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EPIDEMIOLOGY OF BRACHIAL PLEXUS PALSY IN NEWBORNS

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Objective – The aim of this study was to analyze the frequency of brachial palsy by gender, type, side, the newborn mother's parity and to identify its potential risk factors. **Material and methods** – Eighty-four newborn infants with brachial palsy were studied retrospectively at the University Clinical Center of Kosovo. The disease was confirmed by physical examination, neurological examination, and radiography. **Results** – The majority of newborns included in this study were male, with the Erb-Duchene type of brachial palsy. A greater number of newborn infants (70.2%) had sustained injuries to the right side. The most frequent occurrence was to the firstborn baby. Shoulder dystocia (39.3%), macrosomia (16.7%) and vaginal breech delivery (13.1%) were the most frequent potential risk factors identified in this study. The incidence of plexus brachial injury ranges from 1.8 to 3.35, depending on the ordinal number of the mother's delivery. The highest incidence is in mothers on their first- delivery, while the lowest is for those having the second child. The overall average incidence rate of brachial palsy is 2.62 per 1000 newborns. **Conclusion** – Our study has shown that the incidence of brachial plexus palsy is relatively high in newborns. Newborns with shoulder dystocia, macrosomia, and those born by vaginal breech delivery are at greater risk for brachial plexus palsy. Further research should be focused on the treatment and rehabilitation of children with brachial plexus palsy.

Key words: Epidemiology ▪ Brachial plexus palsy ▪ Newborns.

Introduction

Brachial plexus palsy is the flaccid paralysis of the arm at birth that affects different nerves of the brachial plexus supplied by C5 to T1 (1). In Kosovo the incidence of brachial plexus injury ranges from 0.8 to 3.1 per 1000 newborns, and is similar to the incidence of brachial plexus palsy in developed countries, where it is reported to affect 0.5 to 5.1 per 1000 infants (1, 7). There are many types of causes for this lesion, but the most frequent is a lateral traction of the head, neck, or the baby's arm during birth (8, 10). Clinical manifestations depend on the extent and location of the injury and may appear as paresis or paralysis, or as weakness or decreased muscular strength of the affected arm. This type of injury requires long and continuous rehabilitation (3, 11).

According to the clinical features, there are three types of lesions: the upper or Erb-Duchene type due to injury to C5, C6 and C7, the lower or Dejerine-Klumpke type due to lesions to C8, T1, and the mixed or complete type due to injury to C5-T1 (1, 6, 12).

Therefore, accompanying signs of trauma during birth, such as fractures of the humerus or clavicle, hematoma of the sternocleidomastoid muscle and cephalhematoma or intracranial bleeding, favor this conclusion. When defining the severity of a peripheral nerve injury, differentiation between neurapraxic, axonotmetic, and neurotmetic lesions is helpful (11). Predisposing factors for obstetrical brachial plexus palsy are maternal, delivery-related or fetal (1, 13, 14). Infants who are large for gestational age, maternal diabetes, shoulder dystocia, and instrumental delivery have been reported to be risk factors for the occurrence of brachial plexus palsy (1).

The aim of this study was to analyze the incidence of children with brachial plexus palsy by gender, type of brachial palsy, the side of the injured plexus and to identify the potential risk factors for neonatal brachial plexus palsy.

Material and methods

A sample of 84 newborns of both genders with brachial plexus palsy was considered, from the age of birth to 3 months. The sample was collected in cooperation with a gynecologist, neonatologist, pediatrician and physiotherapist. Patients were identified according to the International Classification of Diseases, Ninth Revision (ICD-9), code 767.6 for neonatal brachial plexus palsy (15). The diagnosis was confirmed by physical and neurological examination, and by radiography. Using a retrospective observational approach, we examined medical records and evaluated data on maternal pregnancy, neonatal and delivery-related events, in 84 cases of brachial plexus palsy in newborns. The data extracted from the medical records were:

1. Maternal and pregnancy data: age, number of pregnancies, gestational diabetes,

2. Neonatal: sex, side (left-right) of injury, vertex or breech presentation, birth weight, the Apgar score at 1 and 5 minutes after birth, the birth weight, body length, and head circumference of the newborn, as well as gestational age at the time of delivery were recorded from the hospital perinatal records. Newborns were classified as having macrosomia when their birth weight was >4000 g (16).

3. Mode of delivery: stimulated or spontaneous, delivery types (vacuum extraction, cesarean section, delivery by Smeli-Weit and Bracht), duration of delivery (prolonged labor, longer than 12 hours).

Ethics statement

The study was approved by The Ethics Committee of the Faculty of Medicine, University of Prishtina.

Statistical analysis

The data collected was processed using the In-STAT statistical package. Differences between categorical variables were tested with the χ^2test. Furthermore, statistical research data was tested for reliability and presented in tables. The difference was interpreted as being significant-when $p<0.05$.

Results

Table 1 shows the distribution of brachial palsy in newborn infants by gender, in comparison with the gender of newborns in the general population of the region. A Pearson's chi square test, $\chi^2=2.00$, $p=0.157$, shows that we cannot reject the hypothesis that column 2 and column 4 in Table 1 are independent.

Out of the total number (84) of subjects examined, 51 (60.7%) belonged to the Erb-Duchene type, while 33 (39.3%) belonged to the combined type (upper+lower plexus injury). In our data, we did not find a significant difference between the specific type of brachial palsy; $\chi^2=1.45$; $p>0.05$.

Table 1 Distribution of brachial palsy in newborn infants by gender in comparison with the gender of newborns in the general population of the region

Gender	Newborns with brachial plexus palsy		Newborns in the general population*	
	n	%	n	%
Males	61	72.6	16513	51.6
Females	23	27.4	15482	48.4
Total	84	100	31995	100

*In the region born in the study period; χ^2=2.00, p=0.157.

From the data shown in Table 2, we found a significant difference in the prevalence of the disease according to the affected side, the right side (with 70.2% of the newborns) being more prevalent.

The incidence of plexus brachial injury ranges from 1.8 to 3.35, depending on the ordinal number of the mother's delivery. The highest incidence is in mothers having their first-time delivery, while the lowest is for those having their second child. The overall average incidence rate of brachial palsy is 2.62 per 1000 newborns (Table 3).

Table 2 The side of the body of brachial plexus palsy

Side of the body	Subjects (n; %)
Right	59 (70.2)*
Left	25 (29.8)
Total	84 (100)

*χ^2 =10.15; p<0.01 compared to left.

Table 3 Incidence of newborns with brachial plexus palsy by the ordinal number of the mother's delivery

Newborns by the ordinal number of the mother's delivery	Number of infants with brachial palsy in the respective group	Number of newborns in the respective group in the general population of the region	Incidence of brachial palsy
Firstborn	50	14,899	3.35/1000
Second born	18	9949	1.80/1000
Third born	12	5028	2.38/1000
Fourth born	4	1565	2.55/1000
Others	0	554	0/1000
Total	84	31,995	2.62/1000

From the analyzed data it may be seen that shoulder dystocia (39.3%), macrosomia (16.7%) and vaginal breech delivery (11.9%) were the most important potential risk factors for the occurrence of neonatal brachial plexus palsy (Table 4).

Table 4 Newborns with brachial plexus palsy by risk factors

Risk factors	Newborns (n; %)
Shoulder dystocia	33 (39.3)
Macrosomia (≥4000 g)	14 (16.7)
Breech delivery	11 (13.1)
Gestational diabetes	10 (11.9)
Multiparity	5 (5.9)
Cesarean delivery	1 (1.2)
Prolonged labor	5 (5.9)
Instrumented delivery	5 (5.9)
Total	84 (100)

Newborn characteristics are presented in Table 5. The prevalence of newborns with

Table 5 Characteristics of newborns with brachial plexus palsy

Characteristics	Study group (n=84)
Birth weight (g)	3950.8±465.0*
< 2500 (g)	3 (3.6)**
2500 to <4000 (g)	67 (79.8)**
≥ 4000 (g)	14 (16.6)**
Birth length (cm)	52.8±2.9*
Head circumference (cm)	32.9±1.8*
Gestational age (weeks)	39.1±1.0*
Apgar score 1 minute	6.8±0.9*
Apgar score 5 minute	7.7±0.8*

*Mean±SD; **n (%).

Table 6 Distribution of brachial palsy in newborn infants by weight, in comparison with the gender of newborns in the general population of the region

Gender	Average weight (g) of newborns in the general population*	Average weight (g) of newborns with brachial plexus palsy
Males	3573.7	4082.3**
Females	3071.8	3856.1
Average	3322.8	3950.8

*In the region born in the study period; **p<0.05 compared to females.

birth weight from 2500 to less than 4000 g affected with brachial plexus palsy was 79.7% (67 out of 84). Macrosomia (>4000 g) was found in 16.6% (14 out of 84). There was a decreased Apgar score at 1 min (6.8±0.9) and 5 min (7.7±0.8) among newborns with brachial plexus palsy compared to normal Apgar score values.

In Table 6 the average body weight is presented of newborns with brachial palsy and those without brachial palsy, based on gender. Male newborns with higher body weight were more often affected by brachial palsy (p<0.05).

Discussion

Brachial plexus palsy in newborns occurs immediately after birth, as a result of lesions of the plexus nerves from various causes (18, 19). After analyzing the data it was found that a greater number of males are affected as compared to female babies. Similar results are found from other researchers in terms of the frequency of occurrence of brachial plexus palsy in male children compared to female children (13, 20, 21). The authors of those studies explained this by the differences in body size of newborn boys in comparison with girls. This is in accordance with our results, which show that the average weight of newborn boys with brachial plexus palsy is higher compared to newborn girls.

Furthermore, our data indicate that 60.7% of the infants were affected by the upper or Erb-Duchene type, while 39.3% were affected by the complete paralysis type, but the differences were not significant. The results of other authors (22, 23) are comparable with our data. In research undertaken in Nigeria (22) on a total of 32 investigated newborns with brachial plexus palsy, twenty-five (78.1%) of the patients had Erb-Duchenne palsy, while 3 (9.4%) had Klumpke's paralysis. The Klumpke type of paralysis, which, according to the data in the literature, is rare, was not found in our investigation. In addition, in our study 70.2% of the newborn infants were affected on the right side, and 29.8% on the left side, because the most common delivery presentation was the left occiput anterior vertex (7). The difference is statistically significant. This is similar to the data in the literature (16, 24).

In our sample, the relationship between the birth order and the frequency of brachial plexus palsy was in accordance with the data in the literature (5, 7, 21, 22, 25). This is especially important because being born as the first child is one of the main risk factors for brachial plexus palsy in the newborn.

There are disagreements between the various papers (2, 3, 12, 13, 22) regarding risk factors and the occurrence of brachial plexus

palsy in newborns. The older literature suggested that breech delivery was a risk factor. However, a study by Sibinski and Synder (13) found that breech delivery was not associated with a higher incidence of nerve injuries. Foad et al. (2) showed that there was a 100 times greater risk for shoulder dystocia, an exceptionally large baby (>4.5 kg) had a 14 times greater risk, and in the case of a forceps delivery there was a 9 times greater risk. Protective effects against the occurrence of neonatal brachial plexus palsy include having a twin or multiple birth mates and being born by cesarean section. In addition, Sibinski and Synder found that caesarean section reduced the risk of plexus palsy, but did not eliminate it entirely (13). In our study, from 84 newborns with brachial palsy only 1 (1.2%) was born by cesarean delivery.

In the study of Hudić at al. (3) it was found that the highest factors of risk for brachial plexus injury were birth weight of over 4000 g, a precipitous second stage of labor (<15 minutes), and vacuum-extractor assisted labor. In another study (22) risk factors for brachial plexus palsy in the newborn were shoulder dystocia (odds ratio 16.0; 95% confidence interval 8.9-28.7), fetal birth weight of 4000 g or greater (7.1; 4.8-10.5), and administration of fundal pressure (1.6; 1.1-2.3).

Limitations of the study

A few limitations of our study should be noted. First, the study design was retrospective. Second, we only identified the cases but we did not follow their treatment outcomes. Future prospective studies should be undertaken in order to obtain relevant data regarding the treatment and rehabilitation of children with brachial plexus palsy.

Conclusion

Despite these limitations, our study has shown that the incidence of brachial plexus palsy is relatively high in newborns. The most frequent type of brachial plexus palsy is the upper (Erb-Duchene) palsy. The right-side brachial plexus is more often affected, and it occurs more often in first-born babies. Newborns with shoulder dystocia, macrosomia, and those born by vaginal breech delivery are at greater risk for brachial plexus palsy. Further research should be focused on the treatment and rehabilitation of children with brachial plexus palsy.

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