J Shoulder Elbow Surg (2015) 24, 1268-1273

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Glenoid version and inclination are risk factors for anterior shoulder dislocation

Erik Hohmann, FRCS, FRCS (Tr&Orth), MD, PhD[a,b,*], Kevin Tetsworth, FRACS, MD[c,d]

[a]*Department of Orthopaedic Surgery, Clinical Medical School, University of Queensland, Brisbane, QLD, Australia*
[b]*Musculoskeletal Research Unit, Central Queensland University, Rockhampton, QLD, Australia*
[c]*Department of Orthopaedic Surgery, Royal Brisbane Hospital, Herston, QLD, Australia*
[d]*Department of Surgery, School of Medicine, University of Queensland, Brisbane, QLD, Australia*

Hypothesis: Although the contribution of the capsuloligamentous structures and dynamic muscle balance to shoulder stability has been well documented, the role of the osseous anatomy of the glenoid has not been thoroughly evaluated. This study investigated glenoid version and inclination in patients with a documented anterior shoulder dislocation and compared it with a control group. We hypothesized that patients with a prior anterior dislocation would have more anterior version and increased inferior inclination of the glenoid.

Materials and methods: Patients aged younger than 40 years who underwent arthroscopic shoulder stabilization (study group) were compared with patients (control group) who had previously undergone magnetic resonance imaging (MRI) for a different shoulder condition. Version was measured on axial images, and inclination was measured on coronal images of a T2-weighted spin-echo scan. The MRIs of 128 study group patients (mean age, 24.5 ± 8.6 years) with a confirmed traumatic anterior shoulder dislocation were compared with the MRIs of 130 control group patients (mean age, 30.9 ± 7 years).

Results: The mean version in the study group was −1.7° ± 4.5° (retroversion); the mean inclination was 1.6° ± 5.9° (inferior). The mean version in the control group was −5.8° ± 4.6° (retroversion); the mean inclination was −4.0° ± 6.8° (superior). The between-group differences were significant for version ($P = .00001$) and inclination ($P = .00001$).

Conclusions: The results of this study strongly suggest that glenoid version and inclination are significantly increased in patients with established anterior shoulder instability compared with a matched control group.

Level of evidence: Level II, Retrospective Design, Prognosis Study.

Keywords: Anterior shoulder dislocation; glenoid version; glenoid inclination; risk factor; glenohumeral subluxation; shoulder injury

Shoulder dislocations and recurrent instability are a frequent cause of pain and limitation of function in young athletes. The glenohumeral joint is the most common joint to dislocate,[4,26] typically with the arm in the at-risk position

*Reprint requests: Erik Hohmann, FRCS, FRCS (Tr&Orth), MD, PhD, Musculoskeletal Research Unit, Central Queensland University, PO Box 4045, Rockhampton, QLD 4700, Australia.

E-mail address: ehohmann@optusnet.com.au (E. Hohmann).

1058-2746/$ - see front matter © 2015 Journal of Shoulder and Elbow Surgery Board of Trustees.
http://dx.doi.org/10.1016/j.jse.2015.03.032

of abduction and external rotation or from direct impact to the shoulder.[26] Unfortunately, this injury is associated with a very high rate of recurrence in younger athletes.[14,15,26] Robinson and Dobson[26] reviewed the English literature and reported a recurrence rate of 79.7% in patients after a first-time dislocation. With the development of arthroscopic stabilization techniques, the recurrence rate has been reportedly reduced to only 7.6% in first-time dislocators and to 15.2% in athletes with recurrent instability. Early surgical treatment for young patients has been recommended, and primary arthroscopic stabilization has been shown to be cost-effective compared with initial observation.[6,25]

Although the contribution of the capsuloligamentous structures and dynamic muscle balance to shoulder stability has been well documented, the role of the osseous anatomy of the glenoid has not been thoroughly investigated.[4,7,21,25] To our knowledge, anatomic skeletal features of the glenoid that could potentially increase the risk of anterior shoulder dislocation have not been previously described. This is somehow surprising, given that the bony alignment of the knee joint has been shown to have a potential influence on knee stability and the kinetics of the anterior and posterior cruciate ligaments.[11,13] In fact, an increased posterior tibial slope has recently been identified as a significant risk factor for noncontact anterior cruciate ligament injury.[2,12]

In contrast to anterior shoulder instability, excessive retroversion of the glenoid has been considered the primary etiology for posterior instability of the shoulder, but glenoid version or inclination has not been investigated in relation to anterior shoulder instability.[3,32] The purpose of this study was therefore to measure and compare glenoid version and glenoid inclination in a study group with a prior documented anterior shoulder dislocation and in a matched control group without a history of shoulder dislocation. We hypothesized that patients with an anterior dislocation would have both elements contributing, with more anterior glenoid version and increased inferior inclination of the glenoid.

Materials and methods

The study was designed as a retrospective case-control study.

Patient selection

The study included patients who presented to the Orthopedic Sports Injury Clinic between 2010 and 2014 and underwent arthroscopic stabilization. This clinic caters to more than 80% of the sporting community in the region, and referrals are made through the emergency department, the general practitioner, sports physician, or physiotherapist of the injured individual. Patients were included if they fulfilled the following inclusion criteria: documented anterior shoulder dislocation by the referring medical practitioner or with a dislocation documented on an available radiograph, history of trauma, anterior labral tear on both magnetic resonance imaging (MRI) and during surgery, and physically active between the age of 16 and 40 years. Patients were excluded if there was evidence of injuries to the biceps anchor, posterior labrum, humeral avulsion of glenohumeral ligament and anterior ligamentous periosteal sleeve avulsion lesions, rotator cuff, previous fracture dislocations, bony Bankart lesions, glenoid or humeral chondral damage, previous surgery to the glenoid or proximal humerus, and with a history of atraumatic and habitual dislocations.

The control group was established searching the IMPAX database (electronic database and storage of all MRIs performed within the department of radiography; Agfa HealthCare Corporation, Greenville, SC, USA) of the same hospital for those who presented to the emergency department or to the general orthopedic clinic with shoulder pain. An independent research associate reviewed the medical records of individuals who were identified. The main inclusion criteria included the availability of a shoulder MRI study. Individuals were included if they fulfilled the following inclusion criteria: age between 16 and 40 years, history of trauma, or recent onset of shoulder pain. For the control group the same exclusion criteria were applied. However, young patients with acute isolated partial or full thickness tears of the rotator cuff and a short history of less than 3 months were included. These patients were assumed not to have any chronic changes to the glenoid typically observed in patients with a long-standing history.[1,30]

Outcome measures

Standard MRIs were obtained within 7 days of presentation to the clinic using a 3-Tesla system. All scans were performed by the same radiology technician to a pre-established protocol. All images were obtained with the patient supine and the arm placed on the side of the body, the forearm supinated, and the hand under the hip to maintain humeral position during the examination. The MRI study included sagittal, axial, and oblique coronal images. The coronal oblique images were taken in a plane parallel to the supraspinatus tendon.

Version

Glenoid version was measured using the technique described by Tétreault et al.[30] The axial image immediately inferior to the supraspinatus muscle where the posterior border of the scapular neck was clearly visible was selected. A line was the drawn along the axis of the glenoid surface. The scapular axis was defined as a line joining the posterior glenoid neck and junction of the scapular body medially. Glenoid version was calculated by subtracting 90° from the angle formed by the glenoid surface and the scapular body (Figs. 1 and 2). Anteversion was defined as a positive angle and retroversion by a negative angle.

Inclination

Inclination was determined using the method suggested by Maurer et al.[22] The coronal oblique image displaying the deepest point of the supraspinatus fossa was identified, and the scapular body line was drawn along the deepest point of the supraspinatus fossa. The glenoid fossa line was defined as the line connecting the uppermost to the lowermost point of the glenoid. Similar to glenoid version, inclination was calculated by subtracting 90° from the angle formed by the glenoid fossa line and the scapular body line (Figs. 3 and 4). Caudal inclination was defined as a positive angle and cranial inclination by a negative angle.