

# Risk Factors for Obstetrical Brachial Plexus Palsy

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## Abstract

**Objective:** The study was aimed to identify the risk factors for obstetrical brachial plexus palsy (OBPP). **Patients and Methods:** A retrospective case-control study was designed. A comparison was performed between cases of brachial plexus paralysis ( $n = 32$ ), with controls without brachial plexus paralysis ( $n = 30$ ) randomly selected from physical rehabilitation medicine examination. Statistical analysis was performed using the SPSS Package. **Results:** Independent risk factors for brachial plexus paralysis were macrosomia (birth weight 4000 g; odds ratio [OR] = 12.353; 95% confidence interval [CI] 2.510–60.802,  $P < 10^{-3}$ ), labor dystocia and instrumental vaginal delivery (forceps delivery and vacuum extraction; OR = 8.8; 95% CI 2.743–28.234,  $P < 10^{-3}$ ), and prolonged pregnancy (OR = 1.28; 95% CI 1.066–1.538,  $P = 0.011$ ); however, vaginal breech delivery (breech presentation or extraction; OR = 3.231; 95% CI 0.598–17.456,  $P = 0.258$ ), parity (OR = 2.545; 95% CI 0.677–9.565,  $P = 0.206$ ), shoulder dystocia (OR = 1.957; 95% CI 0.571–6.702,  $P = 0.367$ ), and after cesarean section (OR = 1.103; 95% CI 0.987–1.234,  $P = 0.238$ ) do not represent any risk factor. **Conclusions:** In our population ( $n = 62$ ), macrosomia, labor dystocia, instrumental vaginal delivery, and prolonged pregnancy were the significant risk factors for neonatal brachial plexus paralysis, while shoulder dystocia, breech deliveries, parity, and cesarean section were not. Despite our small sample, we found three significant risk factors associated with OBPP.

**Keywords:** Neonate, obstetrical brachial plexus injuries, risk factors

## INTRODUCTION

Obstetrical brachial plexus palsy (OBPP) is a nerve injury and damage. In this case, the brachial plexus nerves are stretched or torn in the perinatal period, this leads to a weak or paralyzed upper extremity of the newborn,<sup>[1]</sup> and it can cause different levels of disabilities ranging from mild to severe restrictions. During the stages of delivery, there is a potential risk factor of OBPP; the brachial plexus injury could occur during the baby's extraction from the uterus.<sup>[2]</sup>

Brachial plexus injury remains a potentially serious consequence of childbirth, with an incidence of 0.5–1.9 per 1000 live births. Although many infants with plexopathy recover with minor or no residual functional deficits, some do not regain sufficient limb function and develop bone deformities and joint contractures.<sup>[2]</sup>

There are multiple types of injuries, tear at the root section, tear at the mid-section of the proximal longer portion of the nerve, or stretch in the proximal part of the nerve.<sup>[3]</sup> The consequences of these injuries lead to abnormal positioning of the upper limb. These abnormalities are contributed with

medial rotation of the shoulder, extension of the elbow, and the wrist and flexion of fingers.<sup>[4]</sup>

Risk factors for brachial plexus palsy could be maternal, fetal, and/or labor related. The prevalence has not changed despite the increased awareness of the condition, increased rate of cesarean section delivery, and prevention of fetal macrosomia.<sup>[5]</sup> Based on the literary aspect of this research, the maternal factors for this issue are obesity, excessive maternal weight gain, diabetes, and advanced maternal age. The labor-related factors for this issue are shoulder dystocia, prolonged second stage of labor, vaginal breech delivery, operative vaginal delivery, and epidural analgesia. The most important fetal factors are macrosomia. Even though we have

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limited knowledge of the multiple risk factors pertaining to OBPP, the majority of the patients do not have the main characteristics of this condition. Our ability to predict or prevent brachial plexus paralysis is limited due to the minimal and insufficient resources.<sup>[3,6,7]</sup>

Our objective is to identify the risk factors for OBPP.

## PATIENTS AND METHODS

A retrospective case-control study was designed for this objective. A total of 62 medical records of infants within the research were examined. A comparison was performed between 32 cases ( $n=32$ ) of the brachial plexus palsy and 30 controls ( $n=30$ ) lacking brachial plexus palsy, who were randomly selected from physical rehabilitation medicine examinations.

We have reviewed all charts of patients less than 3 years of age with OBPP.

Infants born with OBPP who have other complications not related with the paralysis or other deformities were excluded.

Maternal data were collected from the patient's chart at the time of enrollment. Neonatal data were obtained from his health records.

The study was approved by the local institutional review board.

A serial of the maternal and perinatal elements were collected from their historical data.

We recorded on our data the maternal factors, such as maternal age, gravity, and parity.

The labor-related factors include labor dystocia and instrumental vaginal delivery, shoulder dystocia, vaginal breech delivery, and cesarean section.

The fetal factors include prolonged pregnancy defined by gestational age at delivery, macrosomia which is birth weight  $\geq 4000$  g.

## Statistical analysis

Using the Student's *t*-test, the means were compared, using Chi-square test or Fisher's exact test for analyzing differences in qualitative variables in case and control samples.

We evaluated odds ratio (OR) with its confidence interval (CI).

All analysis was performed using IBM Statistics for Windows SPSS package (Version 20.0, Chicago, USA). Threshold *P* value was set at  $<0.05$  owing to multiple concurrent analyses.

## RESULTS

### Samples characteristics

Our sample contained 62 infants, with 30 controls and 32 OBPP. In 17 infants, the defect was on the right side of their upper limb, and in 17 infants, the defect was 15 on the left side of their upper limb. There were 34 females and 28 males with sex ratio (M: F) equal to 0.82 The mean age was  $7.63 \pm 10.23$  months.

Table 1 shows that there is no significant difference between age, gravity, and parity in the OBPP and controls groups, concerning the maternal characteristics. Furthermore, there is no significant difference in sex ratio pertaining to infants characteristics; however, the difference was significant between the two groups in relation with infant age, birth weight, and prolonged pregnancy rate. Concerning labor-related factors (OBPP and controls), there is no significant difference between shoulder dystocia, vaginal breech delivery, and cesarean section. However, there was a significant difference found in labor dystocia and instrumental vaginal delivery [Table 1].

### Independent risk factors for obstetrical brachial plexus palsy

There were no significant maternal risk factors which are maternal age, gravity, and parity incriminated for OBPP in our study.

Independent risk factors for brachial plexus paralysis were labor dystocia and instrumental vaginal delivery (forceps delivery and vacuum extraction with OR equal to 8.8) [Table 2].

However, shoulder dystocia, vaginal breech delivery, and cesarean section are not significant.

The significant OR of prolonged pregnancy is equal to 1.28 and those of macrosomia which means birth weight more than 4000 g is equal to 12.353 [Table 2].

**Table 1: Clinical and obstetrical characteristics comparison between obstetrical brachial plexus palsy and control group**

|                                                  | OBPP<br>( $n=32$ ), $n$<br>(%) | Control<br>( $n=30$ ), $n$<br>(%) | <i>P</i>      |
|--------------------------------------------------|--------------------------------|-----------------------------------|---------------|
| Maternal characteristics                         |                                |                                   |               |
| Age (years)                                      | 31 $\pm$ 13.45                 | 31.20 $\pm$ 5.85                  | 0.93<br>(NS)  |
| Gravity                                          | 2.94 $\pm$ 1.59                | 2.13 $\pm$ 1.18                   | 0.067<br>(NS) |
| Parity                                           | 2.94 $\pm$ 1.59                | 2.13 $\pm$ 1.18                   | 0.067<br>(NS) |
| Infant characteristics                           |                                |                                   |               |
| Sex-ratio (male:female)                          | 7:10                           | 1:1                               | 0.61<br>(NS)  |
| Age (months)                                     | 12.69 $\pm$ 11.04              | 2.89 $\pm$ 6.63                   | 0.000         |
| Birth weight (kg)                                | 3.74 $\pm$ 0.6                 | 3.30 $\pm$ 0.537                  | 0.004         |
| Prolonged pregnancy (%)                          | 7 (21.9)                       | 0                                 | 0.007         |
| Labor-related characteristics                    |                                |                                   |               |
| Labor dystocia and instrumental vaginal delivery | 22 (68.8)                      | 24 (80)                           | 0.000         |
| Shoulder dystocia                                | 9 (28.1)                       | 5 (16.7)                          | 0.281<br>(NS) |
| Vaginal breech delivery                          | 6 (18.8)                       | 2 (6.7)                           | 0.156         |
| Caesarean section                                | 3 (9.4)                        | 0                                 | 0.086         |

OBPP: Obstetrical brachial plexus palsy, NS: Nonsignificant

The study biases are a small number of samples and the nonhomogeneity in the two groups control and OBPP which are not completely comparative.

## DISCUSSION

The etiology of brachial plexus injury is believed to be excessive downward traction on the fetal head during the attempt to deliver the anterior shoulder in a vaginal delivery.<sup>[8]</sup>

In an era of increased rate of cesarean deliveries, and perhaps increased accuracy of birth weight estimation, the rate of shoulder dystocia gradually declines.<sup>[7]</sup>

The maternal forces, in the no shoulder dystocia palsies, eventually result in the descent of the stuck shoulder (possibly through its rotation to an oblique diameter) below the promontory of the sacrum, and it therefore is no longer stuck at delivery, but the nerve stretching and Erb's palsy have already occurred. Thus, in approximately two-thirds of the posterior arm injuries, there is no associated shoulder dystocia.<sup>[9]</sup>

The forces applied to give birth to a child with brachial plexus paralysis injury in dystocic deliveries requiring instrumentations are no more important than those applied

to give birth to a newborn without brachial plexus paralysis injury in a same condition of delivery.<sup>[10]</sup>

Shoulder dystocia and infant birthweight of 4500 g and more are the strongest risk factors for OBPP in a Swedish population.<sup>[11]</sup>

Weizsaecker *et al.* said that mothers of children with Erb's palsy had a higher term body mass index and more gestational diabetes than those of controls. Even cases without diabetes had higher blood glucose values after a 50-g glucose challenge than did controls. Cases had a higher birthweight and a lower ratio of head-to-thoracic. In a multiple logistic regression model, variables independently associated with brachial plexus injury were long deceleration phase of labor, long second stage, high birthweight, black race, and high neonatal or maternal body mass circumference than controls.<sup>[12]</sup>

The literature review of OBPP risk factors published by Zafeiriou and Psychogiou<sup>[3]</sup> is diabetes mellitus, obesity or excessive weight gain, maternal age (35 years), maternal pelvic anatomy, and primiparity. Breech delivery combined with low birth weight, shoulder dystocia, and high birth weight more than 4 kg [Table 3].

However, Okby and Sheiner in their study<sup>[6]</sup> showed that labor dystocia, vacuum delivery, vaginal breech deliveries, shoulder dystocia, and macrosomia were the significant risk factors for neonatal brachial plexus palsy, while maternal characteristics such as obesity and diabetes were not.

Our results are similar to those of Okby and Sheiner; the significant risk factors of OBPP are macrosomia, labor dystocia, instrumental vaginal delivery, prolonged pregnancy, while maternal factors were not [Table 3].

This study was initiated by the continuing debate on how the etiology of OBPP is related to vaginal delivery and modes of manual assistance. Two principle theories exist in the literature regarding the etiology of OBPP in newborns which include the intrauterine origin and traction applied during delivery of the infants.

Despite our growing knowledge concerning the risk factors associated with brachial plexus palsy, unfortunately, this issue is still appearing with many patients.

Interestingly, in our study's population, risk factors were basically attributed to the delivery process and birth weight,

**Table 2: Risk factor analysis between obstetrical brachial plexus palsy and control**

| Independent risk factors for OBPP                | OR     | CI 95%       | P                 |
|--------------------------------------------------|--------|--------------|-------------------|
| Maternal factors                                 |        |              |                   |
| Maternal age                                     | 0.105  | 0.005-2.411  | 0.104             |
| Gravity                                          | 2.07   | 0.47-9.98    | 0.328             |
| Parity                                           | 2.545  | 0.677-9.565  | 0.206             |
| Labor-related factors                            |        |              |                   |
| Labor dystocia and instrumental vaginal delivery | 8.8    | 2.743-28.234 | <10 <sup>-3</sup> |
| Shoulder dystocia                                | 1.957  | 0.571-6.702  | 0.367             |
| Vaginal breech delivery                          | 3.231  | 0.598-17.456 | 0.258             |
| Cesarean section                                 | 1.103  | 0.987-1.234  | 0.238             |
| Fetal factors                                    |        |              |                   |
| Gestational age at delivery prolonged pregnancy  | 1.28   | 1.066-1.538  | 0.011             |
| Birth weight: Macrosomia                         | 12.353 | 2.510-60.802 | <10 <sup>-3</sup> |

OR: Odds ratio, CI: Confidence interval, OBPP: Obstetrical brachial plexus palsy

**Table 3: Comparison of similar studies**

|                         | Zafeiriou and Psychogiou, 2008 Literature review                                                                   | Rania Okby 2012 (n=5525)  | Our study (n=62)                       |
|-------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------|
|                         | Diabetes mellitus, obesity or excessive weight gain, maternal age (35 years), maternal pelvic anatomy, primiparity |                           |                                        |
| Vacuum delivery         |                                                                                                                    | 16.4 (3.7-70.5), P=0.001  |                                        |
| Labor dystocia          |                                                                                                                    | 40.8 (7.9-188.2), P=0.001 | 8.82 (2.74-28.23), P<10 <sup>-3</sup>  |
| Vaginal breech delivery | Breech delivery combined with low birth weight                                                                     | 36.1 (4.5-262.5), P=0.032 |                                        |
| Shoulder dystocia       | Shoulder dystocia                                                                                                  | 525 (51-4,977), P=0.001   |                                        |
| Macrosomia              | High birth weight (4 kg)                                                                                           | 16.3 (3.7-70.2), P=0.001  | 12.35 (2.51-60.80), P<10 <sup>-3</sup> |
| Prolonged second stage  |                                                                                                                    | 40.8 (7.9-188.2), P=0.001 | 1.28 (1.06-1.53), P=0.011              |

while maternal characteristics were not associated with brachial plexus paralysis.

## CONCLUSION

In our population ( $n = 62$ ), macrosomia, labor dystocia, instrumental vaginal delivery, and prolonged pregnancy were the significant risk factors for neonatal brachial plexus paralysis, while shoulder dystocia, breech deliveries, parity, and cesarean section were not. Despite our small sample, we found three significant risk factors associated with brachial plexus paralysis.

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## Conflicts of interest

There are no conflicts of interest.

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