Management of bone loss in shoulder instability

Chu-Hao Chiang
Co-Authors: Abhinav Gulihar & Nicholas Little

Management of glenohumeral joint (GHJ) instability can be challenging in the presence of structural bone defects of the glenoid or humerus. The presence of glenoid or humeral bone loss has been shown to be an important factor in the failure of arthroscopic stabilisation of the GHJ. Therefore, it is important to recognise the presence of any bone defects prior to surgery in patients with instability.

The average anterior/posterior dimensions of the glenoid is 24 to 26 millimetres. Therefore, even a minor bone defect of 6 to 8 millimetres represent about 25% glenoid bone loss. Lo et al. described the inverted pear shaped glenoid which is usually associated with a significant structural defect of greater than 30%.

Plain radiographs should include an antero-posterior view with the shoulder in internal rotation to demonstrate a Hill-Sachs lesion and a glenoid profile view to assess for anterior glenoid bone loss. The presence of a Hill-Sachs on an external rotation view usually indicates a large lesion. Computed Tomography (CT) scans with 3D construction allow visualisation of the defect’s size and location (Figure 1). Bone loss can also be measured intraoperatively (Figure 2).

Figure 1: Pre-operative CT scan demonstrating glenoid bone loss

Figure 2: Intraoperative image from superior viewing portal demonstrating anterior glenoid bone loss

We believe that bone loss of more than 20% should be reconstructed using autologous bone.

Management

Yamamoto et al. demonstrated through cadaveric biomechanical studies that glenoid bone loss of 25% led to significant instability. This figure has been confirmed by Burkhart et al. who noted a 67% failure rate of Bankart repairs in patients with greater than 25% glenoid bone loss, compared with 4% in those without bone loss. However, cadaveric studies have shown glenoid bone loss of 15% leads to instability.

Consequently, Balg et al. suggested that young patients, with higher demands, would benefit from reconstruction of glenoid bone loss of 15% or more.

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A meta-analysis comparing open and arthroscopic Latarjet procedure found that although they both provided a comparable clinical outcome with a less than 3.5% recurrence rate, the arthroscopic procedure was significantly more expensive as a result of the longer operation time and the use of additional equipment.

Although infrequent, glenoid bone loss can occur posteriorly. There are varied results in the literature. Barbier et al. published a case series of eight patients who underwent tricortical bone grafting for posterior glenoid bone loss. At three year follow up 80% of patients reported a satisfactory outcome, although none had resumed their normal sporting activities at the preinjury level. In a different series of fifteen patients, Struck et al. had satisfactory results and 67% had resumed sport at the preinjury level.

Although rare, Hill-Sachs lesions can also be managed with remplissage. Remplissage involves the tenodesis of the infraspinatus tendon into the infraspinatus tendon into the defect. Buza et al. published a systematic review of six studies on the use of arthroscopic remplissage and found an overall 5.4% recurrence rate in 167 patients.

The management of Hill-Sachs lesions between 30% and 40% is controversial. Patients with defects of this size can be potentially managed with remplissage, an osteochondral allograft transplantation (OAT) procedure or a partial resurfacing prosthesis such as HemiCap. Garcia et al. published a case series comparing 19 patients who underwent OAT procedures and 20 who underwent remplissage. They reported a 50% decrease in the recurrence rate with the remplissage technique.

Miniaci reported a case series of 18 patients who underwent OAT procedure and reported no recurrences. Although, a systematic review of 12 studies including 35 patients reported that though there was a significant improvement in their shoulder motion and only 3% of patients suffered from recurrent instability, there was a 32% incidence of residual pain and a complication rate of 22%.

In lesions involving greater than 40% of the joint surface, patients require either partial resurfacing or a shoulder arthroplasty. Sweet et al. published a retrospective case series of nineteen patients treated with a HemicAP and reported no major complications.

### Bipolar Defects

Bone loss on both the glenoid and the humeral head (bipolar defects) following dislocation has a prevalence rate of 33% in primary instability and 62% in recurrent instability. A CT study of 100 patients reported an even higher incidence of bone loss with Hills-Sachs lesions in 94% and glenoid bone loss in 86% of patients.

Burkhart et al. identified that if a Hill-Sachs lesion ‘engaged’ with the glenoid at 90° of external rotation and abduction, the shoulder was at high risk of recurrence dislocation despite a Bankart repair. Yamamoto et al. further identified an area they defined as the glenoid track. This is a band of the articular surface on the postero-superior humeral head. Bone loss outside this area is associated with a loss of stability. If there is glenoid bone loss, then the glenoid track reduces in width. A Hill-Sachs lesion that lies within the area of the glenoid track is said to be ‘on-track’, whereas one that lies outside is ‘off-track’. An off-track lesion is associated with an increased
risk of failure following soft tissue Bankart repair alone. Tracking has redefined the management of bipolar bony defects. Shaha et al. published a case series, which confirmed that the glenoid track concept was a better predictor of the failure of arthroscopic stabilisation than the measurement of glenoid bone loss. It therefore follows that on-track lesions can be successfully treated with arthroscopic stabilisation alone. The aim of treating off-track lesions is to turn them into on-track lesions. This can be done by treating the humeral bone loss or increasing the glenoid track. The use of the Latarjet procedure to enlarge the glenoid track and converting an off-track Hill-Sachs lesion to an on-track has been reported, but no long-term follow up results have been published. Using tracking we believe that an algorithm can be used for managing these patients (Figure 5).

**Conclusion**

Bone loss post GHJ dislocation is a challenging problem. Pre-operative and intra-operative planning is of paramount importance to avoid high recurrent dislocation rates. The concept of the glenoid track and on/off-track lesions is redefining the management of bipolar bone loss. The literature is limited to level 4 and 5 evidence and better studies are required to definitively evaluate the different modalities of treatment for bone loss in shoulder instability.

Originally from New York, Dr Chiang obtained his MSc in Human Anatomy from the University of Edinburgh after his medical training. He completed his Foundation Training in the Severn Deanery and is currently a Senior House Officer in Trauma and Orthopaedics at Epsom and St Heliers NHS Hospitals and is pursuing a career in Trauma and Orthopaedics.

**Correspondence**

Email: Cchiang@doctors.org.uk

**References**

References can be found online at www.boa.ac.uk/publications/JTO or by scanning the QR Code.

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*Young patients with high demand (High ISIS score), may require fixation with glenoid bone loss of 15%.
References