

Obstetric Forum

Antepartum uterine relaxation with nitroglycerin at Caesarean delivery

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In this case report, NTG provided sufficient uterine relaxation to allow difficult twin extraction at Caesarean delivery. Administration of NTG in this situation was controversial, and if it had not been effective, time may have been lost before general anaesthesia could have been induced. Nitroglycerin merits further evaluation as an antepartum uterine relaxant, but the initial experience is encouraging.

Il s'agit d'un cas où la nitroglycérine (NTG) a fourni un relâchement utérin suffisant pour permettre l'extraction difficile de jumeaux lors d'une césarienne. L'administration de NTG dans cette situation était controversée; si elle n'avait pas été efficace, il aurait pu y avoir perte de temps avant l'induction de l'anesthésie générale. La nitroglycérine mérite une évaluation plus poussée comme myorésolutif utérin antepartum, mais l'expérience initiale est encourageante.

Urgent uterine relaxation is occasionally necessary to allow obstetric manoeuvres within the uterus antepartum for both vaginal and Caesarean delivery. Trauma inflicted by fetal manipulation when the uterus is tightly contracted may lead to neonatal death.¹ Uterine relaxation may be of particular value during difficult twin and breech deliveries and with fetal transverse lie. Anaesthesia with halogenated agents will relax the uterus, but this is time-consuming, requires rapid sequence induction and tracheal intubation,

Key words

ANAESTHESIA: obstetric;

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and is potentially hazardous. A safe, reliable way of providing transient uterine relaxation in the conscious patient would be of great value. In this report nitroglycerin (NTG) was found to be a useful agent for this purpose.

Case report

A 25-yr-old, healthy nullipara with known twin pregnancy came to the Obstetric Suite in good labour at 30 wk gestation. Initial examination revealed cervical dilatation of 4 cm progressing to 7 cm, 20 min later. There was no evidence of fetal distress in either twin. Caesarean delivery was decided upon. Preoperative blood pressure (BP) was 120/80 mmHg and heart rate 80 bpm. Spinal anaesthesia was administered with hyperbaric bupivacaine (12 mg) after an intravenous infusion of 1.5 L of normal saline. A sensory level to T₃ was achieved and systolic BP decreased briefly to 95 mmHg, returning to normal after ephedrine 10 mg *iv*. Surgery was uneventful until after the low transverse uterine incision was made, when a senior obstetrician was unable to extract the twins because the uterus was tightly contracted. Vertical extension of the uterine incision was performed but was of no benefit. The obstetrician then requested induced uterine relaxation. Nitroglycerin 100 µg *iv* resulted in excellent relaxation within 60–90 sec and both twins were extracted easily. Systolic BP decreased to 85 mmHg during delivery, but responded rapidly to further ephedrine 10 mg *iv*. The patient did not experience nausea, vomiting or headache after NTG administration. After delivery of the placenta oxytocin 20 U · L⁻¹ was infused and uterine tone was noted to be good. Blood loss was not excessive. The remainder of the surgery and the recovery period were uneventful, and the twins subsequently did well, with no evidence of trauma. APGAR Scores, birth weights, umbilical vein pH, uterine incision to delivery intervals are shown in the Table.

Discussion

Organic nitrates (e.g., nitroglycerin) and nitrites (e.g., amyl

TABLE Details of delivery and infants' data

	Twin #1	Twin #2
Uterine incision delivery interval (min)	5	5.5
Apgar - 1 min	6	7
Apgar - 5 min	8	8
Umbilical vein pH	7.33	7.28
Birth weight (g)	1,530	1,810

nitrite) are esters of nitric and nitrous acid respectively and relax smooth muscle. This relaxation is achieved through increased intracellular production of cyclic guanosine monophosphate, which acts as a mediator for the dephosphorylation of myosin light chain.² The vasodilator properties of both nitroglycerin and amyl nitrite have been exploited to relieve angina pectoris since the middle of the nineteenth century, but today amyl nitrite is rarely used. However, nitroglycerin remains a popular, effective and versatile vasodilator.

In 1882, Barnes described a patient with a retained placenta trapped behind an ergot-induced contraction ring.³ After the patient inhaled amyl nitrite, uterine tone decreased perceptibly and the placenta was delivered easily. In 1934, Croft reviewed six cases of successful treatment of uterine contraction ring with amyl nitrite.⁴ An interesting footnote to this paper suggested that NTG may be a useful uterine relaxant. Kumar showed that amyl nitrite was effective in attenuating oxytocin-induced contractions of the human uterus but produced minimal reduction of spontaneous uterine contractions.⁵ The use of amyl nitrite to produce uterine relaxation has greatly declined. Amyl nitrite, provided in an ampoule, is a highly volatile liquid for inhalation from a reservoir bag or cloth and is flammable and explosive in air.

Nitroglycerin would be an attractive alternative to amyl nitrite for the production of uterine relaxation, if it were effective. It is non-flammable because of the addition of inert compounds, is easy to administer, and anaesthetists are familiar with its properties. In the rat uterus, NTG has been shown to reduce contraction frequency and attenuate the tension developed during both spontaneous and stimulated contraction.⁶ Recent case reports have shown the value of NTG to facilitate the removal of retained placenta. Peng used NTG 500 μg *iv* in 15 patients, and achieved successful placental removal in all.⁷ He noted that the uterus relaxed 80 sec after NTG administration, and this was accompanied by an 8% decrease in systolic BP. DeSimone found that NTG 50–100 μg *iv* allowed successful removal of the placenta in 21 patients without ensuing hypotension.⁸ Uterine relaxation appeared to last for one minute. While the effect of NTG on blood pressure was minimal in the studies of Peng and DeSimone, this

may not be true if the patient is hypovolaemic. Randomized, controlled trials of the use of NTG to relax the postpartum uterus for placental removal are needed.

The urgency of the need for relaxation makes it unlikely that controlled antepartum trials of NTG as a uterine relaxant will ever be done. However, McMorland has suggested that NTG be used when the after-coming head of a breech is trapped at delivery.⁹

The fetus and neonate appear to be tolerant to the antepartum administration of NTG. The half-life of NTG in the adult is one to three minutes, and the drug is metabolized in the liver by glutathione-organic nitrate reductase. Nitroglycerin has a molecular weight of 227 and should cross the placenta easily. Wheeler showed that in sheep, an infusion of NTG (mean dose: 19 $\mu\text{g} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) produced a decrease in maternal BP, but no changes in uterine blood flow or uterine vascular conductance.¹⁰ De Rosayro noted a decrease in uterine blood flow in the sheep after NTG (mean dose: 113 μg) was infused over 15 min, to produce a 30% reduction in maternal BP.¹¹ However, there were no changes in fetal cardiovascular or acid-base values during the NTG infusion. The mean fetal/maternal artery ratio of NTG was 0.04 ± 0.007 . These low fetal NTG concentrations could be due to rapid fetal drug metabolism.

Hood, in a controlled study, used NTG with success to attenuate the hypertensive response to tracheal intubation in women with severe preeclampsia.¹² Nitroglycerin was infused immediately before induction of anaesthesia, to produce a 20% reduction in mean arterial BP and this was maintained until delivery. Neonatal BP, heart rate, APGAR scores and umbilical cord blood gas values did not differ between the NTG and control group.

COMMENTARY

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For many years it was common for anaesthetists to be called to the delivery room to find a parturient in the lithotomy position and be asked by the obstetrician to "give her a whiff." This would imply the administration of a volatile anaesthetic agent frequently by face mask, for some brief vaginal obstetrical manoeuvre. Administration of general anaesthesia in these circumstances is hazardous and failure to protect the airway with a cuffed endotracheal tube is still not uncommon. Hew *et al.*,¹³ in a survey of Toronto hospitals, reported that "eleven percent of anaesthetists at university-affiliated hospitals and 54% in

community hospitals sometimes conducted general anaesthesia without tracheal intubation in obstetrical patients." During the 1982–1984 triennium, there were 19 anaesthesia-related deaths in England and Wales, of which seven were due to pulmonary aspiration of stomach contents.¹⁴

Avoidance of inhalational anaesthesia to achieve transient uterine relaxation is obviously desirable. Inhalation of amyl nitrite is effective, but it has an unpleasant odour and, as Mayer and Weeks warn, is flammable in air. At Grace Hospital, Vancouver, the intravenous administration of 50–100 µg nitroglycerin has become the technique of choice when uterine muscle relaxation is required for a brief period. It is effective and, so far, there have been no untoward effects. These small doses, even when repeated, have not been associated with clinically important hypotension. However, uncorrected hypovolaemia, due to haemorrhage or dehydration, is regarded as a contraindication to this technique, or at least, indicates the need for caution and careful monitoring. In all cases, a rapidly-running intravenous infusion is mandatory.

COMMENTARY

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This case report is important because it describes a novel approach to uterine relaxation. The classic methods of providing uterine relaxation all have potential problems, and are used reluctantly and with concern for considerable morbidity.

Intravenous nitroglycerin (NTG) is a potentially useful and easily administered method of uterine relaxation and appears to have less undesirable side-effects. Recently, intravenous NTG has been used for the manual extraction of retained placentae in the awake patient. Drs. Mayer and Weeks have reviewed the literature concisely and suggest another application for *iv* NTG. It is worth highlighting that, in this case, there was only a slight decrease in blood pressure after NTG administration and that the patient had no symptoms from either the drug or the hypotension. There was a rapid response to ephedrine and pitocin. Blood loss was usual.

The anaesthetists at this commentator's institution have used uterine relaxants in patients undergoing Caesarean delivery for breech presentation (with and without labour) or for the premature infant. Both ritodrine and nitroglycerin have been used effectively in over 35 patients. We believe the nitroglycerin is the better agent, in that side-

effects are much less frequent. In addition, anaesthetists find it easy to administer and are familiar with its use.

Our usual dose of NTG is a 250 µg bolus, repeated two or three times, if necessary. The results have been very encouraging. The dose that we have used is higher than that in this case report and highlights the need for further investigations of the effectiveness, dose, and side-effects of bolus administration of NTG, as well as an assessment of the effects on the newborn.

Based on personal experience¹⁵ and that of my colleagues, I believe that we should all be aware of, and use this method whenever uterine relaxation is requested. Try it: you will be as delighted with the results as were we and the physicians looking after this patient!

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