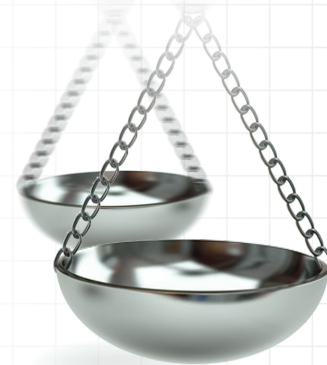




Core temperature monitoring during cesarean delivery under spinal anesthesia: a quality improvement descriptive study

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Aim: To analyze intraoperative temperature change over time following spinal anesthesia for cesarean delivery using temperature enabled Foley catheters. **Materials & methods:** 512 records of women who underwent scheduled cesarean deliveries were retrospectively identified from January 1, 2018 through September 9, 2018 using our anesthesia information management system. **Results:** Median minimum temperature at min 1 following foley insertion was 35.24°C (interquartile range: 1.43), with an average of 12 minutes until temperature equilibration at median maximum temperature of 36.54°C (interquartile range 0.39). Temperature dropped to a nadir of 35.9°C at the 45 min mark, reflecting an average 0.64°C decline in temperature. **Conclusion:** Bladder temperature is a useful surrogate for core temperature and offers a practical solution to continuous temperature monitoring in awake patients.

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The incidence of hypothermia might be as high as 91% in women receiving spinal anesthesia for cesarean delivery [1]. Hypothermia has long been implicated in adverse outcomes in the surgical patient, including increased risks of wound infection, myocardial ischemia and coagulopathy [2]. Neonatal hypothermia, which may be caused by maternal hypothermia, is associated with significant neonatal morbidity and mortality [3]. Despite this, routine temperature monitoring by anesthesiologists during regional anesthesia is as low as 33% [4], perhaps in part due to the challenge of monitoring core temperature at common sites like the distal esophagus or nasopharynx in an awake patient. Previous studies involving temperature monitoring during cesarean deliveries are limited, relying on temperature snapshots in time, or in one instance, an invasive continuous monitoring technique through use of an ingested intestinal temperature sensor [5].

Our institution has adopted use of temperature-enabled Foley catheters during cesarean deliveries as the standard of care, allowing for a continuous measurement of core temperature as part of routine intraoperative care. Herein, we conducted a quality improvement observational study to analyze intraoperative temperature change over time following spinal anesthesia for cesarean delivery.

Materials & methods

Using our anesthesia information management system, we retrospectively identified records of women who underwent scheduled cesarean deliveries under spinal anesthesia at our institution from 1 January 2018 to 9 September 2018, during which temperature monitoring Foleys were utilized as part of routine clinical practice. For cesarean deliveries, our standard spinal anesthesia medications included 1.6 ml of 0.75% hyperbaric bupivacaine with 8.25% dextrose, 20 mcg fentanyl and 200 mcg preservative-free morphine. An infusion of phenylephrine at 50 mcg/min was immediately started upon placing the patient supine with left uterine displacement and then titrated to maintain a systolic blood pressure within 10% of baseline. Active warming was performed with an underbody warming blanket, started after placing the patient supine. Ambient operating room temperature was maintained at 25°C as per WHO recommendations [6].

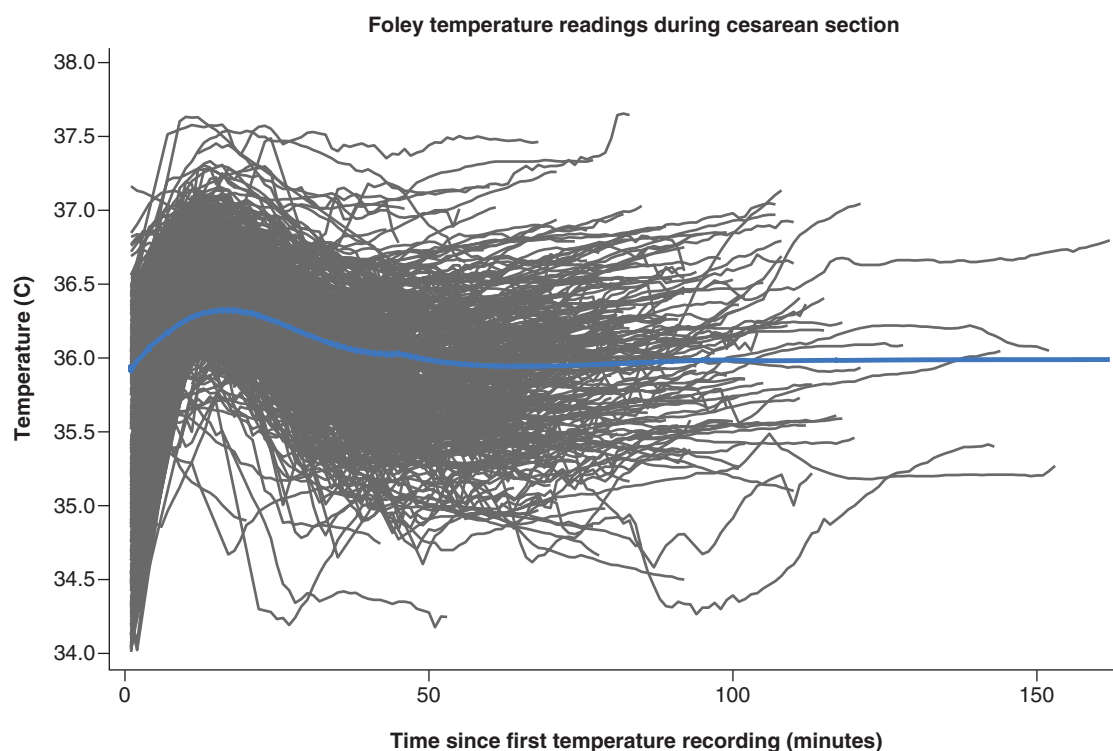


Figure 1. Locally weighted scatterplot smoothing graph of bladder temperature versus time following Foley catheter insertion.

Temperature measurements were automatically recorded every 15 s from time of Foley insertion immediately after neuraxial placement until surgical end. Data for individual patients was modeled using a locally weighted scatterplot smoothing graph of temperature versus time. Additional descriptive outcomes included time of rise to maximum temperature following Foley insertion, time to minimum temperature nadir following Foley insertion and minimum temperatures recorded. This project was approved by the Institutional Review Board of Weill Cornell Medical College.

Results

There were 512 patients included in the analysis. The median age was 36 years (interquartile range [IQR]: 33–39), and the median BMI was 29 (IQR: 26–33). Median minimum temperature at min 1 following Foley insertion was 35.24°C (IQR 1.43), with an average of 12 min until temperature equilibration at median maximum temperature of 36.54°C (IQR 0.39). Temperature dropped to a nadir of 35.9°C at the 45 min mark, reflecting an average 0.64°C decline in temperature. (Figure 1).

Discussion

Maternal hypothermia is common during cesarean delivery and may be associated with adverse maternal and neonatal outcomes [2,3]. However, intraoperative temperature monitoring is infrequently performed, in part due to difficulty measuring core temperature in an awake patient [4], likely limiting provider awareness of hypothermia and efforts to actively warm patients.

Our study offers a descriptive account of intraoperative temperature change over time during cesarean delivery. We observed a slight increase in temperature after Foley insertion followed by a steady decline. This initial ramp-up in temperature is likely device-related as previous studies examining temperature measurement at other sites (e.g., gastrointestinal) have also reported an initial increase in temperature reading [5]. Notably, we also observed a 0.64°C temperature drop over 45 min following Foley insertion to a nadir of 35.9°C, which is a similar finding to previously published temperature changes after neuraxial anesthesia during cesarean delivery [3]. We did not analyze postdelivery temperature readings as temperature monitoring in recovery was not a standardized process at our institution.

Conclusion

Bladder temperature is a useful surrogate for core temperature when urine flow is adequate and offers a practical solution to continuous temperature monitoring in awake patients [7]. Future studies should be aimed at describing broader perioperative temperature changes with the goal of improving recognition and management of hypothermia, and assessing whether maintenance of normothermia can be improved with this simple monitoring modality.

Summary points

- Previous studies involving temperature monitoring during cesarean deliveries are limited, relying on temperature snapshots in time or invasive continuous monitoring techniques.
- At our institution, we adopted use of temperature enabled Foley catheters during cesarean deliveries as the standard of care, allowing for a continuous measurement of core temperature as part of routine intraoperative care.
- Analysis of intraoperative temperature change over time following spinal anesthesia for cesarean delivery showed a 0.64°C temperature drop over 45 min to a nadir of 35.9°C, which is a similar finding to previously published temperature changes after neuraxial anesthesia during cesarean delivery.
- Bladder temperature is a useful surrogate for core temperature when urine flow is adequate, and offers a practical solution to continuous temperature monitoring in awake patients.

Financial & competing interests disclosure

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

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