Surgical treatment alternatives in traumatic posterior glenohumeral dislocations

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Due to limited number of evidence based studies about posterior shoulder dislocations, there is no absolute treatment algorithm. Eventhough variety of classification methods have been proposed, there is lack of a classification method to define treatment. Posterior shoulder dislocations may be seen after specific conditions such as epileptic seizures and electric shock besides high energy traumas. Difficulty in diagnosis complicates the treatment. Treatment approach changes in presence of any fractures. For treatment there are a variety of surgical options presented such as close reduction, soft tissue based approach and bone based approaches. In this study we are presenting current literature about diagnosis and treatment of posterior shoulder dislocations.

Keywords: Posterior shoulder dislocation; treatment; diagnosis; surgery


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Introduction

Posterior shoulder dislocation is a rarely seen injury which comprises 2%-5% of all shoulder dislocations [1, 2]. First-time traumatic posterior shoulder dislocations have been reported at the rate of 1.1 per 100,000 [3]. However, it is extremely difficult to determine the incidence completely as it has been reported that the diagnosis is missed during the first medical consultation at a rate of 50% [3]. Adequate physical and radiological examinations are required for correct diagnosis. This injury is generally seen as a result of high-energy trauma or together with epileptic seizures [4].

Posterior shoulder dislocation (PSD) is a rarely seen event and management is also extremely complex. When diagnosis is delayed, the treatment choices change. Surgical treatment alternatives extend from soft tissue procedures to osteotomy and prosthesis. In this study, information is presented on the current approaches to diagnosis and treatment of PSD.

Classification

There are few studies in literature on posterior glenohumeral dislocations and most of these are in the form of case series and case reports. Therefore, there is no widely accepted classification system.

Detenbeck et al. defined a classification system as acute, chronic and recurrent instability according to the dislocation status during diagnosis [5]. Recurrent instability is sub-divided as traumatic and atraumatic. Heller et al. classified PSD anatomically [6]. In this system, the dislocation
is classified as subacromial, subglenoid or subspinous posterior dislocation according to the position of the humerus head to the glenoid. However, this classification has been reported to have limited effect in terms of treatment management as is it based only on anatomy.

Hawkins et al. and Robinson and Aderinto defined PSD as acute when the period was shorter than 6 weeks and chronic when more than 6 weeks \cite{7, 8}. In terms of determining treatment, according to the humerus head impression defect, which is extremely important, separation is made into 3 categories of <20\%, 20\%-45\% and 45\%-50\%.

PSD is often seen together with proximal humerus or shaft fractures. By evaluating this factor, Robinson et al. separated a classification system into 2 basic groups of simple PSD and complex \cite{9}. Complex dislocations are sub-divided into 3 according to the classification system of Neer for proximal humerus fractures.

PSD, which are not related to a bone lesion with an impression defect on the humerus head joint surface and those seen together with a fracture can be separated into 3 categories \cite{4}.

**Diagnosis**

**Physical examination**

Some specific findings of PSD are found in physical examination. The coracoid is more prominent as the humerus head is posterior and the angulated appearance of the anterolateral acromion are accepted as examination findings \cite{10, 11}. Some findings in the range of movement examination indicate PSD. As there is a mechanical block, there is limitation in external rotation \cite{12}. The related extremity is found to be in internal rotation. There is restriction in abduction and flexion. As the humerus head is locked in the posterior of the glenoid, the dislocated extremity is locked in internal rotation.

Rowe and Zarins defined a specific test for PSD \cite{13}. When the arm is taken into anterior flexion, as there is a shoulder internal rotation deformity, the forearm cannot be brought into supination.

**Radiography**

True anteroposterior radiograph, axillary radiograph and Y-radiograph are necessary for diagnosis \cite{14}. As there is only an appearance of subluxation on the true anteroposterior radiograph, it is difficult to interpret. Some findings of PSD have been defined which are of assistance in diagnosis on the direct anteroposterior radiograph \cite{15, 16}. These are that as the humerus head is fixed in the posterior of the glenoid, it seems to be in internal rotation. The rim sign is a gap of >6mm between the anterior glenoid rim and the humerus head. The Moloney line is the equivalent of the Shenton line used for evaluation on hip radiographs \cite{17}. In PSD, the Moloney line is broken. The dimensions of the humerus head anteromedial defect can be determined on the axillary lateral radiograph. Due to pain and muscle spasms, it may not be possible to take an axillary radiograph. If an axillary lateral radiograph cannot be taken, a modified axillary lateral or lateral scapular radiograph can be taken \cite{18, 19}. The relationship of the humerus head with the glenoid is evaluated on the lateral scapular radiograph.

Computed tomography is extremely useful in the determination of the exact location and size of reverse Hill-Sacs lesion and in the evaluation of whether or not there is any pathology in the glenoid \cite{20}.

**Treatment**

As there are insufficient high-level studies on the subject of PSD treatment, there is no definitive treatment algorithm. However, several factors have been determined that play a critical role in optimal treatment. According to the current approach, the size of the reverse Hill-Sacs defect, whether or not there is a concomitant fracture and the duration of the dislocation are taken into account for the surgical treatment strategy \cite{4, 14}. It is necessary to differentiate acute, traumatic first-time PSD from recurrent posterior shoulder subluxation or luxation \cite{4}. Recurrent posterior shoulder subluxation or luxation is a completely separate entity and not related to trauma. Methods such as conservative treatment or posterior shoulder reconstruction are used in treatment \cite{21}. There is no consensus on the separation of acute and chronic PSD \cite{13, 22}.

**Closed-Open reduction**

In cases of less than 6 weeks with <20-25\% reverse Hill-Sacs lesion, closed reduction can be applied. In those with a greater Hill-Sacs lesion, recurring dislocations leading to instability decrease the success rates \cite{23}. It is recommended that closed reduction is applied only under general anaesthesia \cite{2, 14, 24}. After radiographic confirmation of successful reduction, the shoulder must be kept in a position of 10˚abduction and 10˚-20˚ external rotation for 4-6 weeks \cite{4, 24}. This position has been found to contribute to providing apposition in the appropriate position of the avulsed posteroslabral complex \cite{23}. Isometric external rotator strengthening exercises should be applied in the brace. After immobilization, a progressive series of range of motion and
internal and external rotator strengthening exercises should be applied [5, 23].

In patients with unsuccessful closed reduction and reverse Hill-Sacs lesion of 20%-25%, open reduction can be applied. Although several approaches have been defined for open reduction, the classic approach is the deltopectoral approach. The humerus head is disimpacted with open reduction and stabilization is evaluated by assessing range of motion after reduction. An alternative method to open reduction is the arthroscopic approach. Reduction with an arthroscopic approach has been reported to be an excellent diagnostic and treatment approach [12, 25, 26].

**Subscapularis transfer**

This technique was first described by McLaughlin. In the original technique, the subscapularis tendon is separated from the attachment point and transferred to the Hill-Sacs defect. Thus, the humerus is prevented from engagement with the glenoid posterior [10, 23]. This technique was later modified by Hugs and Neer [27]. By making a lesser tuberosity osteotomy, fixation of the defect was made to the inside. Therefore, the possibility is increased of a more stable fixation and more successful healing [23]. There are current arthroscopic methods of subscapularis tendon transfer which have been described [28, 29].

The subscapularis tendon is mobilized and fixed to the defect with the aid of a suture anchor with this technique. Thus, while surgical trauma is minimized, the visualization within the joint and surroundings is increased [28].

**Transhumeral headplasty and humerus head reconstruction**

As an alternative method to subscapularis tendon transfer, the anatomic structure of the joint surface can be reconstructed by elevation of the humerus head impression defect and grafting [30, 31]. Thus, internal rotation movement and loss of strength as possible complications of subscapularis tendon transfer are avoided [23]. This technique can be applied to acute patients with 20%-45% reverse Hill-Sacs defect [23].

Another method as an alternative to subscapularis tendon transfer is reconstruction of the humerus head defect with allograft [23]. This method can be applied to chronic cases. Diklic et al. applied this method to patients with chronic locked PSD and reported reduced pain and sufficient function and strength [32].

**Humeral rotation osteotomy**

As an alternative to the above-mentioned methods, humeral rotational osteotomy has been described in literature [33, 34]. However, the indications for application are extremely limited because of technical difficulties, a high possibility of osteoarthritis and a high risk of osteonecrosis in the humerus head [8].

**Glenoid reconstruction**

One of the methods for glenoid reconstruction is glenoid osteotomy and grafting. It is aimed to give the appropriate glenoid version angle in this method [23]. By aiming to achieve a posterior buttress effect to the glenoid, posterior dislocations can be prevented. However, there may be serious complications associated with this method, such as recurrent posterior instability, iatrogenic anterior instability, iatrogenic coracoid impingement syndrome and avascular necrosis [35]. Therefore, this operation is only indicated when glenoid retroversion is >30° and can be considered as a rescue procedure when other methods have not been successful [23].

Another method used in glenoid reconstruction is the use of grafting for augmentation of the posterior glenoid. With this method, it is aimed to prevent posterior dislocations by widening the joint surface of the glenoid (Figure 1). This
method is one of the alternatives that can be applied to young patients with chronic reverse Hill-Sac’s lesion of 25%-50%. Due to the high rate of long-term complications of shoulder arthroplasty, which is one of the most important alternatives for patients aged below 50 years, glenoid augmentation is one of the most important treatment choices [36,37]. In a study by Mueffels et al. in which glenoid augmentation was applied to patients with a mean follow-up of 18 years, poor long-term results were reported for posterior instability [38]. It was also reported that there was a high possibility of glenohumeral arthritis in patients with post-traumatic instability. Barbier et al. applied glenoid augmentation to 8 patients and in a mean follow-up period of 3 years reported a decrease in pain and satisfactory results of adequate function [39].

Arthroplasty

Total or partial shoulder prosthesis is indicated for patients with reverse Hill-Sac’s lesion of >45% ongoing for more than 6 months [40]. Total or partial shoulder arthroplasty for PSD patients has been described in literature. No clear differentiation has been made on the subject of indications for hemi-arthroplasty or total arthroplasty [25]. In elderly patients with rotator cuff failure, reverse shoulder prosthesis is one of the alternative treatments. Wooton et al. applied partial and total shoulder arthroplasty to 32 patients with chronic locked PSD and the mean follow-up period was 8.2 years [41]. Although a reduction in pain, increased external rotation and low rates of recurrent instability were reported, the success rate was found to be low because of glenohumeral arthritis. However, in a study by Johnson et al. of shoulder arthroplasty in patients below the age of 50 years, implant failure and functional deterioration were reported as the most important problems in the long-term results of shoulder prosthesis [37]. Therefore, these factors must be taken into consideration when applying shoulder prosthesis to a young patient group with PSD.

Summary

The treatment of PSD is extremely complex. One of the most important points is that diagnosis should be made in the shortest time possible. In cases such as epileptic seizures and electric shocks, it should be kept in mind. The size of the reverse Hill-Sac defect can be seen on the axillary lateral radiograph [14]. While operations based on soft tissue and closed reduction will be successful when diagnosis has been made early, when diagnosis is delayed, it may be necessary to apply methods such as glenoid augmentation or arthroplasty. Other factors significant in the determination of treatment can be listed as the age of the patient, the size of the reverse Hill-Sac’s lesion, concomitant fractures and functional expectations.

Conflicting interests

The authors have declared that no conflict of interests exist.

Author Contributions

MAEA have composed concept and design of the manuscript, acquisitioned data and drafted the manuscript. MU have acquisitioned data, analysed and interpretated data. NT have been involved revising it critically for important intellectual content and have given final approval of the version to be published.

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