Acute Shoulder Posterior Dislocation with Impression Fracture of the Humeral Head – A New Surgical Approach and Review of the Literature

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Acute posterior dislocation of the shoulder is a rare and often misdiagnosed disease caused by trauma, epileptic fits or electric shock. It mostly occurs in active, young people. Several lesions can be found associated with the dislocation: posterior capsular lesions, ruptures of the rotator cuff, fractures of the humeral surgical neck and of the tuberosities, (rarely) fractures of the posterior glenoid margin and, above all, the anteromedial humeral head defect or impression fracture.1,2

Computed tomography (CT) provides excellent visualisation of the relationship between the glenoid and the humeral head and is the most pertinent technique for evaluating the size of the impression fracture, as it allows classification of the fracture as a percentage of the humeral articular shape involved. Recommendations for treatment have been based on the fracture’s pattern, the size of the defect and delays in diagnosis.3–6 However, due to the rarity of this disease, there are no evidence-based guidelines for treatment.8

In cases of acute impression defect without displaced osteochondral fragment and that involve 20–50% of the humeral articular surface, the most widely used technique is still the Neer modification of the McLaughlin technique – a transposition of the lesser tuberosity and subscapularis into the humeral head defect.9 However, this approach of changing the shoulder anatomy can limit internal rotation and complicate future prosthetic reconstruction. In contrast, the reconstruction of the humeral head shape by elevation of the depressed cartilage or by the use of a solid osteochondral allograft to fill the defect does not alter the skeletal anatomy. The anatomical reconstruction, although theoretically the best choice, can be challenging to achieve as the elevated osteochondral tissue tends to collapse, while the allograft reconstruction is a demanding surgical technique.

The purpose of this paper is two-fold: to review the literature about the surgical treatment of the medium-sized McLaughlin lesion (20–50%) due to an acute posterior shoulder dislocation; and to report on the use of a new, less invasive, easy and safe surgical technique.

Review of the Literature

In the event of posterior shoulder instability persisting after closed reduction or impression fractures affecting more than 25–30% of the humeral articular shape, a surgical approach is usually recommended.6,10 The procedures can be divided into two main groups: anatomical or non-anatomical techniques.

Non-anatomical Techniques

The non-anatomical approach was the first technique to be used and is still popular. McLaughlin and Hill in 1952 described a subscapularis transfer into the humeral head defect for an impression fracture of between 20 and 40% to limit maximal internal rotation and prevent the edge of the defect from falling behind the posterior rim.1 Neer modified this method by osteotomising the lesser tuberosity with the attached subscapularis.9 This modification was designed to provide better bony filling of the defect and more secure reinsertion of the subscapularis. Hawkins et al. reported success in four of four patients with an impression defect that involved 20–40% of the surface of the joint, dislocated for less than six months and treated with the McLaughlin procedure.3 The authors also described failure in five patients treated with the same procedure who had an impression defect involving more than 40% of the surface of the humerus or dislocated for more than 12 months. Four patients who were treated by transfer of the lesser tuberosity into the defect had good results and, according to the same authors, this procedure appeared to be superior to the results for the McLaughlin transfer of the subscapularis tendon.

Walch et al. treated acutely (within 45 days) six shoulders with impression defect less than 50% using the McLaughlin or Neer procedure, achieving good to excellent functional results.11 Finkelstein et al. used the modified McLaughlin procedure acutely in seven shoulders with a defect involving 20–45% of the humeral head, obtaining excellent results.12 Checchia et al., using McLaughlin or Neer procedures in patients with impression fractures of 20–50%, found good or excellent results in five of five patients with a less than four-week delay of treatment. Of nine patients with a more than four-week delay of treatment, seven cases were considered excellent or good, one fair (head collapsed) and one poor (post-operative infection and humeral head osteonecrosis).13

According to all of these studies, the acute (within four weeks) treatment of posterior dislocation of the shoulder with impression defect involving 20–50% of the surface of the humerus with McLaughlin or Neer procedures achieved a good to excellent functional result. The time of surgery can be delayed for six months, but the results will be worse. Within these indications, these procedures can still be considered the operation of choice.

Recently, Krackhardt described his arthroscopic technique, an adaptation of the McLaughlin procedure, performed in 12 shoulders without major complications.14

Despite the good clinical results described, it must be underlined that, at a follow-up of approximately three years, Checchia et al. found mild osteoarthritis of the shoulder in patients treated acutely (<4 weeks).13 Moreover, whether performed by open surgery or arthroscopically, the
transposition of the subscapularis can limit the internal rotation and complicate future prosthetic reconstruction.\textsuperscript{12,13}

Rotational osteotomy of the proximal part of the humerus has also been described as a non-anatomical procedure.\textsuperscript{15} After a transverse osteotomy of the surgical humeral neck, the shaft is rotated internally and fixed with an angled blade plate. Only six of the 10 patients treated with this technique achieved good results. Due to its complexity and intrinsic complications, this technique should be used in young people only when it is the sole alternative to shoulder arthroplasty.

Anatomical Techniques

Alternative treatments to the above-described procedures are the anatomical restoration of the humeral head through the use of allograft, osteochondral autograft or the elevation of the depressed cartilage and subchondral buttressing with autologous cancellous bone graft.

Dobousset was the first to use the anatomical technique, re-establishing the humeral shape with an autogenous bone graft associated with the reconstruction of the posterior glenohumeral capsule.\textsuperscript{16} This surgical option aims to anatomically restore the humeral head shape, preserving the cartilage, the articular congruity and the lesser tuberosity contribution of the concavity-compression effect. Nevertheless, in the authors’ experience the limitation of this approach is the instability of the elevated cartilage and subchondral bone, which is prone to collapse, thus negating all of its advantages.

Gerber et al. introduced the use of allograft to fill the defect, restoring the sphericity of the head. He used this technique in nine shoulder dislocations with a delay in treatment ranging from one to 12 months and with a McLaughlin defect involving 40–55% of the humeral articular surface.\textsuperscript{17} The author reported that this technique yielded similar results to the modified McLaughlin procedure without altering the osseous architecture. The use of allograft represents an alternative to hemiarthroplasty or total joint arthroplasty in carefully selected larger defects in chronic cases (six to 12 months), but is a demanding surgical technique.

In rare cases when the impression defect is bilateral, an osteochondral autograft can be taken from one shoulder during hemiarthroplasty and used to fill the defect in the contralateral side, in a similar way to the autograft reconstruction described by Gerber.\textsuperscript{18} Considering the limits and advantages of anatomical reconstruction, it was thought that combining the Dobousset principles with the use of the subcondral bone as an autograft would achieve a strong and safe support.

Surgical Technique

The patient is positioned supine semi-sitting on a beach chair with the upper body approximately 60–70° from the horizontal plane, with the shoulder operating table placed ‘cut-away’ to facilitate the procedure. The whole arm is prepared and draped to allow for assisted free movements (performed by an assistant). The advantage of this position is that the surgeon can access the whole operative site from above and overlook the fracture from 360°, ensuring better access and control of the entire surgical field area.

First, an anterior deltopectoral standard approach is performed. The subacromialis bursa is removed and the rotator cuff interval is opened (see Figure 1). The visualisation of the fracture is obtained by opening the rotator interval without detaching the subscapularis tendon from the lesser tuberosity.

The next step is the creation of a little cortical window (of about 10x10mm), 2cm distal from the greater tuberosity apex and 2cm lateral to the long head of biceps sulcus (see Figure 2). To elevate the bone defect, specific tools were developed (see Figure 3): a hollow trephine cutter to create a bone carrot, and a bone tapper that allows optimal running into the hollow trephine (10mm in diameter). The reduction procedure is performed via the cortical window using the bone tapper, moving from the cortical window to the impression fracture. Using the hollow trephine cutter in an oblique direction from cortical window to the impression fracture, a bone carrot is obtained. This bone tissue is used to perform the reduction of the head defect using the bone tapper (see Figure 2). The anatomical reduction through the open rotator cuff interval is evaluated step by step. Finally, once the head surface is adequately reduced, it is secured definitively with a 9x30mm interference biabsorbable screw (see Figure 4) inserted through the window perpendicularly in the same direction as the depression. The humeral head is tested in free movements by the
assistant to check for a good stability level. The window is covered with the previous cortical bone using a press-fit technique. The posterior capsule is not surgically addressed. The shoulder is positioned in 20° of external rotation, 10° of abduction and 10° of extension. The patient wears the cast for five weeks, and additional radiographs are performed to confirm the humeral head reduction. The post-operative programme is two weeks of pendulum exercise and passive assistant motion, and at five weeks the brace is removed and full active and passive motion is allowed.

Critical Concepts
The indications for the use of this technique are an acute (assessed within three to four weeks) impression defect, without displaced osteochondral fragment, involving up to 50% of the articular surface of the humerus (see Figure 5). Obviously, good bone quality and a young, active patient increase the chances of a successful procedure.

An absolute contraindication is to perform this procedure in patients over 70 years of age with osteoporotic bone. A relative contraindication is the treatment of patients in whom a very large articular surface is involved (more than 50–60%).

In the authors’ experience, the opening of the rotator interval cuff is enough to evaluate the depression fracture of the articular surface and to control the reduction obtained. Should the visualisation be insufficient, the surgeon can extend the interval split more medially. However, detaching the proximal subscapularis tendon from the lesser tuberosity should be the surgeon’s last option as it will have a negative impact on the patient’s recovery time. The aim of the interference screw is to fill the cancellous bone gap left by the tapper. The screw must not reduce the fracture, but is used only to prevent the collapse of the surface. To date, the authors have performed two of these surgical procedures, obtaining good anatomical reduction of the impression defect, and after more than 24 months there have been no signs of osteoarthrits, collapse or other late complications. The range of motion is normal without limits in internal rotation. The authors’ anatomical technique therefore represents a safe and easy anatomical alternative to subscapularis transfer in acute humeral head defects involving up to 40–50% of the humeral shape.19

The McLaughlin impression fracture is a rare but clinically and radiologically well-defined lesion. Even though there is no evidence-based treatment protocol in case of an acute, medium-sized impression defect in a fit patient, the operation is mandatory. Among all the techniques, the non-anatomical approach is still widely used due to the reproducible good results, especially when performed acutely. The authors’ technique can be a viable alternative in this case as it is safe and easy. Once again, this report underlines the need for early diagnosis and treatment.