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Influence of Entonox (mixture of 50% nitrous oxide and 50% oxygen) on physiological labor and neonatal outcome in own material

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ABSTRACT

Objectives: The aim of the study was to compare maternal and neonatal outcome of delivery with inhaled anesthesia to delivery without pain control.

Material and methods: Authors performed retrospective analysis of 260 term deliveries. In the study group (130 women) a mixture of nitrous oxide and oxygen was used. The control group included 130 patients who used no pain relief during delivery.

Results: In nulliparas the pain assessment in 11-points scale was similar in both groups, but the labor was longer (350 ± 152 vs 228 ± 113 minutes; $p < 0.001$ for the first stage and 46 ± 37 vs 18 ± 18 minutes; $p < 0.001$ for the second stage), episiotomy incidence was higher (81.4% vs 41.9%; $p < 0.001$) and perineal laceration lower (2.3% vs 25.7%; $p < 0.001$) in the study group.

In multiparas the pain assessment was lower in the study group (5 vs 7 points; $p = 0.006$), oxytocin was administered more frequently (45.5% vs 21.4%, $p = 0.011$), but labor duration was the same in both groups. Episiotomy was more frequent (61.4% vs 37.5%, $p = 0.02$), but there was no difference in perineal laceration.

Apgar score was the same in the study and control group.

Conclusions: We found that Entonox prolongs labor significantly and increases frequency of episiotomy in primiparas with no clear analgesic effect. Offering Entonox to the patients giving birth for the first time is thus questionable. In multiparas it has a good analgesic effect but increases probability of episiotomy with no significant influence on perineal tear, what seems not very high cost of decreased pain related to delivery.

Key words: analgesic effect; labor; labor pain management; nitrous oxide; pain; pain relief

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INTRODUCTION

Pain caused by uterine contractions during labor is assessed as the strongest pain felt by humans basing on the McGill scale, similar to pain related to limb amputation [1]. Strong pain has a negative effect on the mother and fetus. It may prolong the delivery and worsen condition of the neonate after delivery [2]. The pain is described as strong pain by 23.4% of women, as moderate pain — by 37.9%, as quite strong — by 29.5% and pain of low intensity — 9.2% [1].

First reports of labor pain control we found in antiquity. Herbs with analgesic activity like willow bark and cannabis were used. Pharmacological pain relievers — ether and chloroform — were used for the first time in XIXth century [3]. In 1880 first delivery with nitrous oxide analgesia was reported [4]. This type of analgesia has sedative activity with very simple way of dosing, personal pain and fear are well controlled, decreased consciousness degree results in calming and decreasing anxiety [5–7]. It doesn't require anesthesiologist's assistance like epidural anesthesia, is very safe and convenient [8]. In many patients when epidural anesthesia is contraindicated or not available it is a very willingly used method of pain control [9].

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Table 1. Information about the patients in the study and control group

	Study group	Control group	p value
Primiparas	86 (66.2%)	74 (56.9%)	NS
Multiparas	44 (33.8%)	56 (43.1%)	
Maternal age	18–39 years	18–39 years	NS
Gestational age	40 weeks (38–43)	40 weeks (38–42)	NS

NS — not significant

Table 2. Pain relief after nitrous oxide use in primiparas and multiparas

	Study group	Control group	p value
Primiparas	7 points (1 to 10)	9 points (1 to 10)	NS
Multiparas	5 points (1 to 8)	7 points (1 to 10)	p = 0.006

NS — not significant

Objectives

The aim of the study was to compare maternal and neonatal outcome of delivery with inhaled anesthesia to delivery without pain control.

MATERIAL AND METHODS

Authors performed retrospective analysis of 260 term deliveries given by women 18 to 39 years old in Obstetrical-Gynecological Ward of St. John Hospital in Starogard Gdanski in 2010–2012. We included in the study only patients with uncomplicated pregnancy and delivery who gave informed consent to use medical data in analysis. Patients with indications for elective cesarean section known before the beginning of delivery were excluded from the study. Characteristics of the groups is presented in Table 1.

In the study group (130 women) a mixture of nitrous oxide and oxygen in proportion 1:1 (Entonox®) was supplied by reducer and feeder by Linde-Gas® during labor according to the manufacturer instruction, current maternal condition and labor progression. The control group included 130 patients who used no pain relief during delivery. Obstetrical care offered during labor was the same in both groups. Oxytocin during labor was offered for secondary hypotonic uterine dysfunction.

Subjective pain assessment during labor was performed basing on the numerical scale starting from 0 for no pain at all and ending with 10 points for unbearable pain (NRS, Numerical Rating Scale). During the first two hours after delivery all patients completed the questionnaire and data regarding labor (duration of the 1st, 2nd and 3rd stage, subjective pain assessment during labor, need for Oxytocin use, perineal laceration and episiotomy, curettage) and neonate (Apgar score) were collected in Microsoft Excel 2010 for Windows 10 from medical records. Statistica 12.0 software was used for the statistical analysis. We used following statistical methods: Shaprio-Wilk test, Mann-Whitney U test and χ^2 test. A p value < 0.5 was considered statistically significant.

RESULTS

Total of 260 women participated in the study: 130 in study group and 130 in the control group. In the study group average maternal age was 26.4 ± 3.8 years, in the control group — 26.9 ± 3.6 years and there was no difference between the two groups (U Mann-Whiney test, p = 0.09). In both groups analyzed delivery was more frequently the first one for the woman than the second or more (66.2% in the study group and 56.9% in the control group, χ^2 test, p = 0.13). Gestational age at delivery was 40 weeks in the study group and 40 weeks in the control group, and there was no statistical difference (Mann-Whitney U test, p = 0.13).

Pain relief

Median result of the pain assessment in the study group was 6 points (1–10) and in the control group — 7 points (1 to 10). The difference was not significant (p = 0.52). In primiparas there was also no difference found (median 7, from 1 to 10 and median 6 from 2 to 10 respectively, p = 0.49).

We found significant difference in the result of the pain assessment in the group of multiparas (p = 0.006). It was 5 points (from 1 to 8) in the study group, and that was lower than in the control group where the median was 7 points (from 1 to 10). Results are presented in Table 2.

Labor duration

Statistical analysis revealed that delivery was prolonged in the study group when compared to the control group. Duration of the first stage of labor was shorter in the control group (average time was 231 ± 123 minutes, from 5 to 885) than in the study group (325 ± 149, 5–900 respectively) with p < 0.001. Similar difference was observed for the 2nd stage

of labor: 19 ± 18 min (5 to 110) for the control group and 44 ± 36 min (3 to 180) for the study group with p < 0.001. Average duration of the 3rd stage of labor was 7.7± 5.5 min in the control group and 8.3 ± 4.0 in the study group. The difference was significant with p = 0.04.

In primiparas duration of the first stage of labor was shorter in the control group (average time was 228 ± 113 minutes, from 50 to 675) than in the study group (350 ± 152, 60–900 respectively) with p < 0.001. A similar difference was observed for the 2nd stage of labor: 18 ± 18 min (5 to 110) for the control group and 46 ± 37 min (5 to 180) for the study group with p < 0.001. Average duration of the 3rd stage of labor was 6.9 ± 3.5 min in the control group and 8.0 ± 3.6 in the study group. The difference was significant with p = 0.04. Results are presented in Table 3.

In multiparas, the duration of the first stage of labor was similar in the control group (average time was 234 ± 134 minutes, from 5 to 885) and in the study group (263 ± 123, 5–580 respectively) with p = 0.08. Significant difference was observed for the 2nd stage of labor: 18 ± 18 min (5 to 95) for the control group and 40 ± 31 min (3 to 150) for the study group with p < 0.001. Average duration of the 3rd stage of labor was 8.5 ± 6.8 min in the control group and 9.0 ± 4.8 in study group. The difference was not significant with p = 0.24.

Oxytocin administration

Oxytocin was administered more frequently in the study group — in 51 (39.2%) patients, vs 29 (22.3%) in the control group (p = 0.003). The difference was not significant for primiparas (36.0% vs 23.0%, p = 0.07), but significant for multiparas (45.5% vs 21.4%, p = 0.011).

Perineal trauma

Perineal laceration was diagnosed in 6 (4.6%) women in the study group and more frequently, in 30 (23.1%) patients, in the control group (p < 0.001). In primiparas the pattern was also observed (2.3% vs 25.7%, p < 0.001) whereas in multiparas we found no significant difference (9.1% vs 19.6%, p = 0.14).

Incidence of episiotomy was higher in the study group than in the control group (74.6% vs 40.0%, p < 0.001). In primiparas the difference was much more significant (81.4% vs 41.9%, p < 0.001) than in multiparas (61.4% vs 37.5%, p = 0.02). Results are presented in Table 4.

Curettage

Frequency of curettage after delivery was similar in the study and control group (5.4% and 8.5%, p = 0.33). We found also no difference in primiparas (3.5% vs 5.4%, p = 0.55) nor in multiparas (9.1% vs 12.5%, p = 0.59).

Neonatal outcome

Neonates born in both analyzed groups were usually in a good condition. Apgar score was similar in the study and control group (average 9.5 ± 0.97 and 9.7 ± 0.64 respectively, p = 0.11). There was no difference for primiparas (9.2 ± 0.75 and 9.7 ± 0.72 respectively, p = 0.20) and multiparas (9.4 ± 1.3 and 9.8 ± 0.50 respectively, p = 0.35).

DISCUSSION

There are many publications assessing influence of pain relief on the delivery and neonate, but there are still many questions regarding the use of different methods [10–17]. Different pain management methods are used in delivering women. One of them is nitrous oxide, very safe and non-invasive pain modality. There are some side-effects of nitrous oxide which must be considered and discussed with the patients before offering it. The first one of them, usually causing anxiety in the patients, is prolongation of delivery [18–20]. Most women want to deliver as fast as it is possible, and they are very cautious with accepting longer period of uterine contractions even when contractions are supposed to be less painful. In our analysis the opinion was confirmed. All stages of labor were prolonged in primiparas using Entonox. The first stage was by over two hours longer

Table 3. Influence of nitrous oxide on labor duration in primiparas

Stage of labor	Study group	Control group	p value
Stage I	350 ± 152 minutes	228 ± 113 minutes	p < 0.001
Stage II	46 ± 37 minutes	18 ± 18 minutes	p < 0.001

Table 4. Episiotomy and perineal laceration according to nitrous oxide use during labor in primiparas

	Study group	Control group	p value
Episiotomy	81.4%	41.9%	p < 0.001
Perineal trauma	2.3%	25.7%	p < 0.001

than in patients not using Entonox. The length of the second stage of labor was doubled in women using this pain relief. In multiparas only second stage of labor was longer when compared to the patients not using Entonox, the first stage was similar in study and control group. Our results are similar to those presented by other authors [20, 21].

Prolongation of delivery should be confronted with the pain assessment. We should accept longer delivery if it is less painful. Most authors are enthusiastic about the effect of nitrous oxide [16, 22, 23], but there are some critical voices as well [12, 19]. In our study, primiparas using Entonox, who suffered uterine contractions longer, reported pain intensity similar to this reported in control group. It is interesting, if the pain was not controlled by Entonox, or patients reported the same intensity of the pain, although it was lighter, because it lasted longer, and prolongation of the contractions by two hours gave the impression of stronger pain. To exclude the influence of the labor duration on the pain assessment, the assessment should be repeated few times during labor, not performed retrospectively like in this study. It is very important to mention what some authors found — despite questionable effect on pain perception, nitrous oxide improves satisfaction of women what was not analyzed in our study [24].

Very interesting was the pattern of secondary uterine contractility weakening. Oxytocin use in different studies is different — there are many schedules of administering it during labor [25, 26]. In our study Oxytocin was used more frequently in multiparas in the study group, although the length of the first stage of labor was not affected. It means, that secondary weakening uterine contractions were probably manifested in advanced first stage, and Oxytocin administration was effective in these women. In primiparas, where the first stage of labor was significantly longer, Oxytocin was not used more frequently in the study group when compared to the control group. Despite overall slower progression of labor in the study group, weakening contractions requiring Oxytocine, were not observed more frequently.

From medical point of view, more important than labor duration, is pregnancy outcome. Our analysis included complications of delivery and neonatal condition after delivery.

Entonox use seemed to increase frequency of episiotomy in primiparas and in multiparas. It may be related to prolonged second stage of labor, and tendency to perform interventions shortening the time of fetal head delivery. Frequency of perineal laceration in primiparas had reversed tendency, but it may be the result of higher number of patients with no episiotomy, which is supposed to prevent perineal tear. No difference in the group of multiparas, despite above mentioned difference in episiotomy frequency, seems to confirm that the episiotomy is the clue to the perineal tear protection in primiparas. In discussing with the patients about possible disadvantages of pain relief with Entonox, we should present the increased risk of episiotomy in multiparas — for some patients it may be an important argument for or against the use of Entonox. We found no literature regarding perineal trauma in correlation to the nitrous oxide use during labor, but study assessing maternal outcome revealed no influence of this type of pain relief on the analyzed measures [27].

In our study we found no difference in the neonatal outcome. We compared Apgar score in study and control group, and we found no difference for the total cohort, for primiparas nor for multiparas. After finding no difference in Apgar score, we did not go further with the analysis of neonatal outcome. No influence of nitrous oxide is confirmed in other studies as well [8, 18, 23, 28].

CONCLUSIONS

Concluding our results, we found that Entonox is not very effective in primiparas: it does not decrease the pain intensity, prolongs labor significantly and increases frequency of episiotomy. Offering Entonox to the patients giving birth for the first time is thus questionable. In multiparas it has a good analgesic effect. The consequences are prolonged second stage of labor and increased probability of episiotomy with no significant decreased frequency of perineal tear, what seems not very high cost of decreased pain related to delivery.

Conflict of interest

All authors declare no conflict of interest.

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