Balloon treatment of posterior shoulder dislocation with reverse Hill–Sachs injury: description of a new technique

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Received: 12 March 2013 / Accepted: 13 March 2013 / Published online: 9 April 2013
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Abstract

Purpose Posterior shoulder dislocations are rare, and are usually the result of seizures. Anterior defects of the humeral head known as “reverse Hill–Sachs lesions” may increase the risk of recurrent dislocation and are difficult to treat. We developed a percutaneous technique for reduction of the dislocation or reduction of the anterior impaction fracture, using percutaneous balloon dilatation and cement fixation. **Methods** From 2009 to 2012, three patients aged 33, 72 and 75 years were admitted to our institution with a posterior shoulder dislocation showing an anterior “reverse Hill–Sachs” impaction fracture. One case was bilateral (four fractures). Patients were operated upon in the sitting position; the humeral head was stabilised by external fixator pins during balloon inflation. Reduction or filling of the defect was obtained in all cases. All patients were followed up and two patients (three fractures) were examined after one year by an independent observer. The clinical results were assessed using the Constant score and the RAND-36 physical components score. A computed tomography (CT) scan was obtained in all patients before and after the operation and at the latest follow-up. **Results** At three months postoperatively, all patients had resumed work or daily life activities with no limitation. The mean Constant score was 71 and RAND-36 score was 85.5. After one year, the mean Constant score was 73 and the RAND-36 score was 86.4 for the two patients who had

sufficient follow-up. On the postoperative radiograph and CT scan, sphericity of the humeral head was restored, and the reverse Hill–Sachs impaction was filled or reduced in all cases. There was no recurrent dislocation.

Conclusion Based on this small series, we believe that this technique should be added to our current armamentarium for posterior shoulder dislocations showing a deep impaction fracture of the humeral head that are at risk for recurrent dislocation.

Introduction

Posterior shoulder dislocations are rare, usually the result of seizures [1] and often bilateral [2]. Creation of an anterior impaction fracture of the humeral head by impaction on the posterior rim of the glenoid process is known as a “reverse Hill–Sachs” lesion [3] and greatly increases reduction difficulties and the likelihood of recurrent dislocations [4]. The risk of a recurrent dislocation was 17.7 % in a series of 120 cases within the first year [5], and in the presence of an anterior impaction fracture is estimated to be close to 30 %. Surgical intervention has been advocated [6] to alleviate the presence of an anterior humeral head impaction fracture in cases where 25 to 50 % of the humeral head is involved, from transposition of the subscapularis tendon to allograft filling of the defect or filling with exogenous material [7]. Cases where more than 50 % of the humeral head is involved warrant prosthetic shoulder replacement. However, these techniques are invasive and necessitate an extensive surgical approach to the shoulder. We have developed a percutaneous technique for reduction of the dislocation or reduction of the anterior impaction fracture using percutaneous balloon dilatation and cement fixation. We have used

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this technique in four shoulders (three patients) with excellent results.

Material and methods

Cases

From 2009 to 2012, three patients aged 33, 72 and 75 years were admitted to our institution with a posterior shoulder dislocation showing an anterior “reverse Hill–Sachs” impaction fracture. One case was bilateral. We thus had to treat four shoulders with a posterior dislocation following seizures. Balloon kyphoplasty was performed in all cases in different circumstances.

In the first case, a 72-year-old woman with the first of a series of seizures and a severely impacted, irreducible, dislocation with a 30 % humeral head impaction and an undisplaced fracture of the humeral head, balloon reduction was used as a salvage technique to obtain reduction of the dislocation and the fracture, and fracture fixation.

In the second case, a 35-year-old male with known epilepsy and a bilateral, reduced dislocation, the technique was used to fill the anterior reverse Hill–Sachs injury, prevent the onset of recurrent dislocation, and allow early return to work.

In the latest case, a 75-year-old man, it provided fracture reduction in an emergency and allowed early mobilization.

Cases are detailed in Table 1.

Technique

The procedure was performed under general anesthesia in the sitting position with help of an image intensifier focused on the affected shoulder in an antero posterior direction. Draping was similar to that for a shoulder arthroplasty. A set of two Hoffman external fixator pins were used to stabilise the humeral head and provide a guide for the balloon expansion. Pins were inserted from lateral to medial immediately posterior to the impaction zone in the humeral head. The balloon was then introduced from lateral to medial just anterior to those pins and posterior to the impaction (Fig. 1). The position of the balloon was controlled under

Fig. 1 Pins were inserted from lateral to medial immediately posterior to the impaction zone in the humeral head. The balloon was then introduced from lateral to medial just anterior to those pins and posterior to the impaction and slowly inflated

fluoroscopy, by moving the shoulder to ascertain the balloon's exact location. The balloon was then slowly inflated to disimpact the bony fragments. Depending on the cases, a pressure of 50 to 150 psi was required to obtain reduction of the impaction. In one case, the first case with a fracture humeral head and an impacted posterior dislocation, restoring the humeral head sphericity through the balloon inflation provided simultaneous reduction of the dislocation (Fig. 2). Once the reduction of the impaction was obtained, the balloon was slowly deflated and extracted, and a sufficient amount of regular kyphoplasty PMMA cement was injected into the humeral head to provide immediate stabilization. The Hoffman external fixation pins were removed and all orifices were closed using absorbable sutures and oxyl2-metacrylate glue (Dermabond®). The affected shoulder was then immobilised in a sling for three to six weeks depending on the fracture and early mobilisation was started. Patients were seen by the surgeon at three and six weeks, and then every three months. All patients had a CT-scan examination before (Fig. 3) and after (Fig. 4) the procedure and then one year after the operation. A plain AP and lateral radiograph was performed at each time-point and the Constant Shoulder score was computed; the RAND-36 score was also recorded. The first two patients were

Table 1 Cases

Pt #	1	2 (Right)	2 (Left)	3
Age	72	33	33	75
Aetiology	Seizure	Seizure	Seizure	Seizure
Delay to surgery	4 days	3 weeks	3 weeks	2 days
Dislocation reduced prior to surgery	Yes	No	No	No
Duration of surgery	50 min	45 min	30 min	25 min
Mobilisation	6 weeks	Day 1	Day 1	3 weeks
Hospital stay	2 days	2 days	2 days	3 days
Follow up	24 months	22 months	22 months	4 months

Fig. 2 In one case, the first case with a fracture humeral head and an impacted posterior dislocation, restoring the humeral head sphericity through the balloon inflation provided simultaneous reduction of the dislocation

examined after one year by an independent observer who had not participated in the operation and who administered the Constant score at this time. The last patient has not yet reached one year since the operation.

Results

No operative complication occurred. Neither recurrent dislocation nor recurrent seizure was observed.

Postoperatively, skin and soft tissue scarring was minimal. The 35-year-old man resumed work after two months.

On the postoperative radiograph and CT scan, sphericity of the humeral head was restored, the reverse Hill–Sachs impaction was filled or reduced in all cases, and there was no recurrent dislocation.

Fig. 3 A CT-scan examination before the procedure in a 72-year-old woman with a first seizure and a severely impacted, irreducible, dislocation with a 30 % humeral head impaction and an undisplaced fracture of the humeral head

Fig. 4 A CT-scan examination after the procedure, same patient as in Fig. 3

At three months postoperatively, all patients had resumed work or daily life activities with no limitation. The Constant and RAND-36 scores at three months and one year are shown in Table 2.

The one-year radiograph and CT scan showed no modification and no degradation.

Discussion

Posterior shoulder dislocations are frequently associated with anterior impaction of the humeral head as a “reverse Hill–Sachs” injury [8, 9]. This impaction fracture is known as a risk factor for difficulties in reduction, instability, and chronic recurrence of dislocations.

Different procedures have been advocated and used in the past to treat the defect due to the impaction fracture: Transposition of the subscapularis tendon into the defect [8, 9], transposition of the tuberosity and the tendon [10],

Table 2 Constant and RAND-36 scores after one year

Pt #	1	2 (Right)	2 (Left)	3
3-months follow-up				
Constant	60 (84,5 %)	80 (93 %)	75 (83 %)	69 (92 %)
RAND-36 Physical Score	80,0	93,7	93,7	75
1 year follow-up				
Constant	60 (84,5 %)	80 (93 %)	78 (86 %)	N/A
RAND-36 Physical Score	72,5	93,7	93,7	N/A

N/A Not applicable

autologous bone grafting and capsular repair [11], acromial bone block [12], rotation osteotomy of the proximal humerus [13], defect filling using screws and osteoconductive material [14], allograft reconstruction as the most used technique [15] and shoulder arthroplasty [16]. All these techniques are open surgical procedures performed through large deltopectoral anterior approach. Soft tissue scarring is extensive and bone graft reconstructions take usually three months to allow complete use and mobilisation.

Given the spherical shape of the humeral head, obtaining the reduction by inserting a balloon in the epiphysis and inflating it seems a logical idea. Reduction may then be obtained as the humeral head “pops” like a ping-pong ball and recovers its shape. However, the anatomy is more complex than that of a ball, necessitating great care to ensure that the balloon is properly directed and positioned. Furthermore, reduction of the impaction fracture may prove difficult depending on the age of the dislocation, and one may have to consider only filling the defect rather than reducing the impaction fracture.

The percutaneous technique we used obtained reduction in one case with combined undisplaced surgical neck fracture. All patients were pain-free and recovered normal function with no recurrent dislocation. The series (four cases in three patients) is small with a follow-up limited to one year. However, this type of injury is rare.

Reducing the humeral impaction fracture in anterior shoulder dislocations using the balloon technique has already been proposed by Sandmann et al. [17]. This was a feasibility study in an artificial fracture model in six cadavers with no shoulder pathology. To our knowledge, our study is the first report where a balloon procedure is detailed as a real operation in patients. However, posterior dislocations are rare and pose unique problems to the surgeon.

Anterior shoulder dislocations on the contrary are a very common injury with a high rate of recurrent dislocations leading to chronic disability and necessitating surgery. The role of anterior soft tissue injuries has been clearly demonstrated and most surgical techniques used to treat the chronic instability try to address this matter with anterior stabilisation. However, creation of a posterior humeral head defect at the time of the first injury, known as a “Hill–Sachs” defect, is clearly a recurrence factor, although its exact contribution is unclear. It remains to be seen whether reduction of the Hill–Sachs injury in anterior dislocations would be a beneficial procedure to the patients. To our knowledge, no patient has yet been operated upon using such a technique in anterior dislocation cases, either acute or chronic, and whether using such a technique may alleviate the risk of chronic instability in some patients remains to be demonstrated. A percutaneous arthroscopic technique has been described using a percutaneous guide and a bone tamp [18] on four

cases with no recurrence so far in anterior dislocations with posterior Hill Sachs defects. We believe that a better understanding of the recurrence factors in anterior dislocation through imaging immediately following the initial dislocation may be warranted, and there may be a point in trying to correct the posterior notch using balloon kyphoplasty as an emergency tool in these patients before the initial fracture heals with a defect prone to increasing the risk of recurrence.

The technique we used for reduction as an inflation balloon is directly derived from the vertebral kyphoplasty techniques we have been using since 2003 in the spine. We also started using such techniques in limb fractures such as displaced calcaneal fractures with thalamic involvement since 2006 [19–21], and fractures of the lateral tibial plateau as early as March 2009. The use of methacrylate (PMMA) cement as a filling material and fixation device has not caused any issue in the spine nor in limb fractures. On the contrary, PMMA has proved to be an excellent biocompatible fixation material. Using a bioabsorbable material instead, such as calcium sulphate or calcium phosphate, may be a better solution. However, these, unlike PMMA, have no “glue” effect on trabecular bone, and since their mechanical properties are so weak with currently available products, it is unclear whether acceptable stabilisation of the impaction fracture would be obtained.

In conclusion, based on the experience gained from this small series, we believe that this technique should be added to our current armamentarium for posterior shoulder dislocations showing a deep impaction fracture of the humeral head that are at risk for recurrent dislocation.

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