

Anatomical reconstruction for Reverse Hill-Sachs lesions after posterior locked shoulder dislocation fracture: a case series of six patients

Peter Bock · Rainer Kluger · Beat Hintermann

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Abstract

Introduction Posterior locked shoulder dislocation fracture is a rare injury. Impression fractures of the humeral articular surface are common with this injury. Different methods exist to restore impression fractures. We present a case series and the results of six patients that had an anatomical repair with spongiotic autograft/allograft for humeral head impression fractures after locked posterior shoulder dislocation.

Material and methods Six patients with an average age of 52.5 years at time of surgery were included. All patients had an anteromedial impression fracture, one patient had an additional two part fracture. The injury was caused by epileptic seizures in five and by direct trauma in one patient. The diagnosis was made on the day of the injury for two patients (33%). For the other patients the time span between the injury and the diagnosis ranged between 5 and 180 days. The impressed cartilage of the defect was first elevated in one piece, the defect filled with the graft and the cartilage fixed on top of the graft by Mitek ancrs introduced under the affected area. One patient had an additional two-part fracture that was fixed separately.

Results At a mean time follow-up of 62.7 (18–95) months the result was found to be excellent for two patients and good for four patients with a mean Constant Score of 88.2 points (range 83–98). One patient had a redislocation after

three months that was fixed by the same method. At the last follow-up no redislocation or graft collapse was seen.

Conclusion The proposed method of anatomical head reconstruction by spongiotic auto/allograft proved to be a valid and good method to restore shoulder function and stability.

Keywords Posterior shoulder dislocation fracture · Reverse Hill-Sachs lesion · Impression fracture · Anatomic reconstruction · Allograft · Autograft

Introduction

Posterior locked shoulder dislocation fracture is a rare injury encountered in orthopedic practice constituting only 2–4% of all shoulder dislocations. Association with epileptic seizures is the most common cause [15], followed by electric induced convulsions and trauma. Combined with humeral fractures posterior shoulder dislocations are even more rarely encountered [6] and occur with an incidence of less than 1% [18]. The injury is difficult to diagnose and is overseen in up to 60% at first examination [7]. This is why Mc Laughlin [17] called it a “diagnostic trap”.

Neer [18] described several fracture types that are encountered with posterior shoulder dislocations. One of them is the anteromedial humeral head impression fracture or “Reverse Hill-Sachs lesion”.

The difficulty to treat this injury lies within the fact that with a temporal delay of the diagnosis a further treatment becomes more difficult. Not only is the head vascularization at risk but the head defect can become more extended. A more extended defect risks provoking a following instability and osteoarthritis. Thus, apart from the extent of the head injury and the age of the patient, the treatment also

P. Bock (✉) · R. Kluger
Department of Orthopaedic Surgery, Donauespital Wien,
Langobardenstrasse 122, 1220 Wien, Austria
e-mail: bock_p@yahoo.com

B. Hintermann
Department of Orthopaedic Surgery, Kantonsspital Liestal,
Rheinstrasse 26, 4410 Liestal, Switzerland

depends on the time span between the occurrence of the injury and the diagnosis.

Different treatment options on how to restore an impression fracture have been described in literature. One of these options is a non-anatomic reconstruction such as a transfer of the subscapularis tendon or the minor tubercle into an anterior head lesion [9, 13, 17, 18]. Another treatment option for larger impression fractures is joint arthroplasty by either a total or partial shoulder replacement.

The present study wants to show a method of anatomic reconstruction with spongiotic allograft/autograft for impression fractures as a result of locked posterior shoulder dislocation. We present the method and the results of this treatment using an international scoring system to make our results comparable to other methods.

Materials and methods

Between 1996 and 2003, ten patients (10 shoulders) were treated surgically for locked posterior shoulder dislocation fractures. Six of those patients were suitable for an anatomical repair of the humeral articular surface according to the inclusion criteria described later. Those patients were thus included in this study. Among the other four patients, three had a shoulder hemiarthroplasty and one patient only had a head reconstruction without repair of the articular surface.

We followed a treatment algorithm that has been described by Neer [18] and includes the following inclusion criteria for an anatomical repair of the articular surface: locked posterior shoulder dislocation fracture of any etiology, a time span between injury and diagnosis of up to 6 months, affected humeral head surface area of more than 20% and less than 45% (as diagnosed by the CT scan). Exclusion criteria were a head injury of more than 50%, a time span between injury and diagnosis of more than 6 months and any situation in which surgery would not be recommended due to any medical cause.

The average age at the time of the injury was 52.5 years (range 40–74 years). All but one patient were males. The

injury was caused by trauma in one case: car accident. In the other five patients the cause was an epileptic seizure.

The diagnosis was made on the day of the injury for two patients (33%). For the other patients the time span between the injury and the diagnosis ranged between 5 and 180 days (see Table 1).

After clinical examination every patient underwent standard X-ray (a.p. and axial) and CT scan (Fig. 2). According to Neer's classification [18], five patients were diagnosed humeral articular head impression fractures only. One patient was diagnosed a two-part fracture and a humeral articular head impression fracture.

After the radiological examination a closed reduction was tried for all six patients under full anesthesia and successful for three patients. After successful reduction none of the three shoulders was stable and could be redislocated by an elevation greater than 30° and internal rotation greater than 10°.

Surgical technique

A deltopectoral approach through the rotator interval was used to reach the shoulder joint and visualize the head defect. By the same approach the shoulder joint was evaluated for eventual other lesions (labral or rotator cuff). In this case series no other lesions were found. Then the impressed cartilage with adjacent cortical and spongiotic bone was elevated from the impressed area—if possible in one piece. In the chronic case (180 days) we first carefully freed the impressed cartilage area with a chisel and then elevated it. One or more Mitek anchors were introduced at the bottom of the defect. Then the remaining defect was filled with bone graft, which was impacted into the defect. In two cases (30% head defect each) only spongiotic bone from the iliac crest was used. In three other cases (40–45% head defect) we used a combination of spongiotic bone from the iliac crest with spongiotic allograft. In one patient (30% head defect) only spongiotic allograft was used because the patient did not want to have bone taken from his iliac crest. Lastly, the affected area was sealed with the previously

Table 1 Patients' data

Case	Sex, age	Cause of dislocation	Delay until diagnosis (days)	Diagnosis	Humeral head involvement (%)	Graft used	Therapy
1	m, 44	Epileptic seizure	180	Impression fracture	40	Auto-/allograft	Articular reconstruction
2	m, 56	Epileptic seizure	10	Impression fracture	30	Autograft	Articular reconstruction
3	m, 48	Car accident	0	Impression fracture	40	Auto-/allograft	Articular reconstruction
4	m, 53	Epileptic seizure	14	Impression fracture	45	Auto-/allograft	Articular reconstruction
5	f, 40	Epileptic seizure	0	Impression fracture	30	Allograft	Articular reconstruction
6	m, 74	Epileptic seizure	5	Two part + impression fracture	30	Autograft	ORIF + articular reconstruction

removed cartilage. The former removed cartilage was then firmly fixed on top of the impacted bone graft using the absorbable suture material on the Mitek anchors introduced before under the affected area (Fig. 1). Thus re-dislocation of the shoulder was prevented by anatomic reconstruction of the humeral articular surface.

Humeral head reconstruction for the two-part fracture was achieved by one cannulated AO screw (one patient).

Post-operative management and evaluation

Patients with articular surface reconstruction and/or fracture fixation had their upper limb kept in a pre-fabricated orthoses in neutral position for 6 weeks post-operatively. Three weeks after surgery passive mobilization without rotation was begun. Active mobilization was allowed 6 weeks after surgery. Twelve weeks post-operatively, full range of motion and full activity were allowed.

Follow-up examinations were done 6 weeks after the surgery, then 3 months after the surgery, and 12 months after surgery. The final follow-up examination was done an average of 62.7 (18–95) months after surgery. During the last appointment, patients were X-rayed in addition to a

clinical examination. All patients were evaluated with use of the functional shoulder-scoring system described by Constant and Murley [5]. The patients were examined according to the original protocol established by Constant and Murley [5] for all parameters except strength, which was evaluated with the Isobex dynamometer (Cursor AG, Bern, Switzerland). The patients were required to sustain actively a position of 90° of abduction in the scapular plane, with the elbow extended and the forearm pronated, against a resistance measured in kilograms, derived from the dynamometer, which was applied to the wrist. The average of three readings of an effort of 5 s has been established as the most reproducible measurement [10] and was therefore used to calculate the component for strength in the scoring system of Constant and Murley [5].

Apart from the Constant and Murley [5] score the patients were asked for a personal overall evaluation of the result of their surgery. The patients were asked to choose between very satisfied, satisfied, less satisfied and not satisfied.

Radiographically special attention was paid to the incorporation of the graft and the congruency of the joint (Fig. 3).



Fig. 1 Coronal view of the humeral head and the glenoid. Anatomical articular head surface reconstruction by allograft impaction and fixation by Mitek anchors. The Mitek anchors are fixed in the defect under the graft

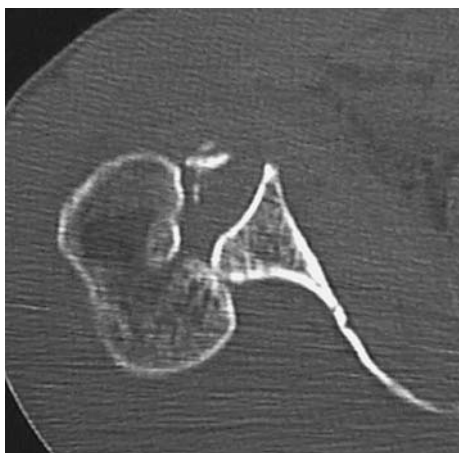


Fig. 2 Pre-operative CT scan of a two-part fracture with articular impression fracture (case 6)



Fig. 3 Post-operative radiograph after humeral articular surface reconstruction with autograft and head reconstruction by one AO screw. The humeral head is relocated and the congruency maintained (case 6)

Results

After an average of follow-up time of 62.7 (18–95) months two patients were very satisfied and four patients satisfied with the obtained results (see Table 2). No patient was dissatisfied. The average constant score was 88.2 points (range 83–98).

According to Iannotti et al. [14] there were two patients with an excellent result (90–100 points) and four patients with a good result (80–89 points).

Range of motion for anteversion ranged between 150° and 160° (average 158.3°), for abduction between 140° and 160° (average 146.7°), for external rotation between 50° and 60° (average 58.3°) and internal rotation from lumbar spine segment III to thoracic VII.

Return to work could be accomplished an average of 16 weeks (12–20) after surgery. None of the patients was involved in heavy labour.

Radiographs made at the final follow-up examination revealed no signs of allograft failure. The contour of the graft was maintained in all shoulders. No evidence of avascular necrosis was found in any patient. All but one (see complications) patient were free from redislocation at the time of final follow-up. One patient showed a progression of osteoarthritis after humeral head surface reconstruction compared to the pre-operative situation but these changes were not associated with subjective complaints.

We did not see any radiological or clinical difference between patients where we used autograft only, allograft only or a combination of autograft and allograft. One patient suffered from prolonged pain (3 months) after spongiotic bone harvest from the iliac crest but recovered later on.

Complications

One patient was operated on a second time due to a re-dislocation 3 months after the first surgery. This patient had a temporal delay in diagnosis of 180 days and showed a primary articular surface defect of 40%. Both times a

combination of allo- and autograft was used. During the second operation the dorsal labrum was refixed and dorsal capsulorrhaphy was done by a dorsal approach. A second head reconstruction with allograft and Mitek anchor fixation was done by a ventral approach. After the second surgery there was no redislocation or avascular necrosis of the humeral head.

Discussion

This study shows the results of an anatomic repair as a treatment for anteromedial impression fractures as a result of a locked posterior shoulder dislocation fracture based on the treatment algorithm proposed by Neer [18]. Other than Neer [18] we did not apply a subscapularis tendon transfer or transfer of the lesser tuberosity, but filled the defect with spongiotic allograft/autograft.

This injury is rare and we opted only to include those patients with a humeral head impression fracture where according to the treatment algorithm proposed by Neer [18] a head preserving technique is possible. We excluded all those cases where either a head preserving procedure was not possible or a reconstruction of the humeral articular head surface was not indicated due to its small extent.

Limitations of the study include the relatively small number of patients and a rather short follow-up time of an average of 62.7 months. Due to the small number there is no control group where another surgical method was applied. We could also not show if the method we applied would be valid for patients with a longer than 6 months delay in diagnosis or a larger defect because we excluded those patients from this study and applied another method. Another limitation is the lack of an MRI at the latest follow-up in order to show vitality of the graft and exclude osteonecrosis of the humeral head. The present sphericity of the humeral head in standard X-rays was taken as a sign for a vital humeral head.

The treatment for posterior locked shoulder dislocation fractures accompanied by anteromedial impression fractures

Table 2 Post-operative results

Case	ROM (°)					
	Duration of follow-up (months)	Satisfaction	Flexion involved/contralat	Abduction involved/contralat	Ext. Rotation involved/contralat	Constant-Murley Score
1	68	Satisfied	160/160	150/160	60/70	90
2	95	Satisfied	160/170	150/160	50/80	85
3	95	Very satisfied	160/170	140/170	60/70	98
4	47	Very satisfied	160/170	140/170	60/80	88
5	59	Satisfied	150/170	150/160	60/80	85
6	12	Satisfied	160/170	150/160	60/70	83

should establish stability and function of the shoulder while maintaining anatomic soft tissue attachments and preserving the remaining humeral articular surface. In this case series the method of spongiotic bone grafting and fixation with Mitek ancrs proved to give reliable results.

Two patients (33%) were very satisfied, and the other four patients satisfied with the result of their treatment. No patient was dissatisfied with the treatment. All the patients gained a very good mobility after the surgery at the time of follow-up in all directions compared to the non-injured shoulder and could handle their daily life without problems.

Using the Constant and Murley Score [5] and the grading system used by Iannotti et al. [14] two patients showed an excellent result and four patients a good result. There was no poor result in this case series.

Anatomic reconstruction of the humeral articular surface with allograft and autograft has been described by other authors [4, 12, 21]. However those authors used either a femoral head allograft [12, 21] or an autograft of the contralateral shoulder [3].

Comparison of our results with results in other case series is limited because different scores had been used. Only Gerber and Lambert [12] used the Constant and Murley Score [5] system. Gerber and Lambert [12] report about a case series of four patients with femoral head allografts and fixation by screws. The delay until diagnosis ranged from 1 to 12 months. The average Constant and Murley [5] score was 72.5 points after a minimum follow-up of 5 years. They saw one avascular necrosis 76 months post-operatively and one collapse with flattening of the contour of the original humeral head and progressive osteoarthritis within the sixth year after surgery. The latter one had a diagnostic delay of 12 months and pre-operative signs of osteoarthritis. The authors conclude that the results of anatomical reconstruction with allogeneic bone appear comparable with other recommended techniques of treatment and that their technique is a viable alternative to subscapularis transfer for smaller defects as well as an alternative to hemiarthroplasty and total shoulder arthroplasty for carefully selected cases. As we applied the recommendations given by Neer [18] we did not perform anatomic reconstruction after a temporal delay of the diagnosis of more than 6 months.

Connor [4] reports about one case of acute posterior fracture dislocation with an anteromedial defect that was reconstructed by an osteochondral autograft of the other shoulder that was also injured and fixed by hemiarthroplasty. The osteochondral graft was fixed by screws. At a 2 year follow-up examination the patient had an excellent function of the reconstructed shoulder without pain. The author concludes that this method is an alternative to a reconstruction with either allograft or autograft of the iliac crest especially in bilateral shoulder injuries.

Cicak [3] means that allograft implantation should be used in patients where one can find a good bone quality of the residual bone and no signs of osteoarthritis. He does not give any recommendation for a time limit in diagnostic delay.

Assom [1] and Re [19] both propose a method with retrograde elevation of the depressed area. Assom uses an absorbable screw to secure the result and presents two cases with recent lesions of up to 4 weeks. According to Assom the indication for this surgical approach are recent lesions. Re et al. [19] propose cancellous allograft to elevate the depressed area.

Checcia et al. [2] used the same treatment algorithm as we did, but with the difference of either using a subscapularis tendon transfer or the Neer's modification to treat the reverse Hill-Sachs lesion with an extent of 20–50% of the head surface. He used the UCLA (University of Los Angeles) scoring system [8]. The results are similar to the results in our study. Within the chronic cases (diagnostic delay >4 weeks) the humeral head collapsed during the surgery in one case. The diagnostic delay for this patient was more than 10 months but the patient did not agree with hemiarthroplasty. Another patient developed an infection and a following head necrosis. The patients with a shorter diagnostic delay (<4 weeks) had a better post-operative range of motion with an average of 145° elevation and 66° external rotation than the more chronic cases with an average of 123.8° elevation and 60° external rotation.

Hawkins et al. [13] report about a total of 41 shoulders with locked posterior shoulder dislocation fracture. Hawkins [13] did not use any scoring system. Of those 41 patients four had a unilateral subscapularis tendon transfer presenting with a humeral head defect of 20–45% and a dislocation for less than six months. Other five patients had already had a tendon transfer elsewhere that failed and were thus sent to their clinic for revision. The results concerning the range of motion are comparable to our results.

We see our method as a safe and good strategy in order to anatomically reconstruct the shoulder joint. The described surgical technique with anterograde defect filling gives the possibility to exactly visualize the filling of the defect and thus ensure an anatomic situation of the humeral head and reconstruction of the joint line. We admit that the elevation of articular cartilage in the very chronic cases (180 days) is a difficult technique and will not work for every case. We saw one redislocation in a patient with a very long delay in diagnosis where on one hand we did not refill the defect sufficiently and on the other hand did not treat the soft tissue lesion. A critical point in this technique is the elevation of the cartilage and adjacent bone in one piece from the impressed area and the firm impaction grafting of spongiotic graft into the remaining defect as to give enough stability to the reconstruction and not to cause graft

collapse. If the graft is firmly impacted we did not see any danger of collapse. For some of the patients we used a combination of autograft and allograft if we did not want to create too big a defect within the iliac crest. The combination of both types of grafts turned out to be stable. One patient refused to have bone taken from the iliac crest and thus only received allograft.

We were happy not to have seen more than one complication with this technique as we know that another critical point of graft incorporation and fracture healing seems to be a well vascularized humeral head knowing that the vascularization of the humeral head [11] is at high risk with posterior dislocation. Another factor to consider is a secondary deformity of the articular cartilage due to resorption of the subchondral bone [20] after prolonged dislocation. Even after a temporal delay in diagnosis of 6 months no head collapse was seen in our patient series. Radiologically, all the grafts were well incorporated as congruity, mechanical stability and incorporation of all grafts as well as fracture healing was achieved for all patients. Still we have to be aware of this problem with defects of greater extents and longer delays in diagnosis.

Conclusion

Posterior shoulder dislocation fracture is a complex injury and often involves the anteromedial aspect of the humeral articular head surface. The treatment should be able to fulfill the demand for a functional and stable shoulder joint. The strategy in this case series to reconstruct the shoulder joint in an anatomical way until a diagnostic delay of up to 6 months instead of opting for a shoulderarthroplasty seems to be a promising one knowing the outcome of shoulderarthroplasty [16]. Autograft, allograft and the combination of allograft/autograft as a means to restore the humeral head articular surface and fixation by Mitek anchors could be shown as a successful method. It seems a viable alternative to subscapularis transfer or rotational osteotomy with the advantage of unaltered shoulder anatomy.

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