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ORIGINAL ARTICLE

Arthroscopic release of the subscapularis for shoulder contracture of obstetric palsy

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Abstract
Objective Retrospective study of one surgeon's experience with arthroscopic release in obstetrical brachial plexus palsy.
Methods Over a four-year period, 6 patients who presented with a shoulder contracture secondary to obstetric palsy before the age of 8 years were treated arthroscopically. Small arthroscopy instruments, small shaver blades, including a 2.7-mm, 30° angled scope, and 90° radiofrequency probe, were used for this surgery. Patient selection for this approach was based on the lack of bone deformity and targeted soft tissue release. Postoperative brace immobilization for 6 weeks was used in all patients. Functional status of the patients was evaluated pre- and postoperatively with the assessment of external rotation.
Results The case series consisted of 2 girls and 4 boys with a mean age of 5.1 years (range, 3–8 years). No patient was lost to follow-up, and all patients completed a minimum 1 year of clinical and radiographic follow-up. Increases in external rotation were observed in all patients. There was no intra- or postoperative complications.
Conclusion Arthroscopic treatment of the shoulder contracture in obstetric palsy was found to be a safe and effective procedure in patients who are likely to undergo future tendon transfer or bone surgery.

Keywords Obstetric palsy · Shoulder arthroscopy · Pediatric shoulder arthroscopy · Subscapular release

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Introduction

Obstetrical brachial plexus paralysis (OBPP) refers to complete or partial injury of the brachial plexus produced at the time of birth. OBPP involves most commonly the upper cervical roots (C5, C6) resulting in muscle imbalance between internal and external rotators of the shoulder [1]. Although the majority of the patients (80–90%) recover spontaneously, some have a remaining imbalance causing severe functional impairment [1, 2]. In addition to diminished function, prolonged muscle contractures result in bony deformities in both the glenoid and proximal humerus. Internal rotation contractures due to external rotational weakness are the most common deformity in OBPP. Contracture release, tendon transfers, and rotational osteotomies are surgical methods used, depending on the level of deformity and the patient's age. To achieve functional external rotation of the arm, contracted structures should be released first. Currently, there is a lack of consensus on which procedures offer the best outcome for mobility and function, and what are the precise indications for each type of surgery. There is also a large variation of practice between centers [1]. This is further compounded by the heterogeneity in the assessment methods between the different studies, making comparison difficult.

Achieving shoulder balance in a timely manner may help in centering the humeral head in the glenoid achieving joint congruence. This will result in better clinical scores and joint geometry. Isolated release of the subscapularis is the preferred method in the younger age group (<4 years old) before latissimus dorsi or teres major tendon transfers are needed [3]. Subscapularis release was generally performed as an open procedure, though there have been reports using arthroscopic release [4]. To our knowledge, little information has been published on the outcome of arthroscopic subscapularis release [5]. This study observes the results and outcome in six cases of arthroscopic subscapularis release.

Patients and methods

The institutional review board (IRB) from our institution approved this retrospective study. The series included six children with OBPP treated for internal rotation deformity in our institution. All the patients were treated by a senior surgeon (D. M.). The medical records and radiographs of the patients were reviewed. From the total of 10 children treated for OBPP, four were eliminated due to lost to follow-up ($n = 1$), incomplete data ($n = 1$), and not meeting the minimum of one-year follow-up ($n = 2$). Remaining six children with full data underwent complete evaluation for this study. Demographic information (gender, age at presentation) as well as clinical files, surgical records, and medical history were reviewed.

Patients were examined for ranges of motion both preoperatively and postoperatively. Indications of surgical intervention with this technique were internal rotation contractures,and a deficit in passive external rotation with no contractures of the elbow joint, and below age nine ideally earlier than 6 years before unreconstructible glenoid deformities occurred. Physical examination revealed that none of the patients were able to elevate the hand up to the mouth level. Stretching exercises and conservative therapy were recommended first. Surgery was decided after 2 months of unsatisfactory conservative treatment. Two patients had a previous sural nerve grafting for upper OBPP.

Surgical technique

Surgical technique was performed in lateral decubitus under general anesthesia. Small arthroscopy instruments, small shaver blades, including a 2.7 mm, 30° angled scope, and 90° radiofrequency probe, were used for this surgery. A posterior portal was established first. The posterior portal was made at the posterior glenohumeral joint line about 1 cm below the level of the posterior part of the acromion. Because of the limited range of motion and contracture, it was helpful to abduct and apply traction to the arm to enter the joint with a blunt trocar. An anterior portal was made from outside in, under direct visualization through the posterior portal. The anterior portal was used after placing a 5.5-mm working cannula. To visualize the entire subscapularis tendon, it is necessary to release the anterior capsular ligaments at their attachment to the glenoid labrum. A radiofrequency probe set on 25 W was the most useful instrument to perform the release. The tendinous portion of the subscapularis was released. Low-profile forceps and arthroscopic scissors were helpful, especially for releasing the capsular ligaments. After release of the anterior soft tissues, the axillary nerve was commonly seen.

After standard arthroscopic evaluation, subscapular tenotomy and anterior release were performed in all patients. Subscapular tenotomy was done from the tendon's insertion (Fig. 1). The increased external rotation arc was amplified by releasing the tissues from the rotator interval to the coracoid process.

After surgery, all patients were immobilized in a cast brace in the external rotation for 4 weeks. Then, physical therapy was initiated including stretching exercises and bracing in external rotation at nights for another 4 weeks. Patients were seen for follow-up at routine postoperative intervals by the treating surgeon until consolidation and were revisited for this study. Clinical examination was based on evaluation of shoulder function. The method of follow-up included an assessment made by an independent observer (M. A.). Clinical results including ranges of motion, shoulder function, and muscle strength were carefully noted. The results were compared as of the situation at

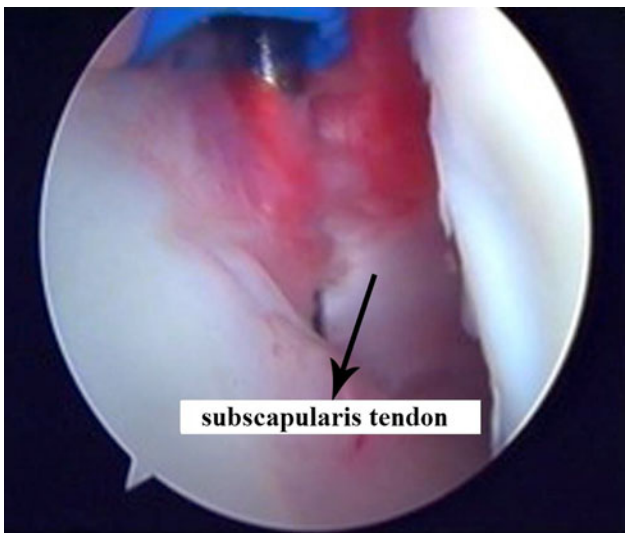

Fig. 1 Arthroscopic release of subscapularis tendon

clinical presentation, and data from this observation were displayed in the "Results" section.

Results

The study included 4 boys and 2 girls with an average age of 5.1 years (range, 3–8 years). The observed level of the OBPP was C5–C6 in 4 cases and C5–C6–C7 in 2. Hand function was good in all patients. The demographic and clinical characteristics of the patients as well as the preoperative and follow-up results are summarized in Table 1.

There were no intraoperative problems such as neurovascular injury associated with the arthroscopic approach. The mean operative time was 35 min (range, 25–60 min). No postoperative complications were observed in this series including wound infection or nerve palsy. Average follow-up was 33.5 months (20–50).

A significant improvement in active abduction was observed with an average of +32.5° (mean 47.5–80°). Active external rotation was increased with an average of +34° (mean from 7.5–41.5°) (Fig. 2).

Discussion

OBPP occurs in 0.4–2.5 per 1,000 live births, and the most commonly injured brachial plexus nerve roots in these injuries are the upper cervical roots (C5, C6) [6–9]. Despite considerable improvement observed in most cases, in a significant percentage of patients (5–19%), a residual dysfunction may result due to muscular imbalance related to the primary neurologic lesion [10]. Weakness of external rotators and abductors may lead to internal rotation and flexion contracture, and finally to posterior subluxation of the humeral head [11]. Continuous muscular imbalance causes deformities of the humeral head and scapula in the growing bones of children, which may persist despite neurological improvement [11, 12]. Therefore, timely intervention for balancing the forces among the shoulder joint is of paramount importance. Since Fairbank's definition in 1913, a number of procedures have been defined and used for correcting different levels of contracture and deformity, including isolated soft tissue release or combined muscle transfer and bone osteotomy [4, 6]. Despite this significant experience, there is currently no general agreement on the timing, exact indications or surgical procedures to be used in the treatment of these deformities [6, 8]. Basically, soft tissue procedures are the preferred modalities in the younger age group before development of bone deformities, while external rotation osteotomy of the humerus is preferred in children over 8 years with an incongruent glenohumeral joint [13, 14]. Soft tissue procedures may include isolated release of both the subscapular tendon and the anterior shoulder capsule or tendon transfer of the latissimus dorsi muscle [1, 4]. Long-term shoulder stiffness is the main issue after Fairbank's isolated subscapularis, capsular release, and open reduction [8, 14]. Considering this complication, Birch defined shortening of the abnormal coracoids process and subscapular release [13]. Although active shoulder function improved with this procedure, a very disabling external rotation contracture was observed in up to 20–40% of the patients, necessitating a corrective rotational humeral osteotomy [8, 13]. Other variants of this procedure include those by Carlioz and Brahimi, Gilbert et al., and Pearl, the latter using an arthroscopic approach [3, 4]. The arthroscopic approach has well-known potential advantages, including minimal invasiveness, healthy evaluation of intraarticular structures, and avoidance of unnecessary trauma during an open surgical approach, especially in the case of a growing child who may potentially undergo further surgery for the remaining functional deficits. The

Table 1 Demographic and clinical characteristics of six patients with obstetrical palsy

No	Age	Sex	Side	Preoperative active ext rotation (°)	Postoperative active ext rotation (°)	Follow-up (months)
1	4	F	Right	10	50	50
2	3	M	Left	0	30	20
3	8	M	Right	10	45	35
4	8	M	Right	5	35	38
5	3	F	Left	5	30	22
6	5	M	Right	15	60	36

Fig. 2 Three-year-old male patient. Twelve months after surgery showing external rotation, hand to head, and hand to mouth motion

low infection rates and decreased blood loss are the other advantages of arthroscopy compared to open surgical techniques.

The strength of this study is that it brings information about a procedure that is not very common and that may be very helpful in the management of this not-so-rare condition. The results are very good in terms of functional outcome, and the invasiveness of the procedure is limited. Recommending this procedure in the early development of the disease may bring hope, comfort, better life quality, and better mobility to a group of specific patients at an early age.

The limitations of this study include the lack of a control group and the limited number of patients. Our conclusion is that arthroscopic subscapularis and anterior capsular release for internal rotation deformity in OBPP shows promising results in the younger age groups.

Conflict of interest No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

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