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Focussed classification of scapula fractures: Failure of the lateral scapula suspension system

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ABSTRACT

Introduction: Following an increase in the incidence of scapular fractures and interest in the outcome of their treatment, a basic classification system was developed for ease of use in the emergency setting. It has been expanded to a comprehensive system to allow for more in-depth classification of scapular fractures for clinical research and surgical decision making. It focusses on three specific regions of the scapula: the scapular body, the glenoid fossa and the lateral scapular suspension system (LSSS). This article presents a classification of the LSSS involvement to better characterise the injuries of this region and to emphasise its relevance to evaluation of the position of the scapula, hence the glenoid fossa, and so the centre of rotation of the shoulder joint.

Methods: An iterative consensus and evaluation process comprising an international group of seven experienced shoulder specialist and orthopaedic trauma surgeons was used to specify and evaluate the failure of the LSSS associated with scapula fractures. This was supported by a series of agreement studies. The system considered lack of involvement (S0), incomplete (S1) and complete (S2) failure of the LSSS. The last evaluation was conducted on a consecutive collection of 120 scapula fractures documented by three-dimensional computed tomography (3D CT) reconstruction videos.

Results: Surgeons agreed on the involvement/failure of the LSSS in 47% of the 120 cases with an overall Kappa of 0.54. The sample most likely included 70 S0, 29 S1 and 21 S2 cases, where surgeons showed median classification accuracies of 93%, 71% and 80% for these categories, respectively. While two surgeons showed some uncertainty about their classification, the remaining surgeons only failed to identify LSSS failure in <20% of the cases. Kappa coefficients of reliability for classification of incomplete and complete LSSS involvement according to subcategories were 0.85 and 0.82, respectively.

Conclusion: While LSSS involvement can be reliably identified, its characterisation regarding complexity is problematic even with 3D CT images. The proposed LSSS system is considered clinically relevant and sufficient to further assess its role in treatment-decision processes and outcome prognosis.

There has been an increase in incidence and interest in the outcome of scapula fracture treatment.[1] While non-operative treatment is appropriate for many fractures, not all fractures have a favourable long-term outcome.[2] The outcomes for fractures of the scapular processes associated with disruption of the scapular suspensory system[3] have been less well documented, even though the spectrum of these fractures may comprise up to 28% of all scapular fractures.[4] The concept of the 'floating shoulder' was derived from a combination of a disruption of the superior scapular suspensory system, SSSS,[3] and an associated scapular neck fracture.[5,6] The SSSS was defined as a linked system of the lateral clavicle–acromioclavicular joint (ACJ)–acromion–coracoclavicular ligament–coracoid/glenoid; it was designed to emphasise the

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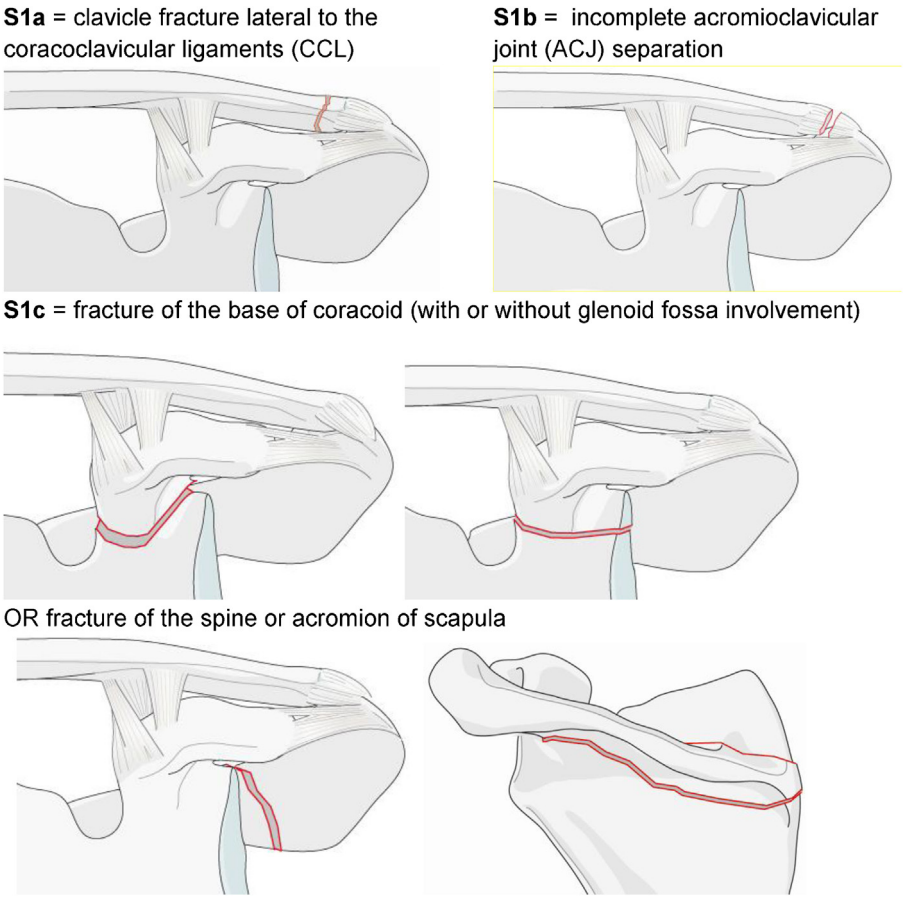

Fig. 1. Incomplete failure of the lateral scapular suspension system (S1). NB: Coracoid fractures (P1) are defined by a separate fracture line not affecting the glenoid fossa or any part of the body. If the line extends into the glenoid fossa, the coracoid is not considered fractured, but the fossa (F). In S1c failures, the fracture line may extend medially to the scapula notch. Acromion fractures (P2) are defined by a fracture line lateral to the plane of the glenoid fossa. Failure of the LSSS however occurs when the fracture line extends to the spine, which may also be fully separated from the rest of the scapula.

potential for ligament disruption to contribute to scapular displacement. While useful, diagnosis of disruptions of the SSSS has been difficult in clinical practice: the greater adoption of three-dimensional (3D) cross-sectional imaging, including magnetic resonance imaging, in the acute injury might well help to redefine its role. However, the range of disruptions which can lead to functionally important displacements of the glenoid fossa is greater than those defined by the SSSS. The clinical behaviour of lateral clavicular fractures and ACJ disruptions is similar[7]: the mechanism of injury, the reasons for treatment failure and the functional and clinical outcomes are similar.

A system of classification which recognises this logical concurrence would be useful in clinical practice. Concepts which help to understand the mechanism of injury and the associated patterns of disruption of the shoulder girdle[5,7] assist decision-making in treatment, which is principally aimed at restoring the orientation of the glenoid fossa in relation to the body axis. Currently, specific components of a complex disruption of the scapula suspension system are separately classified, for example, a lateral clavicular fracture with a coracoid base fracture and an associated glenoid fracture could be classified separately by Neer,[8] Ogawa et al.[9] and Ideberg et al.,[10] whereas assessment of the whole injury would theoretically guide improved treatment algorithms. For this reason, a systematic approach to the classification of disruptions of the scapula suspension system components was developed. To distinguish it from the medial scapular suspension muscles, the multilinkage system is denoted the lateral scapular suspension system (LSSS). Disruption of the LSSS is a further example of a spectrum of injuries ranging from the simple partial capsular sprain injury of the ACJ to a complex scapulothoracic dissociation (internal disarticulation of the scapula): the classification system enables the clinician to quickly evaluate the probability of associated regional and distant injury, including neurovascular injuries.[11]

In order for meaningful functional outcome studies to be performed, a clinically relevant classification system is required.[12] Existing scapular classification systems have been developed using plain radiographs[4,10] but lack adequate correlation with clinical data sets of actual fracture patterns.[13] To address this, a basic scapular fracture classification system was developed and validated by an international scapular classification group of seven experienced orthopaedic trauma surgeons and shoulder surgeons.[14] This system, developed as described by the AO Classification Advisory Group,[15] has been expanded into a comprehensive system to support more detailed morphological classification of scapular fractures for clinical research and surgical decision making.

This article presents a detailed validation of a logical classification system for LSSS injuries designed to characterise the injuries of this region more completely and to emphasise the relevance of this to evaluation of the position of the scapula, hence the glenoid fossa and so the centre of rotation of the shoulder joint.

Materials and methods

Classification system of LSSS failure

The LSSS is classified according to three failure conditions: