Functional Outcome Following Proximal Humeral Derotation Osteotomy in Erb's Palsy

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ABSTRACT

Background: Obstetric brachial plexus palsy is an injury to the nerves of the upper extremity of the newborn that happens during labor. Erb's palsy (C5, 6) is the most common type of obstetric brachial plexus palsy. Most of the infants with Erb's palsy will show spontaneous full recovery, however 20 -30 % will have residual neurological defects, some of them will have residual weakness of shoulder's external rotation, which will result in an internal rotation deformity of the affected shoulder in these children. If this internal rotation deformity is not repaired, it may progress to posterior dislocation of the shoulder joint with bony deformity of the glenoid.

Objective: To present functional outcome and results from patients with Erb's palsy who underwent external rotational humeral osteotomy.

Methods: Proximal humeral osteotomy was done for fourteen patients to correct deformity during age ranging from 13 to 20 years. Preoperative; early postoperative and late postoperative functional assessments were compared using mallet-grading system.

Results: Preoperatively out of 14 patients 10 (seven females, 3 males) were grade 2 mallet grading system range (8-12 points), four were grade 3 range (12-18 points) mallet grading system (2 males, 2 females). One month follow up post operatively patients with grading two (10 patients) mallet system preoperatively seven patients of them became grade 4 (70%). After one year, three patients became grade 3 (15 points) (30%). Two years follow up, 13 patients out of 14 were in grade 4 (20 points), one patient with grade 3 (15 points). Eight of the 14 patients were followed up 3 years postoperatively all of them had grade 4 in comparison between pre-operative function of the shoulder joint and 2 years post proximal humeral osteotomy, 9 out of 14 (64%) patients upgrade from grade 2 into grade 4, and 5 out of 14 (36%) patients upgrade from grade 3 to grade 4.

Conclusions: Proximal humeral osteotomy gives good function of shoulder movement and patient satisfaction. The gaining of functional improvement was clear in early and late time following rotational humeral osteotomy

Keywords: Erb's palsy, Proximal humeral osteotomy, Mallet grading system.

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Obstetric brachial plexus palsy (OBPP) is an injury to the nerves of the upper extremity of the newborn that happens during labor due to high birth weight, cephalo-pelvic disproportion, shoulder dystocia, and forceps delivery. Erb's palsy (C5, 6) is the most common type of OBPP. Occupational and physiotherapy is the cornerstone of the initial treatment. Most of the infants with Erb's palsy will show spontaneous full recovery, however, 20 - 30% of them will have residual weakness of shoulder's external rotation, which will result in an internal rotation deformity of the affected shoulder in these children. If internal rotation deformity is not repaired, it may progress to posterior dislocation of the shoulder joint with bony deformity of the glenoid[1].

The Mallet grading system is a commonly used functional scoring system to assess shoulder abduction/external rotation deficits in children with obstetric brachial plexus palsy[2,3], (Table 1).

The aim of this study will show how can this procedure (proximal humeral osteotomy) will improve the function of the affected shoulder and after all improving the patient activity, make him socially more active and the community will gain more healthy, less morbid person.

Table 1: The Mallet grading system for shoulder function.

Grade	Description
I	Flail shoulder
II	Active abduction ≤30° Zero degrees of external rotation Hand to back of neck impossible Hand to back impossible Hand to mouth with marked trumpet sign
III	Active abduction 30–90° External rotation up to 20° Hand to back of neck with difficulty Hand to back with difficulty Hand to mouth possible with partial trumpet sign (over 40° of shoulder abduction)
IV	Active abduction over 90° External rotation over 20° Hand to back of neck easy Hand to back easy Hand to mouth easy with less than 40° of shoulder abduction
V	Normal shoulder

Methods

Fourteen children with Erb's (C5/6) obstetric brachial plexus palsy with mean age of 16 years (ranging between13 and 20 years) underwent proximal humeral osteotomy to treat internal rotation contracture of the shoulder and were assessed after surgery for a mean of 2 years postoperatively (1-3 years). Nine were females and five were males. The study was done in the Imamain Al-kadhimain Medical City from 2009 to 2017.

The osteotomy procedure was done during age ranging from 13 to 20 years. Preoperative, early postoperative and late postoperative motor assessments were compared. We included children with Erb's palsy who had internal rotation deformity, limited shoulder abduction and difficult hand to mouth movement. We excluded patients with dislocated shoulder, any associated other congenital anomaly, children with less than one month follow up.

Table 2 shows the pre-operative assessment of shoulder function using mallet-grading system.

The operative procedure that was done for the patients to correct the deformity was proximal humeral osteotomy. By anterior approach, proximal humeral osteotomy 5 cm distal to the joint using reciprocating saw, under direct vision externally rotating the distal fragment of the humerus 90 degrees. The osteotomy was fixed by small four holes plate and screws. We assess the shoulder joint stability per operatively to achieve 40 degree external rotation without dislocation. No cast was needed, early postoperative visits 4 days and 14 days. We remove stiches at 14 days, early physiotherapy with muscle exercise and shoulder joint movement were started after stitches removal.

Functional assessment was achieved using mallet-grading system. The follow up visit and reassessment of shoulder function post operatively was 1 month, 6 months, 1 year, and 2 years, 3 years, respectively.

Table 2: Patients age, gender and preoperative score.

Patient No.	Age	Gender	Preoperative score
1	13	male	8 (grade2)
2	16	male	11 (grade2)
3	15	female	10 (grade2)
4	13	male	11 (grade2)
5	14	female	9 (grade2)
6	14	male	10 (grade2)
7	16	female	9 (grade2)
8	15	female	9 (grade2)
9	13	female	8 (grade2)
10	20	female	8 (grade2)
11	13	female	14 (grade3)
12	13	female	15 (grade3)
13	16	male	17 (grade3)
14	14	female	16 (grade3)

Results

Preoperatively, 10 of 14 patients 71% were grade 2 mallet grading system range (8-12 points), 4 of 14 patients 29% were grade 3 range (12-18 points) mallet grading system.

One month postoperatively, among patients with grading two mallet system preoperatively (10 patients) seven patients became grade 4 (70%), three patients became grade 3 (30%) 2 of them upgrade into grade 4 (66%) after 6 months.

All of the patients who with grade 3 preoperatively (four patients) became grade 4 (100%). All of the patients got one grade or higher than their preoperative grades (100%).

After 1 year and 2 years follow up,13 patients out of 14 were in grade 4 (93%), one patient with grade 3 (7%).

Eight of the 14 patients were followed up 3 years postoperatively all of them had grade 4, (Table 3).

In comparison between pre-operative function of the shoulder and 2 years post proximal humeral osteotomy, 9 out of 14 (64%) patients upgrade from grade 2 into grade 4, and 5 out of 14 (36%) patients upgrade from grade 3 to grade 4 .

Table 3: Preoperative and 1 month, 6 months, 1 year, 3 years postoperative score of the 14 patients.

Patient No.	Preoperative score	1 month post-operative score	6 months post-operative score	1 year post-operative score	3 years post-operative score
1	8 (grade2)	15(grade3)	15(grade3)	15(grade3)	
2	11 (grade2)	14(grade3)	20(grade4)	20(grade4)	
3	10 (grade2)	15(grade3)	20(grade4)	20(grade4)	
4	11 (grade2)	20(grade4)	20(grade4)	20(grade4)	20
5	9 (grade2)	20(grade4)	20(grade4)	20(grade4)	20
6	10 (grade2)	20(grade4)	20(grade4)	20(grade4)	20
7	9 (grade2)	19(grade4)	19(grade4)	19(grade4)	20
8	9 (grade2)	20(grade4)	20(grade4)	20(grade4)	20
9	8 (grade2)	19(grade4)	19(grade4)	19(grade4)	19
10	8 (grade2)	18(grade4)	18(grade4)	20(grade4)	20
11	14 (grade3)	20(grade4)	20(grade4)	20(grade4)	20
12	15 (grade3)	19(grade4)	19(grade4)	20(grade4)	
13	17 (grade3)	20(grade4)	20(grade4)	20(grade4)	
14	16 (grade3)	20(grade4)	20(grade4)	20(grade4)	

Discussion

Many studies were done for evaluating the efficacy of proximal humeral osteotomy in gaining had better function of shoulder in patients with Erb's palsy

In Kirkos JM, Papadopoulos study in 1998[4], the extremity was immobilized in a plaster shoulder-spica cast for six weeks. At the latest follow-up evaluation, the average, increase in active abduction was 27 degrees (range, 0 to 60 degrees) and the average increase in the arc of rotation was 25 degrees (range: 5 to 85 degrees), in the current study we didn't need cast, we use arm sling only post operatively.

In Goddard NJ, Fixsen JA study[5] before operation only one patient was independent, but after operation, nine of them became independent.

In Rühmann O, Grossé F study[6], the mean age of the patients at the time of operation was 29 years (range 15 to 42) external rotation was improved in all patients, the mean increase being 42° (range 25° to 60°).

In Al-Qattan MM study[7], the mean age of patients was 6.5 years, all 15 children had improved shoulder function and obtained a modified Mallet score of 4.

In Sibinski and Synder study[8] they analyzed the clinical results of 9 patients in the average age of 12.5 years treated with humeral derotational osteotomy In all patients the improvement of shoulder function was 5 points according to Mallet classification.

In Amr A Abdelgawad and Miguel A Pirela-Cruz[9] study they compare between internal and external rotation humeral osteotomy in treating the deformity. They found internal rotational osteotomy could be used in cases of posterior sublaxation or dislocation of the gleno-humeral joint.

In this study no dislocation or severe sublaxation occurred. We performed preoperative gleno-humeral stability assessment before osteotomy fixation.

In A Aly, J Bahm study[10], a percutaneous humeral osteotomy was done with osteosynthesis by Hoffmann external fixator to avoid scar and second operation.

Akinici[11] evaluated 40 patients with Erb's palsy treated with external rotational osteotomy, Internal rotation contractures improved in all of the patients. Patients having better preoperative range of motion and who were at younger ages benefited the most from surgical treatment.

In S Al-zahrani[12] surgical correction in 12 consecutive patients by combined Sever's release of the shoulder and osteotomy of the humerus. After an average follow-up of 3 years, the average gain of active external rotation of the shoulder was 32° and average gain of active abduction was 61°. In the current study, good functional release was obtained by humeral osteotomy without tendon release or transfer may be because release acts in younger children before shoulder structural changes.

In conclusion; The proximal humeral osteotomy is one of surgical procedures used in late Erb's palsy that give good function of shoulder movements and patient satisfaction. The gaining of functional improvement was clear in early and late time following rotational humeral osteotomy.

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