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Obstetric brachial plexus palsy: 20 years' experience at a tertiary center in Turkey

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Summary

Aim: The aim of this study was to examine cases of obstetric brachial plexus palsy (OBPP) treated over 20 years at a single tertiary center.

Material and Method: We retrospectively reviewed 777 cases of OBPP who were observed at the Pediatric Neurology Department at Istanbul Medical Faculty between March 1989 and December 2010. The patients were evaluated in terms of demographic characteristics, treatment methods, surgical approaches, complications and functional levels according to Narakas Clasification Scale.

Results: Out of a total of 777 OBPP patients, 393 were female and 384 were male. The mean birth weight was 3968.9 g. Three of the patients were siblings. OBPP was bilateral in 3 patients; right sided in 463 patients and left sided in 311 patients. In terms of concomitant conditions, 82 patients had torticollis, 62 had Horner's syndrome, 47 had broken clavicle, 3 had broken humerus, 3 had cerebral palsy and 1 had facial paralysis. According to the Narakas classification, 430 patients (55%) were evaluated as stage 1 OBPP, 219 (28.5%) were evaluated as stage 2, 66 (8.5%) were evaluated as stage 3 and 62 (8%) were evaluated as stage 4. One third of the patients (%33) underwent Vojta and neurodevelopmental therapy in addition to routine physiotherapy. Complete recovery was observed in 439 (%56) of all patients, in 66% of the patients with stage 1 OBPP, in 56% of the patients with stage 2 OBPP, in 35% of the patients with stage 3 OBPP and in 18% of the patients with stage 4 OBPP. Botulinum Toxin Type A was applied in 97 cases; 30 patients underwent primary nerve surgery and 94 underwent multiple surgical procedures (25 of them required a second surgery and 15 required a third surgery). Various joint contractures were seen in 200 patients.

Conclusions: Despite physiotherapy, Botulinum Toxin Type A application and surgical intervention, one out of three patients had difficulty using their arm and developed contractures and disabilities that affected their every day life. In conclusion, OBPP continues to be a severe problem leading to functional impairment and disability. *(Turk Arch Ped 2013; 48: 13-16)*

Key words: Botulinum toxin type A, Narakas classification, obstetric brachial plexus palsy, physiotherapy, torticollis

Introduction

Obstetrical brachial plexus paralysis (OBPP) is a brachial plexus injury which occurs during vaginal delivery. It is thought that excessive pulling applied after the birth of the head of the baby and sticking of the shoulders lead to this condition. The fact that the frequency of OBPP has remained relatively constant in contrast to other delivery traumas in the last 50 years during which the number of cesarean sections has increased led to interrogation of reasons including fetal rotation disorder and sticking of the posterior shoulder to the sacral promontorium independent of the practices of the healthcare professionals carrying out the delivery (1,2). The prevalence was reported to be 1.7 in 1000 live births in 1997 and 1.3 in 1000 live births in 2003 in USA (3). This prevalence was reported to be 3 in 1000 live births in the Norwegian study and 4,6 in Sweden (4,5).

There is no study reporting the prevalence of OBPP from our country. According to the data of the Turkish Statistics Institution 1 262 333 births occured in 2008 in our country. Considering this number it may be calculated that 1600-5800 infants per year would encounter with this condition using the prevalence data of the other countries (6).

The aim of the therapies used in obstetrical brachial plexus paralysis is to prevent joint contracture and joint disorder, increase the functional use of the arm and prevent refusal of use of the extremity (7). In these children, presence of imbalance of stregth between the muscles during the recovery period of the nerve and inadequate movement of the arm lead to contracture, dislocation and disorder in the shoulder, elbow

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and hand joints. It has been reported that patients who do not recover completely have limitations in use of the arm in daily life and the disability increases with decreased function of the arm because of bone and joint contractures (8,9,10).

Istanbul University Istanbul Medical Faculty, Division of Pediatric Neurology has been working as a referral center for these patients since the late 1980s. This study was performed to show the long-term results of our center on this area.

Material and Method

In this study, 777 patients who were followed up with a diagnosis of OBPP between March 1989 and December 2010 in Istanbul University, Department of Pediatrics, Division of Pediatric Neurology were examined retrospectively. The age, gender, involved side, complications accompanying the paralysis, delivery mode, birth weight, birth place, age at presentation to hospital for treatment, type of involvement (according to Narakas classification), upper extremity circumference and lenght measurements, muscle strength, joint contracture and disorders, shoulder functions, botilinum toxin A application, surgery number and characteristics were recorded from the patient files. Narakas classification was used to classify obstetric brachial plexus paralysis. OBPP is divided into four groups according to Narakas classification (Table 1) (5).

Developmental levels, upper extremity atrophies, contractures, shoulder functions and recovery times of the patients who had been followed up for more than one year were investigated. Among these patients, the ones who were applied botilinum toxin A and who underwent primary and secondary surgery were determined.

Results

393 (50.5%) of the patients with OBPP were female and 384 (49.5%) were male. 16 of the patients were born at home and 137 (18%) patients were born only with the assistance of a midwife. Six of the patient were born by cesarean section. 17 of the patients who were born by normal vaginal delivery had breech presentation and one had arm presentation. The mean birth weight of the patients was 3968,9 g (+572,1 g). 377 (48.5%) patients had a birth weight above 4000 g and 14 had a birth weight below 2500 g. While the heaviest birth weight was 5600 g, the lightest birth weight was 2060 g. 332 (43%) of the patients were born as the result of the first pregancy of the mother, 260 (33%) were born as the result of the second pregnancy of the mother, 129 (17%) were born as the result of the third pregnancy of the mother and 56 (7%) were born as the result of the fourth or later pregnancy of the mother. Two patients were twin mates. Three patients were siblings born from the same mother (Table 2).

Obstetrical brachial plexus paralysis occured in the right side in 463 (60%) patients, in the left side in 311 (40%) patients and bilaterally in three patients. OBPP was accompanied by torticollis in 82 (10.5%) patients, Horner syndrome in 62 (8%) patients, clavicula fracture in 47 (6%) patients, humerus fracture in three patients and left facial palsy in one patient. Physiotherapy was applied in all patients with torticollis and none underwent surgical intervention. When the patients were evaluated according to Narakas classification, 430 (55%) patients were grade 1, 219

Table 1. Narakas classisication

Narakas grade 1	C 5-6 involvement; lowest grade of affection
Narakas grade 2	C 5-7 involvement
Narakas grade 3	Complete involvement including C 8 involvement
Narakas grade 4	Horner syndrome accompanies complete involvement

Table 2. Findings and interventions related with the patients

The total number of cases: 777		**n (%)**
Mode of delivery	Normal vaginal	771 (99.3%)
	Cesarean section	6 (0.7%)
Birth place	At hospital with the assistance of a midwife	137 (17.6%)
	At hospital with the assistance of a physician	618 (79.5%)
	Delivery at home	16 (2%)
Gender	Female	393 (50.5%)
	Male	384 (49.5%)
Birth weight	<4 000 g	377 (48.5%)
	4 000 g-2 500g	386 (49.6%)
	>2 500 g	14 (1.8%)
Affected side	Right	463 (60%)
	Left	311 (40%)
	Bilateral	3 (0.3%)
Accompanying problems	Torticollis	82 (10.5%)
	Horner syndrome	62 (8%)
	Clavicula fracture	47 (6%)
	Cerebral palsy	3 (0.4%)
	Humerus fracture	3 (0.4%)
	Facial palsy	1 (0.1%)
Narakas classification	1	430 (55%)
	2	219 (28.5%)
	3	66 (8.5%)
	4	62 (8%)
Treatment approach	Classical treatment	254 (33%)
	Vojta+classical treatment	523 (67%)
	Botilinum toxin A application	97 (13%)
	Secondary botilinum toxin A application	42 (5.4%)
	Tertiary botilinum toxin A application	30 (3.9%)
Surgical intervention	Primary surgery	30 (3.9%)
	Secondary surgery	96 (12.3%)
	Second surgical intervention	25 (3.2%)
	Third surgical intervention	15 (1.9%)

Table 3. Evaluation of the rates of recovery according to Narakas classification

Narakas classification	Grade 1	Grade 2	Grade 3	Grade 4
The rate of the patients who recovered completely (%)	66	56	35	18
The rate of the patients who recovered with sequelas without functional loss (%)	30	38	44	55
The rate of the patients with sequelas and with functional loss (%)	4	6	21	27

Table 4. Contractures and deformities in the patients

Contracture	The number of joints involved
Shoulder joint contractures	56
Elbow flexion contracture	72
Elbow pronation contracture	50
Radius head dislocation	4
Wrist contractures	23
Scapula alata	49
Finger contractures	50
Total	304

(28.5%) patients were grade 2, 66 (8.5%) patients were grade 3 and 62 (8%) patients were grade 4 (Table 2).

Treatment was started on the 1-524th day of life in the patients. Excluding 65 patients who were started to be followed up after the age of one the mean age at initiation of physical therapy was found to be 36 days+24.8 days. Vojta and traditional treatment approaches were performed in 33% of the patients and only traditional treatment approaches were performed in 67%. Complete recovery was provided in 439 (56%) of all the patients. While complete recovery was provided in 284 (66%) of the patients who were evaluated as grade 1 according to brachial plexus paralysis Narakas classification, it could be provided in only 11 (18%) of the patients who were evaluated as grade 4 (Table 3). 62.8% of the patients were followed up for more than one year. While the mean follow-up period was 14.6 months (+8.4 months) in the patients who recovered completely, it was 46.5 months (+23.2 months) in the patients who recovered with a marked functional loss.

Botilinum toxin A was applied in 97 of the patients because of co-contraction of muscles and imbalance of strength between muscle groups. Among these patients, botilinum toxin A was applied for two times in 42 patients and for three times in 30 patients (Table 2). The muscles into which botilinum toxin A is applied include pectoralis major, lattismus dorsi, triseps, pronator teres and subscapularis. Botilinum toxin A was applied in 22 patients who had inversion contracture in the shoulder and in 50 patients who had elbow flexion and supination limitation. Both applications were performed together in 25 patients.

In 30 of the patients, brachial plexus exploration and repair were performed. The mean age at the time of primary nerve surgery was found to be 6,9 months (2-14 months). Secondary surgery was performed in 96 of the patients. To improve use of the arm 25 of these patients underwent surgery for a second time and 15 underwent surgery for a third time. Only subscapular loosening was performed in 18 of the patients. Teres major and lattisimus dorsi transfer together with subscapular loosening were performed in 78 patients. The mean age of the patients at surgical intervention was found to be 5.7 years (4 years-11.5 years).

Contractures related to the shoulder, elbow and wrist joints and fingers and scapula alata were found in a total of 304 joints in 200 patients among 487 patients who were followed up for more than one year. Contractures related to the shoulder and elbow joints and scapula alata were observed in 20 patients, pronation and elbow flexion contractures were observed in 25 patients, elbow flexion contracture, shoulder contracture, wrist and finger contracture were observed in 20 patients. Contractures observed in the patients are shown in Table 4.

Discussion

Shoulder dystocia and high birth weight are the two risk factors which have been stongly associated with obstetrical brachial plexus paralysis (11). When the mode of delivery was interrogated in our patients, it was noted that the number of the patients who were born at home without assistance or with the assistance of a midwife was high. Inglis et al. (12) reported that the frequency of OBPP was reduced significantly in the same obstetric clinic after education of shoulder dystocia management. In addition, it was found that delivery of high birth weight infants by cesarean section decreased the frequency of OBPP (13). It has been reported that the risk of OBPP increases significantly in infants with a birth weight above 4000 g born by vaginal delivery (11). The mean birth weight in our patient series was 3968 g and approximately half of the patients had a birth weight above 4000 g. Our results suggest that management of delivery of infants with a predicted birth weight of above 4000 g in specialized centers can decrease the frequency of OBPP.

An important part of non-muscular torticollis cases have been associated with OBPP (14). In 82 (10.5%) of our cases, an association of OBPP and torticollis was found. Hervey-Jumper et al. (15) reported this association with a rate of 43% in their retrospective study and did not find a relation between presence of torticollis and OBPP severity and recovery rates.

In our patients, the association of OBPP and torticollis was found with a lower rate compared to the series of Hervey-Jumper et al. This may be related with the fact that mild torticollis accompanying OBPP might have been overlooked and recovered until treatment was started or was not recorded. The fact that all patients with torticollis in our series recovered completely with only physiotherapy supports the view that this association does not lead to permanent defect.

In various studies performed with infants with OBPP, complete recovery has been reported with a rate of 68-95% (16,17). 10% of the patients have recovered with permanent disability. Narakas classification has been associated strongly with the prognosis (17,18). Results based on meta-analysis showed that Narakas grade 1 and 2 patients had a significatly better prognosis compared to Narakas grade 3 and 4 patients (19). Similarly, complete recovery was found with a rate of 66% and 56% in grade 1 and 2 patients and with a rate of 35% and 18% in grade 3 and 4 patietns in our series.

Despite the physiotherapy program which we applied to the patients, contractures which affected functional capacity with a high rate including elbow flexion contracture and shoulder joint contracture were observed in the patients who recovered partially similar to other long-term follow-up studies (9,10).

There is no consensus on the indications and timing of nerve surgery treatment in OBPP. Exploration in the 3rd month is recommended in an infant with complete involvement and Horner finding. Infants with upper truncus involvement are operated at the 3-6th month (20). The fact that our mean age at the time of nerve surgery was 6,9 months and our youngest patient was two months old shows that our timings of nerve surgery were similar to other centers.

Secondary surgical interventions are recommended for children who are older than 2-3 years, who can comply with post-operative exercise program, who have shoulder flexion, abduction and external rotation limitation and thus have difficulty in daily activities (21,22). The mean age at the time of intervention in 96 patients who recovered inadequately and underwent muscle and tendon transfer operations in our study was 5,7 years which was compatible with the other studies performed in this area. The fact that 25 patients required a second surgical intervention and 15 patients required a third surgical intervention shows that surgery planning should be done considering the expectations of the family, the child's age and compliance and the inadequacy in use of the arm in daily-life may persist despite surgical intervention.

In approximately 1/3 of 777 patients who we followed up in our study, persistent difficulty in using the arm, contracture and disability occured and the children's participations in daily-life were affected despite regular physiotherapy applications and interventions.

Conclusively, OBPP continues to be an important problem which results in functional inadequacy and leads to sequela in spite of numerous efforts directed to improve the use of the arm and functional development.

Conflict of interest: None declared.

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