Recurrent, Locked Posterior Glenohumeral Dislocation Requiring Hemiarthroplasty and Posterior Bone Block With Humeral Head Autograft

MICHAEL D. RIGGENBACH, MD; ROBERT G. NAJARIAN, MD; JULIE Y. BISHOP, MD

This article describes the case of a 77-year-old man with a recurrent posterior shoulder dislocation, treated with humeral hemiarthroplasty and reconstruction of a large posteroinferior glenoid defect with a bone block created from humeral head autograft. On examination, the patient’s left arm was held in internal rotation against his stomach, with minimal swelling about the deltoid. His shoulder was nontender to palpation; however, he had substantial motion restrictions, and attempted motion was painful. He could forward elevate to 30°, extend to 0°, internally rotate to belly, and passive external rotation was limited to −30°. He maintained full elbow, wrist, and hand range of motion, and his neurovascular examination was intact. Radiographs revealed a recurrent posterior glenohumeral dislocation, with a large reverse Hill-Sachs defect involving the lesser tuberosity and humeral head. Computed tomography with 3-D reconstruction revealed the humeral head defect involving the lesser tuberosity and approximately 40% of the humeral head and a large comminuted posteroinferior glenoid fracture measuring 2.7 × 0.8 cm, encompassing approximately 30% of the posteroinferior glenoid surface. Standard fixation was not possible; therefore, the resected humeral head was fashioned into an elliptical piece mirroring the size of the defect of the posteroinferior glenoid. Rough measurements of the defect were made and marked on the humeral head, which was then cut with an oscillating saw to approximate the size and shape of the defect. The glenoid graft provided an extension to the glenoid and prevented posterior subluxation with no block to motion. One year postoperatively, he had full strength (5/5) with external rotation, forward elevation, and internal rotation, 140° of active forward elevation, 30° of external rotation, internal rotation to T7, and no episodes of instability. To our knowledge, this is the first report of this technique in the literature. It is an alternative to total shoulder arthroplasty.

Drs Riggenbach, Najarian, and Bishop are from the Department of Orthopaedics, The Ohio State University Medical Center, Columbus, Ohio.

Drs Riggenbach, Najarian, and Bishop have no relevant financial relationships to disclose.

Correspondence should be addressed to: Julie Y. Bishop, MD, Department of Orthopaedics, The Ohio State University Medical Center, 2050 Kenny Rd, Ste 3300, Columbus, OH 43221 (julie.bishop@osumc.edu).

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Figure: Sagittal computed tomography scan (A) showing posterior glenoid fracture with comminution and bone loss (arrow). 3-dimensional reconstruction showing bone loss (arrow) (B).
Posterior shoulder dislocations account for <3% of shoulder dislocations.\textsuperscript{1,4} They usually occur as a result of high-energy trauma, electrocution, or seizure,\textsuperscript{5,7} although drug dependency\textsuperscript{9} and hypoglycemic\textsuperscript{9} episodes have also been implicated as causes. Patients typically present with the arm held in internal rotation with a mechanical block to external rotation.\textsuperscript{2} Lack of pain during external rotation may indicate a chronic dislocation and subsequent humeral head remodeling. Adequate radiographic analysis requires orthogonal views, including axillary, modified axillary, or Velpeau views, which gauge anteroposterior placement of the humeral head.\textsuperscript{10-13} Computed tomography (CT) can further detail associated bony injuries, such as reverse Hill-Sachs lesions or potential glenoid fractures, which determine the extent of treatment necessary for each patient.

Treatment of posterior dislocations varies from benign neglect to total shoulder arthroplasty. The extent and type of treatment depends on the duration of dislocation, the health and functional status of the patient, and the presence of concomitant pathology (ie, reverse Hill-Sachs or glenoid fracture). A high index of suspicion is necessary because approximately 50% of posterior shoulder dislocations are diagnosed in a delayed fashion due to late presentation, low index of suspicion, and inadequate radiographic analysis.\textsuperscript{14,17} If these injuries are recognized acutely, a closed reduction is often successful in regaining stability if the reverse Hill-Sachs is <20% in size. Lesions >20% are often unstable after closed reduction and may require operative intervention, using allograft bone grafting or a lesser tuberosity transfer. Lesions >40% to 50% typically require arthroplasty to restore stability.\textsuperscript{1} However, if glenoid bone loss is substantial, addressing only the humeral head defect may not restore stability and could cause recurrent posterior dislocation. In chronic dislocations, glenoid bone loss more likely results from erosion. However, in the acute setting, although rare, posterior glenoid fractures occur and must be factored into the treatment plan.\textsuperscript{14}

This article describes a case of recurrent posterior shoulder dislocation treated with humeral hemiarthroplasty and reconstruction of a large posteroinferior glenoid defect, with a bone block created from humeral head autograft. To our knowledge, this technique has not yet been reported in the literature. It is an alternative to total shoulder arthroplasty to restore a stable and functional glenohumeral joint.

**Case Report**

A 77-year-old man presented with left shoulder pain. Nine days previously, he awoke with excruciating left shoulder and elbow pain and no known inciting mechanism. He went to another emergency department, where a posterior shoulder dislocation was diagnosed. The dislocation was reduced using intravenous sedation, and the arm was placed in an abduction sling after radiographs confirmed reduction. He presented to our institution 6 days later. He reported no remotely related event that could have produced this injury and no history of trauma, seizure, diabetes mellitus, drug or alcohol consumption, or dislocation.

On examination, his left arm was held in internal rotation against his stomach, with minimal swelling around his deltoid. His shoulder was nontender to palpation; however, his shoulder was not tender to palpation; however, he exhibited substantial range of motion (ROM) restrictions, and attempted motion was painful. He could forward elevate to 30°, extend to 0°, and internally rotate to belly, and passive external rotation was limited to −30°. He maintained full elbow, wrist, and hand ROM, and his neurovascular examination was intact.

Radiographs revealed a recurrent posterior glenohumeral dislocation with a large reverse Hill-Sachs defect involving the lesser tuberosity and humeral head (Figure 1). Computed tomography with 3-dimensional reconstruction images showed the humeral head defect involving the lesser tuberosity and approximately 40% of the humeral head and a large comminuted posteroinferior glenoid fracture measuring 2.7×0.8 cm encompassing approximately 30% of the posteroinferior glenoid surface.

Because of the recurrent dislocation, persistent pain, and functional disability, surgical treatment was recommended. Because of the patient’s age, the recurrent instability and the size of the reverse Hill-Sachs lesion, humeral head replacement was recommended. The large posteroinferior glenoid fracture was also addressed to prevent posterior instability of the prosthesis. However, our concern was that the degree of comminution and potentially

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**Figure 1:** Anteroposterior radiograph showing glenohumeral overlap and classic double-density sign (A). Axillary radiograph showing large reverse Hill-Sachs lesion (arrow) and a perched humeral head on the glenoid (B).
poor glenoid fracture fragment bone quality would preclude open reduction and internal fixation. Therefore, we proceeded with humeral head replacement, using the osteotomized remaining humeral head as a posterior bone block via the deltopectoral approach.

The patient was given a preoperative interscalene block, underwent general anesthesia, and was placed in a beach-chair position, with the left shoulder prepared and draped in a normal, sterile fashion. A standard deltopectoral incision was made, the biceps was tenotomized, and a tenodesis was performed. After ligation of the circumflex vessels, it was evident that the lesser tuberosity was crushed, detached from the head, and held in place by a tenuous capsular attachment. The lesser tuberosity was lifted up in osteotomy fashion and tagged with the attached subscapularis. The inferior capsule was peeled off the calcar, allowing joint reduction and revealing the large engaging reverse Hill-Sachs lesion. Inspection of the glenohumeral joint revealed a large posteroinferior comminuted glenoid fracture involving one-third of its surface inferiorly. The remaining glenoid had an intact articular surface with no signs of arthritic change.

Based on the patient’s age and the intraoperative findings, we proceeded with humeral head replacement. The humerus was prepared, and a trial stem was placed, which sat well despite the comminution anteriorly involving the lesser tuberosity. After obtaining glenoid exposure, it was evident that extensive comminution existed, which prohibited standard fixation (Figure 4A). Due to the amount of bone loss and lack of arthritic wear on the glenoid surface, a glenoid component was not necessary. A trial humeral prosthesis was inserted to determine if the joint would regain stability with humeral reconstruction; however, stability could not be achieved. Therefore, the resected humeral head was fashioned into an elliptical piece mirroring the size of the defect of the posteroinferior glenoid. Rough measurements of the defect were made and marked on the humeral head, which was then cut with an oscillating saw to approximate the size and shape of the defect (Figure 4B). A trial implantation showed that it matched the defect and radius of curvature of the glenoid well. It was fixed in place with two 3.0-mm cannulated screws placed in the scapular pillar. One screw was placed percutaneously with a transdeltoid technique to obtain a better fixation angle. Both screws achieved excellent purchase in the scapula, allowing excellent fixation of the graft (Figure 4C).

The humeral component was then implanted in 30° of retroversion. It was reduced and stable in all planes of motion, including forward elevation and internal rotation. The glenoid graft provided an excellent extension to the glenoid and prevented posterior subluxation, with no block to motion. A nice contour existed to the glenoid, with <1 mm graft-native glenoid articular incongruity.

The lesser tuberosity and subscapularis was repaired to the proximal humerus with transosseous suture fixation. The patient was maintained in an abduction sling postoperatively, and radiographs revealed a reduced glenohumeral joint and intact fixation of the humeral head allograft (Figure 5).

The patient had an uncomplicated postoperative hospital course and was placed in an abduction sling in 15° of external rotation for the first 6 weeks. He initially started with pendulums, no internal rotation past neutral, passive external rotation to 30°, and passive forward elevation in the scapular plane to tolerance. At 6 weeks postoperatively, the sling was removed, and he progressed ROM to tolerance, while still avoiding internal rotation across the body or behind the back.
and observing subscapularis precautions. At 12 weeks postoperatively, gentle, progressing strengthening began, and he progressed to terminal stretches, including internal rotation.

At 1-year follow-up, he demonstrated full strength (5/5), 140° of active forward elevation, 30° of external rotation, internal rotation to T7, and no episodes of instability. Belly press and lift-out were negative. The patient was satisfied with the result.

**DISCUSSION**

According to Hawkins et al.5 “Rarely with long standing dislocation, there is extensive erosion of the posterior margin of the glenoid base.” Posterior glenoid bone loss in the setting of posterior dislocations is unusual. Most cases of posterior glenoid bone loss are reported with chronic posterior dislocation or recurrent episodes of posterior subluxations or instability. Most studies available are small, and if they describe bone block techniques, they focus on isolated posterior bone loss, which is addressed via a posterior approach.2,5,18-22 One study mentioned concomitant reverse Hill-Sachs lesions on preoperative radiographs, which may have contributed to recurrent instability and failure. Compared with anterior glenoid lesions and recurrent anterior glenohumeral instability, few reports exist regarding the treatment of glenoid lesions in acute, recurrent, locked posterior dislocations. Furthermore, little to no guidance exists on how to address large lesions on the humeral head and glenoid in traumatic, locked, posterior dislocations, in particular those requiring humeral head replacement.

In a locked posterior dislocation, the humeral damage (primarily the reverse Hill-Sachs) often requires humeral head replacement or total shoulder arthroplasty if the glenoid is arthritic.5 Griggs et al.23 recommended treatment based on the duration of dislocation, size of bony defects, presence of glenoid changes, and surgeon experience. They proposed a treatment algorithm for chronic posterior dislocation recommending humeral head replacement in young patients with viable glenoid cartilage and total shoulder arthroplasty in patients with >50% impaction injury at any age or <50% impaction injury in older patients with poor bone stock, and in any patient lacking viable cartilage surface.23

Hawkins et al.5 treated 10 of 41 shoulders with total shoulder arthroplasty, 3 of which were revisions from previous humeral head replacements. One patient dislocated in the immediate postoperative period. The other 5 primary total shoulder arthroplasties were followed up for 2 to 8 years and had no pain or mild pain at the latest examination. Two total shoulder arthroplasty patients required humeral head grafts to augment the arthritic glenoid when inserting the component and showed no signs of absorption at 2-year follow-up. Cheng et al.24 treated 7 locked chronic, posterior dislocations 23 months after injury with a total shoulder arthroplasty and experienced no episodes of recurrent instability. However, no patients required glenoid bone grafting.

This article describes a case of an acute, unstable, locked posterior dislocation with a large comminuted posteroinferior glenoid fracture in addition to a 40% reverse Hill-Sachs lesion. This case
is novel because it incorporated a humeral head autograft as a posterior bone block in combination with a humeral head replacement. A humeral head replacement alone would not have restored stability to the glenohumeral joint; however, performing primary open reduction and internal fixation of the glenoid was not possible due to the comminution. Because we were performing a humeral head replacement and osteotomizing the remaining humeral head, this humeral head was the best graft source for the patient. In addition, the remaining glenoid articular surface was intact, and glenoid arthroplasty was not warranted. This eliminated the need for glenoid arthroplasty with primary bone grafting, which is associated with a ten-fold higher rate of failure.25

This operation was also novel because it was performed entirely through a deltopectoral incision with no need for an iliac crest, scapular, or acromial graft. Other posterior bone block procedures describe a standard posterior approach to the shoulder using the interval between the infraspina- tatus and teres minor2,18,19,21 and also have the added morbidity of harvesting autogenous bone graft. The circumstances of our case allowed us to avoid a posterior approach to the shoulder. Although the deltopectoral approach allowed completion of the entire procedure, inability to access the posterior joint with instrumentation required percutaneous placement of screw fixation to achieve the appropriate trajectory needed for screw fixation. These were placed carefully with knowledge of the anatomy of the axillary nerve and using tactile feedback of the axillary nerve’s course to avoid injury.

The tug test, described by Flattow and Bigliani,26 was used to locate the course of the axillary nerve. With the course of the axillary nerve located and palpated, percutaneous fixation can safely be undertaken. However, no literature has been published regarding risk to the axillary nerve with this approach has. Therefore, the authors recognize that this approach is higher risk, and many surgeons may be uncomfortable performing this surgery. It is likely more preferable to place the screws from the anterior approach; however, this approach does not allow an angle that avoids the anterior surface of the glenoid. Thus, this requires the use of a cannulated screw system with a countersink aspect, and then one can bury the screw head. This is an accepted technique for bone grafting in shoulder replacements with posterior glenoid bone loss and poses no risk to the axillary nerve.25 Many screw systems allow this technique. This technique allows for the primary goal of bone block placement and the avoidance of neurovascular injury or the need for a large posterior approach to the shoulder.

Conclusion
In patients with reverse Hill-Sachs lesions >40% and posterior glenoid bone loss with an otherwise intact glenoid articular surface, HHR with posterior bone block using humeral head autograft is an option to reduce pain and restore glenohumeral joint stability and function. It can restore stability, avoid the need for other graft sources, maintain the remaining native glenoid, and allow for a revision to glenoid arthroplasty should the articular surface deteriorate. Because this is a novel technique in the treatment of shoulder instability, further evaluation is needed to confirm its efficacy in creating a stable, functional glenohumeral joint.

REFERENCES
Case Report


