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## Intravenous Nitroglycerin Aids Manual Extraction of a Retained Placenta

*To the Editor:*—Retained placenta with the uterus firmly contracted around the placenta occurs in about 1% of all vaginal deliveries and may require uterine muscle relaxation to facilitate manual extraction.<sup>1</sup> Usually, uterine muscle relaxation is accomplished with a potent inhalation agent; however, this procedure exposes the parturient to an otherwise unnecessary general anesthetic with the attendant risks of regurgitation and aspiration. Inhalation of amyl nitrate,<sup>2</sup> as well as intravenous nitroglycerin<sup>3</sup> (NTG) (500 µg) have been used to produce uterine relaxation without general anesthesia, but systemic side effects may occur with these therapies. In addition, amyl nitrate may explode upon crushing, especially in an enriched oxygen environment.<sup>4</sup> We report the results of a pilot study to determine the safety and efficacy of NTG 50 µg for uterine relaxation and our subsequent experience with this technique.

We observed six postpartum patients who required uterine muscle relaxation after obstetric diagnosis of a retained placenta with the uterus firmly contracted around the umbilical cord. We monitored maternal ECG continuously and blood pressure every minute with an automated blood pressure cuff. We provided analgesia with either epidural injection of local anesthetics (10–15 ml 2% 2-chloroprocaine, n = 5) or iv sedation (fentanyl 100 µg and midazolam 2 mg, n = 1).

We prepared the NTG by diluting commercially prepared NTG (Tridil® 5 mg/ml) in normal saline to produce a 10 µg/ml concentration. After recording baseline vital sign measurements, we injected NTG 50 µg iv and instructed the obstetrician to remove the placenta when the uterus relaxed. The obstetrician assessed the degree of uterine muscle relaxation, the ease of removal of the retained placenta, and the time until recovery of uterine muscle tone. We continued to monitor blood pressure, ECG, and maternal subjective effects for 5 min after the NTG injection.

Uterine muscle relaxation sufficient to permit manual removal of the placenta occurred 30–40 s after the intravenous NTG in 5 patients. One patient required an additional bolus dose of NTG 50 µg for uterine relaxation to allow complete removal of the placenta. Recovery of uterine muscle tone occurred approximately 1 min after injection in all patients. There were no clinically significant changes in blood pressure or heart rate after the NTG injection. No patient complained of headache, palpitations, or other subjective effects. Subsequently, we have successfully used NTG 50–100 µg for uterine relaxation in an additional 16 patients with no apparent side effects.

Intravenous NTG is an effective smooth muscle relaxant with a short plasma half-life (2 min) and a brief duration of action.<sup>5</sup> NTG, when administered intravenously, can be titrated to effect and produces controlled smooth muscle relaxation of short duration. Peng *et al.* reported that NTG 500 µg iv provided effective uterine muscle relaxation but that it was associated with subsequent systolic hypotension requiring treatment with intravenous crystalloid solution.<sup>5</sup> A lower dose of NTG,

50 µg, relaxes smooth muscle enough to allow removal of the placenta without profound dilation of the venous system.

With low doses of NTG, the degree and duration of uterine muscle relaxation can be easily controlled, such that manual extraction of a retained placenta can be performed without significant maternal risks of side effects.

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## Emergency Transtracheal Jet Ventilation System

*To the Editor:*—We recently found it necessary to construct a simple transtracheal jet ventilation system, similar to the most economical one described by Benumof and Scheller,<sup>1</sup> quickly and from materials readily

at hand. Theirs consisted of the endotracheal tube adaptor from a 4.0-mm (ID) tube, oxygen supply tubing, and the cut-off barrel of a 1-cc syringe applied to a transtracheally applied catheter. We cut the cannula