

Analysis of obstetrical deliveries under conduction anesthesia and immediate neonatal repercussion

Análise do resultado obstétrico de partos submetidos a anestesia de condução e das repercussões neonatais imediatas

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Gontijo GR, Araújo MM, Reis ZSN. Analysis of obstetrical deliveries under conduction anesthesia and immediate neonatal repercussion / *Análise do resultado obstétrico de partos submetidos a anestesia de condução e das repercussões neonatais imediatas*. Rev Med (São Paulo). 2020 Sept-Oct;99(5):448-55.

ABSTRACT: Introduction: Anesthesia is an important resource for pain relief during labor. It is not a risk-free procedure and its use involves decision-making based on clinical and obstetric conditions, a woman's desire and availability of the procedure. This study aimed to analyze the association between this intervention and the occurrence of operative delivery and low Apgar score. Method: Retrospective study of a hospital database containing 5,282 parturients with single gestation of a fetus with cephalic presentation born alive and without malformation, among the 8,591 births that occurred from 2014 to 2017, in the Clinical Hospital's Maternity of UFMG. Outcomes of interest were compared between deliveries conducted with or without anesthesia by association tests. Results: The occurrence of labor conduction anesthesia was 29.9%, being more frequent among adolescents (33.3% versus 29.1%; $p = 0.008$), nulliparous (39.7% versus 21.6%; $p < 0.001$), those with induced delivery (40.6% versus 26.5%; $p < 0.001$), patients with heart disease (53.5% versus 29.6%; $p < 0.001$) and parturients whose babies weighed 2500 g or more at birth (31.3% versus 19.7%; $p < 0.001$). There was an association between anesthesia and increased use of forceps (15.7% versus 1.8%; $p < 0.001$) and vacuum extractor (2.0% versus 0.6%; $p < 0.001$), however, there was a reduction in the occurrence of cesarean section (7.3% versus 12.9%; $p < 0.001$). Anesthesia was associated with a higher occurrence of 1st minute Apgar < 7 ($p < 0.001$) but did not change the 5th Apgar score ($p = 0.243$). Nulliparity seems to influence the occurrence of cesarean delivery (8.6% versus 5.2%; $p = 0.013$) and forceps use (19.4% versus 9.8%; $p < 0.001$). Conclusion: The use of labor conduction anesthesia was associated with operative vaginal delivery, the lowest cesarean section rate, with no impact on the 5th minute Apgar score.

Keywords: Pregnant women; Hospitals, maternity; Anesthesia; Labor, obstetric.

RESUMO: Introdução: A anestesia é um recurso importante no alívio da dor durante o trabalho de parto (TP). Não é um procedimento isento de riscos e sua utilização envolve decisão com base nas condições clínicas e obstétricas, desejo da mulher e disponibilidade do procedimento. O objetivo deste estudo foi analisar a associação entre essa intervenção com a ocorrência de parto operatório e baixo escore de Apgar. Método: Estudo retrospectivo de base de dados hospitalar contendo 5.282 parturientes com gestação única, de feto em apresentação cefálica nascido vivo e sem malformação, entre os 8.591 nascimentos ocorridos no período de 2014 a 2017, na maternidade do Hospital das Clínicas da UFMG. Desfechos de interesse foram comparados entre partos conduzidos com ou sem anestesia, através de testes de associação. Resultados: A ocorrência de anestesia de condução de TP foi de 29,9%, sendo mais frequente entre adolescentes (33,3% versus 29,1%; $p = 0,008$), nulíparas (39,7% versus 21,6%; $p < 0,001$), naquelas com parto induzido (40,6% versus 26,5%; $p < 0,001$), portadoras de cardiopatias (53,5% versus 29,6%; $p < 0,001$) e parturientes cujos recém-nascidos pesaram 2500 g ou mais ao nascer (31,3% versus 19,7%; $p < 0,001$). Houve associação entre anestesia e aumento do uso de fórceps (15,7% versus 1,8%; $p < 0,001$) e de vacum extrator (2,0% versus 0,6%; $p < 0,001$), porém ocorreu redução das taxas de cesariana (7,3% versus 12,9%; $p < 0,001$). O uso da anestesia associou-se à maior ocorrência de Apgar de 1º minuto < 7 ($p < 0,001$), mas não alterou o de 5º ($p = 0,243$). A nuliparidade parece ter influência sobre a ocorrência de parto cesariano (8,6% versus 5,2%; $p = 0,013$) e uso de fórceps (19,4% versus 9,8%; $p < 0,001$). Conclusão: O uso de anestesia de condução no parto associou-se ao parto vaginal operatório, e à menor taxa de cesariana, sem impacto no Apgar de 5º minuto.

Descritores: Gestantes; Maternidades; Anestesia; Trabalho de parto.

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INTRODUCTION

The pharmacological relief of pain associated with labor was first used by the physician Sir James Young Simpson in 1847 in the form of ether, which revolutionized the moment of labor, offering pregnant women greater comfort when giving birth¹.

Current recommendations are that anesthesia during labor can be offered to women who complain of pain and request relief, as long as they don't present any medical contraindication, according to the American College of Obstetricians and Gynecologists (ACOG)². The American Society of Anesthesiology (ASA)³ states that the choice of anesthetic technique depends on the patient's medical conditions, anesthetic risk factors, obstetric risk factors, the patient's preference, the labor's progression and the resources available in the institution.

Through the relief of painful uterine contractions, it is possible to reduce the secretion of maternal catecholamines and thus control the exaggerated increase in heart rate, cardiac output, and maternal blood pressure⁴. However, it is up to the health professional to assess which method is more suitable to be used for pain relief, because, despite all its benefits, it is known that obstetric anesthesia is not risk-free⁵.

Depending on the tolerability to anesthetic block and the dose applied, the pregnant woman may have clinical repercussions, the most common of which are nausea, vomiting, pruritus, and hypotension⁶. The latter, due to its effect in reducing uterine perfusion, may result in lower oxygen supply for the fetus. Other effects of labor conduction anesthesia, pointed out by the Ministry of Health, are muscle relaxation of the pelvic floor and abdominal wall, resulting in difficulties in fetal rotation in the birth canal and increased incidence of instrumental deliveries^{5,7}.

For neonates, the consequences of anesthesia can be reflected in fetal bradycardia, increasing the risk of emergency cesarean sections, fetal acidosis and impaired ability to adapt to external life⁶.

Considering these data, the purpose of this study was to analyze the association between labor conducting anesthesia with immediate obstetric and neonatal outcomes. Additionally, it identified the profile of women who received labor conducting anesthesia in quaternary care maternity. The hypotheses raised were that the rates of labor conducting anesthesia would be higher in a given profile of women and that this type of analgesia would increase the rates of operative vaginal delivery.

METHOD

This is a retrospective cross-sectional study of a hospital database containing clinical-obstetric and neonatal information on births that took place at Otto

Cirne Maternity at Clinical Hospital (Federal University of Minas Gerais - UFMG), from 2014 to 2017. The study was approved by the Research Ethics Committee at UFMG, CAAE 10286913.3.0000.51.49.

In the evaluated period, 8591 births occurred. 2355 pregnant women who were admitted without labor for scheduled cesarean section did not participate in the analysis. 526 malformed fetuses, 144 sets of twins, 170 breech presentation, 34 deliveries in traffic, 2 abortions, and 78 stillborn babies were excluded from the analysis. These variables could influence the monitoring and conduction of deliveries and the indication of anesthesia, generating bias in statistical analysis. 5282 women with single gestation, cephalic presentation, and live newborn were included. Figure 1 shows the flowchart of cases excluded from the analysis.

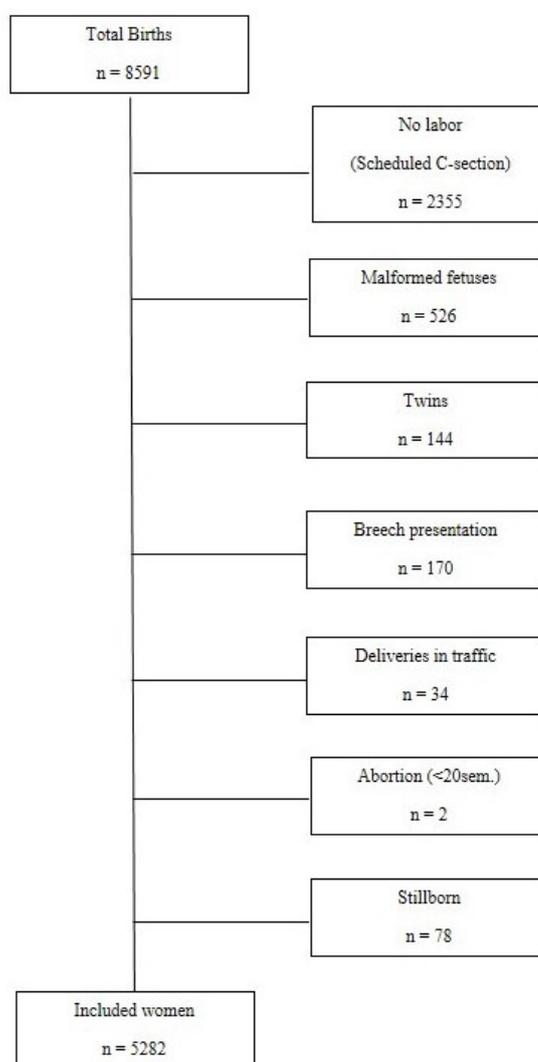


Figure 1 – Flowchart of case selection showing inclusion and exclusion criteria

All variables were obtained from a proper computer system, the SIS Mater®, which calculates indicators related to obstetric and neonatal care. The information was entered by doctors who perform obstetric and neonatal care. The data underwent a quality audit carried out by specialists through a conference in comparison with the pregnant women's medical records⁸.

The maternal characteristics included in the analysis were: age; parity; classification of gestational risk, defined by criteria referenced by the Ministry of Health's low-risk prenatal care manual⁹, with emphasis on maternal heart disease, severe hypertensive disease and diabetes mellitus; the occurrence of spontaneous or induced labor, until the active phase of labor; prematurity rate; the occurrence of previous abortions; and newborn weight at birth.

Additionally, as outcomes of the use of labor-carrying anesthesia, the following were evaluated: use of forceps or extractor vacuum; the way of delivery; and Apgar scores for the first and fifth minutes. The same outcomes were compared between nulliparous and multiparous women who received labor conduction anesthesia.

The use of labor conduction anesthesia was determined by obstetric or anesthesiological indication, by the woman's desire and availability at the service. The applied technique varied between epidural, spinal, or combined block, according to the criteria of conduct protocol of the Clinical Hospital Maternity-School UFMG¹⁰, the anesthesiologist being responsible for choosing the most suitable block for each case.

The use of conduction anesthesia was statistically associated with the variables of interest using the chi-square test. The significance of the hypothesis test was a p-Value less than 0.05. All tests were performed using the IBM SPSS Statistics 24 software.

RESULTS

Among the 5282 parturients evaluated, 1581 (29.9%) used some type of conduction anesthesia in active labor.

The average age among the pregnant women analyzed was 26.6 ± 6.7 years, with 1041 (19.7%) between 10 and 19 years old¹¹. Regarding gestational age at the time of delivery, the average was 38, 4 weeks, and the median, 39.0. The standard deviation was equivalent to 3.0. The mean weight of newborns at birth was 3071.7 ± 544.9 g.

Among women studied, 1931 (43%) were at high risk and 2431 (46.2%) were nulliparous at the time of admission to the maternity ward. Table 1 presents the description of the other variables analyzed in the study.

Table 1 - Maternal and neonatal characteristics of the analyzed sample

Analyzed variable	n	Relative frequency n (%)
Adolescents	5281	1041 (19,7)
Nulliparous	5266	2431 (46,2)
Previous abortion	4894	826 (16,9)
High-risk pregnancy	4486	1931 (43,0)
Arterial hypertension	4486	537 (12,0)
Maternal cardiopathy	4486	60 (1,3)
Diabetes Mellitus	4486	300 (6,7)
Prematurity rate	4486	383 (8,5)
Spontaneous labor	5278	3979 (75,4)
Conduction anesthesia	5281	1581 (29,9)
Vaginal delivery	5281	4688 (88,8)
Forceps	5281	315 (6,0)
Vacuum extractor	5281	53 (1,0)
Apgar 1 st minute > 7	5232	4800 (91,7)
Apgar 5 th minute > 7	5234	5170 (98,8)
Newborn with birth weight \geq 2500g	5242	4678 (88,6)

After this characterization, the relationships between obstetric variables and the rates of anesthesia use were analyzed. According to the statistical analysis, these rates were higher among adolescents (33.3% versus 29.1%; $p = 0.008$), nulliparous women (39.7% versus 21.6%; $p < 0.001$), women with induced delivery (40.6% versus 26.5%), pregnant women without previous abortion (31.0% versus 25.5%; $p = 0.002$), cardiac patients (53.5% versus 29.6%; $p < 0.001$) and women whose newborns weighed 2500 g or more at birth (31.3% versus 19.7%; $p < 0.001$), in relation to the absence of these factors (Table 2).

Regarding obstetric outcomes, there was an increase in the use of forceps (15.7% versus 1.8%; $p < 0.001$), of extractor vacuum (2.0% versus 0.6%; $p < 0.001$) and decreased evolution to cesarean delivery (7.3% versus 12.9%; $p < 0.001$) in parturients who received PT conduction anesthesia (Table 3).

The immediate neonatal result, assessed by the Apgar score of 1 minute, was worse in the group submitted to anesthesia, but at 5 minutes of life the difference in the occurrence of Apgar <7 was not significant ($p = 0.243$).

Table 2 - Occurrence rates of labor conduction anesthesia among considered obstetrics variables (%)

Evaluated characteristic	Parturient with evaluated characteristic n (%)	Parturient without evaluated characteristic n (%)	p-Value*
Adolescent	347 (33,3)	1234 (29,1)	0,008
Nulliparous	966 (39,7)	612 (21,6)	<0,001
Previous abortion	211 (25,5)	1262 (31,0)	0,002
High-risk pregnancy	574 (29,7)	767 (30,0)	0,831
Hypertensive disorders	142 (26,4)	1199 (30,4)	0,063
Maternal cardiopathy	32 (53,3)	1309 (29,6)	<0,001
Diabetes Mellitus	82 (27,3)	1259 (30,1)	0,316
Induced labor	527 (40,6)	1054 (26,5)	<0,001
GA < 37 semanas	106 (19,5)	1472 (31,2)	<0,001
Newborn with birth weight \geq 2500g	1466 (31,3)	111 (19,7)	<0,001

* p-Value obtained through the chi-square test

Table 3 - Frequency of maternal and neonatal outcomes in parturients who received labor conduction anesthesia and those who did not receive

Occurrence of analyzed outcome	Pregnant woman with labor conduction anesthesia n (%)	Pregnant woman without labor conduction anesthesia n (%)	p-Value*
Cesarean section	115 (7,3)	477 (12,9)	<0,001
Forceps	248 (15,7)	67 (1,8)	<0,001
Vacuum extractor	31 (2,0)	22 (0,6)	<0,001
Apgar 1 st min < 7	176 (11,2)	256 (7,0)	<0,001
Apgar 5 th min < 7	15 (1,0)	49 (1,3)	0,243

* p-Value obtained through the chi-square test

Concerning parity analysis, the data showed that women who were nulliparous at the time of admission to the maternity hospital had higher rates of evolution to cesarean delivery (8.6% versus 5.2%; $p = 0.013$) and use of forceps

(19.4% versus 9.8%; $p < 0.001$). The differences between the rates of use of the extractor and between the Apgar scores in these groups were not statistically significant, as shown in Table 4.

Table 4 – Comparison of maternal and neonatal outcomes among women classified as nulliparous and multiparous, at the time of hospital admission, and who received anesthesia for conducting labor

Occurrence of analyzed outcome	Nulliparous n (%)	Multiparous n (%)	p-Value*
Cesarean section	83 (8,6)	32 (5,2)	0,013
Forceps	188 (19,4)	60 (9,8)	<0,001
Vacuum extractor	22 (2,3)	9 (1,5)	0,264
Apgar 1 st min < 7	115 (11,9)	61 (10,0)	0,232
Apgar 5 th min < 7	11 (1,1)	4 (0,7)	0,333

* p-Value obtained through the chi-square test

DISCUSSION

The maternity hospital where the study was conducted is characterized by being a highly complex quaternary service, with a significant rate of high-risk pregnancies (43%, according to analyzed cases). The present study allowed the survey of some important elements that constitute the profile of women attended in this service, focusing on the use of anesthesia during labor. Through associative tests, some maternal characteristics that could influence the anesthesia usage were identified and some effects of the anesthesia were also detected in these pregnant women. Thus, these results contribute to a reflection on the practice and can optimize the institution's clinical protocol, since it would help service professionals to foresee pregnant women who would have a greater demand for anesthesia and prevent possible negative effects. Additionally, it allows the assessment of the most timely administration of anesthesia, if available, in those women with obvious benefits.

The most important contribution of this analysis was the association between the use of labor conduction anesthesia and cesarean sections rates. We found that in deliveries in which anesthesia was used, the occurrence of cesarean sections was less than the occurrence of vaginal deliveries. The systematic review by Anim-Somuah et al.¹² showed that epidural analgesia does not influence the risk of cesarean section. The recommendations of the World Health Organization¹³ for intrapartum care gathered evidence of moderate certainty that suggests that epidural anesthesia provides that fewer women progress to cesarean delivery compared to parturients without anesthesia. Women who receive labor conduction anesthesia may be more participatory and collaborative, resulting in lower conversions from vaginal to cesarean section. In favor of this practice, the World Health Organization recognizes that epidural anesthesia can be recommended for healthy pregnant women who request pain relief during labor, depending on the woman's preferences¹³.

One limitation found was that in the analyzed information system records, the type of anesthesia that was performed in each analyzed case was not specified. Therefore, we treat the technique in a generalized way, even though we have presented data found in the literature regarding specific techniques, such as an epidural. Despite this, we have statistically significant associations concerning a high number of analyzed cases ($n = 5282$). Although they are not part of this analysis, the use of other non-pharmacological techniques for pain relief, such as the presence of the obstetric nurse and Doula, and the introduction of practices such as bath, and Bobath ball, have been applied in this unit since 2015. We believe that in the future the joint analysis of humanizing measures in association or not with analgesia may further elucidate the advantages and disadvantages of such methods.

Conduction anesthesia has been widely used for pain control during labor in many experiments already published, which describe positive and negative points. The usage rate in analyzed cases was 29.9%. In the United Kingdom, this value is approximately 20% and in the United States, 60%¹⁴. As an advantage, anesthesia ensures that the pregnant woman remains collaborative and prevents excessive maternal hyperventilation and its consequences for the fetus, such as metabolic acidosis, and bradycardia⁶. Other advantages are the decrease in anxiety, the increase in uterine blood flow and placental intervillous spaces, the regularization of contractions, and greater hemodynamic stability during labor^{15,16}.

As with any procedure, the use of conduction anesthesia during labor should be cautious, since it can present risks such as headache, nausea, vomiting, maternal hypotension, low back pain, pruritus, paraesthesia, extensive and prolonged motor block, in case of iatrogenesis, and others^{5,6,14,16}. Numerous hemodynamic changes occur in women's bodies during pregnancy, such as increased cardiac output, heart rate, blood volume, and reduced peripheral vascular resistance. Such changes may not be well tolerated by cardiac patients who, in addition to dealing with these changes, must also deal with changes induced by the heart disease itself¹⁷. Therefore, for these women, anesthesia guarantees some protection by avoiding sudden changes in pressure and volume. Still, this anesthesia must be carefully titrated¹⁸. Considering this context, we can expect that anesthesia rates will be higher in patients with cardiopathy than among those without this condition, as our study showed.

Regarding the profile of parturients who received analgesia during labor, the analyzed data showed that the use was greater in nulliparous women delivery than in multiparous women. According to the National Guidelines for Assistance to Normal Childbirth (MS, 2017), the second stage of labor can last from 0.5 to 2.5 hours in nulliparous women without epidural and from 1 to 3 hours with epidural. In multiparous women, these values are, respectively, on average, 1 and 2 hours¹⁹. In addition to that, parturients may experience severe pain during this stage of delivery due to distension of the pelvic floor, vagina, and perineum and also due to traction of the parietal peritoneum, bladder, and rectum⁴. For these reasons, it is plausible to assume that nulliparous women would receive anesthesia more often to optimize pain relief and to reduce stress during labor, corroborating the results found in our study.

When comparing nulliparous and multiparous women (classified in this way according to hospital admission status) who received labor conduction anesthesia, a higher occurrence of cesarean sections and forceps usage was observed among the first group. The review by Amaral et al.⁶ presented similar results for the mode of delivery and points out that the forceps are commonly used to reduce the expulsive period in nulliparous women submitted to

epidural analgesia. Parity does not seem to have influenced the vacuum extractor usage and the Apgar scores.

In relation to pregnant adolescents, our analysis showed that this group received more anesthesia when compared to adult women. No specific data were found in literature about the rate of anesthesia administration in adolescents. However, it is possible that results found may be due to the great intersection between adolescents and nulliparous women (81.1% of the adolescents included in the study were nulliparous. Among women aged 20 or over, this value was 37.6%; $p < 0.001$). A lower rate of labor conduction anesthesia was observed in women with previous abortion (25.5%) when compared to pregnant women without previous abortions (31.0%; $p = 0.002$). We neither found elements to interpret this association nor similar experiences published in the scientific literature.

The information regarding the “high-risk pregnancies” available in SISMATER® includes patients who presented with varied conditions such as arterial hypertension, diabetes mellitus, hypothyroidism, and others, besides the cardiopathy itself. Our study showed that 29.7% of women with some category of gestational risk received anesthesia, a value that had no statistical difference when compared to usual risk pregnancies. In our review, we did not find any specific study on the relationship of high-risk pregnancies, in general, and the rates of labor conduction anesthesia, as these risk factors tend to be analyzed separately. This value will likely be influenced by conditions that are already indications of anesthesia. In addition to what was previously mentioned about cardiopathy, this also applies to preeclampsia. According to the technical manual for high-risk pregnancies of the Ministry of Health, neuraxial anesthesia (epidural, spinal, or combined) should be the technique of choice for the delivery of these pregnant women, be it normal delivery or cesarean section²⁰. Despite such recommendation, our study also found no significant association between anesthesia rates and women with hypertensive disorders. The classification “hypertensive disorders” that exists in the analyzed information system⁸ covers not only preeclampsia but also chronic hypertension and gestational hypertension, which may have contributed to the found result. There were also no significant differences between anesthesia rates in diabetic and non-diabetic pregnant women.

Another finding that deserves analysis was the higher rates of anesthesia among women who had induced labor when compared to those with spontaneous labor. A study by Guerra et al.²¹ also found an association between induced labor and higher rates of conduction anesthesia. The institution’s conduct protocol determines that the following are indications for inducing labor: maternal hypertensive syndromes, nephropathies, diabetes, IUGR, maternal-fetal alloimmunization by the Rh factor, gestational age greater than 41 weeks, fetal anomalies, and

rupture of membranes¹⁰. Considering these data, although we do not find in the literature the cause of this increase in anesthesia rates, we can assume that there is a need to guarantee greater stability to these pregnant women, who have, in their majority, high-risk pregnancies. The review by Anim-Somuah et al.¹² states that the onset of labor is one of the variables that influence the need for analgesia.

The parturients who had premature newborns received more labor conduction anesthesia, compared to pregnant women with term labor. In preterm newborns, combined analgesia (spinal and peridural) can be beneficial as it minimizes the maternal stress reaction and its consequences on the fetus²².

Women who had newborns weighing 2500 g or more also received higher rates of conduction anesthesia. The review by Antonakou et al.¹⁴ found similar results and concluded that birth weight can influence the labor conduction anesthesia rates and cesarean section.

Higher rates of forceps and vacuum extractor usage were observed in pregnant women who received anesthesia. A possible explanation for this increase in operative vaginal delivery as a result of labor conduction anesthesia is the importance of ensuring the greatest comfort possible for the parturient in which will be necessary to use forceps or extractor vacuum, as recommended by the institutional protocol¹⁰. Other reasons would be the relaxation of the pelvic floor muscles induced by anesthesia, which may result in delayed rotation of the fetus head, decreased desire to exert force due to decreased expulsion reflex, and reduced uterine activity⁵. The systematic review of Anim-Somuah et al.¹² gathered studies that compared results from groups that received epidural analgesia and groups that received other types of analgesia or did not receive any analgesia. The authors concluded that epidural analgesia may be related to increased operative vaginal delivery, although this association has not been seen in studies after 2005, suggesting that modern techniques may no longer have such an association¹².

Another systematic review that compared the forceps usage to vacuum extractor usage included 10 clinical trials with 5,051 women²³. The authors found that the vacuum extractor usage was associated with a lower risk of maternal trauma (RR = 0.41; 95% CI: 0, 33-0.50), the use of general or regional anesthesia (RR = 0.59; 95% CI: 0.51-0.68), and less perineal pain within 24 hours (RR = 0.54; 95% CI: 0.31-0.93). Although the extractor vacuum increased the risk of cephalohematoma (RR = 2.38; 95% CI: 1.68-3.37) and retinal hemorrhage (RR = 1.99; 95% CI: 1.35-2.96), there was no difference in other neonatal results, including Apgar scores below 7, use of phototherapy, perinatal death, and need for hospital readmission²³.

Our data indicated that the 1st minute Apgar was significantly lower in neonates whose mothers received anesthesia, which did not occur for the 5th minute Apgar, showing good neonatal recovery. The review by Anim-

Somuah et al.¹² showed that epidural analgesia does not seem to affect immediate neonatal outcome. Another example is the review by Amaral et al.⁶, whose gathered studies concluded that there wasn't any change in the Apgar score in the first and fifth minutes after birth.

Finally, concerning the external validity of the findings, the analysis reflects the reality of a quaternary reference service in obstetric public care network. Among the studied women, there was a predominance of vaginal delivery, with spontaneous labor, without using anesthesia to conduct labor. The rates of conduction anesthesia were higher among adolescent parturients, nulliparous women and women without previous abortion, cardiac patients, women with induced labor, those with full-term newborns, and those whose newborn weighed 2500g or more at birth. Among the parturients evaluated (single gestation of a fetus without malformations, in cephalic presentation and with an alive newborn), adult women were predominant, with

Authors participation: *Gontijo GR*: Responsible for data analysis and article writing; *Araújo MM*: Technical consultancy on the information presented about anesthesiology; *Reis ZSN*: Guidance and article review.

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full-term and multiparous pregnancies. Most newborns showed good neonatal results. In this care profile, the use of labor conduction anesthesia increased the rates of operative delivery and reduced the occurrence of cesarean section.

CONCLUSION

Among the analyzed women, the rates of labor conduction anesthesia were higher in young, nulliparous women, without previous abortion and whose newborns weighed ≥ 2500 g at birth. This anesthesia was also associated with an increase in the occurrence of operative vaginal delivery and a reduction in cesarean section rates. Thus, the identification of this profile of pregnant women and the administration of this pharmacological analgesia will possibly provide greater comfort to these parturients and prevent the conversion of vaginal delivery into a cesarean section.

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Received: 2018, September 19

Accepted: 2020, August 28