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The Dilemma of General Anesthesia for Cesarean Section: Adequate Fetal Oxygenation *vs.* Maternal Awareness during Operation

To the Editor:—Concern over the deleterious effects on the fetus and newborn of maternal exposure to nitrous oxide in the once usual concentration of 70 per cent with 30 per cent oxygen during cesarean section has led to widespread adoption of higher concentrations (50 per cent or more) of oxygen instead.[1] The resultant increased incidence of awareness during operation has in turn been countered by the addition of low concentrations of halothane,[2] enflurane,[3] methoxyflurane,[4] or trichloroethylene,[5] or of ketamine,[6] each with its own problems.

An unorthodox alternative, thiopental–(or thiamylal-) succinylcholine–oxygen anesthesia for cesarean section was devised in Japan[7] and confirmed in a study at Columbia University, reported by Poppers at the IV European Congress of Anesthesiology in Amsterdam, 1974, but never published in full because the control group received nitrous oxide 70 per cent. Briefly, the technique consists of 5 min of breathing 100 per cent oxygen, followed by 4 mg/kg thiopental and 100 mg succinylcholine intravenously, tracheal intubation, and manually controlled ventilation with 100 per cent oxygen (avoiding hypocapnic decrease in fetal oxygenation[8]). If delivery is not completed within 5 min, a second dose of 1.3 mg/kg thiopental is administered and 10 min later (*i.e.*, 15 min from the start), if the baby is still undelivered, a third dose of 1 mg/kg. Additional doses of 20 mg succinylcholine are injected as needed. (A curious stipulation for greater uniformity in the original study,[7] induction of labor in patients not already in labor, has long since been abandoned. As a corollary, however, for the patient who *is* in labor, injection of thiopental at the start of a contraction will minimize its access to the fetus.) In the Columbia study, mean one minute Apgar scores were not significantly higher than in the companion nitrous oxide group; no episodes of intraoperative awareness or unpleasant dreams were reported.

This innovative technique, based upon pharmacokinetic principles, provides analgesia equivalent to that of 70 per cent nitrous oxide at the peak plasma concentrations of thiopental (ordinarily deemed a non-analgesic sedative-hypnotic) and subsequently at appropriate intervals restores maternal blood levels sufficiently high to block all awareness and continue to provide some analgesia. Thiopental levels in the fetus and newborn, derived from a falling plasma curve in the mother, are not excessive with this dose schedule (table 1). In contrast, nitrous oxide accumulates continuously in the fetus, reaching 90 per cent equilibration with the maternal bloodstream by 15 min.[9] Subsequent diffusion hypoxia in the newborn thus becomes a possibility,[9] albeit readily countered by oxygen administration at birth. A much greater and real hazard, uterine vasoconstriction, may result from increased secretion of catecholamines due to maternal awareness and apprehension during light nitrous oxide anesthesia[10,11]; this does not happen with thiopental and tracheal intubation.[12]

TABLE 1. Thiopental Plasma Levels (mg/l ± SD)*

Duration of Anesthesia	Under 10 Min		Over 10 Min	
Agent	N_2O†	O_2‡	N_2O†	O_2‡
Number of cases	14	14	6	6
Maternal artery	6.3 ± 2.8	10.6 ± 2.1	3.9 ± 1.0	13.2 ± 6.1
Umbilical vein	3.3 ± 0.6	7.1 ± 1.3	2.9 ± 0.7	6.0 ± 1.9
Umbilical artery	2.3 ± 0.5	3.8 ± 0.8	2.7 ± 0.9	3.6 ± 1.2

* Poppers PJ, Finster M, Mark LC, Perel JM: Unpublished data.
† Preceded by 250 mg thiopental intravenously.
‡ Thiopental dosage as in text.

Note that general anesthesia for cesarean section has been criticized because of poorer neonatal neurobehavioral responses than with spinal anesthesia.[13] Following ketamine–nitrous oxide anesthesia, scores were intermediate but not significantly higher than after thiopental–nitrous oxide.[13] Thiopental–oxygen has not been so studied.

Thiopental–succinylcholine–oxygen anesthesia for cesarean section has stood the test of time. A recent survey found that 29 per cent of medical schools in Japan currently are using the technique.* It presents a viable option, especially under conditions of fetal distress or severe maternal cardiopulmonary dysfunction.

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* Mayumi T, Matsumiya N, Namiki A, et al: National survey on the type of anesthesia for cesarean section in Japan (in Japanese). J Clin Anesth 4:1465–1468, 1980

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Air Embolism: Placement of Central Venous Catheters

To the Editor:—Numerous publications during the last few years have been concerned with the use of central venous catheters in the detection and treatment of venous air embolism. In this context, the recent editorial[1] in ANESTHESIOLOGY is welcome. A recent survey of neurosurgical centers in the United Kingdom showed that in 52 per cent a right atrial catheter is routinely inserted in patients undergoing surgery in the sitting position,[2] although it is possible that this figure has increased slightly during the time that has elapsed since the data were first collected (1978–1979). Our own practice is to introduce a venous catheter via an arm vein after the induction of anesthesia and to confirm the location of the catheter tip by chest radiography. During the ten to fifteen minutes that elapses before the radiograph is available, the patient is positioned upright. If the catheter is then found to be incorrectly sited, no further attempt is made and we rely on intra-arterial blood pressure measurement and a Doppler ultrasonic probe. An end-tidal CO_2 analyzer will be available shortly.

Interestingly, a personal unpublished series confirms almost exactly the 10 per cent failure rate and time of 10–15 minutes required for the procedure that has been reported by others.[3] To our knowledge no institution in the United Kingdom currently uses a pulmonary artery catheter and in our view the potential risk, cost, and time involved precludes the routine use of this monitoring device.

In two patients at the Mayo Clinic large volumes of air were withdrawn via catheters in the superior vena cava (SVC)[1] and Bunegin *et al.*,[4] using their experimental model, have found that with a single-orifice catheter the optimal position of the tip is 3.0 cm above the junction of the SVC and right atrium. The following case report, therefore, may be of interest.

REPORT OF A CASE

A 22-year-old woman with signs and symptoms of obstructive hydrocephalus underwent posterior fossa craniotomy for removal of a large mid-line space-occupying lesion. After induction of anesthesia, a venous catheter was inserted via the left basilic vein but chest radiography showed that the catheter tip had passed upwards into the right internal jugular vein (fig. 1). The catheter was withdrawn until it was judged that the tip lay in the SVC. Anesthesia in the sitting position using nitrous oxide, oxygen, pancuronium, and fentanyl was uneventful until craniectomy and dural opening had been completed. However, tumor retraction caused immediate arterial hypotension to 50 mmHg systolic and simultaneous positive Doppler signals. The operation site was covered with a moist pack and 30 ml of air were withdrawn from the SVC. The blood pressure returned to normal within 90 s, and since the surgeon could find no obvious entry site the pack was removed and the tumor retracted once more. A second episode of hypotension (45 mmHg) and positive Doppler signals almost immediately occurred; 20 ml of air was aspirated.