

# Evaluation of pain in vaginal and caesarean section birth newborns before and after intramuscular injection

*Avaliação da dor em recém-nascidos de parto vaginal e cesariana antes e após injeção intramuscular*

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## ABSTRACT

**BACKGROUND AND OBJECTIVES:** It is already known that the painful experiences to which the newborn is subjected may be related to future reactions and differences in the behavioral response to pain in newborns from different birth routes. This study aimed to evaluate the response to pain in infants born by cesarean section and vaginal delivery routes.

**METHODS:** This is a prospective cohort study. Newborns born at full term were allocated into two groups: cesarean section and vaginal delivery. The intramuscular vitamin K injection was performed as an acute pain stimulus because it is a routine injection at birth. The newborns were evaluated for pain on two scales, a one-dimensional, the Neonatal Facial Coding System, and a multidimensional, the COMFORT Behavior Scale (Comfort b), in addition to heart rate counting, moments before, immediately after and 10 minutes after the stimuli. Students *t*-test was used for statistical analyzes, and the level of significance was 5%.

**RESULTS:** Eighty-three children were evaluated. The pain intensity assessed by both scales before the pain stimulus was higher in the cesarean section group, but not statistically significant. Heart rate values after the stimulus showed a statistically significant difference ( $p < 0.05$ ), higher in the cesarean section group than in the vaginal delivery.

**CONCLUSION:** The results did not suggest that there are differences in the perception of pain among newborns born vaginally and cesarean section.

**Keywords:** Acute pain, Cesarean section, Newborn, Obstetric delivery.

## RESUMO

**JUSTIFICATIVA E OBJETIVOS:** As experiências dolorosas as quais o recém-nascido é submetido podem ter relação com reações futuras e que existem diferenças no comportamento de resposta à dor nos recém-nascidos oriundos de diferentes vias de parto. O estudo teve como objetivo avaliar a resposta à dor em bebês nascidos por cesariana e parto vaginal.

**MÉTODOS:** Estudo coorte prospectivo que incluiu recém-nascidos nascidos a termo, de cesariana e parto vaginal. Utilizou-se, como estímulo doloroso agudo, a injeção intramuscular de vitamina K rotineira ao nascimento. Os recém-nascidos foram avaliados quanto à dor pela escala unidimensional *Neonatal Facial Coding System* e pela multidimensional *COMFORT Behavior Scale* (Comfort b), além da frequência cardíaca nos momentos antes, imediatamente após e 10 minutos após o estímulo. Foi utilizado teste *t* de Student para a análise estatística com significância de 5%.

**RESULTADOS:** Foram avaliadas 83 crianças. A intensidade da dor avaliada por ambas as escalas antes do estímulo doloroso foi maior no grupo de recém-nascidos de cesariana, porém não foi estatisticamente significativa. Os valores da frequência cardíaca após o estímulo mostraram diferença estatisticamente significativa ( $p < 0,05$ ) maiores no grupo cesariana que no parto vaginal.

**CONCLUSÃO:** Os dados obtidos não evidenciaram diferenças na percepção da dor entre recém-nascidos de parto vaginal e cesariana.

**Descritores:** Cesariana, Dor aguda, Parto obstétrico, Recém-nascido.

## INTRODUCTION

It was believed that newborns (NBs) did not feel pain because, at birth, the nervous system would still be immature. Research has found that newborns respond to painful stimuli, and their experience is subject to objective diagnosis and evaluation<sup>1,2</sup>. Imaging studies are being conducted to help understand the pain processing in children. Functional nuclear magnetic resonance

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(fMRI) showed significant brain activity in newborns in 18 of the 20 brain regions, also active in adults during the painful stimulus<sup>3</sup>. Assuming that the painful experiences that the NB is subjected could be related to his future reaction to new stimuli, a clinical study showed that in 87 boys, circumcision in the neonatal period is associated with an increased response to pain when intramuscular injection vaccination is performed after 4 to 6 months after the surgery.

Several experimental studies have correlated the response to painful stimuli in newborns and adults. The incision in the paw of newborn rats produced somatosensory memory, influencing the future response to the new lesion as adults, concluding that the long-term effects after the neonatal lesion indicate the need for effective preventive strategies<sup>5</sup>.

Some studies have shown that there are differences in the behavior of pain response in vaginal delivery and elective cesarean sections newborns<sup>6-8</sup>. In addition, higher levels of catecholamines<sup>9</sup> and beta-endorphin<sup>10-12</sup> were found in NBs by vaginal delivery, compared to those by cesarean sections.

Many factors can influence the newborn's pain behavior at birth. Vaginal delivery NBs who have had assistance with vacuum extraction may demonstrate changes<sup>7</sup>. The use of opioids during anesthesia for childbirth, depending on the route and the drug used, is also an important influence<sup>13</sup>, and the use of illicit drugs by the pregnant woman can change the level of cortisol in NB<sup>8</sup>. Signs of fetal distress can lead to changes in pain perception in NBs<sup>8</sup>. The presence of meconium-stained liquor during delivery, for example, is associated with changes in the clinical expression of pain in the first 24 hours of NBs life, even if slightly<sup>7</sup>. As for the Apgar Score, scores lower than 7 in the 5<sup>th</sup> minute can alter the NB perception of pain<sup>6</sup>.

The presence of a ruptured of membranes greater than or equal to 18 hours is an important predictor of early sepsis in NBs. Knowing that neonatal sepsis is a clinical syndrome characterized by a systemic inflammatory response that increases morbidity and mortality, the presence of a prolonged rupture of membranes could be a factor that would alter the response to pain in children after birth<sup>14</sup>.

Based on the assumption that newborns feel pain that is measurable<sup>15</sup> and that the route of delivery can change the perception of pain in newborns, the study aimed to assess the response to pain soon after the birth of NBs by vaginal delivery and cesarean section.

## METHODS

Women in labor classified as physical status ASA II (American Society of Anesthesia Classification System)<sup>16</sup>, admitted to the selected tertiary maternity hospital between May 2016 and October 2017, with gestational age between 37 weeks and 41 weeks and six days, without a rupture of membranes of 6 or more hours, and who did not use illicit drugs, alcohol, and tobacco during pregnancy, were invited to participate in the study.

A previous statistical study estimated the number of participants needed, scheduling a timetable for collections.

After agreeing and signing the Free and Informed Consent Form (FICT), the women in labor were included. The first group con-

sisted of newborns by vaginal delivery whose mother has not been submitted to episiotomy and did not receive any type of analgesia and/or anesthesia.

The second group consisted of NBs by elective C-section. The anesthesia was with subarachnoidal bupivacaine, and the opioid used was subarachnoidal morphine, at the maximum dose of 100µg.

NBs from labor lasting more than 24 hours, presence of meconium-stained liquor, and the use of forceps or vacuum extraction were excluded from the study<sup>6,7</sup>, as well as newborns who had scores below 7 in the 1<sup>st</sup> and/or 5<sup>th</sup> minutes<sup>6,8</sup>, considering that both scores are important for neonatal physiology<sup>17</sup>.

The NBs were evaluated after the acute painful stimulation at birth, using two pain scales, in addition to heart rate (HR) measurement. All assessments were performed by one single examiner, blind about the route of delivery, who, two months before the beginning of the evaluations, studied the scales and was trained to use them in the study.

The COMFORT Behavior Scale (COMFORT b) validated for the Portuguese language<sup>18</sup> and derived from the original COMFORT scale was used. It is a multidimensional instrument, suitable for the assessment of acute pain compatible with the age group of the study. Scores are between 6 and 30 points, with six meaning no pain and 30 being maximum pain<sup>15</sup>, and values less than or equal to 10 mean little or no pain.

The HR was checked, an important parameter in the assessment of acute pain<sup>6,18</sup>. The Neonatal Facial Coding System (NFCS) was also used, a unidimensional instrument suitable for acute pain and newborns. The maximum possible score is 8 points, which considers the presence of pain when three or more facial movements appear consistently<sup>19</sup>.

At birth, it is recommended that NBs receive vitamin K (phytonadione), and the Ministry of Health<sup>20</sup> recommends the intramuscular formulation. As it is a routine procedure, it was the acute painful stimulus used.

After birth, the NB was comforted by the mother by skin contact. Then, the baby was taken to the assessment room, a calm and peaceful environment, with adequate temperature<sup>20</sup>, where general care was performed. Before the painful stimulus, the HR was checked in beats per minute (bpm), with a warm stethoscope in the precordial region for 15 seconds, after which the Comfort b and NFCS scales were applied. These measurements were performed after the painful stimulus, and 10 minutes after. The NBs remained in a warm crib between the assessments. After assessing the pain intensity, the physical and neurological tests were performed, since changes in these assessments could alter the response to pain<sup>6,21</sup>. The semiological parameters and birth weight were checked to see if there was any sign of fetal distress<sup>21,22</sup> as well as the neurological evaluation with the crying test, attitude, tone, movement, and neurological reflexes, in addition to the head circumference and percentile on the curve. NBs with neurological changes and/or small for the gestational age were excluded<sup>23,24</sup>.

The Ethics Committee of the Institution approved this study under opinion number 48553015.3.0000.5411.

**Statistical analysis**

The statistical analysis was performed using Student's *t*-test<sup>25</sup>, comparing the means between the two groups in relation to the moments studied. Fisher's Exact test<sup>26</sup> was used for the analysis of qualitative variables and the associations among them. The significance level adopted was 5%.

**RESULTS**

Eighty-three women in labor were included, totaling 83 NBs (Table 1). The gender distribution was similar in each group.

**Table 1.** Distribution by gender and route of delivery

Delivery type	Female (n and %)	Male (n and %)	Total (n and %)
C-section	31 (37)	22 (27)	53 (64)
Vaginal	14 (17)	16 (19)	30 (36)
Total	45 (54)	38 (46)	83 (100)

The maximum labor time for vaginal deliveries was 16 hours, and for C-section was 14 hours, showing that the samples were similar. Before the end of the evaluations, no NB was breastfed because it could interfere with reactions to pain<sup>27</sup>. The time in minutes before the first measurement was recorded, with no statistical difference.

Regarding the COMFORT b and NFCS scales, differences were found in absolute numbers, drawing attention to the values obtained before the painful stimulus, with an average score in the C-section newborns of 17.47 and 2.47, respectively in each scale, with a maximum value of 26 and 6. In vaginal delivery NBs, it was 16.53 and 2.2, with a maximum value of 20 and 4 points, respectively (Table 2), but on both scales, there was no statistical difference (*p*>0.05) (Table 3).

Regarding the HR, the values found before and immediately after the painful stimulus were similar in both groups. However, in the 10-minute after the injection, there was a significant difference (*p*<0.05 - table 3). In the C-section group, the mean was 143 bpm, and in vaginal delivery, 135 bpm (Table 2).

**Table 2.** Minimum, maximum and average values found in the C-section and vaginal delivery groups, before and after the acute painful stimulus

Variables	Time	Minimum With PV	Maximum With PV	Mean With PV
Comfort b	Before the stimulus	9/ 12	26/ 20	17.47/16.53
	Immediately after the stimulus	15/ 17	29/ 29	24.75/24.83
	10 min after the stimulus	8/ 7	20/ 20	12.32/12.67
NFCS	Before the stimulus	0/ 0	6/ 4	2.47/2.2
	Immediately after the stimulus	1/ 1	8/ 8	5.57/5.53
	10 min after the stimulus	0/ 0	4/ 3	0.49/ 0.53
Heart rate (bpm)	Before the stimulus	112/ 112	190/ 188	148.6/146.9
	Immediately after the stimulus	128/ 120	196/ 200	161.9/159.6
	10 min after the stimulus	116/ 110	180/ 168	143.1/135

Comfort b = COMFORT Behavior Scale; NFCS = Neonatal Facial Coding System; min = minutes; bpm = beats per minute.

**Table 3.** Means, variations, and p-values in each group studied

Variables of assessment	Evaluation period	C-section	Vaginal delivery	p-value
Comfort b	Before the stimulus	17.47±2.81	16.53±2.01	0.112
	Immediately after the stimulus	24.75±3.32	24.83±3.28	0.917
	10 min after the stimulus	12.32±2.60	12.66±2.60	0.562
NFCS	Before the stimulus	2.47±1.44	2.20±1.32	0.4
	Immediately after the stimulus	5.56±1.53	5.53±1.50	0.925
	10 min after the stimulus	0.49±0.99	0.53±0.77	0.839
Heart rate (bpm)	Before the stimulus	148.6±15.59	146.9±18.66	0.664
	Immediately after the stimulus	161.9±15.21	159.6±19.64	0.553
	10 min after the stimulus	143.2±15.18	135±13.66	0.016

Comfort b = COMFORT Behavior Scale; NFCS = Neonatal Facial Coding System; bpm = beats per minute; min = minutes.

## DISCUSSION

The present study included 83 NBs. Thirty by vaginal delivery and 53 by C-section, while another study<sup>6</sup> included 76 NBs, 53 by vaginal delivery, and 23 through C-section. The evaluated newborns were all at term. The importance of the gestation time is shown in other studies that were also concerned in including patients with a gestational age greater than 37 weeks<sup>6,8</sup> except for the study<sup>7</sup>, which included NBs at 35 weeks of gestation, which can diversify the sample.

Regarding the weight, the studies included NBs not classified as small for the gestational age<sup>6,8</sup>, except for one study that used a minimum weight of 2,000g regardless of the gestational age<sup>7</sup>. Regarding the Apgar score, studies are concerned with the value in the 5th minute to be greater than 7<sup>6,8</sup>, different from this study, which considered values greater than 7 for the 1<sup>st</sup> and 5<sup>th</sup> minutes, excluding NBs when there was meconium in the amniotic fluid, and similarly to another study<sup>6</sup>, excluded NBs whose labor lasted more than 24 hours.

Concerning pain assessment in NB, studies consider the face movement in NBs as a parameter, as well as the Comfort b and NFCS scales<sup>6,8</sup>. The validated NFCS was used in this research similarly to the study<sup>6</sup> which used it with fewer parameters, considering criteria such as the easiness of application, raising questions about the results; and pain assessments were performed by different health professionals with different backgrounds, unlike this study in which the assessments were performed by one single investigator with full medicine and pediatrics background, previously trained.

The present study showed higher pain scores on the Comfort b and NFCS scales for those born by vaginal delivery before the painful stimulus, but the difference was not significant and did not last in the other evaluations, either immediately after the painful stimulus or 10 minutes after the stimulus, different from other studies in which the NB by C-section felt more pain after the acute painful stimulus when compared to those born vaginally<sup>6,8</sup>. The study<sup>7</sup> showed that NBs by C-section experienced greater pain immediately after birth compared to vaginal delivery, but this difference was not statistically significant. Therefore, regarding the assessment of pain right after birth, the data obtained in the present research confirm this result.

One study showed that HR is physiologically lower in those born vaginally compared to those born by C-section<sup>6</sup>. However, in the present study, stability was found in both groups, before and immediately after the painful stimulus. The same study<sup>6</sup> showed that the HR increased progressively during the first hours of life in NBs vaginally and not in those born by C-section. However, in this study, in the late 10-minute measurement after the intramuscular injection, the group born via C-section showed significantly higher HR values. With regard to pain, these findings do not allow inferring differences in pain perception in the two groups since the physiological variables alone are not very sensitive for this type of analysis<sup>28</sup>.

## CONCLUSION

The pain intensity assessed by the Comfort b and NFCS scales did not show any difference in pain perception between newborns delivered vaginally and through C-section.

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