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PROGNOSTIC RELEVANCE OF RISK FACTORS FOR OBSTETRICAL BRACHIAL PLEXOPATHY

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ABSTRACT - We did a case-control study to verify if the birthweight, forceps delivery or perinatal asphyxia have any significant effect on the prognosis of obstetrical brachial plexopathy. Group A was composed of 25 infants who completely recovered at the age of 6 months. Group B was composed of 21 infants who were still not able to remove a blindfold from the face with the affected limb in the sitting position at the age of 12 months. There was no statistical difference of the median birthweight or median first minute Apgar score between the groups. There was also no relation between birthweight higher than 4000g, first minute Apgar score lower than 6 or forceps delivery with a poor prognosis.

KEY WORDS: brachial plexus, obstetric paralysis, risk factors, birth weight, obstetrical forceps, Apgar score.

Relevância prognóstica dos fatores de risco para plexopatia braquial obstétrica

RESUMO - Realizamos um estudo caso-controle para verificar se o peso ao nascimento, parto forceps ou asfixia perinatal apresentam efeito significativo no prognóstico da plexopatia braquial obstétrica. O grupo A foi composto por 25 lactentes que apresentavam recuperação completa aos 6 meses de idade. O grupo B foi composto por 21 lactentes incapazes de remover uma venda do rosto com o membro acometido na posição sentada aos 12 meses de idade. Não houve diferença significativa entre as medianas de peso ao nascimento ou do boletim Apgar do primeiro minuto entre os grupos. Também não foi observada relação entre peso ao nascimento maior que 4000g, boletim Apgar do primeiro minuto menor do que 6 ou parto forceps com um prognóstico desfavorável.

PALAVRAS-CHAVE: plexo braquial, paralisia obstétrica, fatores de risco, peso ao nascimento, forceps obstétrico, escore de Apgar.

Obstetrical brachial plexopathy (OBP) still is a common consequence of birth trauma. Its incidence in developed countries is around 0.15%[1,2] and has not been reduced despite progress in obstetrics[2,3]. Fortunately, most patients with OBP will fully recover after a few months, but 5% to 25% of them will remain handicapped[2,4-8]. The brachial plexus is formed by the anterior branch of the spinal roots from C5 to T1[9]. Supraclavicular plexus lesions, such as OBP, can be clinically and anatomically divided into superior (C5-C6), middle (C7) and inferior (C8-T1) levels[10]. Pure upper level plexopathy, or Erb palsy, accounts for 50% of the cases[11]. These patients have poor elbow flexion, shoulder abduction, arm external rotation, and forearm supination[12]. The wrist extension may also be weak due to the involvement of the extensor carpi radialis muscles. The resulting posture is classically described as "waiter's tip"[11]. One third of the patients with OBP have an upper and middle levels plexopathy. Middle level plexus involvement leads to poor elbow, wrist, and fingers extension[12]. Pure lower level plexopathy, or Klumpke palsy, is extremely rare[11]. These patients have poor fingers flexion and thumb opposition, and may also exhibit a Horner syndrome (miosis, ptosis, enophthalmos and anhydrosis). One sixth of the patients with OBP have a complete brachial plexus lesion (from C5 to T1) and show a total limb paralysis (flail arm), with or without Horner syndrome[10].

Several risk factors for OBP have been identified, the most well know being high birthweight and assisted delivery[1,2,4,13,14]. Perinatal asphyxia may also be a contributing factor, because the associated hypotonia would make the fetus more vulnerable to stretch injuries[10,15]. Although the relation of these factors with the occurrence of OBP has been established, their effect on neurological prognosis is uncertain.

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The objective of this study was to verify if these risk factors have prognostic relevance or not.

METHOD

From July 2000 to December 2004, 79 infants with OBP (0-10 months old) were referred to the child neurology outpatient unit of the Clinics Hospital of Sao Paulo. We did a case-control study based on two groups selected from these children. The research ethical committee of the hospital approved this study.

Group A (good prognosis) was composed of 25 infants who showed complete recovery and no strength asymmetry at the age of 6 months. There were 21 patients with C5-C6 palsy; 3 patients with C5-C6-C7 palsy, and one patient with C8-T1 palsy. All patients were admitted before 60 days of age (median=16 days). The follow-up of these children was at least 4 months long (range: 4-12 months; median=6 months).

Group B (poor prognosis) was composed of 21 infants who still were unable to remove a blindfold from the face with the affected limb in the sitting position at the age of 12 months. There were 10 patients with complete brachial plexus paralysis (C5-T1); 10 patients with C5-C6-C7 palsy (one of them bilateral), and one patient with C5-C6 palsy. Twelve patients were admitted before 60 days of age (median=28 days), and nine patients were referred later for surgery, at the age of 3 to 10 months (median=8 months). The follow-up of these children ranged from 2 to 52 months (median=32 months). Seventeen patients from this group were followed-up until at least two years of age and none of them developed good arm function. Five of these children were submitted to brachial plexus neurolysis before the age of 12 months, but there was no strength loss after the surgery. Therefore, the poor outcome could not be attributed to the surgical procedure.

The patients excluded from the study had an incomplete follow-up (n=18), intermediate outcome (n=9), cerebral palsy (n=3), or were submitted to brachial plexus surgery with nerve grafts (n = 3). Patients submitted to surgery with nerve grafts can lose muscle power after the surgery because the nerves are sectioned in order to place the grafts. Patients with intermediate outcome were able to remove the blindfold from the face with the affected limb at 12 months of age, but still had clear strength asymmetry (usually for supination and arm external rotation) or scapular winging.

We compared the two groups in relation to birthweight, first minute Apgar score (FMAS) and mode of delivery. FMAS was employed in order to evaluate the possible role of fetal hypotonia secondary to birth asphyxia during delivery and not the eventual hypoxic-ischemic encephalopathy. Data on birthweight and delivery mode were available in all patients. The FMAS was available in 24 patients of group A and 17 patients of group B. We used the ANOVA test to compare mean birthweight and Kruskal-Wallis test for median FMAS. Birthweight and FMAS were also transformed in categorical variables to calculate the odds ratios. The patients exposed to risk factors should have birthweight higher than 4000g, FMAS of less than 6 and forceps delivery. The confidence intervals for odds ratios were calculated using 95% exact confidence limits. Statistic analysis was done using the Epi Info 2002 program (CDC, Atlanta, USA).

RESULTS

In group A, birthweight ranged from 2570 g to 4450 g (Fig 1). The median birthweight is shown in Table 1. Eight patients weighted more than 4000g (Table 2). There were two pre-term and 23 full-term infants. Eleven infants were large-for-gestational age, and 14 were adequate-for-gestational age. In group B, birthweight ranged from 2000 g to 5515 g (Fig 1). The median weight is shown in Table 1. There were 9 patients who weighted above 4000g (Table 2). All infants were full-term. Nine infants were large-for-gestational age, one patient was small-for-gestational age, and 11 had adequate-for-gestational age.

Table 1. Differences of medians of birthweight and first minute Apgar scores between the two groups.

Parameter	Group A*	Group B†	p value
Birthweight	3,780 g	3,950 g	0.16
1st min Apgar score	6	5	0.19

*Good prognosis group; †Poor prognosis group.

Table 2. Proportion of patients exposed to the risk factors in the two groups, and odds ratio and confidence interval for a poor prognosis based on the presence of the risk factors.

Risk factor	Group A*	Group B†	Odds Ratio	C.I.‡
Birthweight > 4 Kg	32%	43%	1.59	0.41-6.30
1st Apgar score < 6	46%	53%	1.33	0.32-5.52
Forceps delivery	36%	24%	0.56	0.12-2.38

*Good prognosis group; †Poor prognosis group; ‡95% confidence interval.

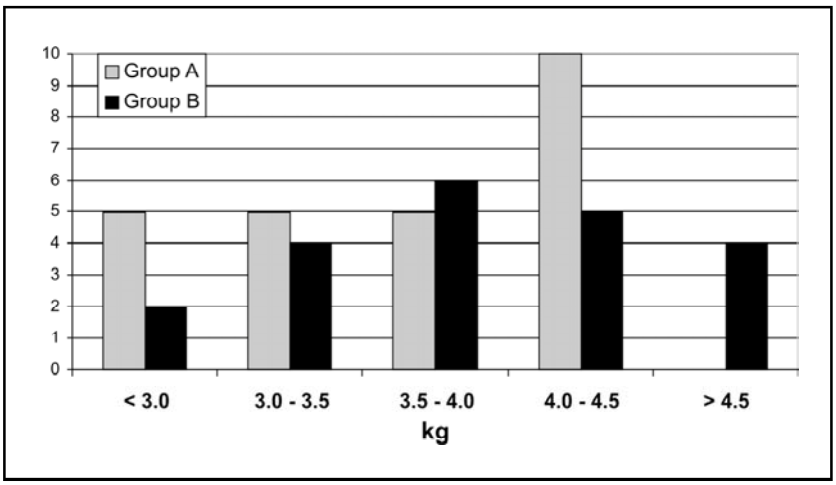

Fig 1. Birthweight histogram of the infants of both groups.

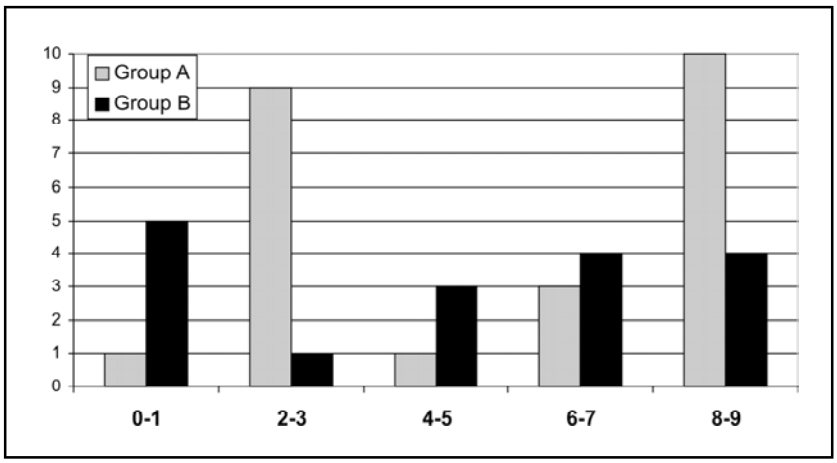

Fig 2. First minute Apgar score histogram of the infants of both groups.

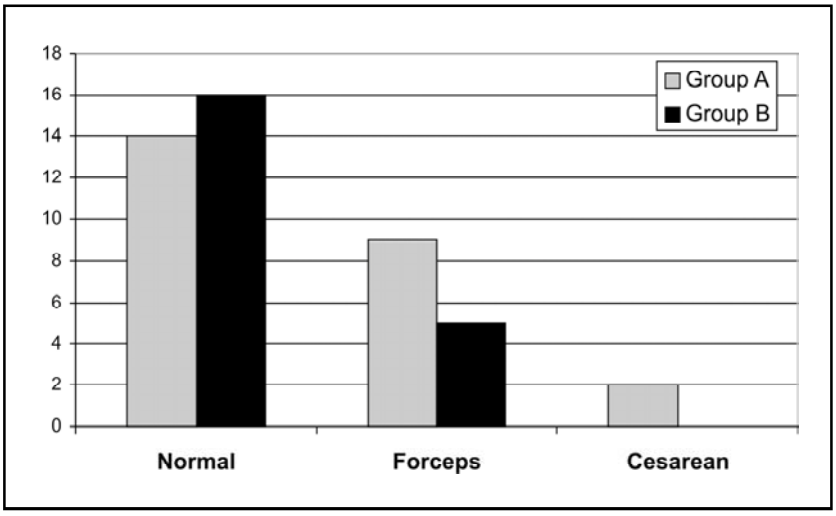

Fig 3. Delivery mode histogram of the infants of both groups

There was no statistically significant difference of birthweight between the groups.

In the group A, the FMAS ranged from 1 to 9 (Fig 2). The median FMAS is shown in Table 1. There were 11 patients with a FMAS below 6 (Table 2). In the group B, the FMAS ranged from 0 to 8 (Fig 2). The median FMAS is shown in Table 1. There were 9 patients with a FMAS below 6 (Table 2). There was also no statistically significant difference between the groups.

In the group A, there were 14 normal deliveries, 9 forceps deliveries, and 2 cesareans (Fig 3). In the group B, there were 16 normal deliveries and 5 forceps deliveries (Fig 3). There was no statistically significant difference between the groups (Table 2).

DISCUSSION

We could not demonstrate any relation between birthweight, perinatal asphyxia or forceps delivery and neurological prognosis of infants with OBP. Patients with poor prognosis had slightly higher birt hweight and slightly lower FMAS than patients with good prognosis, but this was not statistically significant. Surprisingly, patients with good prognosis had a higher proportion of forceps deliveries, but this was also not statistically significant.

There is a clear relation between the rate of recovery and the final prognosis of patients with OBP. The ideal age to define the final outcome would be three years, because the patients are not expected to improve after this age[16]. However, Noetzel et al. could correctly predict the 18-24 months outcome of infants with OBP based on the neurological impairment at 6 month of age[17] and Basheer et al. found that 90% of patients reach their final clinical status at 6 months of age[18]. Our criterion for poor prognosis relies on a functional test at the age of 12 months. This test was based on the "cookie test" employed by Clarke and Curtis at the age of nine months as a criterion for surgical intervention[19]. It has the advantage of being objective and easily performed. All children from the "good prognosis" group were able to perform this test at 6-7 months of age.

Our study may not have enough power to detect the prognostic effect of birthweight and FMAS due to the small sample size. Larger studies or meta-analysis could possibly answer this question with more certitude. However, OBP is not a common condition and large series are difficult to provide. Meta-analysis is almost impossible since the follow-up period, the assessment protocol and the definitions of "good" and "poor" prognosis are so different among the publications dealing with OBP prognosis that the data cannot be compared[16].

High birthweight is a very important risk factor for OBP[1,2], but the effect of birthweight on the prognosis of affected newborns is controversial. Nehme et al. did a retrospective study with 30 patients and found that high birthweight was associated with poor prognosis in a multivariate analysis when associated with the neurological involvement[20]. Bager, in a prospective cohort study with 41 patients, could not find any association between birthweight and the neurological outcome[2].

Assisted deliveries, including forceps and ventouse, carry a higher risk for OBP[1]. Vacuum extraction assisted deliveries are not usually performed in our country. Although forceps delivery is clearly associated with an increased risk of OBP[14], Brown believes that the forceps has no causal relation and that it is only another consequence of a difficult delivery[21].

Evans-Jones et al. did a large study based on active surveillance for OBP in the United Kingdom and Ireland[3]. The outcome assessment was based on 322 questionnaires sent to consultant pediatricians, from which 276 questionnaires returned. The assessment was done at the age of 23 weeks (range 18-27). There were 52% cases with full recovery, 46% with partial recovery, and 2% with no recovery at that age. They did not find a higher rate of incomplete recovery for macrosomic infants (relative risk: 1.37; confidence interval: 0.91-2.04) or patients with assisted deliveries (relative risk: 0.93; confidence interval: 0.72-1.22).

We are not aware of any study that specifically addresses the effect of FMAS on the prognosis of infants with OBP. Perinatal asphyxia is frequently associated with OBP[4,7,14]. The theory that hypotonia induced by perinatal hypoxia predisposes the fetus to a brachial plexus stretch injury seems logical[15], but lacks experimental confirmation. Furthermore, the asphyxia should occur prior to the brachial plexus lesion, which is impossible to be sure in this study. Fetal blood pH is a better instrument than Apgar score to measure fetal hypoxia[22].

In summary, the prognosis of OBP cannot rely on factors such as birthweight, delivery mode or perinatal asphyxia. Nerve conduction studies may be helpful for prognostic assessment[23], but the best prognostic guides still are the neurological impairment and the rate of recovery[17,19,24].

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