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Long-term results of latissimus dorsi transfer for internal rotation contracture of the shoulder in patients with obstetric brachial plexus injury

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Background: This study evaluated the long-term outcome of patients with obstetric brachial plexus injury who underwent transfer of the latissimus/teres major tendon to restore shoulder external rotation and determined whether loss of internal rotation would affect their quality of life.

Methods: All patients with a history of obstetric brachial plexus injury who underwent latissimus dorsi transfer for internal rotation contracture were included. Results from 3 clinic visits (preoperative, and short-term and long-term postoperatively) were recorded. Quality of life was evaluated with a questionnaire. Internal rotation impairment was evaluated using the Activities of Daily Living which require active Internal Rotation scoring system.

Results: The study included 45 patients. At a mean 5 months postoperatively, shoulder motion was significantly improved in abduction and external rotation. This was associated with a significant loss of active internal rotation. These results deteriorated over time (at a mean 7.64 years postoperatively), especially in internal rotation (from being able to reach the sacrum to only being able to reach the trochanter) and in external rotation with the arm abducted. This decrease in function led 10 patients (22%) to undergo revision surgery. The mean score on the activities of daily living which require active internal rotation (ADLIR) at the last follow-up was 53.

Conclusion: Although the short-tem results of latissimus dorsi transfer and subscapularis release are encouraging, these gains deteriorated over a longitudinal follow-up period. Abduction is maintained over the long-term, but external rotation deteriorates. Internal rotation deteriorated over a long-term longitudinal follow-up, leading to functional impairment.

Internal rotation contracture of the shoulder may occur in up to 56% of patients with obstetric brachial plexus injury (OBPI).[23] This leads to posterior shoulder subluxation or dislocation secondary to varying degrees of glenohumeral bony deformity.[4,9,23,41,44,49] Although there are many reports on the management of these internal rotation contractures, most studies are small case series with short-term follow-up.[5,30,32,36,43] The most common surgical treatment involves the release of the subscapularis tendon, with or without release of the pectoralis major tendon, and transfer of the latissimus/teres major tendon to restore shoulder external rotation.

Although evaluation of this treatment shows short-term improvements in motion, the only long-term study on this procedure reported that results deteriorate progressively over time.[11] The main outcome measure used in these studies was the Mallet[31] score, a very common and popular score that most authors have used to evaluate functional outcome of the upper extremity in patients with OBPI. However, this score undervalues the importance of shoulder internal rotation in the global function of the shoulder.

There remains a paucity of long-term longitudinal studies evaluating the shoulder function in patients who have undergone internal rotation contracture release with latissimus/teres major tendon transfer. Furthermore, even the short-term studies do not comment on the functional disability that may result from the loss of shoulder internal rotation. The purpose of this study was to evaluate the long-term outcome of patients who underwent internal rotation contracture release with latissimus/teres major tendon transfer and to determine whether loss of internal rotation would affect their quality of life. We hypothesized latissimus dorsi transfer and subscapularis release would lead to increased external rotation with minimal loss of internal rotation over a long-term follow-up.

The Mayo Clinic Institutional Review Board approved this study (IRB Application #: 13-006565). All investigations were conducted in conformity with ethical principles of research.

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Materials and methods

A review examined all patients at our institution with a diagnosis of OBPI who underwent subsequent latissimus dorsi transfer to the rotator cuff between January 1, 1991, and December 31, 2005, with a minimum 2-year follow-up. Patients were included if they had a confirmed diagnosis of OBPI in the electronic medical record, did not experience spontaneous resolution of their symptoms, and were treated with a latissimus dorsi transfer for internal rotation contracture of the shoulder. The study excluded 11 patients because active assessment was not possible or reliable enough because of the young age of the patient.[34]

Demographics

During an 82-year period (from January 1, 1923, to December 31, 2005) we identified 56 patients who underwent subscapularis release and latissimus dorsi transfer for sequelae of OBPI. Although the time period was 82 years, the latissimus dorsi transfer only started to be performed in 1991. Among these 56 patients, 45 had a minimum 2-year follow-up with a reliable clinical examination. There were 23 male (51%) and 22 female (49%) patients. The right upper extremity was injured in 31 patients (69%). Every patient used the uninjured extremity as the dominant extremity. The patients were born at an average of 39.8 weeks, with an average birth weight of 4.22 kg. The mean age at the time of surgery was 3.4 years (range, 10 months-11 years).

Clinical evaluation

Clinical analysis was performed through a review of the electronic and paper medical record. The medical record was examined to obtain other variables, including demographics, comorbidities, birth history, past surgical interventions for shoulder dysfunction, and shoulder function. Active abduction and external rotation were recorded in degrees. External rotation was measured with the elbow by the side and with 90° of abduction. Active internal rotation was measured as the most superior vertebral segment reached by the thumb. Results from 3 different clinic visits were recorded: the last preoperative clinic visit, the first postoperative clinic visit after removal of the spica cast, and the last clinic visit.

Subjective evaluation

Every patient participated in a telephone interview at the last follow-up in which they were asked the following questions:

- What motion is the hardest for you to do?
- During the last clinic visit it was noticed that you had inability to internally rotate the arm. Is this still a major problem? Better? Worse?
- Does it affect you in your everyday life?
- If we could give you this function without losing too much external rotation, do you think your shoulder function would be much better?

In addition, to better evaluate the effect on internal rotation of the transfer of latissimus dorsi at long-term follow-up, we asked patients to answer a questionnaire designed to evaluate their capacity to perform common tasks. A specific scoring system, the ADLIR (Activities of Daily Living which require active Internal Rotation) score, was designed with a given number of points according to the severity of the handicap to obtain a subjective assessment by the patient for his or her internal rotation function. A maximum score of 100 points indicated that the patient had no impairment in his or her daily life due to a limitation in internal rotation (Table I).

Table I
Postoperative quantification of activities of daily living which require active internal rotation

Activities of daily living requiring active internal rotation	Points
Does your loss of internal rotation affect the global function of the shoulder?	
Significantly	6
Moderately	10
Occasionally	15
Not at all	20
Is it difficult for you to reach the top of your back with the affected arm?	
Impossible	1
Very difficult	5
Difficult	6
Somewhat difficult	8
Not difficult	10
Is it difficult for you to reach your lower back with the affected arm?	
Impossible	1
Very difficult	5
Difficult	6
Somewhat difficult	8
Not difficult	10
Is it difficult for you to reach with the affected arm for personal hygiene?	
Impossible	1
Very difficult	5
Difficult	6
Somewhat difficult	8
Not difficult	10
Is it difficult for you to reach your opposite shoulder and/or axilla with the affected arm?	
Impossible	1
Very difficult	5
Difficult	6
Somewhat difficult	8
Not difficult	10
Is it difficult for you to button your shirt?	
Impossible	1
Very difficult	5
Difficult	6
Somewhat difficult	8
Not difficult	10
Is it difficult for you to fasten a belt?	
Impossible	1
Very difficult	5
Difficult	6
Somewhat difficult	8
Not difficult	10
Is it difficult for you to tie your shoes?	
Impossible	1
Very difficult	5
Difficult	6
Somewhat difficult	8
Not difficult	10
Is it difficult for you to open/close a door/curtains?	
Impossible	1
Very difficult	5
Difficult	6
Somewhat difficult	8
Not difficult	10

Surgical procedure

Nine patients (20%) had undergone a previous operation to restore shoulder function: neurolysis of the brachial plexus in 4 (44%), microsurgical nerve repair or neurotization in 4 (44%), and subscapularis release in 1 (12%). The mean age at the time of transfer was 51 months (range, 10 months-41 years). Subscapularis release was performed in 40 patients (89%) at the same time as the transfer by a subscapularis slide technique,[5,18] and 27 (60%) underwent concomitant transfer of the latissimus dorsi and teres major early on to attempt to create a strong and long-lasting external rotation function.

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