Active Warming During Caesarean Delivery

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This study tested the hypothesis that 15 minutes of forced air pre-warming, combined with intraoperative warming, prevents hypothermia in patients undergoing elective caesarean delivery and that maintaining maternal normothermia increases newborn temperature, umbilical vein pH, and Apgar scores

Thirty patients were randomly assigned to forced-air warming or to passive insulation. Warming started 15 minutes before the induction of epidural anaesthesia. Results showed that core temperatures after two hours of anaesthesia were greater in the Actively Warmed than in the unwarmed patients. Babies of warmed mothers had significantly greater core temperatures and umbilical vein pH.

Hypothermia
Anaesthesia reduces the threshold for vasoconstriction and shivering and often provokes a core-to-periphery redistribution of body heat. The situation is further complicated because core temperature is rarely measured during neuraxial anaesthesia and because reductions in core temperature are poorly perceived by patients. Surgical patients given epidural or spinal anaesthesia frequently become hypothermic but this is rarely detected by either the patient or the anaesthesiologist.

Mild hypothermia causes complications including morbid myocardial outcomes, coagulopathy and reduced resistance to wound infections. It can cause shivering-like tremor which is common during caesarean deliveries and disturbing to mothers and clinicians.

It is difficult to treat the core-to-peripheral redistribution of body heat that follows the induction of anaesthesia but redistribution can be prevented by pre-warming. An hour or more of pre-warming will not fit the clinical routine of most hospitals but a brief period of pre-warming would be easy to accommodate and could be combined with intraoperative warming, which is undoubtedly effective.

The study
This involved 30 healthy pregnant women undergoing caesarean delivery with epidural anaesthesia. Indications for caesarean delivery included previous caesarean and breech presentation. Patients were excluded if they were under 18, had a diagnosis of preeclampsia or eclampsia, a history of a clotting disorder or were taking any chronic medications.

All were premedicated with 150 mg of oral ranitidine two hours before surgery; all had fasted for at least six hours. All fluids were warmed to 37°C and patients were randomly assigned to be covered with a single cotton blanket (Passive Insulation) or to forced-air heating (Active Warming).

The forced-air cover (Bair Hugger) was positioned over the upper body 15 minutes before insertion of the epidural catheter and set to “high” (43°C). The intraoperative ambient temperature was maintained near 24°C. The designated warming method was continued during catheter placement and throughout surgery.

Heart rate and blood pressures were measured, along with core temperature via aural probes. Mean skin temperature was calculated from measurements at the chest, arm, thigh, and calf. Shivering was graded using a four-point scale (from ‘no shivering’ to ‘continuous, intense shivering’).
Patients used a visual scale to quantify pain and thermal comfort was evaluated every 15 minutes on a scale from ‘worst imaginable cold’ to ‘insufferably hot’.

Umbilical vein blood from the infants was sampled for pH directly after birth. The rectal temperature of the infants was recorded immediately with a digital thermometer and a paediatrician determined Apgar scores of the infants one, five, and 10 minutes after birth.

Characteristics and the duration of surgery were similar among the groups. The lumbar segments at which the epidural catheter was inserted (L2-3 or L3-4) and the total volume of epidurally injected ropivacaine did not differ and there were no statistically significant haemodynamic differences between the groups. Preinduction temperatures were comparable and core temperatures decreased comparably in each group for the first 30 minutes of warming.

Previous studies have shown that 1–2 hours of pre-warming prevents intraoperative hypothermia, even in unwarmed patients undergoing prolonged abdominal surgery. Studies suggest that as little as 30 minutes should provide clinical benefit.

Subsequently however, core temperatures in the Passive Insulation group continued to decrease, whereas temperatures in the Actively Warmed patients increased linearly for the remainder of the study. Consequently, core temperatures differed by more than 1°C at the end of surgery.

- Preoperative and intraoperative mean skin surface temperatures were approximately 1.5°C greater in the Actively Warmed patients.
- During epidural anaesthesia, 8 of 15 Actively Heated patients and 9 of 15 Passively Warmed patients were vasoconstricted.
- Shivering was observed in 9 of 15 of the Passively Warmed mothers, but in just 2 of 15 of the Actively Heated mothers.
- Umbilical vein pH was higher in babies of Actively Heated mothers and rectal temperatures of the newborns were higher in these babies. Apgar scores were similar in the two group.

Heat transfer

Skin temperature in the unwarmed patients was approximately 33°C, which is typical. Forced-air warming increased mean skin temperature by around 2°C. Skin temperature in the Actively Warmed patients thus remained well below core temperature but heat transferred by the warmer combined with metabolic heat production was sufficient to increase core temperature; in contrast, core temperature consistently decreased in the others.

Babies born to mothers who were actively warmed remained a full degree centigrade warmer than those born to unwarmed mothers.

The half-hour delay before core temperature began to increase in the Actively Warmed patients is an intrinsic feature of cutaneous warming noted in other studies. Delayed transfer of heat applied to the skin surface is the major reason that core to peripheral heat redistribution dominates core temperature changes during the initial hour after the induction of anaesthesia—with or without surface heating. For the same reason, postoperative rewarming is faster in patients with residual spinal anaesthesia than in those recovering from general anaesthesia.

Because even mild hypothermia may cause adverse outcomes, there is more or less a consensus that efforts should be made to maintain intraoperative core temperature greater than 36°C. Blood loss is larger in patients at 36°C than those at 36.5°C.

Pre-warming is effective in preventing redistribution hypothermia after both epidural and general anaesthesia.

In summary

Perioperative forced-air warming of women having caesarean deliveries with epidural anaesthesia prevented maternal and fetal hypothermia, reduced maternal shivering, and improved umbilical vein pH.

The clinical implication is that women undergoing caesarean delivery with epidural anaesthesia benefit from active warming. This study recommends active warming in all women undergoing caesarean delivery with high risk of bleeding, difficulty with wound healing, and cardiac problems and especially in cases of emergency caesarean delivery.

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