Intrathecal Morphine in a Parturient with a Single Ventricle

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The congenital cardiac defect known as a single or primitive ventricle is a relatively rare anomaly found only in 0.5–1.5 per cent of patients with congenital heart disease. The hemodynamic feature of this condition consists of a common mixing chamber receiving pulmonary and systemic venous blood via two atrioventricular valves. Pregnancy results in an increased morbidity and mortality in patients with right to left shunting, especially in cases associated with polycythemia and decreased arterial oxygen saturation. The incidence of heart failure, bacterial endocarditis and cerebral thrombosis is increased. Most complications arise from decreases in systemic vascular resistance, causing an increase in right to left shunting and further hypoxemia and acidosis. For this reason, the major regional anesthetic techniques so well suited to obstetrics are often avoided in this class of patients. Small doses of morphine injected intrathecally in patients with chronic pain have been shown to produce analgesia for several hours without significant motor or autonomic effects. We report here, a case of labor and delivery in a patient with a single ventricle, managed with intrathecal morphine analgesia.

Report of a Case

A 19-year-old primigravida with a congenital cardiac anomaly known as a single ventricle was admitted to the obstetric unit at 36-weeks gestation. As a child, she developed congestive heart failure, due to inadequate egress of the increased blood volume in the lungs and a pulmonary artery banding had been performed. This prevented the development of pulmonary hypertension, but her cyanosis progressed as she outgrew the pulmonary artery banding and her pulmonary blood flow decreased. A Glenn procedure was performed in 1978 to increase pulmonary blood flow.

A therapeutic abortion was advocated in early pregnancy, but was refused by the patient. As her pregnancy progressed, she developed an increase in cyanosis and decrease in exercise tolerance and spent the last four weeks of her pregnancy essentially at bed rest. She had a marked chronic hypoxemia. On room air, her $pH$ was 7.49, $P_{CO_2}$ 29 torr, $P_{O_2}$ 52 torr and BE +1. This caused growth retardation of the fetus (>5 percentile).

Elective induction of labor was planned, the date of which was to be determined by maturation of the lecithin/sphingomyelin ratio. Anticoagulant therapy was discontinued on the night prior to induction of labor. The next morning, her platelet count was 108,000/mm³ and all other coagulation values were within normal limits. On admission to the labor unit, central and peripheral venous, and intra-arterial catheters were placed. The electrocardiogram, central venous and systemic arterial pressures were continuously displayed. Labor progressed uneventfully and when the parturient became sufficiently uncomfortable to request medication, a lumbar puncture was performed in the routine manner using a #22-gauge Whitacre needle. Morphine sulfate, 1 mg in 1 ml of normal saline without preservatives was injected intrathecally.

The onset of analgesia occurred within 10 min, and within 20 min, the parturient was no longer aware of uterine contractions. Analgesia was not associated with any changes in blood pressure, pulse rate or venous pressure. There was no alteration of sensory or motor function, marked respiratory alkalosis was noted prior to the injection of the morphine with a $pH$ 7.50, $P_{CO_2}$ 26 torr, and $P_{O_2}$ 69 torr. Following the onset of analgesia, $pH$ was 7.50, $P_{CO_2}$ 35 torr, and $P_{O_2}$ 69 torr. There was no change in uterine activity or fetal heart rate noted following the injection of intrathecal morphine.

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The analgesia lasted for 5 hours, after which time the parturient complained of perineal discomfort and a second injection of 1 mg of morphine was given, intrathecally. Thirty minutes later, a 1700-g male infant was delivered with the aid of forceps. Pudendal block anesthesia with 1 per cent lidocaine, 20 ml, was used for delivery. The Apgar scores for the infant were 9 at both 1 and 5 min. Blood loss at delivery was approximately 500 ml and was well tolerated by the parturient. Following delivery, the parturient was transferred to the intensive care unit for observation. After an uneventful 24-hour period there, she returned to the postpartum ward.

The following day she complained of mild spinal headache. However, since anticoagulant therapy had been re instituted, an epidural blood patch was not performed. The headache lasted two days and responded to analgesics and hydration. She had no other apparent sequelae and was discharged after ten days. No complications were noted at her six-week follow-up examination.

**Discussion**

According to Mangano, increases in right to left shunt should be avoided in parturients with cyanotic heart disease. Adequate analgesia will probably help prevent release of endogenous catecholamines associated with pain and anxiety, which will in turn attenuate any increase in pulmonary vascular resistance. Also, impaired venous return due to vena caval compression by the pregnant uterus or positive intrathoracic pressure with positive pressure ventilation should be avoided. Adequate blood volume will obviously help to maintain cardiac output. Regional anesthetic techniques may be associated with decreases in systemic vascular resistance and venous return, and according to Mangano are best avoided in these patients.

Traditionally, these parturients have been managed with paracervical, pudendal nerve blocks and systemic analgesics. Excessive doses of narcotics could cause maternal hypercarbia and acidosis and aggravate the existing pathology. Placental transfer of narcotic analgesics may also be associated with neonatal depression.

We postulated that the intrathecal administration of narcotics may provide analgesia and alleviate some of the above potential problems with other anesthetic techniques. The isolation of opiate receptors and endorphins in nervous tissue has prompted the investigation of the effectiveness of small doses of morphine injected intrathecally in patients with chronic pain. This appears to be a pharmacologically-specific, dose-dependent effect, which is thought to be due to opiate binding in the substantia gelatinosa of the dorsal horn. There is apparently no effect on motor or autonomic function. In pregnant animals, no neonatal respiratory or behavioral depression is noted.

A disadvantage of this technique however, is the possibility of postdural puncture of cephalgia. The incidence with a #25-gauge needle is 4 per cent, and 2 per cent with a #26-gauge. The incidence of headaches in nonpregnant individuals following the use of a #20-gauge Whitacre needle was found to be 2 per cent. There are no reports of the incidence of headaches following the use of a #22-gauge Whitacre needle.

The use of spinal anesthesia in a parturient who has been on anticoagulant therapy is also controversial. Cases have been reported of epidural hematomas associated with the epidural catheter technique but none with the single injection spinal or epidural techniques. The real incidence is difficult to ascertain since few cases have been reported. We feel that if performed meticulously and atraumatically, the danger is minimal. Great care is exercised to detect early spinal cord or cauda equina compression. An early symptom is severe back pain, followed by numbness, weakness and paresthesias, which if noted, require urgent neurologic evaluation.

The use of intrathecal morphine in this parturient resulted in adequate analgesia for labor and the probable lack of effect on motor and autonomic function and fetal viability is obviously advantageous.

**References**

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Neurologic Depression after Intrathecal Morphine

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Numerous investigators have administered intrathecal and epidural morphine sulfate for postoperative analgesia. While early reports indicated no side effects, others have recently indicated respiratory depression that was reversed by an intravenous administration of naloxone.1–3 In the following report we describe an instance of respiratory as well as neurologic depression after the intrathecal injection of an inadvertent large dose of morphine sulfate.

**REPORT OF A CASE**

A 55-year-old man scheduled for inguinal herniorrhaphy consented to participate in a study to evaluate postoperative analgesia associated with the intrathecal administration of morphine sulfate, 2 mg. The protocol was approved by the University's Committee for the Protection of Human Subjects. The patient had a history of alcoholism and portal hypertension but hepatic and coagulation studies were normal. During the four months before surgery, the patient had abstained from alcohol.

One hour before surgery, diazepam, 10 mg, was taken orally. In the operating theater the patient was mildly sedated and could answer questions appropriately. Respiratory rate was 16 breaths/min. He was placed in the right lateral decubitus position. A 22-gauge spinal needle was inserted into the L3–L4 interspace and a free flow of spinal fluid was obtained. Tetracaine, 11 mg, and epinephrine, 0.2 mg, mixed in an equal volume of 10 percent dextrose solution were then injected. According to the experimental protocol, morphine sulfate,‡ 2 mg, was to be added to the anesthetic; however, morphine sulfate, 20 mg (1.3 ml), inadvertently was added. This preparation of morphine also contained 0.5 per cent chlorobutanol (chloroform derivative) and less than 0.1 per cent sodium bisulfate. The anesthetic mixture was injected into the intrathecal space. Spinal anesthesia to the level of the sixth thoracic dermatome was obtained within a few minutes and surgery began uneventfully. After approximately one hour, the spermatic cord was manipulated and the patient became nauseated. The discomfort was relieved by the intravenous administration of benzquinamide hydrochloride, 25 mg, without affecting respiratory rate. The patient became more sedate during surgery, but continued to respond to questions appropriately.

Vital signs remained stable throughout the anesthetic course. Postoperatively, approximately four hours after the subarachnoid injection, the respiratory rate decreased within 15 minutes from 16 to 6 breaths/min. The patient appeared lethargic, but was arousable and could answer questions appropriately. With an \( \text{FiO}_2 \) of 0.21, \( P_{\text{Aco}_2} \) was 59 torr, \( P_{\text{Ago}_2} \) 65 torr, and \( P_{\text{H}_2} \) 7.22. Oxygen, 2 l/min, was administered via nasal prongs and then naloxone, 0.4 mg, was given intravenously. Within one minute, the patient became more alert and his respiratory rate increased to 8 breaths/min. Fifteen minutes later, \( P_{\text{Aco}_2} \) was 51 torr, \( P_{\text{Ago}_2} \) 97 torr, and \( P_{\text{H}_2} \) 7.27. The patient had slurred speech, lethargy, downbeat nystagmus, and loss of sensation to pin prick and of motor function of the lower extremities. The latter presumably were due in part to the effects of the intrathecal tetracaine. The intravenous administration of physostigmine, 2 mg, produced no changes.

Because of persistent neurologic signs and symptoms of central depression, additional naloxone, 1.5 mg, was administered intravenously over the next two hours and then more naloxone was given by continuous intravenous infusion. The infusion rate (maximal naloxone dosage, 3 mg/hr) was adjusted to maintain an arousable mental state and a respiratory rate greater than 8 breaths/min. \( P_{\text{Aco}_2} \) was 42 torr. The patient's mental state showed gradual improvement over the following 16 hours at which time the naloxone was discontinued without the recurrence of any neurologic depression. The total dose of naloxone, 30 mg, was administered over a period of 20 hours. At no time during the postoperative period did the patient complain of pain nor did he receive an analgesic. The patient was discharged from the hospital three days after surgery.

**DISCUSSION**

Neurologic depression after the intrathecal administration of morphine has not been observed by all investigators. Wang et al.4 reported that intrathecal