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Surgical treatment of displaced fractures of the glenoid cavity

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Abstract Between 1994 and 1999 ten patients with displaced glenoid cavity fractures were treated operatively. Nine of the fractures were the result of road traffic accidents. There were eight men and two women patients, their average age was 38 (range 22–54) years, and the follow-up ranged from 18 to 84 months. Functional outcome was assessed in terms of pain, range of movement, muscle power, and performance of daily activities, and the results were excellent or good in eight patients.

Résumé Entre 1994 à 1999 nous avons opéré dix malades avec des fractures déplacées de la glène de l'omoplate. Il y avait 8 hommes et 2 femmes, et l'âge moyen était de 38 (22–54) années. Neuf des fractures résultaient d'accidents de la voie publique. Le suivi était de 18 à 84 mois. Le résultat fonctionnel a été étudié sur la douleur, l'amplitude de mouvement, la force musculaire et la performance dans les activités journalières. Le résultat a été estimé comme excellent ou bon pour 8 malades.

Introduction

Fractures of the scapula comprise 1% of all fractures, and 10% of these involve the glenoid cavity (one of 1,000 of all fracture types). However, only 10% of fractures of the glenoid cavity are substantially displaced [5, 6, 9], giving an incidence of only one in every 10,000 fractures.

Direct high-impact trauma is the usual cause of fractures of the scapula and the glenoid cavity and therefore there is a high prevalence of associated osseous and soft-tissue injuries. These injuries may be multiple, major and even life-threatening [4, 7, 9]. Fractures of the glenoid cavity are intra-articular and can result in considerable morbidity due to chronic instability of the shoulder or de-

generative joint disease, or both. The aim of our study was to assess the outcome of surgical treatment for displaced fractures of the glenoid cavity, as these injuries are rare and have received little attention in the literature.

Classification and mechanism of injury

Glenoid rim fractures

True fractures of the glenoid rim are distinct from the small chip fractures that occasionally occur when a dislocating humeral head strikes the anterior part of the rim of the glenoid. True fractures of the glenoid rim are generally larger and occur when a lateral force drives the humeral head directly against this structure [6, 9].

Glenoid fossa fractures

The most common mechanism of fractures involving the glenoid fossa is a violent force applied laterally to the proximal part of the humerus, which is then driven into the glenoid cavity [1]. A transverse fracture of the glenoid fossa occurs and then spreads in one of several directions, depending on the direction of the traumatic force [6, 9].

Material and methods

Between 1994 and 1999 ten patients with displaced intra-articular glenoid cavity fractures requiring operation were treated. These included three fractures of the glenoid rim and seven of the glenoid fossa. Sex distribution was unequal, with eight men and two women. The youngest patient was 22 years and the oldest 54 years. Nine patients had multiple injuries and were treated by secondary or delayed operation. In three patients there were additional injuries of the ipsilateral limb or shoulder girdle – one humeral fracture, one clavicular fracture and one dislocation of the acromioclavicular joint.

When a fracture of the glenoid cavity is noted or suspected, true anteroposterior and axillary radiographs of the glenohumeral

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Fig. 1 **a** Case number 2: Pre-operative radiograph showing a markedly displaced glenoid fossa fracture. **b** Pre-operative CT showing marked displacement and incongruity of glenoid cavity. **c** Post-operative radiographs 5 years after surgery showing good congruity of glenoid cavity

joint are essential. A true anteroposterior radiograph allows the best view of any disruption of the glenoid fossa and any associated articular incongruity or separation (Fig. 1a). The axillary radiograph will demonstrate fractures of the glenoid rim and help to determine whether the humeral head is subluxated, as well as confirming later the stability of any reduction. Computerised tomographic scanning is usually necessary due to the complex osseous anatomy of this region (Fig. 1b).

Operative technique

Correct positioning of the patient is vital and should permit the surgeon and assistants to work efficiently and comfortably, as well as allowing all of the involved anatomical structures to be displayed. The semi-sitting position fulfils these criteria for approaches to the superior, anterior and inferior portions of the glenoid. The patient lies on the table with the upper part of the body elevated from 45° to 60° above the horizontal, with the knees flexed to ensure stability. The injured limb is free for manipulation, a sandbag is placed under the shoulder, and the table tilted slightly away from the surgeon. For posterior approaches the patient lies prone with a sandbag under the chest wall of the affected side. The head is turned away from that side and the outstretched arm is supported on a table.

Depending on the fracture type either the anterior or posterior approach is chosen, as recommended by Goss [3]. Fractures of the

anterior or inferior rim of the glenoid are approached anteriorly. Fractures of the glenoid fossa are best approached posteriorly. Fractures of the glenoid cavity are reduced and provisionally fixed with Kirschner wires. They are then secured with screws and an easily contoured 3.5 mm reconstruction plate applied as a buttress to the lateral margin in order to prevent inferior displacement of the fragment (Fig. 1c).

Post-operative management and rehabilitation

A splint immobilising the shoulder is applied for 1 week. Functional rehabilitation is then started, with passive and active movement under supervision for 6 weeks. Normal use of the shoulder is then encouraged.

Results

Patients were interviewed and examined clinically and radiologically. The shortest follow-up was at 18 months and the longest at 84 months. Fracture healing was achieved in all patients by 6–8 weeks after surgery.

The outcome was assessed in terms of pain, range of movement, muscle power and performance of daily ac-

Table 1 Pre- and post-operative data of patients studied ($n=10$)

Case No.	Age (years)	Sex	Fracture type		Follow-up (months)	Post-operative				
			Fossa	Rim		Pain	Range of movement	Muscle power (grade)	Complications	Functional outcome
1	35	Male	+	–	84	None	Full	5	–	Excellent
2	43	Male	+	–	82	Occasional with routine activity	Moderate limitation	3	Superficial infection	Fair
3	22	Female	+	–	78	Occasional with heavy activity	Mild limitation	4	–	Good
4	48	Male	+	–	70	None	Full	5	–	Excellent
5	50	Male	–	+	66	Occasional with heavy activity	Mild limitation	4	Haematoma	Good
6	26	Male	+	–	58	None	Full	5	–	Excellent
7	37	Female	–	+	50	None	Full	5	–	Excellent
8	59	Male	+	–	45	Constant	Severe limitation	2	Arthritis	Poor
9	46	Male	+	–	41	None	Full	5	–	Excellent
10	32	Male	–	+	18	Occasional with heavy activity	Mild limitation	4	–	Good

tivities (Table 1). An excellent result was achieved in five patients who had near-normal function. Three patients had a good result with only slight limitation of movement, abduction of power 4 and occasional pain with heavy use. Patients with excellent and good results were able to perform their usual activities without disability. A fair result was recorded in one patient who had pain with daily activities, moderate restriction of movement (less than 30° loss of abduction) and grade 3 muscle power. This patient had some disability and loss of normal activity. One patient had a poor result, with a painful stiff glenohumeral joint associated with infection and metal failure. Arthrodesis was eventually required.

Complications

One patient developed a superficial infection that healed completely after drainage and antibiotics. Another developed a haematoma that required evacuation. There was one example of metal failure after deep infection that resulted in glenohumeral arthritis and was considered to be a poor result.

Discussion

Scapular fractures are relatively rare and are usually caused by high-impact trauma, which often produces other injuries. In patients with multiple injuries scapular fractures are often overlooked or neglected as other life-threatening problems are the focus of attention. In our series attention was drawn initially to the gleno-

humeral region, either by the patient's complaints of discomfort in the area, by abnormal physical signs in the region (swelling, crepitus, ecchymosis, etc.), or by abnormalities on a chest radiograph taken on admission.

The aim of operative repair is to correct osseous instability and thus prevent chronic instability and degenerative joint disease, and our indications for surgery were comparable to those suggested by Goss [3]. In displaced glenoid fossa fractures operation is indicated where there is a 'step' of 5 mm or more in the articular surface or severe separation of the articular surface and inferior displacement of an inferior glenoid fragment with associated inferior subluxation of the humeral head. In a displaced glenoid rim fracture the indication for surgery was a fracture resulting in persistent subluxation and instability of the humeral head (failure of the humeral head to lie concentrically within the glenoid fossa, as revealed on plain axillary radiographs and computed tomographic scans). Instability can be anticipated if the fracture is displaced by 10 mm or more and at least one-quarter of the anterior aspect of the cavity or one-third of the posterior aspect of the cavity is involved [1, 4].

The choice of implants depends on the surgeon's experience and preference and available bone stock. Rigid internal fixation is desirable but an inability to achieve this does not preclude an excellent anatomical and functional result [3]. In our series fixation was achieved by easily contoured 3.5 mm reconstruction plates and screws using the available substantial solid bone of the scapular neck and the lateral border of the scapular body.

Functional outcome was excellent or good in eight of our ten patients. Unfortunately, we have been unable to

find any study in the literature that records the functional outcome of surgical treatment of these markedly displaced and rare fractures. However, it has been our experience from this series, as well as that of other surgeons [2, 8], that these displaced intra-articular fractures are managed better by operative than by conservative treatment.

Functional end result and avoidance of post-traumatic instability or degenerative joint changes after surgery for these markedly displaced intra-articular fractures demand experience and a thorough knowledge of anatomical approaches, adequate operative conditions with strict asepsis, and a strict post-operative rehabilitation programme. Operative indications, therefore, do not depend solely on the pattern of the fracture.

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