (25 %)	<0.001*
No	22 (34 %)	10 (21 %)	12 (65 %)	
Perception suffering fracture post-injury				
Yes	16 (25 %)	16 (33 %)	0 (0 %)	0.001*
No	30 (47 %)	16 (33 %)	14 (88 %)	
Maybe	18 (28 %)	16 (33 %)	2 (13 %)	
Expected benefit from consulting a healthcare professional				
Yes	42 (66 %)	36 (75 %)	6 (38 %)	0.003*
No	11 (17 %)	4 (8 %)	7 (44 %)	
Maybe	11 (17 %)	8 (17 %)	3 (19 %)	
Afraid unnecessary using health care system				
Yes	12 (19 %)	11 (23 %)	1 (6 %)	0.080
No	47 (73 %)	35 (73 %)	12 (75 %)	
Maybe	5 (8 %)	2 (4 %)	3 (19 %)	
Self-treatment				
Yes	27 (42 %)	19 (40 %)	8 (50 %)	0.465
No	37 (58 %)	29 (60 %)	8 (50 %)	
Previous bad experience ER				
Yes	9 (14 %)	6 (13 %)	3 (19 %)	0.600
No	52 (81 %)	39 (81 %)	13 (81 %)	
Missing	3 (5 %)	3 (6 %)	0 (0 %)	

*Statistically significant

in countries with a high rate of individuals without health care insurance.

We believe that there is a large unknown group of scaphoid fracture patients who did not seek medical attention after their initial injury, but eventually did achieve fracture healing, making seeking medical attention redundant. Contrary, when adequate fracture healing is absent and initially no medical attention is sought, most patients would eventually attend because of secondary symptoms following nonunion. This latter patient group is studied in our cohort. The moment of attendance depends on the progression and severity of osteoarthritis, which may vary considerably among patients. We experienced several cases with a delay of decades after the initial injury. Some patients however might still not seek medical attention despite having a chronic nonunion, as they e.g. might have lowered their functional demands for daily living or have been deceased before developing symptomatic osteoarthritis. This forms a second unknown group of patients for which clinical data is absent.

In conclusion, a quarter of the patients with a scaphoid nonunion waited more than 6 months before consulting a medical professional. As there appears to be no demographic or injury characteristics associated with patient delay, future developments of strategies to lower the threshold to seek medical

attention (e.g. education at sport facilities) should be focussed on all patients with a suspected scaphoid injury. These strategies may vary between countries, depending on their medical system.

Compliance with Ethical Standards

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Conflict of Interests All named authors have declared that they have no (potential) conflicts of interest to disclose.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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