

Massive air embolism—a possible cause of death after operative hysteroscopy using a 32% dextran-70* pump

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Although hysteroscopy is considered a safe procedure, potentially fatal complications such as cardiac CO₂ embolism and anaphylactic reaction have been reported (1, 2). We report a fatal outcome after operative hysteroscopy using a 32% dextran-70 pump.

CASE REPORT

A 27-year-old woman was admitted for operative hysteroscopy because of intrauterine adhesions diagnosed by hysterosalpingogram. Her past medical history was unremarkable. The procedure was performed under epidural block. Thirty-two percent dextran-70 in dextrose (Hyskon; Pharmacia, Uppsala, Sweden) was administered through a pump (Quinones pump; Storz, Tuttlingen, Germany). Approximately 75 minutes after the beginning of the operation, a Hyskon bottle was replaced, apparently while the pump was still functioning. The patient became restless and coughed. Severe bradycardia appeared (50 beats/min), followed by electromechanical dissociation lasting 30 seconds, cyanosis, and respiratory arrest. A generalized rash was also noted and disappeared a few minutes later. The procedure was terminated. During the vigorous resuscitative efforts, crepitant femoral pulses were pal-

pated, and when an arterial line was introduced, blood with foam was obtained. Initial arterial blood gases were PCO₂, 77 mm Hg; PO₂, 16 mm Hg; pH, 7.18. Massive air embolism was suspected by the attending team, and the patient was transferred to our institute for hyperbaric oxygen (HBO) therapy.

On arrival at our institute, 3 hours after the event, the patient was in deep coma and artificially ventilated via an endotracheal tube. She was unresponsive to painful stimuli, with dilated pupils unreactive to light, and no tendon reflexes could be elicited. Systolic blood pressure was 80 mm Hg with intravenous dopamine drip. Chest x ray revealed interstitial congestion compatible with pulmonary edema and ruled out pneumothorax. Arterial blood gases before initiation of HBO were (FIO₂, 1.0); PO₂, 40; PCO₂, 35; pH, 7.34; bicarbonate, 19; base excess, -6. Hyperbaric oxygen treatment was given in a multiplace hyperbaric chamber while the patient was ventilated with a gas mixture according to the following treatment protocol: [1] 30 minutes at 6 atmospheres of absolute (ATA), 50% O₂, 50% N₂. [2] Three cycles of 20 minutes at 2.8 ATA, 100% O₂. [3] 30 minutes slow decompression to 1.9 ATA, 100% O₂. [4] Two cycles of 60 minutes at 1.9 ATA, 100% O₂. During the treatment, a neurological examination revealed that the patient was in coma but had regained spontaneous breathing. Right hand movements were noted, both spontaneously and as a response to pain. The pupils were dilated and unreactive to light. General hypotonia was noted more on the left side. Biceps reflexes were weak bilaterally,

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and the Achilles reflex was absent on the right side. Arterial blood gases were PO₂, 361; PCO₂, 42; pH, 7.23; bicarbonate, 18; base excess, -9. Throughout the 5-hour treatment the patient was hemodynamically unstable, and the pulmonary edema did not resolve. The patient was transferred to an intensive care facility, where she died 2 days later.

The main findings at autopsy were cerebral edema, hemorrhagic infarction of the left occipital lobe, epicardial and pleural effusions, pulmonary edema, and ascites. The heart was examined under immersion, and a few gas bubbles escaped from the left ventricle. Microscopic examination of the endometrium revealed inflammatory infiltrates, necrosis, and hemorrhage. The tubes and ovaries were normal. The pathologist's diagnosis was anaphylactic shock.

DISCUSSION

The pump used during the procedure can generate a maximal pressure of 300 mm Hg, which is sufficient to push air or dextran into the endometrial vascular bed during operative hysteroscopy. The same mechanism of introducing gas under pressure into a body cavity resulting in gas embolism has been reported in laparoscopy and in orogenital sex during pregnancy (3). The resultant massive venous air embolism would explain the acute respiratory failure, the electromechanical dissociation, and the prolonged pulmonary edema, as large volumes of air are trapped in the right ventricle and in the pulmonary vasculature.

Massive venous air embolism can lead to arterial embolism in one of two ways. First, the increase in right atrial pressure may open a potentially patent foramen ovale, which has been reported in 20% to 35% of the general population. Unfortunately, the pathologist did not rule out this possibility in our patient. Second, large volumes of air in the pulmonary vascular bed may be transferred to the left atrium by means of physiological pulmonary shunts, or by overcoming a critical volume.

The crepitant pulses, the frothy blood obtained through the arterial line, the sudden neurological and cardiovascular collapse at the time the pump was functioning without Hyskon, and the initial favorable reaction to HBO all support the diagnosis of massive arterial air embolism. Generalized rash may also accompany air embolism.

Ahmed et al. (4) describe three cases of severe anaphylactic reaction associated with the use of 32%

dextran 70 during hysteroscopy. In all three cases, the anaphylactic reaction occurred approximately 10 minutes after exposure to dextran. The authors emphasize that sensitization may occur even without previous exposure to dextran. According to the pathologist's report in our case, the fact that shock occurred 75 minutes after exposure to dextran does not rule out the possibility that the cause of death was anaphylaxis.

The use of HBO for air embolism is well documented. The treatment is based on mechanical compression of the air bubbles to reduce their size (volume and pressure are inversely related). A reduction in the bubbles' volume relieves the vascular obstruction and restores perfusion. Concomitantly, HBO increases the gas gradient between the bubbles (mainly nitrogen) and the surrounding tissue (mainly oxygen) and hastens their resorption. Hyperoxygenation may oxygenate hypoxic neural tissue and by means of vasoconstriction reduce brain edema, which may result from gas embolism.

Hysteroscopy is generally a safe and reliable diagnostic and therapeutic procedure. However, the gynecologist must be aware of the possible serious complications. Cardiac CO₂ embolism and anaphylactic complications have both been described (1, 2). The practicing gynecologist must realize that the female genital tract is a potential portal of entry of gas into the venous plexus that drains the uterus; gas embolism has been reported after orogenital sex (3), criminal and therapeutic abortions (5), hysteroscopy (1), and cesarean section (6). The pregnant woman is at a higher risk of this complication. However, the possibility must be borne in mind when treating the nonpregnant patient too.

SUMMARY

Although considered a safe procedure, operative hysteroscopy has been reported to result in serious and even fatal complications. A fatal outcome is described after operative hysteroscopy. The attending team made a diagnosis of massive air embolism. However, HBO therapy, which is the specific treatment for air embolism, yielded only transient improvement. The pathologist's diagnosis on autopsy was anaphylaxis. These two complications must be borne in mind during the

procedure, and a contingency plan developed for dealing with them should they arise.

Key Words: Hysteroscopy, complications, dextran-70, air embolism, anaphylaxis, hyperbaric oxygenation.

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