

CLINICAL REPORTS

Ronald D. Miller, M.D., Editor

Anesthesiology
58:460-461, 1983

Hypothermia in Pregnancy

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In our clinic, hypothermia is used during resection of some tumors in the posterior fossa to avoid damage in the pons during the manipulation of the tumor and to diminish postoperative cerebral edema.¹ Surgery was necessary in the described case, despite pregnancy, because neurologic pathology was increasing rapidly. We have a routine of cooling the patient to 30°C before the start of surgery and to 27–28°C during the manipulation of the tumor. This case report shows the fetal heart rate response to body temperature.

REPORT OF A CASE

A 25-year-old woman at 21st week of gestation underwent a craniotomy during hypothermia. A subtotal resection of an intracranial neurinoma of the nervus accessorius was performed. Several weeks prior to surgery, neurologic symptoms increased consistently and on computer tomography the tumor showed a deep impression on the pons. The patient was otherwise healthy.

After receiving 7.5 mg droperidol im, anesthesia was induced with 0.5 mg atropine and 350 mg thiopental, iv. Endotracheal intubation was performed after administration of 0.2 mg fentanyl and 100 mg succinylcholine. *d*-Tubocurarine, 6–9 mg, was given intermittently for further skeletal muscle relaxation. Increments of droperidol and fentanyl were given throughout the anesthetic. Ventilation was controlled with 70% nitrous oxide. Esophageal and rectal temperatures were measured and arterial blood pressure monitored via a catheter in the radial artery. The magnitude of ventilation was based on continuous end-tidal CO₂ values and by repeated analysis of arterial blood gases. Electrocardiogram was monitored continuously. The fetal heart rate was recorded with an ultrasonic transducer connected to a fetal monitor and continuously recorded. During anesthesia, the recording was intermittently disturbed, but the fetal heart was easily heard through the microphone and repeatedly counted and checked with the written recordings.

As soon as all equipment was connected, surface cooling with room air of +10° C was started. Cooling, discontinued when the patient was placed in the lateral position, started again when the surgical incision was made and stopped when body temperature was 28.8° C. Thereafter, the temperature fell slowly to 27.8° C in the rectum and 28.5° C in the esophagus. Three hours later, the body temperature

began to rise slowly. The maternal heart rate slowed during cooling from 80 to 30 beats/min. At a temperature of 28° C the sinus rhythm changed to a nodal rhythm with the same frequency. The nodal rhythm was not treated as it did not affect arterial blood pressure. When the temperatures ultimately increased to 34° C, the sinus rhythm returned. Warming with room air of +32° C started four hours after cooling was stopped. Systolic blood pressure was then decreased from 95 to 60 mmHg; otherwise, no major circulatory problems were encountered during anesthesia. The fetal heart rate principally paralleled the maternal heart rate, slowing during cooling and increasing during warming (fig. 1). During the warming period when the rectal temperature was 33° C, the mother had a sinus tachycardia for a few minutes. The fetal heart rate changed simultaneously from 107 to 120 beats/min and then back to 100 beats/min. No explanation for the change in maternal heart rate other than the rising temperature was found.

At the end of surgery, which was without complication, the warming was continued until rectal temperature reached 35.5° C. The patient was transferred to the surgical intensive unit for postoperative care and the trachea was extubated successfully 90 min after the end of surgery, *i.e.* 15 hours after induction of anesthesia. No neurologic symptoms other than those present preoperatively were evident.

During anesthesia 2,000 ml of lactated Ringer's solution with 5% glucose were given. Potassium 20 mEq⁺ was added to avoid hypokalemia during hypothermia. During the next 12 hours after anesthesia, 1,000 ml of 5% glucose solution and water with 80 mEq Na⁺ and 40 mEq K⁺ were given.

Serum electrolytes were checked approximately every 4 hours during the operation and immediately postoperatively (Na⁺ 132–134 mEq, K⁺ 3.6–3.4 mEq, otherwise normal values). While cooling, a moderate acidosis (base excess—5.8 mEq/l) was corrected by the iv administration of 60 mEq sodium bicarbonate. Serum glucose rose from 103 to 223 mg/dl and returned spontaneously to 115 mg/dl the day after the operation. Ventilation with 70% nitrous oxide and a minute ventilation of 8 liters, min at the beginning and end of anesthesia and 5 liters/min during hypothermia, gave a moderate hyperventilation (Pa_{CO₂} 23–26 mmHg) and a Pa_{O₂} of not lower than 120 mmHg.

The recovery from surgery was quick and uncomplicated. The pregnancy continued normally and terminated successfully. A healthy child was delivered at gestational age of 40 weeks, and after one year has had a normal development according to the mother.

DISCUSSION

Only a few cases of hypothermia and pregnancy in humans are reported. Boba² described two cases when the fetus did not survive. One woman underwent surgery for a thalamic arteriovenous malformation in her eighth week of gestation and was cooled to 28° C. She aborted spontaneously in the 14th week. The other

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Received from the Department of Anesthesiology, Södersjukhuset, S-100 64 Stockholm, Sweden. Accepted for publication October 18, 1982.

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Key words: Temperature: body. Anesthetic techniques: hypothermia. Anesthesia: neurosurgical; obstetric.

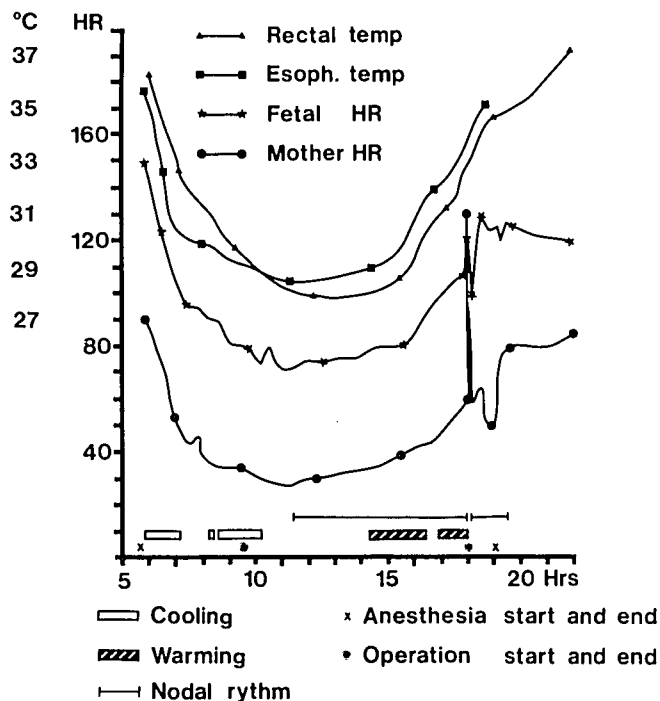


FIG. 1. Maternal temperature (esophageal and rectal) and heart rate (maternal and fetal) during anesthesia with hypothermia. The time when cooling and warming of the mother was performed and the time during which the mother had nodal rhythm is indicated. (The hours indicate the time of the day.)

woman, 5 months pregnant, came to the hospital three days after a history of headache and coma with marked metabolic acidosis. A ruptured arteriovenous malformation in a temporal lobe was excised together with the lobe as an emergency. The recovery of the patient was uneventful, but approximately 4 weeks later, a macerated infant was delivered. Conversely, Rowbotham *et al.*³ describe a woman with severe head injury, where hypothermia of about 30° C for five days was included in the treatment. She was about 8 weeks pregnant at the time and delivered a healthy child at term. Boatman and Bradford⁴ described a case of surgery for an inter-

nal carotid aneurysm in a woman of 12–15 weeks gestation; hypothermia to 30.5° C was employed with no effects on fetal development. The case of a woman in her fifth month of gestation, who underwent two operations in hypothermia (31° C and 30° C) is described by Caron *et al.*⁵ First, she underwent surgery because of a ruptured cerebral aneurysm which was preceded by coma and epileptic seizures. One month later, another cerebral aneurysm was ligated preventively, also with hypothermia. A healthy, premature child was born in the 33rd week of gestation.

One of the two patients who were described⁴ previously failed to continue the pregnancy after hypothermia but obviously had severe acidosis. No information of hypoxia or acidosis was given in the other case. As for the woman with the prematurely born child, we would not regard the hypothermia as the only cause of the prematurity because she may have been hypoxic during the seizures. In our case, hypothermia with no acidosis or hypoxia was without negative effects to the 21-week-old fetus. If unexpected changes of the fetal heart rate had appeared, the fetal situation was to be correlated to that of the mother. Problems with respiratory function, circulation, electrolytes, blood gases, and monitor devices had to be solved. Nothing could be done for the fetus alone.

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