Pediatric EM

Failed validation of the Quebec shoulder dislocation rule for young adult patients in an Australian emergency department

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ABSTRACT

Objective: The Quebec shoulder dislocation rule is a recently derived clinical decision rule to guide physicians on the selective use of radiography in patients with shoulder dislocation. The aim of this study was to validate the Quebec shoulder dislocation rule.
Methods: This was a secondary analysis of data collected in a retrospective cohort study. All patients presenting to the emergency department (ED) between January 1, 2003, and October 31, 2008, with a diagnosis of shoulder dislocation or fracture-dislocation were identified from ED management databases. Data collected included demographics, mechanism of injury, and presence of fracture. The outcome of interest was predictive performance of the Quebec shoulder dislocation rule for patients aged under 40 years on this cohort. Data analysis is descriptive.
Results: Of the 346 patients identified, 196 were aged under 40 years, and 174 (89%) were male; the median age was 25 years (interquartile range 21–29 years), and 58 were recurrent dislocations. One hundred sixteen patients (59%) met the Quebec high-risk criteria, and 80 (41%) were classified as low risk. In the 196 patients aged less than 40 years, 12 fractures as defined were identified (6%). When applied to this cohort, the Quebec clinical decision rule had a sensitivity of 0.42 (95% CI 0.16–0.71), a specificity of 0.40 (95% CI 0.33–0.47), and a negative predictive value of 0.91 (95% CI 0.82–0.96).
Conclusion: The Quebec shoulder dislocation rule had poor sensitivity for clinically significant fractures associated with shoulder dislocations in young patients (aged 16–39 years) presenting to an Australian emergency department. Its use cannot be recommended.

RÉSUMÉ

Objectif : La règle de dislocation de l'épaule en vigueur au Québec est une règle de décision clinique récemment adoptée pour guider les médecins quant à l'utilisation sélective de la radiographie chez les patients ayant subi une dislocation de l'épaule. Le but de cette étude était de valider la règle de dislocation de l'épaule en vigueur au Québec.
Méthodes : On a effectué une analyse secondaire des données recueillies lors d'une étude rétrospective des cohortes. Tous les patients se présentant aux urgences entre le 1er janvier 2003 et le 31 octobre 2008 avec un diagnostic de dislocation de l'épaule ou de fracture-dislocation ont été identifiés dans des bases de données de gestion des urgences. Parmi les renseignements recueillis figuraient les données démographiques, le mécanisme de l'accident et la présence de la fracture. Le résultat qui nous intéresse était le bilan de la règle de dislocation de l'épaule en vigueur au Québec pour les patients de ces cohortes âgés de moins de 40 ans. L'analyse des données est descriptive.
Résultats : Des 346 patients identifiés, 196 avaient moins de 40 ans et 174 (89 %) étaient des hommes; l'âge médian était de 25 ans (intervalle interquartile : 21 à 29 ans) et 58 présentaient des dislocations récidivantes. Cent seize patients (59 %) étaient à risque élevé, selon les critères québécois, et 80 (41 %) à faible risque. Chez les 196 patients de moins de 40 ans, 12 fractures au sens de la définition ont été identifiées (6 %). Appliquée à ces cohortes, la règle de dislocation de l'épaule en vigueur au Québec avait une sensibilité de 0,42 (IC à 95 % de 0,16 à 0,71), une spécificité de 0,40 (IC à 95 % de 0,33 à 0,47), et une valeur prédictive négative de 0,91 (IC à 95 % 0,82 à 0,96).
Conclusion : La règle de dislocation de l'épaule en vigueur au Québec avait une faible sensibilité sur le plan clinique pour les fractures importantes associées aux dislocations de l'épaule chez les jeunes patients (de 16 à 39 ans) qui se sont présentés aux urgences en Australie. Son utilisation ne peut pas être recommandée.

Keywords: dislocation, radiograph, radiography, shoulder

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Submitted February 9, 2010; Revised May 19, 2010; Accepted May 20, 2010

This article has been peer reviewed.

 CJEM 2011;13(3):150-154 DOI 10.2310/8000.2011.110292

Shoulder dislocation is an important injury commonly treated in emergency departments (EDs). Associated bony injury can occur, with the rate of Hill-Sachs lesions reported as 54 to 76% and the rate of greater trochanter fractures reported as 10 to 16%.[1] Pre- and postreduction radiographs are commonly performed to confirm the diagnosis, identify any associated fracture, and demonstrate satisfactory reduction. Some investigators have suggested that emergency physicians can accurately diagnose shoulder dislocation on clinical grounds alone[2,3] but are unreliable in predicting an associated fracture.[4] The use of clinical decision rules, such as the Ottawa ankle rules[5] or NEXUS criteria,[6] has been shown to reduce unnecessary imaging while identifying clinically significant fractures, resulting in more efficient allocation of ED resources and shorter lengths of stay.

The Quebec shoulder dislocation rule is a clinical decision rule derived by Canadian researchers to allow selective use of radiography in shoulder dislocations.[7] This rule suggests that prereduction radiography is required in young adult patients (aged less than 40 years) if the injury has resulted from a motor vehicle collision, an assault or fight, or a fall from greater than the patient's standing height or if it is a sports injury. A separate rule was derived for older patients. The derivation set for young adults had a reported sensitivity of 100% and a negative predictive value of 99.2% for identifying clinically significant fractures and could potentially reduce the number of prereduction radiographs ordered by 27.9%. This clinical decision rule has yet to be externally validated.

The aim of this study was to retrospectively validate the Quebec shoulder dislocation rule on an Australasian patient sample.

METHODS

Study design and setting

This study was a secondary analysis of a retrospective cohort study conducted at Western Hospital in Melbourne, Australia. Western Hospital is a metropolitan teaching hospital with an annual ED census of approximately 36,000. The study was approved as a quality assurance project under the National Health and Medical Research Council (Australia) guidelines by the Western Health research ethics panel. Consent from patients was not required for study participation.

Selection of patients

All adult patients (age > 16 years) who presented to the Western Hospital ED between January 1, 2003, and October 31, 2008, with a diagnosis of shoulder dislocation or shoulder fracture were identified from ED management databases. Patients were excluded if they were not found to have a shoulder dislocation on radiology reports or the medical record or if the mechanism of injury could not be ascertained. The standard of care in the study institution is the performance of imaging before and after reduction.

Data collection

Data were collected from medical records and hospital radiology databases and included age, gender, mechanism of injury, previous shoulder dislocation, presence of a shoulder dislocation and/or fracture, and type of fracture. Data were collected by a single investigator (S.O.), who was blinded to the hypothesis of this analysis at the time of data collection.

Outcome measure

The primary outcome was the diagnostic performance of the Quebec shoulder dislocation rule in predicting a clinically significant fracture. To maintain consistency, we used the same definitions as the study that derived the clinical decision rule.[7] The authors defined a clinically significant fracture as a shoulder fracture associated with a shoulder dislocation in which "special care" was needed during reduction or in which surgical fixation by orthopedics was needed. This excluded Hill-Sachs lesions but included Bankart lesions, fractures of the humeral head and neck, and greater or lesser tuberosity.

Data analysis

Data were analysed using descriptive statistics and clinical performance analysis.

RESULTS

A total of 873 patients were identified, of whom 504 patients did not have a documented shoulder dislocation. Almost all of these were patients with fractures without dislocation. A further 23 patients were excluded as they had an unknown mechanism of

https://doi.org/10.2310/8000.2011.110292 Published online by Cambridge University Press

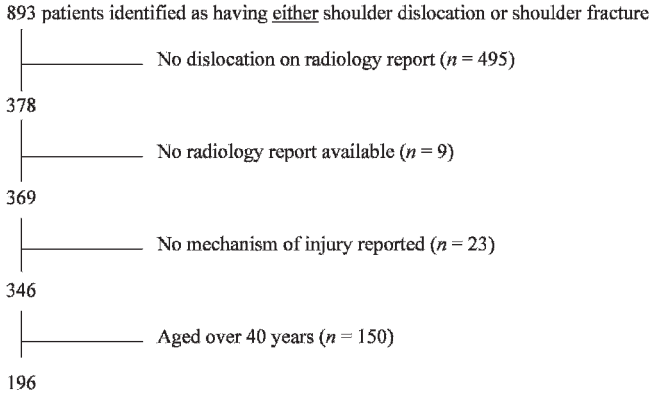

Figure 1. Sample derivation.

injury or missing medical records. Of the remaining 346 patients, 196 were aged less than 40 years and formed the study sample (Figure 1). One hundred seventy-four (89%) were male. The median age was 25 years (interquartile range 21–29 years), and 58 patients had recurrent dislocations. The distribution of mechanism of injury is shown in Figure 2. One hundred sixteen patients (59%) met the Quebec high-risk criteria, and 80 (41%) were classified as low risk.

Of the 196 patients aged less than 40 years, 12 fractures as defined were identified (6%): 8 of the greater tuberosity of the humerus and 4 Bankart lesions. The fracture rate by mechanism of injury is shown in Table 1. When applied to this cohort, the Quebec clinical decision rule had a sensitivity of 0.42 (95% CI 0.16–0.71), a specificity of 0.40 (95% CI 0.33–0.47), and a negative predictive value of 0.91 (95% CI 0.82–0.96) (Table 2). When only greater tuberosity fractures were considered significant, the Quebec clinical decision rule had a sensitivity of 0.50 (95% CI 0.17–0.83), a specificity of 0.40 (95% CI 0.33–0.48), and a negative predictive value of 0.95 (95% CI 0.87–0.98).

The four greater tuberosity fractures in the Quebec rule low-risk group resulted from falls from standing height or less (n = 2), getting out of bed without a reported fall (n = 1), and seizure (n = 1).

DISCUSSION

To our knowledge, this is the first study to attempt to validate the Quebec shoulder dislocation rule. We found it to have low sensitivity when applied retrospectively to our study cohort. This is in stark contrast to the 100% sensitivity and 99.2% negative predictive value reported in the derivation study.[7] Unfortunately, the clinical decision rule failed to predict seven clinically significant fractures. When only greater tuberosity fractures were considered, diagnostic performance remained poor.

The reason for the difference is not clear. One possible explanation is differences in the study cohorts. We included patients with all types of shoulder dislocations, whereas the derivation study

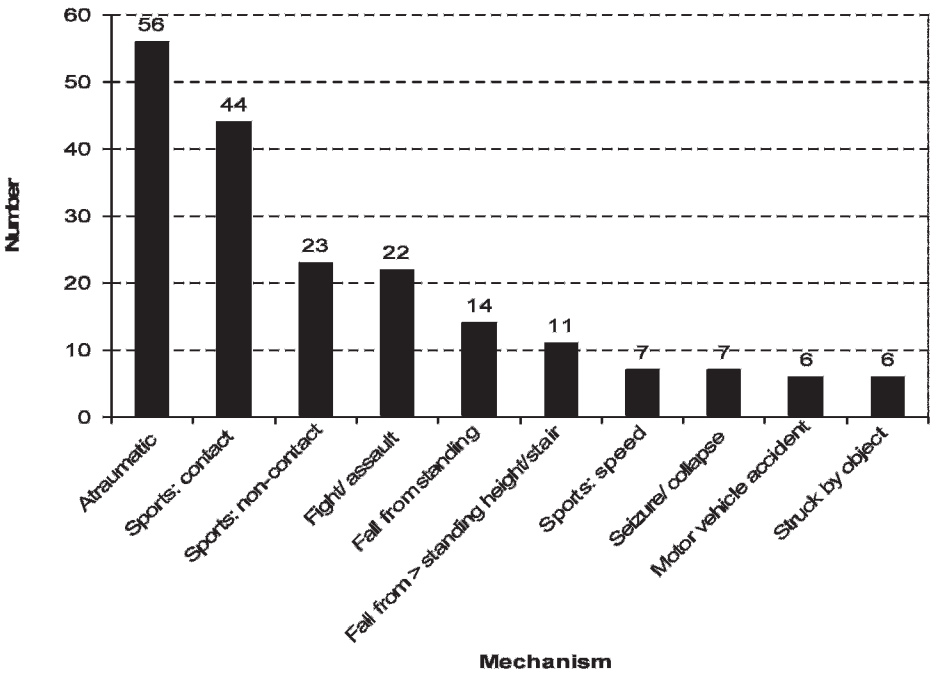

Figure 2. Distribution of fractures by mechanism of injury.

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Table 1. Fracture rate by mechanism of injury

Mechanism of injury	Total	Bankart lesions	Greater tuberosity fractures	Total fractures, *n*, (%)
Atraumatic	56	2	1	3 (5)
Sports: contact	44	0	1	1 (2)
Sports: noncontact	23	0	0	0 (0)
Fight/assault	22	0	0	0 (0)
Fall from standing	14	1	2	3 (21)
Fall from > standing height	11	1	1	2 (18)
Sports: speed	7	0	1	1 (14)
Seizure/collapse	7	0	1	1 (14.3)
Motor vehicle accident	6	0	1	1 (17)
Struck by object	6	0	0	0 (0)
Total	196	4	8	12 (6)

included only anterior dislocations. Our data also included patients who re-presented with recurrent shoulder dislocations, whereas the derivation study did not. Fifty-eight patients in our sample (30%) had recurrent shoulder dislocation compared to 11.6% in the derivation study. That said, we believe that our sample represents a "real-world" cohort appropriate for validation of such a rule. It is also larger in size than the derivation cohort (n = 196 v. 110). Another possible explanation is differences in the mechanism of injury distributions of the cohorts. It is not possible to make a detailed comparison as it is not separately reported in the derivation article; however, the range of sports and the amount of contact may be different. In addition, the Émond and colleagues study does not appear to include any patients who had suffered a seizure, although this was not a stated exclusion criterion.[7] Other differences between the samples may include ethnicity, weight, or diet, which have been reported to be factors contributing to fracture.[8]

Our findings are a serious threat to the wider adoption of the Quebec shoulder dislocation rule. Our data do not support its adoption in Australasia, and successful validation studies from a variety of settings are required if it is to be considered for wider implementation.

Table 2. Diagnostic performance of the Quebec criteria in 196 Australian patients presenting to the emergency department

Quebec risk group	Fracture		Total
	Absent	Present	
High	111	5	116
Low	73	7	80
Totals	184	12	196

This study has some limitations that should be considered when interpreting the results. In particular, data were obtained from medical records, with the well-known limitations of that approach.[9] Implicit in the retrospective design of our study is that information gathered with regard to mechanism of injury and previous dislocation is subject to patient report, adequate documentation, and the single data collector's interpretation of medical notes. This may have introduced selection, reporting, and interpretation bias. The Quebec rule excluded patients with a Glasgow Coma Scale score less than 14. We did not specifically collect data on conscious state, which may have introduced bias. That said, if patients with mechanisms that might have altered the conscious state (eg, seizures or intoxication) are excluded, the best sensitivity for the rule that can be achieved is 0.50. Data were collected from a single metropolitan centre in Australia and so may not be generalizable to other settings.

CONCLUSION

The Quebec shoulder dislocation rule had poor sensitivity for clinically significant fractures associated with shoulder dislocations in young patients (aged 16–40 years) presenting to an Australian ED. Its use cannot be recommended.

Competing interests: None declared.

https://doi.org/10.2310/8000.2011.110292 Published online by Cambridge University Press

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