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Nitrous oxide for pain management of first trimester surgical abortion — a randomized controlled pilot study^{★,★★,★}

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Abstract

Objective—The objective was to determine feasibility of a study comparing mean pain scores between women randomized to nitrous oxide/oxygen (NO) versus oxygen+oral analgesics for trimester surgical abortion.

Study design—Pilot randomized controlled trial comparing NO ($n=10$) versus oxygen+oral analgesics ($n=10$). Feasibility of subject recruitment, and pain and satisfaction scores on a visual analog scale were evaluated.

Results—Fifty-seven percent of eligible women participated. Mean pain scores were similar between groups, and mean satisfaction scores were higher for the NO group (77.5 vs. 46.7, $P=.048$).

Conclusions—The majority of eligible women agreed to participate in this study evaluating an uncommon pain control intervention.

Keywords

Surgical abortion; First trimester; Pain; Nitrous oxide

1. Background

First-trimester surgical abortion, a common and painful procedure [1], most frequently occurs in the United States in the outpatient setting under local anesthesia with a paracervical block (PCB) and oral analgesics [2].

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Optimal pain management for outpatient surgical abortion has not been established. Oral and intravenous nonsteroidal anti-inflammatory drugs, narcotics and anxiolytics have been used with variable success [3]. Use of narcotics and anxiolytics requires patients to have transportation home after the procedure, prolongs postoperative recovery time, may require monitoring and cause adverse effects [4]. Women sometimes decline sedatives to accelerate recovery and avoid side effects [4].

An inhaled mixture of nitrous oxide/oxygen (NO) provides analgesic, sedative and anxiolytic effects by acting on areas of the brain rich in morphine-sensitive cells and other opioid receptors [5]. NO provides rapid-onset pain and anxiety relief that is quickly reversed after stopping inhalation and administering oxygen alone with minimal residual effects. NO is titrated to the level required for the individual patient. Studies demonstrate NO's safety and successful use in other settings, and NO training requirements are less burdensome than those for outpatient intravenous sedation [6].

No studies have examined the effectiveness of NO in combination with local anesthesia versus oral analgesics in pain control for first-trimester surgical abortion [7,8]. We chose women using oral analgesics as the control group because oral sedation is the standard of care at our clinic for women who choose not to receive or do not meet intravenous sedation requirements. Oral analgesics unlike NO require the woman to have transportation home. Patients routinely request oral sedation, although evidence for its efficacy in abortion care is lacking. The primary outcome of this study was to determine the feasibility of randomizing women planning outpatient first-trimester surgical abortion to NO versus oral analgesics. Secondary outcomes were maximum mean procedural pain; baseline, anticipated and postprocedure pain scores; and patient satisfaction with pain management between the NO and oral analgesic groups.

2. Material and methods

We conducted a randomized, controlled, double-blinded pilot study of NO versus oxygen +oral analgesics (1:1 ratio) in women undergoing first-trimester surgical abortion at a university-based clinic from November 2012 to February 2013. The institutional review board of the University of New Mexico approved the study, and all patients completed informed consent.

English-speaking women aged 18 years who presented for surgical abortion at gestational age less than 11 weeks were approached for recruitment. Women with allergies to study medications, upper respiratory infections or home use of anxiolytics or narcotics were excluded. Participants received 800 mg of oral ibuprofen preoperatively and a standardized PCB [9]. The NO group received two placebo pills, and the oxygen group received one masked tablet each of 5/325 mg hydrocodone–acetaminophen and 1 mg of lorazepam preoperatively.

NO versus oxygen alone was administered via a disposable, scented nasal mask. NO was titrated in a standardized manner up to a concentration of 70% nitrous oxide and 30% oxygen. A dedicated physician or nurse administered the inhaled gas to both groups.

Inhalation equipment was obscured from the operating provider and patient's view. Pre- and postoperative blood pressure and oxygenation saturation were obtained. Level of consciousness, observed ventilation function and pulse oximetry were monitored.

Pain scores were recorded on a 100-mm visual analog scale (VAS) pain scale (anchors: 0 mm=none, 100 mm=worst imaginable pain) [9,10]. The primary outcome, maximum mean procedural pain, was measured 2 min after speculum removal to allow the effects of NO to dissipate. Secondary pain outcomes, baseline, anticipated and pain at time of discharge, were also assessed. Satisfaction with pain management was assessed on the VAS scale (anchors: 0 mm=very unsatisfied, 100 mm=very satisfied). Data on gestational age, dilation, cannula size, vacuum source, duration of procedure, surgical complications and other adverse events were collected.

The sample size of $N=20$ was selected for convenience. The randomization scheme was designed in blocks of four and was performed by an independent statistician using SAS (version 9.3; SAS Institute Inc., Cary, NC, USA) statistical software. A research pharmacist formulated the study medications (control and placebo) into identical capsules and packaged them according to the randomization scheme. The capsules were sealed in consecutively numbered opaque envelopes and opened immediately before the procedure by the person administering the inhalation agents. Categorical and continuous variables were analyzed using χ^2 and Student's t tests.

3. Results

Twenty (57%) of 35 women approached for participation enrolled in the study. Demographic characteristics were similar between groups (Table 1). Average duration of aspiration, anticipated procedural pain and maximum procedural pain were similar between groups. Mean patient satisfaction scores with pain management were higher among patients in the NO group compared to those in the oxygen+oral analgesics group (Table 2).

4. Discussion

Our study found that recruiting women to a pilot study of NO versus oxygen+oral analgesics is feasible. Pain scores alone did not adequately capture women's perception of NO's effect on the abortion experience, justifying the use of a satisfaction scale for a larger study (Table 2). When used for labor analgesia, the phenomenon of women experiencing pain of contractions with NO but being less concerned about the pain has been described, possibly explaining the above discrepancy between pain scores and satisfaction.

Two prior studies have examined the use of NO for first-trimester abortion [7,8]. In one study, NO did not further reduce pain for women receiving intravenous sedation [8]. In a second study, mean pain scores were similar for women undergoing first-trimester abortion under local anesthesia and intravenous paracetamol randomized to NO versus oxygen [7]. Paracetamol and oral narcotics both have unproven efficacy in reducing surgical abortion pain [7], and comparison to placebo would be a valid alternative study design.

Given the advantages of NO and our demonstration, in this pilot study, of the feasibility of recruitment into a larger study and a possible improvement in satisfaction with pain management, a larger randomized controlled trial powered to determine the effectiveness of NO in reducing pain and improving satisfaction for women undergoing first-trimester surgical abortion is warranted.

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Table 1

Demographic characteristics

Characteristics	Nitrous <i>n</i> =10	Oxygen <i>n</i> =10	p value
Age (years±SD)	27.3 (±6.15)	26.6 (±5.04)	.78
Race			1.0
■ White	6	7	
■ Other	4	3	
Relationship			.55
■ Single	7	4	
■ Cohabiting	2	4	
■ Divorced	1	2	
Education (%)			.24
■ High school ^a	4	1	
■ >High school	6	9	
Prior abortion (%)	5	4	1.0
Prior SAB (%)	3	5	.65
Vaginal delivery (%)	3	4	.25

SAB=spontaneous abortion.

^aIncludes those participants who either have completed high school or have some high school education.

Table 2

Pain and satisfaction visual analog scores

Outcomes	Nitrous <i>n</i> =10	Oxygen <i>n</i> =10	p value
Anticipated pain ^a	56.6±21.4	39.6±23.3	.42
Worst procedural pain ^a	55.7±20.8	61.3±20.2	.55
Pain at discharge from clinic ^a	25.0±23.4	24.5±22.7	0.92
Satisfaction with pain management ^a	77.5±26.6	46.7±37.1	0.048*

^aMeasurements were obtained using a 100-mm VAS to assess pain (0=no pain, 100=worst imaginable pain) and satisfaction (0=very unsatisfied, 100=very satisfied).