

All patients having general or regional anesthesia should have a perioperative temperature management plan. Usually this plan will indicate the maintenance of normothermia (37°C). In specific cases, the plan will specify therapeutic hypothermia. The plan must be appropriate to patient and procedure.

The following steps offer suggestions for a protocol for using Bair Hugger<sup>®</sup> and Ranger<sup>®</sup> systems to maintain normothermia in those surgical patients for whom therapeutic hypothermia is not indicated.

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**1. Preprocedural warming should be considered for surgical and interventional patients, unless hypothermia is a desired condition.**

Rationale:

- Core temperature drop -1.6°C, on average, in the first hour following the induction of general or regional anesthesia.<sup>12,13</sup>
- As little as 15 minutes of forced-air warming is sufficient to reduce the severity of redistribution temperature drop.<sup>17</sup>
- Using forced-air warming prevents the decline in temperature associated with redistribution heat loss and decreased metabolic heat production.<sup>12,13</sup>

**2. All patients having general or regional anesthesia should have their core temperature monitored every 10-20 minutes or according to established institutional protocols.**

Rationale:

- Anesthetized patients cannot regulate their temperature.<sup>17</sup>
- Temperature should be monitored to record trends and allow for intervention when the temperature has the potential to fall below 36°C.
- Core temperature less than 36°C is associated with many adverse outcomes.<sup>1-8</sup>

**3. Core temperature should be maintained above 36°C (96.8°F) throughout the perioperative period.**

**Patients who fall below 36°C should be treated with forced-air warming.\***

Rationale:

- Published, peer-reviewed studies show that a core temperature of less than 36°C results in adverse outcomes for surgical patients. Outcomes decline in a linear fashion as temperature drops below 36°C: including increased blood requirements,<sup>1</sup> wound infection,<sup>2</sup> hospital stays,<sup>2</sup> myocardial morbidity,<sup>3,4</sup> mortality,<sup>5,6,7</sup> and discomfort.
- Forced-air warming is the most clinically effective warming modality and it transfers the greatest amount of heat as compared to other warming modalities.<sup>8,9</sup>
- A meta analysis of 18 published studies shows that a core temperature of 1.5°C below normal causes many adverse outcomes resulting in associated per patient costs of \$2,500 to more than \$7,000 on average.<sup>9</sup>
- 36°C has been recommended as a minimum core temperature in surgical patients.<sup>10</sup>

**4. All patients at risk of hypothermia, including mild hypothermia, should be treated with forced-air warming.\***

**Some risk factors for hypothermia are:**

- Expected major fluid or blood losses
- Large volume irrigation
- Major body cavity exposure during surgery
- Pediatric patients
- Elderly patients

Rationale:

- Core temperature drops -1.6°C, on average, in the first hour after induction of general or regional anesthesia.<sup>12,13</sup> Most of this heat loss is from anesthesia-caused vasodilation, which results in redistribution of heat from the body core to the colder periphery.
- Forced-air warming is the most clinically effective warming modality and it transfers the greatest amount of heat as compared to other warming modalities.<sup>8,9,18</sup>
- Using forced-air warming prevents declines in temperature associated with redistribution heat loss and decreased metabolic heat production.<sup>12,13,18</sup>

\*When using forced-air warming, follow manufacturers' instructions for use, indications, contraindications and warnings.

**5. Blood and infused fluids should be warmed when the expected infusion rate exceeds 1 liter per hour.**

Rationale:

- The administration of unwarmed fluids can cause reductions in body temperature. Each liter of intravenous fluid infused at ambient temperature into adult patients, or each unit of blood infused at 4°C, decreases the mean body temperature approximately 0.25°C. This cooling effect is cumulative - increasing amounts of cold infused fluids causes greater declines in patient temperature.<sup>8</sup>
- Published, peer-reviewed studies use forced air-warming in combination with fluid warming to maintain normothermia in surgical patients.<sup>1-3</sup>
- Rapid infusion of cold blood via a central venous catheter may cause cardiac arrhythmias or even arrest.<sup>14</sup>
- Cold blood is viscous, difficult to infuse, and worsens peripheral vasoconstriction.<sup>12</sup>

**6. Patients who have core temperatures less than 36°C upon admission to the PACU or ICU should be warmed with forced-air warming.**

Rationale:

- See Number 3 and Number 4
- The mean duration of post-operative shivering is reduced in patients warmed by forced-air warming compared to warm cotton blankets.<sup>15</sup>

**7. Patients should not be discharged from the PACU or ICU unless their core temperature is greater than 36°C.**

Rationale:

- See Number 1, Number 3, and Number 4.
- The duration of PACU stay is directly related to patient temperature.<sup>16</sup>

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