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The Transfer of the Latissimus Dorsi and Teres Major Muscles to the Teres Minor in the Correction of Abduction Deficit in Sequelae of Obstetric Brachial Plexus Palsy (About 75 Cases with Literature Review)

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Abstract **Case Report**

***Objective*:** To study the contribution of the transfer of the latissimus dorsi and teres major muscles to the teres minor muscle in correcting the sequelae abduction deficit of OBPP and to evaluate the factors influencing the final outcome. ***Materials and Methods*:** A retrospective study was conducted on 75 patients followed in the Pediatric Trauma-Orthopedics B department at the Children's Hospital of the Ibn Sina University Hospital Center in Rabat, over a period of 10 years. The Mallet score was adopted for the functional evaluation of the children. All patients were treated with the transfer of the Latissimus dorsi and Teres major muscles to the Teres minor to restore abduction, with postoperative immobilization in abduction-external rotation plaster for 4 weeks, followed by well-adapted rehabilitation with regular follow-up. ***Results*:** The average age at diagnosis was 22 months, and the average age at intervention was 4.20 years. 52% of the patients were female. In 71% of the cases, the affected side was the right, and the predominant form was the total form C5-T1. After the transfer, in terms of abduction, 64% of cases had excellent results (≥150°), 8% had good results (120°-150°), 21% had average results (90°-120°), and 7% had poor results (≤ 90°). Active external rotation improved by 47.67°, with an average of 50.94° (range: 10°-90°). Our average follow-up period was 6.68 years (ranging from 1 to 10 years), demonstrating the stability of the results. However, 2 patients experienced a recurrence of abduction limitation related to pectoralis major contracture and poorly followed rehabilitation.

Keywords: Obstetric Brachial Plexus Palsy – Sequelae – Abduction Deficit – Co-Contractions – Transfers – Mallet Score.

INTRODUCTION

Obstetric brachial plexus palsy remains a significant challenge despite the progress made in its management. Its mechanism and risk factors are known, but this etiological understanding has not been sufficient to eliminate it.

All roots of the plexus can be affected; although the paralysis can be transient in some children with complete and spontaneous recovery during the first 3 months of their lives, others, who recover late or incompletely, develop sequelae and permanent osteoarticular deformities [3-5], that are disabling and do not regain normal function.

The sequelae of obstetric brachial plexus palsy (OBPP) are primarily located at the shoulder (80%), manifesting as defects in abduction and external rotation, and scapular winging. At this stage, the treatment is surgical. Prevention is based on early and effective rehabilitation with the use of night splints during the first weeks of life.

Several therapeutic options have been described, with our study focusing on muscle transfer (latissimus dorsi and teres major to teres minor).

PATIENTS AND METHODS

A retrospective study of 75 cases of obstetric brachial plexus palsy (OBPP) with abduction and external rotation deficits, involving patients of different ages with a minimum follow-up of 1 year. Patients who had been treated with other transfer methods or who had undergone microsurgical nerve repair were excluded.

We Specified for the Patients:

The age at diagnosis and intervention, sex, the affected side, the topography of nerve involvement, associated lesions (humerus/clavicle fracture, Claude Bernard-Horner sign, scapular detachment), the search for co-contractions between shoulder muscles (biceps/triceps; deltoid/pectoralis major, latissimus dorsi, teres major), and the muscle grading of the triceps.

The functional outcome was evaluated pre- and post-operatively using the Mallet score based on 5 criteria: active abduction, passive and active external rotation, hand-to-mouth with the degree of the trumpet sign, hand-to-neck, and hand-to-back. All patients underwent passive and active rehabilitation post-operatively.

RESULTS

The age of diagnosis ranges from day 1 of life to 12 years, with an average of 22 months. The average age of intervention is 4.2 years (extremes 1 year and 13 years). The sex ratio is 0.92 in favor of females. The right side is affected in 53 cases versus 21 cases on the left side, with bilateral involvement in only one case.

51% had a total form (C5 to T1) and 32% had C5 to C6. Only 30 cases had co-contraction, while 62 cases had an intact triceps. Associated lesions were noted in 38 cases with the total form of OBPP versus 1 case with the upper Erb's type C5 C6 form of sternocleidomastoid muscle hematoma. 21 cases had scapular detachment.

Table 1: The preoperative Mallet functional score was grade 3 in 63 cases (84%) and grade 4 in 12 cases (16%).

Mallet score	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
active abduction			63 cases 84%	12 cases 16%	
Passive/active external rotation		16 cases 21%	50 cases 67%	9 cases 12%	
Hand to mouth	3 cases 4%	55 cases 73%	17 cases 23%		
Hand to neck		40 cases 53%	35 cases 47%		
Hand to back		71 cases 95%	4 cases 5%		

Table 2: Postoperative mallet score

Mallet score	Grade 2	Grade 3	Grade 4	Grade 5
active abduction		5 cases 7%	22 cases 29%	48 cases 64%
Passive /active external rotation				72 cases 97%
Hand to mouth	10 cases 13%	29 cases 39%	36 cases 48%	
Hand to neck	11 cases	18 cases	46 cases	
Hand to back	50 cases	4 cases	18 cases	

A sufficient follow-up period of 6.68 years, with extremes ranging from 1 year to 10 years, without any postoperative complications such as infection, hemorrhage, or iatrogenic injury.

Preoperative:

Fig. 1

Post Operative:

Fig. 2

DISCUSSION

Obstetric brachial plexus palsy (OBPP) is a neonatal traumatic nerve injury. All roots can be affected, with Erb's palsy (C5/C6) being the most common, accounting for 32%, leading to a defect in abduction and external rotation. However, a study conducted by Nath *et al*., [9], found that the three forms were represented almost equally: 31% for the total form, 31% for the C5-C6 form, and 38% for the C5-C7 form, and they did not find a direct impact on abduction results after transfer.

The condition is slightly more prevalent in boys (51%) in most series described in the literature [8], whereas in our series, the female sex was predominant, representing 52% of cases. Similarly, a study conducted by Nath R. *et al*., [9], on 71 patients found that the female sex accounted for 58% of cases.

In our study, we did not find a significant correlation between the age at intervention and the postoperative gain in abduction, as reported in the literature by Nath and Somasundaram [7].

According to the literature, OBPP is twice as common on the right side as on the left and rarely bilateral [8-2], our series confirms this data with 71% of cases on the right, 28% on the left, and only one case of bilateral involvement.

Several factors contribute to the occurrence of obstetric brachial plexus palsy (OBPP), including maternal factors (primiparity/weight gain), fetal factors (prematurity/breech presentation/macrosomia), and obstetric factors (shoulder dystocia/use of forceps).

Neurological lesions are highly variable. Initially, the nerve stretches to its maximum due to its elasticity, but then the axons and nerve fibers rupture while the epineurium remains intact. In advanced stages, there is a complete rupture. Several classifications have been described, with the most practical being Seddon's classification into three types: neuropraxia, axonotmesis, and neurotmesis.

The diagnosis is clinical at birth, characterized by a flaccid monoplegia, most often with a global internal rotation-adduction posture of the limb, sometimes with elbow flexion and forearm supination. Additionally, two signs, if present, indicate the severity of OBPP: Claude Bernard-Horner syndrome and diaphragmatic paralysis.

The most used functional assessment score is that of Mallet with its 5 criteria: global abduction, external rotation, elbow to body, hand to mouth, hand to back, hand to neck.

Muscle transfer remains the treatment of choice to restore abduction and external rotation, with several techniques described since 1917 by Schulze-Berge [10]. Initially, an isolated transfer of the latissimus dorsi was performed but did not yield satisfactory results. Then, in 1939, Episcopo [11], described a technique involving the transfer of the insertion of the teres major and latissimus dorsi from their anteromedial part to the posterolateral part of the humerus. This evolved until 2006, when Gerber [12], proposed a transfer of the latissimus dorsi and teres major to the teres minor.

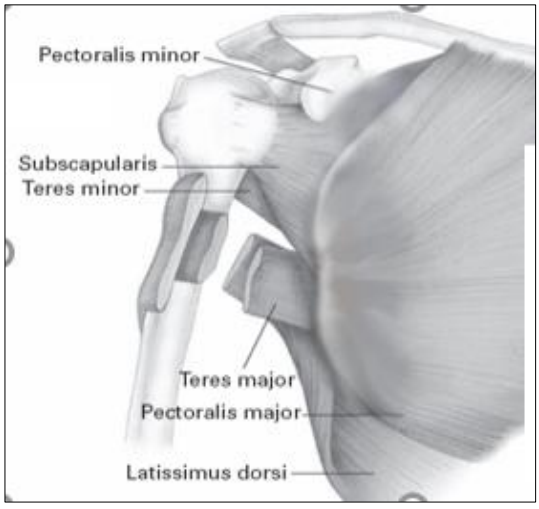
Nath [1], in 2007 confirmed this by transferring these two muscles (LD+TM) to the teres minor in a large number of children with an abduction defect, resulting in very good outcomes.

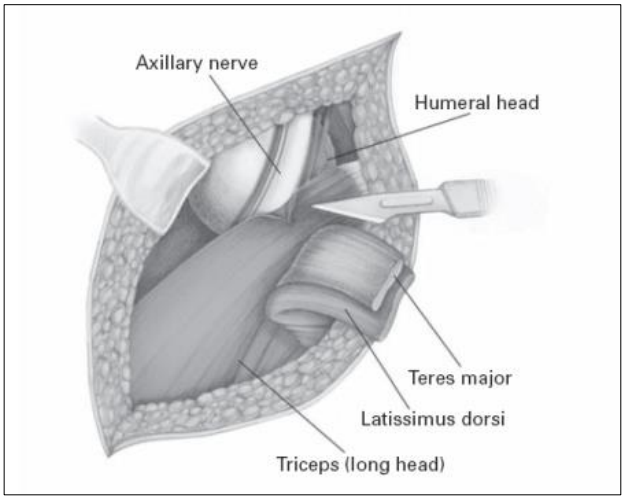
This type of transfer requires certain conditions, notably sufficient muscle strength. The intrinsic strength and length of the graft must be close to those of the muscle being replaced.

In the same context, Nath described the "Mod Quad" intervention that all our patients underwent. It is based on four procedures:

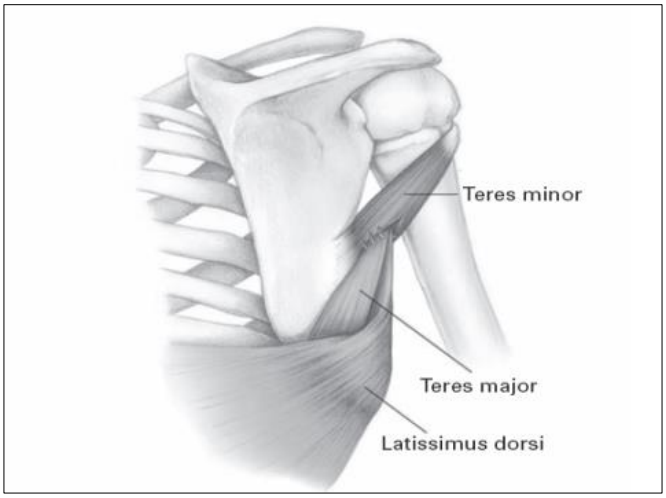
- Transfer of the latissimus dorsi muscle for abduction and external rotation.
- Transfer of the teres major muscle for scapular stabilization.
- Release of the subscapularis muscle, and contractures of the pectoralis major and minor muscles.
- Decompression/neurolysis of the axillary nerve.

All our patients report functional and clinical improvement with this technique, which is consistent with the literature. In a study of 98 cases, Nath [1], achieved at least 160° of active abduction in 77 cases (78.6%).

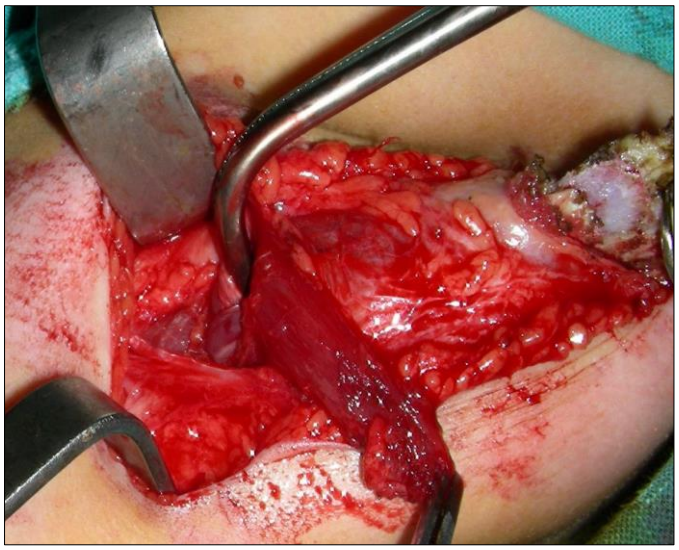




Axillary nerve decompression



LD and TM muscle suture on Teres Minor



Intraoperative image

Post-operative immobilization in external rotation at 90° and abduction at 120° with a cast for a duration of 4 weeks, followed by rehabilitation.

The evaluation of our patients' outcomes was based on the measurement of the postoperative abduction angle, as included in the Mallet score. We classified the results as follows: Excellent result: abduction ≥ 150° ; Good result: abduction > 120° and < 150° ; Average result: abduction > 90° and ≤ 120° ; Poor result: abduction ≤ 90°.

Thus, our patients were distributed as follows:

- Excellent results : 48 cas (64%) corresponding to Mallet grade V
- Good results : 06 cas (8%)
- Fair results : 16 cas (21%)

} Grade IV to Mallet.

- Poor results : 05 cas (7%) corresponding to Mallet grade III.

This percentage of excellent and good results (72%) in our patients was close to that of Nath [1] , which is 78.6% in his series of 98 patients, where the average postoperative abduction was 162° (from 100° to 180°). Ismat *et al.*, [6], reported an average gain in abduction of 47° (10-110°) with 85% of patients achieving functional abduction > 90°.

Furthermore, Nath [1], did not exclude from his study conducted on 72 patients nor from the one conducted on 98 patients, the cases with osteoarticular deformities (such as scapular elevation, humeral head subluxation), which were more related to medial rotation and not a cause of abduction loss. This explains the poor results concerning external rotation and supination, which will require additional corrective procedures (Triangle Tilt Surgery, humeral derotation osteotomy).

Otherwise, in our series, the gain in abduction was not satisfactory in children who exhibited co-contractions between the shoulder abductors (deltoid) and the adductors (pectoralis major, teres major, and latissimus dorsi), as well as those with weak triceps, or both, and presented with moderate and poor results.

CONCLUSION

The abduction deficit secondary to muscle imbalance and co-contraction between strong adductors and weak abductors in OBPP (Obstetric Brachial Plexus Palsy) significantly hinders basic daily activities in these children.

Muscle transfer can achieve good to excellent results, superior to other conventional techniques, and these results are maintained over time.

However, the severity of the co-contraction limiting preoperative abduction and the weakness of the triceps limit the effectiveness of this transfer.

REFERENCES

1. Nath, R. K., & Paizi, M. (2007). Improvement in abduction of the shoulder after reconstructive soft-tissue procedures in obstetric brachial plexus palsy. *The Journal of Bone & Joint Surgery British Volume*, *89*(5), 620-626.
2. Nath, R. K., Somasundaram, C., Melcher, S. E., Bala, M., & Wentz, M. J. (2009). Arm rotated medially with supination–the ARMS variant: description of its surgical correction. *BMC Musculoskeletal Disorders*, *10*, 1-10.
3. ADLER, J. B., & PATTERSON JR, R. L. (1967). Erb's palsy: Long-term results of treatment in eighty-eight cases. *JBJS*, *49*(6), 1052-1064.
4. Birch, R., Bonney, G., & Wynn Parry, C. B. (1998). "Birth Lesions of the Brachial Plexus," In: R. Birch, G. Bonney and C. B. Wynn Parry, Eds., Surgical Disorders of the Peripheral Nerves, Churchill Livingstone, New York, 209-233.
5. Gilbert, A., & Tassin, J. L. (1984). Surgical repair of the brachial plexus in obstetric paralysis. *Chirurgie; memoires de l'Academie de chirurgie*, *110*(1), 70-75.
6. Ismat, G., Naim, C., Fernand, D., & Khalil, K. 95 La réanimation de l'abduction et de la rotation externe de l'épaule dans la paralysie obstétricale du plexus brachial - 19/06/08. Revue de chirurgie orthopédique et traumatologique. Doi: 10.1016/S0035-1040(07)79468-0
7. Nath, R. K., & Somasundaram, C. Successful outcome of modified quad surgical procedure in preteen and teen patients with brachial plexus birth palsy. *Eplasty*, *12*, e54.
8. Romaña, M. C., & Goubier, J. N. (2002). (Paralysie obstétricale du plexus brachial. Encycl Méd Chir (Editions scientifiques et Médicales Elsevier SAS, Paris, tous droits réservés), Appareil locomoteur, 15-001-A-10, 9.).
9. Nath, R. K., Pretto, J. C., & Somasundaram, C. (2013). Comparing the Surgical Outcomes of Modified Quad and Triangle Tilt Surgeries to other Procedures Performed in Obstetric Brachial Plexus Injury. *Surgical Science*, *4*(09), 15.
10. Schulze-Berge, A. (1917). Propfung des Nervus axillaris in den Ulnaris und Ersatz der Heber des Oberarmes (Deltoides und Coracobrachialis) durch den Latissimus dorsi. *Zentralbl Chir*, *25*, 551.
11. L'Episcopo, J. B. (1934). Tendon transplantation in obstetrical paralysis. *The American Journal of Surgery*, *25*(1), 122-125.
12. Favre, P., Loeb, M. D., & Helmy, N. (2008). Gerberc: *JSES*, *17*(4), 650-8.