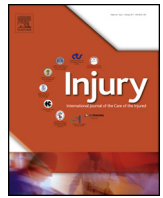




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Clinical outcomes and predictors of patient satisfaction in displaced midshaft clavicle fractures in adults: Results from a retrospective multicentre study

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ABSTRACT

Background: The optimal treatment of displaced midshaft clavicle fractures (Robinson Type 2B1 & 2B2) in adults remains controversial. Little is known about patient satisfaction with treatment for this type of injury. The purpose of this study was to compare clinical outcomes and explore predictors of patient satisfaction after nonoperative and direct-operative treatment of displaced midshaft clavicle fractures in adults.

Methods: A retrospective multicentre study was conducted. Clinical data were retrieved from electronic patient charts. A questionnaire informing on current subjective function (QuickDASH), pain levels (VAS), health-related quality of life (Eq-5D-5L), impact on employment and satisfaction with treatment results was sent to all patients. Univariate and multivariate linear regression was performed to identify predictors of satisfaction.

Results: A total of 278 patients were identified (nonoperative n = 150, direct-operative n = 128). 67% of eligible patients returned the questionnaire. Median questionnaire follow-up was 2.1 years. No differences were found between groups for QuickDASH, Eq-5D-5L or pain VAS scores. Impaired union was observed in 13.2% of nonoperative cases vs. 2.3% in the direct-operative group. Patients in the nonoperative group could resume work after a median of 30.0 days, compared to 13.5 days in the direct-operative group. Patient satisfaction was higher in the direct-operative group, 8/10 vs. 7/10 for overall treatment results respectively. Patients' rating for the level of shared decision-making was the main predictor of overall satisfaction.

Conclusion: Direct-operative management led to higher patient satisfaction, despite similar long-term patient reported outcomes with nonoperative treatment. Patients' rating for the level of shared decision-making was the main predictor of overall satisfaction. This study highlights the need to enhance communication to facilitate shared decision-making.

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Introduction

Clavicle fractures constitute approximately 2.6 to 10% of all fractures in adults and about 35% of all fractures that occur in the shoulder region. About 80% of clavicle fractures occur in the midshaft, most of which are displaced [9,10]. There is an on-going debate on whether to prefer nonoperative or operative treatment for this type of injury. Earlier work shows that 31% of non-operatively-treated patients with displaced midshaft clavicle fractures were dissatisfied with the treatment result [5]. More

recently, patient satisfaction was shown to be higher among operatively treated patients than among their nonoperatively-treated counterparts [1,12]. Little is known about the causes of these differences in satisfaction. The purpose of this study was to compare clinical outcomes and explore predictors of patient satisfaction after nonoperative and direct-operative treatment of displaced midshaft clavicle fractures in adults from a community hospital population.

Materials and methods

Design

A retrospective multicentre study was conducted in three community hospitals in the northern part of The Netherlands. The

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institutional review board issued a waiver for this study (medical ethical committee of University Medical Center Groningen, the Netherlands (2014/581)). The study was conducted in compliance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement and adhered to guidelines of good clinical practice. All patients with an acute (< 4 weeks old) displaced midshaft clavicle fracture (classified as Robinson Type 2B1 or Robinson Type 2B2[10], aged 18–65 years, and presenting between 2011 and 2014 were included. Patients with non-traumatic causes or bilateral fractures, or those mentally or physically incapable of participating in the follow-up were excluded. All medical charts and clinical notes were reviewed and the following items were retrieved: age, gender, affected side, co-injuries, treatment details, length of follow-up and complications. Inherent to the retrospective nature of the study it was chosen to define impaired union as failure of radiological union progression longer than three months, or at least two months with little or no callus observed during surgical reconstruction.

Measurements

A questionnaire was sent to all eligible patients. The shortened Disabilities of the Arm, Shoulder, and Hand (QuickDASH) score was used to assess subjective function[2]. Health-related quality of life was measured using the EuroQol group 5D tool (Eq-5D-5L)[3]. Current pain levels were assessed using a visual analogue score. Customised questions informed on patient demographics and work absenteeism. Overall satisfaction with treatment results was measured using a numerical rating scale ranging from 1 to 10, with 10 representing maximum satisfaction. Separate ratings probed into satisfaction with current shoulder function, care provided at the emergency room and level of shared decision-making. Open-ended questions were added to encourage additional comments and suggestions (see Appendix A).

Data analysis

Patients were classified into either nonoperative or direct-operative treatment groups. Nonoperative treatment was described as treatment of a fracture with a sling or collar-and-cuff. Patients who underwent delayed surgery after initial nonoperative treatment for a minimum of 4 weeks were recorded as non-operatively-treated patients analogue to an intention-to-treat principle. Direct-operative treatment was described as operative reduction and internal fixation (ORIF) within 4 weeks of injury. All operations were performed using locking plates. The window of 4 weeks was chosen to be inclusive of patients with an acute fracture presenting with a delay to the outpatient fracture clinic. Normally distributed continuous variables are presented as averages with

standard deviations given in brackets and were analysed using Student's *t*-test. Non-normally distributed continuous variables are presented as medians with the first and third quartiles given within brackets and analysed using the Mann-Whitney *U*-test. Categorical parameters are presented with counts and percentages given within brackets and were analysed using the chi-squared test. Predictors for satisfaction with overall treatment result were identified using a backward stepwise multivariable linear regression model. The model included all variables that showed a *p*-value < 0.25 upon univariate regression analysis. The model with the highest R^2_{Adjusted} value was retained. All analysis were conducted with SPSS v. 22.0. A *p*-value < 0.05 (two-sided) was considered to be statistically significant.

Results

Baseline characteristics

A total of 404 clavicle fractures were included, 278 (68%) of which were displaced (classified as Robinson 2B1 or 2B2). 150 (54%) were listed to the nonoperative group, 27 (18%) patients underwent delayed operative treatment. 128 (46%) patients received direct-operative treatment. 11 patients in the non-operative group and 6 patients in the direct operative group could not be contacted because they had either moved address, or were medically incapable of completing the questionnaire. Overall questionnaire response amounted to 67% (nonoperative *n* = 94, operative *n* = 81).

Median questionnaire follow-up was 2.1 years. Treatment groups were comparable in terms of baseline patient characteristics (Table 1). No open-fractures were registered. Fractures in the direct-operative group had more shortening on presentation, $28.9 \pm \text{SD}16.4$ vs. $24.7 \pm \text{SD}15.6$ ($p < 0.05$) mm respectively. Co-fractures were more prevalent in the direct-operative group, 19 (14.8%) vs. 11 (7.3%) ($p < 0.05$) respectively.

Clinical outcomes

Impaired union was registered in 20 (13.3%) patients with nonoperatively-treated fractures and three patients (2.3%) in the direct-operative group. In the non-operative group, clinically relevant malunion requiring osteotomy was reported in three cases. Refractures requiring plate fixation were reported in three conservatively treated patients. One case was complicated by a costoclavicular compression syndrome. More complications were reported in the direct-operative group ($p < 0.001$). Hardware failure necessitating re-surgery was seen in five (3.9%) operative cases. No refractures were registered. One surgery was complicated by a deep infection requiring additional surgical treatment. On

Table 1
Baseline characteristics.

	Non-operative N = 150	Direct-operative N = 128	<i>p</i> -Value
Age (years) ¹	42.4 (25.6–55.8)	39.7 (23.6–50.4)	0.125
Male gender (%) ²	117 (78.0)	111 (85.9)	0.088
Comorbidities (%) ²	12 (8.0)	12 (9.4)	0.684
Smoker (%) ²	29 (28.2)	21 (24.7)	0.594
Clavicle shortening on presentation (mm) ³	24.7 (SD15.6)	28.9 (SD16.4)	0.027
Fracture dominant side (%) ²	54 (36.0)	43 (33.6)	0.644
Polytrauma (%) ²	11 (7.3)	19 (14.8)	0.044
Delay from injury to surgery (days) ¹	64.0 (31–64)	6.0 (2.0–10.0)	<0.001
Questionnaire response (%) ²	94 (67.6)	81 (66.4)	0.463
Median questionnaire follow-up (days) ¹	768.0 (455.8–1233.8)	798.0 (544.0–1114.0)	0.848

¹ 17 patients were unavailable for follow up.

¹ Data presented as median (first quartile – third quartile).

² Data presented as count (percentage).

³ Data presented as average (standard deviation).

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