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The frequency and risk factors for subsequent surgery after a simple elbow dislocation

Chetan S. Modi [a,d,*], David Wasserstein [b,c,d], Ian P. Mayne [a], Patrick D.G. Henry [b], Nizar Mahomed [a,c], Christian J.H. Veillette [a,d]

[a] Division of Orthopaedic Surgery, Arthritis Program, University Health Network, Toronto Western Hospital, 399 Bathurst Street, Toronto, ON, Canada
[b] Division of Orthopaedic Surgery, Sunnybrook Health Sciences Centre, Toronto, ON, Canada
[c] Institute for Clinical Evaluative Sciences, Toronto, ON, Canada
[d] University of Toronto Sports Medicine Program, Women's College Hospital, Toronto, ON, Canada

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ABSTRACT

Introduction: Simple elbow dislocations treated by closed reduction are thought to result in a satisfactory return of function in most patients. Little, however, is known about how many patients ultimately proceed to subsequent surgical treatment due to the low patient numbers and significant loss to follow-up in the current literature. The purpose of this study was to establish the rate of and risk factors for subsequent surgical treatment after closed reduction of a simple elbow dislocation at a population level.
Patients and methods: All patients aged 16 years or older who underwent closed reduction of a simple elbow dislocation between 1994 and 2010 were identified using a population database. Subsequent procedures performed for joint contractures, instability or arthritis were recorded. Outcomes were modelled as a function of age, sex, income quintile, co-morbidity, urban/rural status, physician speciality performing the initial reduction and whether orthopaedic consultation and/or post-reduction radiograph was performed within 28 days of the injury, in a time-to-event analysis.
Results: We identified 4878 elbow dislocations with a minimum 2-year follow-up: stabilisation surgery was performed in 112 (2.3%) at a median time of 1 month, contracture release in 59 (1.2%) at median 9 months and arthroplasty in seven (0.1%) at median 25 months. Admission to hospital for the initial reduction was associated with an increased risk of undergoing stabilisation (hazard ratio (HR), 2.50; 95% confidence interval (CI), 1.67–3.74) and contracture release (HR, 1.93; CI, 1.08–3.44). Multiple reduction attempts increased the risk of requiring contracture release (HR, 3.71; CI, 1.22–11.29). Survival analysis demonstrated that all subsequent procedures had taken place by 4–5 years.
Conclusion: Few patients with simple elbow dislocations develop complications requiring surgery, but those that do most commonly undergo soft-tissue stabilisation or contracture release within 4 years of the injury. Contrary to current thinking, surgery for instability is performed more often than joint contracture release, albeit with slightly different time patterns.

Introduction

The elbow is the second most commonly dislocated large joint in adults and the most common in the paediatric population [1] with an incidence of 5.21 per 100,000 person-years for patients aged 10 years and older. Many are associated with sporting injuries [2]. Elbow dislocations can be classified as simple – the absence of fracture – or complex – associated with significant osseous disruption [3]. The goals of treatment are to obtain a stable concentric reduction and to allow early motion of the elbow joint. In simple dislocations, this is usually achieved by a closed reduction and subsequent stability testing. Persistent instability, however, may necessitate bracing and/or early ligament repair. Complex dislocations usually require early operative fixation of associated fractures to achieve a stable reduction followed by rehabilitation, and they have a high complication rate, including a 12–15% reoperation rate (the most common indication being joint contracture) [4–6].

Although the outcomes of simple dislocations are generally thought to be favourable, some studies suggest that up to 60% of

* Corresponding author at: Division of Orthopaedic Surgery, University Health Network, Toronto Western Hospital, 399 Bathurst Street, Toronto, ON, Canada M5T 2S8. Tel.: +1 416 603 5929.
E-mail address: Chetan.modi@uhcw.nhs.uk (C.S. Modi).

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patients may have some residual symptoms [7,8]. These include recurrent instability, joint contracture with loss of motion, pain related to degenerative joint disease and residual neurological symptoms usually of the ulnar nerve [7–11]. The available evidence regarding the incidence of these complications leading to surgical treatment is limited as most studies include small cohorts and significant loss to follow-up as high as 42% [7–9].

The purpose of this study is to establish the frequency and risk factors for subsequent operative intervention after a closed reduction of a simple elbow dislocation in the general population. These data are of value for patient counselling, health care planning and in the design of prospective studies.

Patients and methods

This retrospective study was performed using anonymised Ontario provincial administrative health records accessed through the Institute for Clinical Evaluative Sciences (ICES) (www.ices.on.ca). Ontario Health Insurance Plan (OHIP) physician billing codes were used to identify all patients who underwent a closed reduction of an elbow dislocation in the Province of Ontario between July 1, 1994, and July 1, 2010 (see Table A1 for relevant codes). OHIP provides a universal health care coverage, and the OHIP fee codes and demographic data have previously been demonstrated to be highly accurate on independent chart review [12]. Patient records were followed for outcomes of interest for a minimum of 2 years after the index elbow dislocation in all patients (until 1 July, 2012).

Supplementary Table A1 related to this article can be found, in the online version, at http://dx.doi.org/10.1016/j.injury.2015.02.009.

Demographic data were obtained from the Registered Persons Database (RPD) of all citizens with a valid OHIP coverage. Exclusion criteria were based on clinically relevant factors identified by additional OHIP fee codes (see Table A1 for relevant fee codes) or demographic data. Only patients >16 years were included. Non-Ontario residents were excluded on the basis of potentially poor follow-up. By the OHIP fee code, patients with a concurrent radius, ulna (including coronoid), or humerus fracture (i.e., complex dislocation), or prior elbow dislocation or elbow fractures were excluded. Further exclusions were applied to patients who had a fracture (elbow, any extremity, pelvis) specified by the International Classification of Diseases (ICDs)-9 (July 1994 to March 2002) or ICD-10 (April 2002 to July 2010) codes, on an emergency room visit or a hospital admission to ensure that patients treated and/or admitted to hospital with multiple injuries were not included in the study cohort. The databases same day surgery (SDS), discharge abstracts database (DAD) and National Ambulatory Care Reporting Systems (NACRS) contain ICD codes. Patients are identified in all databases by a unique anonymous identifier.

Outcomes

Three main outcomes were considered (Table A2). The first was any operation for instability defined by specific OHIP codes for a ligament reconstruction or an open reduction of chronic dislocations including radial head reduction. The second was joint contracture release surgery for post-injury stiffness/contracture and degenerative joint disease using either open or arthroscopic techniques (elbow capsulectomy, debridement, osteochondroplasty and soft tissue release). Open and arthroscopic techniques were not differentiated, as separate OHIP codes did not exist until after October 2010. The third was surgery for end-stage arthritis utilising fee codes capturing either prosthetic or interpositional arthroplasty. We also identified whether ulnar nerve release was concurrently performed with each outcome (#N190 – ulnar nerve decompression; #N189 – ulnar nerve transposition). Operations that occurred outside of Canada were not captured in this study. Procedures in other Canadian jurisdictions (outside Ontario) are captured.

Supplementary Table A2 related to this article can be found, in the online version, at http://dx.doi.org/10.1016/j.injury.2015.02.009.

Covariates

Demographic data included age at the time of the index event, sex, urban versus rural residence, income quintile and patient co-morbidity score. Income quintile and urban versus rural residence were estimated using an established method based on home address [13]. Income quintile was considered a surrogate for socio-economic status. Patient co-morbidity was estimated using the adjusted clinical group (ACG) method [14]. Each patient was assigned to any number of 12 collapsed aggregate diagnosis groups (CADGs), defined by constellations of conditions of similar severity and chronicity based on ICD versions 9 and 10 (ICD-9 and ICD-10) and on OHIP coding using a 2-year review period [15].

We identified whether patients were admitted to hospital at the time of a closed reduction by the presence of a DAD or an SDS entry associated chronologically with the service date of the index event OHIP elbow relocation fee code. The speciality code of the physician that performed the initial reduction was identified and categorised (yes/no) as an orthopaedic surgeon or from another speciality (e.g., emergency physician, general practitioner). Repeat attempted closed reductions were considered and defined by a reduction fee code billed by a different physician within 2 weeks of the index event (classified as "single closed reduction" or "more than one closed reduction"). We identified whether patients had orthopaedic follow-up within 4 weeks of the initial reduction (binary outcome yes/no) utilising office consultation or follow-up codes, and whether a subsequent elbow X-ray was performed within 2–28 days after the reduction (binary outcome yes/no).

Statistical Analysis

The main outcomes were analysed using a time-to-event analysis and Cox proportional hazards model to generate Kaplan–Meier (K–M) survival curves over the entire data collection period and to evaluate the effects of the covariates on the outcomes [16] with the calculation of hazard ratios (HRs) and associated 95% confidence intervals (CIs). All reported p-values are two-tailed with an α of 0.05. Survival analysis allowed us to censor patients with a high likelihood of loss to follow-up, which included death and loss of Ontario health insurance (including emigration). A multiple comparison effect was considered in the interpretation of the results, but no statistical correction was applied because no covariate was considered time-dependent [17]. Analyses were performed at the ICES using SAS version 9.1 for UNIX (SAS Institute, Cary, NC, USA). The research protocol was approved by the Research Ethics Board at Sunnybrook Health Sciences Centre, Toronto, ON (through ICES).

Results

An initial database search yielded 14,736 patients. The application of the exclusion criteria resulted in a final cohort size of 4878, with 40 patients (0.82%) excluded on the basis of incomplete demographic data (Table 1). The majority of patients excluded were for age <16 years (n = 6886; 46.7%). The median cohort age was 41 years (interquartile range (IQR), 27–54 years) at the time of the dislocation, and 2607 (53.4%) were females (see Table 2 for demographics). The minimum follow-up was 2 years (median, 9.3 years; IQR, 5.3–13.7 years).