

Substance use and misuse in pregnancy : peripartum anesthetic management of a parturient with recent methanol toluene and isopropanol intake

K. M. KUCZKOWSKI and K. LE

Summary : To date, no reports have specifically addressed the obstetric and anesthetic management of complications stemming from an acute maternal poly-inhalant intake ; we herein present such a case and review the current limited literature available on this subject.

Key words : Inhalants, solvents, toluene, methanol, isopropanol, drug abuse, drug use, drug misuse, pregnancy ; Complications ; Maternal, fetal, obstetrics, obstetric anesthesia ; Complications.

Recreational use of cocaine, amphetamines and opioids, including in pregnancy, has received significant attention over the past 25 years (2, 3, 7) ; however, limited (if any) attention has been given to maternal use of inhalants, which constitute the fastest growing group of substances misused (abused) by parturients. To date, no reports have specifically addressed the obstetric and anesthetic management of complications resulting from an acute maternal poly-inhalant intake ; we herein present such a case followed by a literature review on this timely subject.

CASE REPORT

A 32-year-old, 160 cm, 63 kg, gravida 7, para 5, female with borderline personality disorder, suicidal ideations, desire to terminate pregnancy and kill the fetus, and a history of chronic compulsive inhalants intake (which intensified in pregnancy) at 32 weeks gestation required repeat Cesarean section as a result of poly-inhalant-induced (methanol, toluene, and isopropanol) systemic intoxication, chronic fetal distress, and preterm labor. Her past medical history was significant for a non Q-wave myocardial infarction 2 years ago, however, no additional information could be obtained. Her past surgical history included two prior Cesarean sections performed for fetal indications under regional anesthesia. The course of her current pregnancy

had been significant for eight hospital admissions for inhalants overdose (primarily carbonator cleaner containing methanol, toluene and isopropanol).

On admission, although, her level of consciousness was significantly depressed, she remained hemodynamically stable. Her arterial blood pressure was 102/59 mm Hg, heart rate 65 beats/minute and respiratory rate 18 breaths/minute. Fetal heart rate was 140 beats/min and reassuring. Pulse oximetry revealed arterial blood oxygen saturation of 96% on room air. Her chest was clear to auscultation. An electrocardiogram did not reveal any acute ST-segment or T-wave abnormalities. An obstetrical ultrasound documented a single fetus in cephalic presentation with intrauterine fetal growth restriction (IUGR), and estimated fetal weight of 1400 grams, and a congenital atrial septal heart defect (ASD). Admission laboratory studies revealed a serum methanol level of 59.7 mg/dl, with electrolyte imbalance, metabolic acidosis (serum potassium level of 2.9 mmol/L, serum bicarbonate level of 14 mmol/L, and serum creatinine level of 0.9mg), hemolytic anemia, and hyperbilirubinemia (hemoglobin and hematocrit were 6.5g/dl and 19.0%, respectively). She underwent almost immediate blood transfusion and hemodialysis (for removal of methanol metabolites), was treated with fomepizole (an alcohol dehydrogenase inhibitor), and given intramuscular betamethasone, 12 mg (to promote fetal lung maturity). Following the dialysis uterine contractions

K. M. KUCZKOWSKI, M.D., Assistant Clinical Professor of Anesthesiology and Reproductive Medicine, Director of Obstetric Anesthesia.

K. LE, M.D., Resident in Anesthesiology.

Departments of Anesthesiology and Reproductive Medicine, University of California San Diego, San Diego, California, USA.

Correspondence address : Krzysztof M. Kuczowski, Department of Anesthesiology, UCSD Medical Center, 200 W. Arbor Drive, San Diego, CA 92103-8770. E-mail : kkuczowski@ucsd.edu.

intensified, and the working diagnosis of preterm labor in a poly-substance abusing parturient with chronic fetal distress, IUGR, and congenital fetal heart anomaly was established, and Cesarean delivery was indicated.

An intravenous fluid preload with crystalloid solution was initiated and she was taken to the operating room. Standard anesthesia monitors were applied. A spinal block with 12 mg of 0.75% bupivacaine, 10 µg of fentanyl, 200 µg of preservative-free morphine, and 200 µg of epinephrine at the L2-3 interspace was induced with the patient in the sitting position. A T4 sensory level was established and surgery began. A 1570-g male fetus who had Apgar scores of 2 and 9 after one and five minutes, respectively, was delivered via the Cesarean incision. Surgery was promptly completed and the patient was taken to the post-anesthesia care unit (PACU). No maternal and neonatal postoperative complications were reported.

DISCUSSION

Psychological personality traits predispose to, rather than result from drug addiction. By definition drug addiction is described as self-administration of various drugs that deviate from socially or medically accepted use, which if prolonged can lead to the development of psychological and physical dependence (7).

Inhalants include a chemically diversified group of substances such as organic solvents and volatile agents that affect the central nervous system. Inhalant ingestion leads to an intense central nervous system stimulation and disinhibition similar to alcohol intake. Inhalants may be ingested orally, as well as sniffed from soaked rags, bags or open containers for their narcotic and stimulatory effects. In the United States alone, over a million people misuse (abuse) inhalants (7).

Methanol, a simple alcohol containing one carbon atom, occurs naturally in plants and animals and participates in human metabolism (4). However, despite its ubiquitous presence, methanol can be highly toxic if sufficient quantities are consumed. Ingestion of methanol can result in metabolic acidosis, blindness, and even death. Although the human body has the capacity to metabolize the low doses of methanol, it cannot handle high doses because too much methanol overwhelms the body's ability to remove a toxic metabolite (formate). When formate accumulates, methanol poisoning occurs. One of the factors that

regulates the rate at which formate is removed is the level of the folic acid derivative in the liver. Individuals who are deficient in folic acid (including 15% to 30% of parturients) may be particularly susceptible to the toxic effects of methanol (4). Methanol is cleared from maternal blood within 24 hours. Animal studies provide evidence that exposure to methanol by inhalation in early gestation days may result in dose-related increases in fetal cleft palate, exencephaly, and fetal skeletal defects. Little is known about the consequences of long-term inhalation of methanol vapors, especially in susceptible populations of pregnant women and developing fetuses.

Toluene is a commonly used industrial solvent and a major component in many household cleaning agents and paints. Toluene sniffing may lead to autonomic cardiac dysfunction, ventricular fibrillation and myocardial infarction. Chronic exposure to toluene vapors has been reported to cause changes in the central nervous system such as diffuse brain atrophy and cerebellar degeneration. Increased airway resistance, pulmonary hypertension, acute respiratory distress syndrome (ARDS), and liver toxicity have all been reported in pregnancy with documented exposure to solvents (3, 5, 7, 9). Recreational toluene sniffing in pregnancy has been associated with increased incidence of intrauterine fetal growth restriction (IUGR), preterm delivery and prenatal mortality (5, 9).

The toxicity of isopropanol has been studied extensively. In general, the data showed that isopropanol has a low order of acute and chronic toxicity; does not produce adverse effects on reproduction; is neither a teratogen, a selective developmental toxicant, animal carcinogen, nor a developmental neurotoxicant. Isopropanol is, however, a potential hazard for transient central nervous system depression at high exposure levels (6).

Optimal obstetric and anesthetic management of inhalant abusing parturients requires a high level of suspicion and early diagnosis. Loss of coordination, altered perception of sensory stimuli, nausea, vomiting, headache, and respiratory compromise, may result from inhalant ingestion. Detailed physical examination including determination of possible sensory or motor deficits is indicated prior to induction of anesthesia (3, 7). Regional and general anesthesia in the inhalant abusing parturient may be associated with obstetric and anesthetic peripartum complications. When regional anesthesia is selected combative behavior and altered pain perception may be encountered. Labile blood pressures and cardiac arrhythmias may be encountered

under general anesthesia, which may become necessary in acutely intoxicated parturients.

Most often drug abuse is first suspected or diagnosed during medical management of another condition such as hepatitis, human immunodeficiency syndrome (HIV) or pregnancy (7). Risk factors suggesting substance abuse in pregnancy include lack of prenatal care, history of premature labor, and cigarette smoking. The American College of Obstetricians and Gynecologists (ACOG) has made multiple recommendations regarding management of parturients with drug abuse during pregnancy (1). Women who acknowledge use of illicit substance during pregnancy should be counseled and offered necessary treatment. ACOG also acknowledged that some states consider intrauterine fetal drug exposure to be a form of child neglect or abuse under the law.

In summary the authors of this report believe that the increasing prevalence of recreational inhalants use in pregnancy will lead to the increased incidence of inhalant-related obstetric and anesthetic peripartum complications.

References

1. ACOG Committee Opinion : Committee of Obstetrics : Maternal and Fetal Medicine Number 114, INT. J. GYNECOL. OBSTET., **41**, 102-105, 1993.
2. Andres R. L., *Social and Illicit Drug Use in Pregnancy*. In : Creasy R. K., Resnik R., eds. *Maternal-Fetal Medicine*. Philadelphia : WB Saunders Company, 145-164, 1999.
3. Birnbach D. J., *Substance Abuse*. In : Chestnut D. H., ed. *Obstetric Anesthesia : Principles and Practice*. Mosby, St. Louis, 1027-1040, 1999.
4. Burbacher T., Shen D., Grant K., et al., *Reproductive and offspring developmental effects following maternal inhalation exposure to methanol in nonhuman primates*, RES. REP. HEALTH EFF. INST., **89**, 1-117, 1999.
5. Jones H. E., Balster R. L., *Inhalant abuse in pregnancy*, OBSTET. GYNECOL. CLIN. NORTH AM., **25**, 153-167, 1998.
6. Kapp R. W. Jr, Bevan C., Gardiner T. H., et al., *Iso-propanol : summary of TSCA test rule studies and relevance to hazard identification*, REGUL. TOXICOL. PHARMACOL., **23**, 183-192, 1996.
7. Kuczkowski K. M., *Drug Abuse in Pregnancy – Anesthetic Implications*, PROGRESS IN ANESTHESIOLOGY, **25**, 355-372, 2001.
8. Rogers J. M., Mole M. L., *Critical periods of sensitivity to the developmental toxicity of inhaled methanol in the CD-1 mouse*, TERATOLOGY, **55**, 364-372, 1997.
9. Wilkins-Haug L., Gabow P. A., *Toluene abuse during pregnancy : obstetric complications and perinatal outcomes*, OBSTET. GYNECOL., **77**, 504-509, 1991.