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Assessment of Early Results of Latissimus Dorsi Tendon Transfer to Improve Shoulder Functions in Late Obstetrical Brachial Plexus Palsy

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ABSTRACT

Background: Latissimus dorsi (LD) tendon transfer showed good results and outcomes in management of late obstetrical brachial plexus palsy. **Objective**: To assess the early results of LD transfer on external rotation and abduction of the shoulder in late obstetric brachial plexus palsy patients. **Subjects and Methods:** At Plastic Surgery Department, Zagazig University Hospitals, we conducted this observational case series study on a group of late obstetrical brachial plexus cases (as one group of 14 patients). **Results:** 57.1% of the affected limbs were right side and 42.9% were left side. 2 cases representing 14.3% of the total cases had history of primary surgery. 21.4% of the cases were affected at the level of C5-6 and 78.6% of the cases were affected at the level of C5-6-7. All cases showed significant improvement in all scores. The average operational time was 1.2 hours (from 1.1 hours as a minimum time and 1.5 hours as a maximum time). **Conclusion**: The results of our study support the advantage of LD tendon transfer in late obstetrical brachial plexus cases in improving the abduction and external rotation functions of the affected limb.

Keywords: Latissmus Dorsi Tendon, Obstetrical Brachial Plexus Palsy.

INTRODUCTION

It is not uncommon (2.9 per 1000 live births) for babies to suffer obstetric brachial plexus injury (OBPIs) during labor due to a difficult delivery [(1)]. Nearly major of patients who have suffered from postpartum brachial plexus palsy (OBPP) experience complete recovery of their shoulder functions after giving short period. People with plexus injuries who don't recover fully often develop shoulder medial rotation contracture, which results from muscle imbalance between the medial and lateral rotators. It begins at a young age and can be detected in its most advanced form by the age of two. If left untreated, it might result in a severe shoulder joint deformity [(2)].

Bone problems in older OBPP patients have been linked to atrophy of both the subscapularis and the infraspinatus muscles. Increased muscle stiffness occurs in children with birth brachial plexus injury (BBPI) because of the shortening of the sarcomere length. It's not clear how muscle atrophy, contractures, subluxations, and joint abnormalities are linked at this stage of life. OBPP patients can avoid glenohumeral deformities by learning more about the causes of various joint problems [(3)].

The patient's adduction deficit can be treated with a variety of techniques, including muscle relaxation, tendon transfers, and nerve decompression. Medial rotation contracture correction is more challenging because of the shear deformity [(4)].

If the glenohumeral shoulder joint (GHJ) is supple and congruent, it is possible to perform a tendon transfer if the active external rotation and abduction have not fully recovered. When internal rotation contracture and severe glenohumeral dysplasia go hand in hand, however, humeral osteotomy is the method of choice [(5)].

It was the goal of this study to assess the early results of LD transfer on external rotation and abduction of the shoulder in late obstetric brachial plexus palsy patients.

SUBJECTS AND METHODS

At Plastic Surgery Department, Faculty of Medicine, Zagazig University, a group of late obstetrical brachial plexus cases (as one group n. =14) was included.

Inclusion criteria: Age group between 2, 10 years old, have reasonable elbow, hand functions, subtle shoulder joint, and upper root injury.

Exclusion criteria: Age <2 years old or >10 years old, if any of humeral osteotomy, or capsular plication was necessary during surgery, and pan plexus injury.

All patients were subjected to:

1. A thorough review of the patient's medical history from parents.
2. Complete general and physical examination: Erb's palsy was the most common presenting symptom in every case (Medially rotated arm, extended elbow, pronated forearm, flexed wrist). To determine the degree of extension and external rotation, a range of motion was measured.
3. Routine laboratory investigations were done (total bilirubin, hemoglobin, clotting time, renal and liver functions). Both the injured and uninjured shoulders were subjected to an anterior-posterior, lateral preoperative X-ray. Finally, standardized color digital imaging of the afflicted shoulder was completed.

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Operative technique:

A general anesthetic was used, and the patient was placed in a lateral decubitus position with the affected side facing upwards. Anesthesia was used to evaluate the passive range of motion (PROM) around the shoulder joint.

For this procedure, we employed a posterior axillary approach, creating a 5- to 6-cm long incision along the latissimus dorsi muscle (LDM) tendon. LDM tendon was severed to create an intramuscular plane between the LDM and teres major muscle. Internal rotation of the arm was used to expose the medial lip of the bicipital groove, which allowed for maximal abduction.

Radial nerves cross the LDM anterosuperiorly at this level, while the circumflex vessels and the axillary nerve are medially situated. The tendon was taken from the bone by means of a precise dissection. Tendons were severed from the proximal to the distal end in order to protect the nerves and blood vessels.
Muscle length was increased by releasing it under the skin, which allowed for a more comfortable transfer to the larger tuberosity (Fig. 1).
When the muscle could be gently pulled to the posterior border of the acromion, it was considered appropriately lengthened. Under the deltoid muscle's posterior fibres, a tunnel was drilled (Fig. 2).

Fig. (1): LDM released subcutaneously to achieve a satisfactory length for the tendon transfer over the greater tuberosity.

Fig. (2): Tunnel made under the posterior fibers of deltoid muscle.

LDM's tendon was anchored to the larger tuberosity of the humerus by a heavy polypropylene suture (Polypropylene 1 with a round needle) that was inserted into the infraspinatus tendon (Fig. 3).

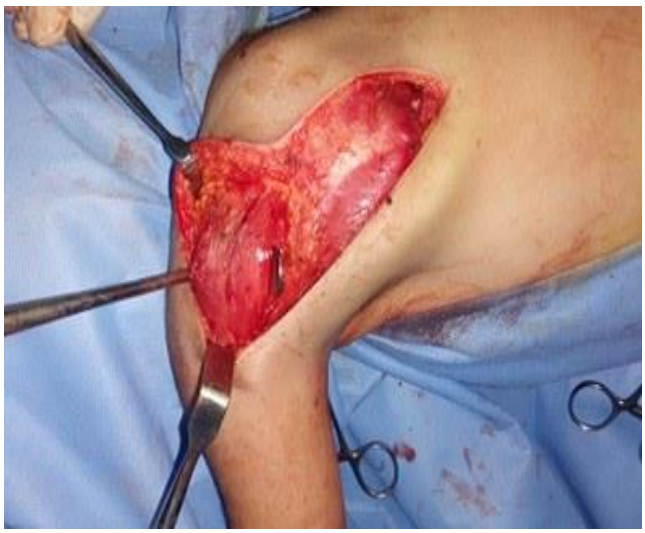

Fig. (3): suturing of the LD tendon with heavy polypropylene suture to the greater tuberosity of the humerus.

The incisions were closed with absorbable sutures in a tiered fashion. To avoid seroma, a drain was inserted. Case was still under general anesthesia and shoulder was abducted, externally rotated at 90° and elbow in 90° flexion when splinting was performed.

Postoperative:

Six weeks of splinting the shoulder (with the arm at 90° abduction, external rotation, 90° flexion, and free movement of the wrist) were required. Custom constructed splints were applied for three months following the removal of the cast from the aeroplane. There was a timetable for physiotherapy.

Ethical consent:

Research Ethics Council at Zagazig University approved the study (ZU-IRB#6189) as long as caregivers of all participants provided informed consent forms. Ethics guidelines for human experimentation were adhered to by the World Medical Association's Helsinki Declaration.

Statistical analysis

In order to analyze the data acquired, Statistical Package for the Social Sciences, version 20 was used to execute it on a computer (SPSS). The quantitative data was presented in the form of the mean, median, standard deviation, and range. The information was presented using qualitative statistics such as frequency and percentage. The student's paired t test (T) was used to assess the data while dealing with quantitative variables. P value of 0.05 or less was considered significant.

RESULTS

Mean age was 5.10±2.82 **(Table 1).**

Table (1): Age distribution among studied group (N=14)

	Age
Mean± SD	**5.10±2.82**
Median (Range)	**5.0 (2-12)**

Female represented 64.3% **(Table 2)**.

Table (2): Sex distribution among studied group

		N	%
Sex	**Male**	**5**	**35.7**
	Female	**9**	**64.3**
	Total	**14**	**100.0**

57.1% of the affected limbs were right side **(Table 3)**.

Table (3): Side of injury distribution among studied group

		N	%
Side	**Right**	**8**	**57.1**
	Left	**6**	**42.9**
	Total	**14**	**100.0**

2 cases representing 14.3% of the total cases had history of primary surgery (both underwent sural nerve grafting) **(Table 4)**.

Table (4): History of previous operation distribution among studied group

		N	%
Previous operation	**No**	**12**	**85.7**
	Yes	**2**	**14.3**
	Total	**14**	**100.0**

78.6% of the cases were affected at the level of C5-6-7 **(Table 5)**.

Table (5): Root affected distribution among studied group

		N	%
Root affected	**C5-6**	**3**	**21.4**
	C5-6-7	**11**	**78.6**
	Total	**14**	**100.0**

All cases showed significant improvement in all scores **(Table 6).**

Table (6): Improvement assessment among studied group

	Pre	Post	P
Abduction	**60.357±14.82**	**109.28±18.06**	**<0.01***
External rotation	**7.14±1.86**	**80.71±8.05**	**<0.01***
Flexion	**14.28±3.42**	**63.57±11.83**	**<0.01***

*: Significant

DISCUSSION

0.29 percent of births are affected with obstetric brachial plexus palsy (OBPP). While caesarean section rates have risen, the frequency of vaginal breech deliveries has decreased, which may be due to the rise in birth weight at the same time as this trend [(6)].

It is possible to improve active shoulder external rotation by using methods other than arthroscopic ones. These treatments include the release, sectioning, or transfer of the "overactive" internal rotators. When it comes to external rotational augmentation tendon transfers, the vast majority of studies have focused on the use of either both conjoined tendons of the latissimus dorsi or just the latissimus dorsi alone [(7)].

This study was clinical trial study included fourteen cases who had reasonable elbow, hand functions, and supple shoulder joint. The duration of the study was 12 months.

The mean age of the cases was 5.10±2.82 with minimum 2, maximum 10. Males were 35.7%, and females were 64.3%. **Farouk *et al.*** [(8)] reported that functioning outcomes were significantly influenced by the age of the children at the time of surgery (p-value=0.00626). In their study, average age at the time of operation was about 3.75 years (45 months) ranged from 2 years old to 7 years old with more favorable results to younger cases. **Waters *et al.'s*** [(9)] study had a virtually identical average age at the time of operation, but the results show an average rise in external rotation grade.

Our results show that regarding side distribution among studied group, 57.1% were right side, 42.9% were left side. 14.3% (2 cases) had history of exploration. 21.4% were affected at C5-6 and 78.6% were affected at C5-6-7. These findings are in contrary of finding reported by **Mersa *et al.*** [(10)]. This is based on their findings that C5-C6 participation was 39 percent; C5-6-6 engagement was

33 percent; and C5-6-6 involvement was 26 percent. C5, C6, and C7 made up 73% of the total, but only 20% of the samples tested were C5-T1. Seventy percent of their surgical cases had full palsy, followed by upper palsy (C5, C6) at 17 percent and palsy (C5, C6, C7) at 13 percent, both of which were associated with avulsion of the C8, T1 disc.

Our results show that mean follow up period 19.5±8.8 months. While the average follow up period in **Mersa *et al.*** [10] was 32.7 months. **Farouk *et al.*** [8] reported that in their study, the mean follow-up time was twelve months, with the shortest follow-up term being six months and the longest being eighteen months.

Our results show that preoperative mean of abduction, external rotation, flexion around the shoulder joint scores were 60.35±17.59, 0.714±2.67, 14.28±4.89 respectively.

In our study the postoperative mean of abduction, external rotation, flexion scores were 109.28±18.06, 80.71±8.05, 63.57±11.83 respectively; showing significant improvement in all scores.

Our results are supported by finding reported by **Ghieth and Saoudy** [11] as the hand-to-spine and hand-to-mouth motions, as well as global external rotation, all showed significant improvement. The capacity to perform their specific responsibilities was not affected in any of the cases.

Werthel *et al.* [12] reported that even though initial results were hopeful, their hypothesis was proven incorrect because these tend to worsen over a longer length of time following latissimus dorsi transfer. These improvements in abduction and external rotation were gradually erodeed over time. In children with internal rotation contracture, a motion that is typically well-preserved, this technique significantly affects internal rotation, resulting in a major functional impairment in the long run. A well-balanced joint can be restored with a combination of transfers and releases that maximize shoulder internal and external rotation after surgical treatment of internal rotation contracture in the context of OBPI.

The transfer of the latissimus dorsi tendon to the posterosuperior part of the rotator cuff for irreparable massive rotator cuff tears was described by **Gerber *et al.*** [13] in 1988, since then treatment for this difficult illness has become a possibility. There is some evidence that it can improve shoulder mobility and function by adding an external rotator and forward flexor to the shoulder joint and by redirecting the shoulder's internal rotator [14].

Regarding tendon transfer procedure, the outcomes can be affected by a variety of approaches. As far as we know, it was the first time this technique had ever been done in an official capacity by **Green and Tachdjian** [16] procedure and **Odeh and Odeh** [16] procedure.

In **Ahmed *et al.*** [17] work, the latissimus dorsi, teres major tendon was transferred to the rotator cuff, when compared to **Al-Qattan** [18], the latissimus Dorsi transfer technique, which involves transferring the tendon directly from the latissimus dorsi to the rotator cuff or the humeral head, resulted in varying results with modified mallet scores ranging from class 3 to class 4. **Murabit *et al.*** [19] in a group of 18 patients who received this surgery, considerable improvements were seen without any worsening of symptoms: younger age and greater shoulder movement were found to be reliable indicators of success.

In the study of **Nath *et al.*** [20] 2 to 11.8 years in age, 22 children were treated for medial rotation contracture, and scapula deformity caused by an abnormal development of the brachial and umbilical cord during pregnancy. The modified Mallet scale was used to evaluate functional movements before surgery and five years afterward in patients who had undergone triangle tilt surgery, which was improved from 14.1. ±2.7 to 20.3. ±2.5.

CONCLUSION

Our study supports the advantage of LD tendon transfer in late obstetrical brachial plexus cases in improving the abduction and external rotation functions of the affected limb. Early surgical intervention provides an efficient solution, with marked improvement of the quality of life, case satisfaction

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