Introduction

Complete injuries of the brachial plexus cause loss of functions of the upper limb. The shoulder acts as an anchorage of the limb to allow movements in three planes, and recovering the shoulder stability is one of the aims of the treatment.

Many procedures have been described in order to provide a functional improvement, such as nervous transfer, called primary surgeries (1,2) tendons transfers, osteotomies and arthrodesis, known as secondary surgeries (3), being considered the later a valid option, bringing off a significant reduction of the sequelae, regarding the functional adaptation of the neighbouring joints. However, the optimal position of shoulder fixation remains controversial.

Patients and Methods

This was a descriptive and retrospective study. A total of 12 patients with traumatic brachial plexus palsy, in which an arthrodesis of the shoulder was performed were included. They aged from 25 to 33 years an all were male.

After surgery, a thoracobrachial cast was used and a physiotherapy program was performed. The mean postoperative follow-up time was 12 months. The mean of active shoulder abduction was 43°. There were 3 cases with complications.
Objective

We aim to describe the surgical technique of a shoulder arthrodesis using a 4,5 mm pelvic reconstruction plate set, in 30° anterior flexion, 30° abduction and 30° external rotation, evaluating the degrees of abduction recovered in patients with complete brachial plexus palsy, and report their functional outcome and complications.

Surgical technique

Patient is placed in beach chair position with interscapular enhancement exposing the anterior and posterior faces of the shoulder. A dorso-lateral approach is performed following the border of the spine of the scapula and then following the axis of the humeral shaft (Fig.1). The distal insertion of supraspinatus is removed, the capsular joint is approached to dislocate...
the joint, providing entire access to cartilage of the humerus and glenoid to be withdrawn, the inferior periosteum of the acromion is also removed, performing, if necessary small drills in those surfaces, to provide a bleeding surface for a 2 x 2 cm iliac crest block obtained and placed in the subacromial space (Fig.2).

The entire system is set by fixing the position of the humerus at approximately 30° anterior flexion, 30° abduction and approximately 30° external rotation using 4.5 mm pelvic plates (with 14-holes, and previously bended) with long cancellous screws so that they traverse the scapulohumeral joint and attach to the scapula (Fig. 3).

Cortical screws are also used to fix the humeral shaft. In regard to the order of screw insertion through the plate, the spine of scapula are first once put in position and then the rest of screws. The arthrodesis is completed by placing small pieces of allograft in the remaining spaces, and attempting to cover by muscles the implants to minimise soft tissue irritation.

Postoperative care and physiotherapy.

Regarding rehabilitation, it is subordinate to the surgical technique; the scapulohumeral arthrodesis provides a postural and aesthetic result, but the patient should be aware that it requires an intensive and constant plan to achieve the better results.

On the other hand, the physiotherapist has to consider the wound healing process, the union of the graft and has to to mobilise the correct planes. A too early mobilisation, an excessive range of mobility or mobilising the wrong planes could imply suboptimal results or could arise complications such as nonunion or overload humeral fractures.

Figure 4: Right shoulder abduction.

Figure 5: Patient interposing an object, (box) by manual press and pectoral.

Figure 6: Left: Postoperative radiology of the shoulder. Right: Radiological image 12 months later.
After surgery a toracobrachial cast is used for 4 weeks and then it is removed. The sequence of mobilisation begins with passive mobility, then active and assisted, to end with active in the scapular plane with few degrees of external rotation. If the patient can make it with good tolerance, he could increase the articular range towards the elevation of the shoulder up to 90 degrees, trying to interpose objects, such as boxes or spheres of different sizes being by manual press or pectoral (Figs. 4 and 5). Radiological studies are performed to assess scapulohumeral arthrodesis union (Fig. 6).

Results

From the total of 12 patients in this study none were excluded. The mean postoperative follow-up time was 12 months. All the patients analysed had an absence of shoulder, elbow and hand function, but they had at least partial preservation of scapulothoracic joint movement by preserving the serratus major, rhomboid and angular of the scapula.

Regarding complications, 3 cases were registered: Infection 1/12, periprosthetic fracture 1/12, and soft tissue irritation 1/12.

The mean of active shoulder abduction was 43° (range 10-100); the lowest value was observed among five patients who achieved between 10 to 28°. Two cases showed excellent abduction, with figures of 90 and 100° respectively (cases 2 and 7). (Table 1 and Fig. 7).

The radiological studies were correct and no cases of non-union were observed.

Discussion

Regarding the approach and surgical position, Boretto et al. (4) prefer the lateral decubitus and lateral approach, performing the arthrodesis without grafting but performing osteotomies of glenoid and humeral head in position of 60 abduction and 30 of anterior flexion, reporting a 50% of cutaneous prominence. In relation to complications, Chammas et al. (5), in 18 cases, achieved stabilisation of the shoulder through arthrodesis in all of them and an average abduction of 35°. Two cases were complicated with nonunion requiring surgical revision, and 3 with a humeral fracture due to overload.

We agree with the low peri implant fracture rate of Wong et al (6), who obtained 47.5° of abduction average in 6 patients with complete paralysis, of whom only one presented as a complication a fracture of the humerus that consolidated with immobilisation. With respect to nonunion, Atlan et al (7) published a series of 54 patients who underwent a shoulder arthrodesis as part of the treatment, comparing the degrees of fusion obtained by placing cancellous bone versus cortical + cancellous bone graft. With a cancellous graft, a significantly superior arthrodesis success was obtained, an active abduction greater than 45° was obtained in more than 75% of cases and an active rotation of 45° in almost 65% of cases.

Table 1: Abduction angle obtained by scapulohumeral arthrodesis in our series.

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Fig. 7: Histogram depicting age distribution.
However, of this series, 32 cases had complete paralysis, while 22 had a partial paralysis.

Souza et al. (8) suggest that the preferred position to obtain a better functional result is 35° of abduction (5° more than those used in this series), slightly more than 30° of flexion, and less than 45° of internal rotation. They arrived at these conclusion when analysing 13 out of 18 operated cases.

Conclusions

The position of 30° internal rotation 30° abduction 30° and 30° flexion, would allow the alignment of the scapular spine, acromion and humeral axis. Pelvic reconstruction plates, fixed with alternating screws, would decrease the stress on the plate and may reduce the risk of peri implant fractures. The tricortical bone graft, placed below the acromion, would decrease the rate of nonunion.

Immobilisation with plaster would ease soft tissues healing, reducing the risk for infection and wound dehiscence. Early preoperative and postoperative rehabilitation would strengthen the peri-scapular muscle as an anchor, favouring abduction and elevation.

References


