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Research Article

The effect of nitrous oxide (entonox) on labour

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ABSTRACT

Background: Labour pain is one of the most severe types of pain ever to be experienced. The severity of pain during labour is different for each woman. Various pharmacological and non pharmacological methods have been evaluated for their effect on labour pain. Entonox is non-inflammable, tasteless, odorless and colorless gas. This study aims to evaluate the effect of nitrous oxide (entonox) on labour.

Methods: This study was conducted on 200 pregnant women with gestational age of 37-41 weeks at New Alma Hospital, Mannarkkad, Kerala, India from March 2015 to July 2015. These patients were randomized to receive either a pre-prepared mixture of 50% nitrous oxide plus 50% oxygen (entonox) (trial) or oxygen (control) groups by a coin. Entonox was started during active phase of labour at the onset of pain in trial group and oxygen was started at 4litres/minute in control group. The patient herself administered entonox connected to the uni-directional valve which enables the women to breathe fresh gas in each inspiration. Parameters such as pain, blood pressure, oxygen saturation, duration of active phase of labour, maternal side effects, Apgar score at 1st and 5th minute were recorded in both the groups.

Results: The intensity of labour pain was significantly lower in entonox group ($p<0.001$) as evident by lower visual analogue scale (VAS) values. There was no difference in blood pressure values in both the groups. The oxygen saturation was higher in control group. The mean duration of active phase of labour in the entonox group was lower compared to the oxygen group. Maternal side effects were significantly higher in entonox group. There were no significant differences in 1st and 5th minute Apgar scores between the two groups.

Conclusions: Entonox is cheap, safe and easily available. Though associated with few maternal side effects, it can be quickly and easily used during painful labour. While nitrous oxide analgesia may not be effective for every woman, it is considered a fairly safe and low cost way to manage pain during labour.

Keywords: Entonox, Labour pain, Nitrous oxide, Visual Analogue Scale (VAS)

INTRODUCTION

"Delivery of the infant into the arms of a conscious and pain-free mother is one of the most exciting and rewarding moments in medicine" by Moir in 1979.

Labour pain is one of the most severe types of pain ever to be experienced.[1] The American college of obstetricians and gynaecologists reaffirmed its joint postion with American society of anaesthesiologists that a woman's request for labour pain relief is sufficient medical indication for its provision.[2] The severity of pain during labour is different for each woman. Various pharmacological and non pharmacological methods have been evaluated for their effect on labour pain.[3]

ENTONOX® is the 50:50 mixture of Nitrous oxide and oxygen. It is very effective analgesic agent with rapid onset and offset characteristics.[4] Entonox is non-inflammable, tasteless, odorless and colorless gas.

Nitrous oxide, sometimes called "laughing gas" because it can produce euphoria is an inhalational anaesthetic and analgesic gas.[5] Nitrous oxide's anaesthetic action is thought to relate to non competitive inhibiton of N-methyl-D aspartate type of glutamate receptors. The mechanism of its action is probably release of endorphin and dopamine in the brain which modulates pain stimuli via descending spinal and nerve pathways and in consequence reduces labor pain to a tolerable level.[6-8]

Entonox is an ideal choice for obstetric analgesia as labour pains during contractions are intermittent. It can be inhaled accordingly to synchronise with contractions. A critical aspect of the use of nitrous oxide during labour is that woman administers the gas to herself and therefore controls when and how much she uses.[1] Nitrous oxide analgesia can be discontinued as quickly and easily as it is started. The effects begin to dissipate immediately after the woman stops breathing nitrous oxide and are completely gone within five minutes.[9] Nitrous oxide is 100% excreted unchanged through the lungs.[10]

Side effects of nitrous oxide may include excessive drowsiness, dizziness or light headedness, nausea and vomiting, dry mouth, buzzing in the ears, rarely'pins and needles' or numbness, dreams, hazy memory of labour, feelings of claustrophobia with use of mask.[11,12]

Atmospheric air is the best antidote to overcome above side effects. Patient is advised to stop inhalation till the symptoms fade off.[13] Nitrous oxide is contraindicated for women, who have impaired consciousness or intoxication, traumatic or spontaneous pnemothorax, air embolism, decompression sickness, who have impaired oxygenation. e.g. upper respiratory tract infection or respiratory disease, deviated nasal septum, nasal polyps, allergic rhinitis, COPD, who have an inability to hold facemask or mouthpiece e.g. maxilla facial fracture, who have received excessive amounts of intravenous opioids or morphine derivatives and/or benzodiapines as sedation may be increased are vitamin B_{12} deficient or receiving vitamin B_{12}, recent ear surgery, inner ear obstruction, have a compromised fetus, are haemodynamically unstable.[13-15]

There is the theoretical risk of bone marrow suppression through the inhibition of methionine synthase, as nitrous oxide inactivates co-factor B_{12}.[16] Any condition that reduces cobalamin function, such as Crohns disease, celiac disease, gluten intolerance, pernicious anaemia, long –term recreational use of nitrous oxide, chronic malnutrition, or adherence to strict vegan diet, increases risks of complications from exposure to nitrous oxide.

There are concerns about apoptotic damage to the brains of immature mammals exposed to high doses of nitrous oxide during late gestation, possible cardiovascular risks from hyper homocysteinemia caused by nitrous oxide, a hypothesis that child exposed to nitrous oxide during birth are more likely to become addicted to amphetamine drugs as adults and possible occupational risks for those who provide care to women using nitrous oxide labor analgesia.[17]

The aim and objective of this study was to investigate the effect of nitrous oxide on severity of labour pain, blood pressure, oxygen saturation, and duration of active phase of labour, Apgar score at 1st and 5th minute and maternal side effects.

METHODS

This study was conducted at New Alma Hospital, Mannarkkad, Kerala, India from March 2015 to July 2015. Total number of 200 women with term pregnancy were recruited and randomly divided into two groups (i.e., entonox (trial) and oxygen (control) groups). Randomization was performed by a coin. The gestational age was between 37 to 41 weeks. The inclusion criteria were primigravida/multigravida with singleton pregnancy, cephalic presentation in active phase of labour (cervical dilatation ≥4cms). The exclusion criteria were macrosomia, contracted pelvis, repeat caesarean section, fetal distress, polyhydromnios, oligohydromnios and multiple pregnancies. Patients who had contraindications for use of entonox were not included in the study and women who underwent emergency caesarean section due to fetal distress and dysfunctional labor were excluded from the study.

This study began when the subjects in both entonox and oxygen group entered active phase of labour. Moreover, differentiating the latent phase from false labour is often difficult. To alleviate these disadvantages, a modified WHO partograph was introduced and incorporated removal of latent phase and defined the beginning of the active phase at 4cms cervical dilatation instead of 3cms.[17] In the present study modified WHO partograph was used in both the groups. In entonox group, entonox was started in active phase of labour at the onset of contraction. The woman herself administered nitrous oxide via a facemask connected to the uni-directional valve which enables the subject to breath fresh gas in each inspiration. Synchronization of uterine contraction and analsgesic affect was key to get desired analgesic effect. In oxygen group, oxygen was started in active phase of labour.

Severity of labour pain was evaluated according to the visual analogue scale (VAS) score; numbering from 0 to 10 (0=no pain, and 10= severe and non tolerable pain). Parturients pains were scored once before any analgesic administration and they were requested to score their maximum pain following each contraction. Total VAS score is the mean scores rated during labor.[18] This was carried out in both the groups.

All parturients were monitored for blood pressure, oxygen saturation were measured before the start of nitrous oxide and oxygen in both groups respectively.

Average of the measurements after 1 hour and 2 hours after exposure were measured.

The progress of labour was plotted using modified WHO partograph. Apgar scores were measured at 1st and 5th minute in both groups. Maternal side effects were also evaluated in both groups.

Statistical analysis

Appropriate statistical analysis was done with help of SPSS version 11. Data were analyzed by unpaired students t test and χ square test. P value <0.001 was considered significant.

RESULTS

A total of 200 women with term pregnancy were recruited and randomly divided into two groups [i.e., entonox (trial) and oxygen (control) groups]. In entonox group 14 women were excluded as they underwent emergency caesarean section for fetal distress and /or dysfunctional labour. Therefore in entonox group there were 86 women (n=86). In oxygen group 20 women underwent emergency caesarean section. Therefore in oxygen group there were 80 women (n=80).

Table 1: Comparison of parity and total number of women in entonox (trial) and oxygen (control) groups.

Parity	Number of women in entonox group (n=86)	Number of women in oxygen group (n=80)
Primigravida	62	34
Multigravida	24	46

Table 2: Comparison of labour outcomes and parameters in entonox and oxygen groups.

		Entonox Group	Oxygen Group	t value	P value
VAS mean score	Before starting	8.32	8.41	0.809	0.42
	Average of 1st and 2nd hour	2.918	5.899	16.421	<0.001
Systolic blood pressure	Before starting	116.86	118.25	0.697	0.487
	Average of 1st and 2nd hour	116.40	118.00	0.816	0.415
Diastolic blood pressure	Before starting	70	69.75	0.202	0.84
	Average of 1st and 2nd hour	69.77	70.12	0.282	0.774
Oxygen saturation	Before starting	95.3	95.85	2.177	0.031
	Average of 1st and 2nd hour	95.238	95.756	2.321	0.022
Duration of active phase of labour		3.06	3.96	8.464	<0.001

Table 3: Apgar score at 1st and 5th minute in entonox (trial) and oxygen (control) groups.

	Entonox group	Oxygen group	t value	p value
Apgar score at 1st minute	5.99	5.99	0.007	0.995
Apgar score at 5th minute	7.99	7.99	0.007	0.995

Table 4: Frequency of maternal side effects in entonox group (n=86).

Variables	Number (n)	Percentage (%)
Mouth dryness	8	9.30
Drowsiness	53	61.63
Weakness	43	50.00
Blurred vision	23	26.74
Pins and needles	26	30.23
Nausea and vomiting	31	36.05
Headache	20	23.26
Uncomfortable feeling	27	31.40

DISCUSSION

This study demonstrates the effect of nitrous oxide (entonox) for analgesia during labour. This study also evaluates the effect of entonox on blood pressure, oxygen saturation, duration of active phase of labour, Apgar score at 1st and 5th minute and maternal side effects.

Pain

The current study showed that intensity of labour pain measured by VAS score was significantly lower in entonox group than the oxygen group (p value <0.001). This result was comparable with the study by Teimoori et al that showed pain severity according to VAS score was significantly lower in patients who received nitrous oxide.[18]

Blood pressure

The current study showed that there was no difference in systolic and diastolic blood pressures in both trial and control groups.

Duration of active phase of labour

The result of our study showed that mean duration of active phase of labour was significantly lower in the entonox group compared to the oxygen group. Similar result was noted by Tazarjani et al, that duration of active phase of labour in entonox group was shorter than control group (4.17 hour versus 5.07 hour, $p<0.05$).[19]

Apgar score at 1st and 5th minute

The current study revealed no differences in 1st and 5th minute Apgar scores between groups. This same result was noted by Abboud et al, Mc Aneny et al, and Scanlon et al.[22]

Maternal side effects

In our study, maternal side effects were higher in entonox group compared to oxygen group. The highest observed adverse effect was drowsiness which was observed in 61.63% of women in entonox group and lowest observed adverse effect was mouth dryness which was observed in 9.30% of women in entonox group. The other side effects were weakness (50%), blurred eyesight (26.74%), pins and needles (30.23%), nausea and vomiting (36.05%), headache (23.26%) and uncomfortable feeling (31.40%).

CONCLUSION

Entonox is cheap, safe and easily available. Though associated with few maternal side effects, it can be quickly and easily used during painful labour. While nitrous oxide analgesia may not be effective for every women, it is considered a fairly safe and low cost way to manage pain during labour. Apart from analgesic effect nitrous oxide also is shown to decrease the duration of active phase of labour which makes labour a pleasant experience for woman.

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