

Patient Temperature Management

Background

Patient temperature management includes active body surface warming (ABSW) to maintain normothermia in the perioperative period, initiating targeted temperature management (TTM) for victims of cardiac arrest and stroke, or rewarming after a hypothermic event.^{1,2} Conductive warming occurs when a warm surface comes in contact with the patient's skin. Reflective warming occurs when a product captures and contains the patient's own body heat. Convective warming is the transfer of heat from a heat source to the patient via circulating air flow.² TTM is achieved via body surface cooling (where circulating water cools pads attached to the patient's body), endovascular cooling (an invasive technique using catheters), or with cold saline fluids and ice bags.¹

Professional Society Statements

The 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care recommend TTM "for all patients who do not follow commands after return of spontaneous circulation (ROSC) to ensure optimal functional and neurological outcome."³ This includes out-of-hospital arrest with any rhythm, and in-hospital arrest with initial shockable or non-shockable rhythm.³

The 2019 Association of periOperative Registered Nurses (AORN) Guideline for Prevention of Hypothermia, the Enhanced Recovery After Surgery (ERAS) Society (2019), and the Association of Surgical Technologists (2019) have recommended the implementation of strategies to prevent or treat hypothermia for all patients undergoing surgery, during all phases of perioperative care, including preoperative.^{2,4,5}

The 2018 World Health Organization (WHO) Global Guidelines for Prevention of Surgical Site Infection and the 2017 Centers for Disease Prevention and Control (CDC) Guideline for the Prevention of Surgical Site Infection both recommend maintaining normothermia in the perioperative period as a prevention strategy.^{6,7}

The Neurocritical Care Society provided guidance on the implementation of TTM in 2017. TTM is best supported by evidence in neonatal hypoxic-ischemic encephalopathy and out of hospital cardiac arrest. TTM has also been studied in ischemic stroke, intracranial hemorrhage and traumatic brain injury.⁸

The National Institute for Clinical Excellence (NICE) offered guidelines on prevention and management of hypothermia in adults having surgery in 2016.⁷ Recommendations included use of various methods to maintain a temperature goal of 36.0°C. Warming should start in the preoperative phase and continue through the intraoperative phase. For those situations in which a forced-air warming device (FAW) is unsuitable, a resistive heating mattress or blanket may be used.⁹

Clinical Evidence

- A 2020 meta-analysis of the effect of perioperative active body surface warming (ABSW) on analgesic and clinical outcomes reviewed 54 studies that included 3,976 patients. ABSW maintained normothermia, and increased patient satisfaction, reduced blood transfusions, shivering, and wound infections. No significant differences were found in fluid administration, blood loss, major adverse cardiovascular events, or mortality. Benefit was greater in abdominal surgeries than cesarean deliveries or neuro/spine surgeries.¹⁰

- A 2016 systematic review of 67 trials and 5,438 participants found trials varied widely related to type of participants, surgical interventions, anesthesia management, co-interventions, and timing of outcome measurement. Risk of performance bias was rated as high. Trials that compared ABSW systems versus control showed a reduction in surgical site infections. Impact on transfusion or total fluids infused during surgery was not significant. ABSW reduced shivering and thermal comfort. The review found no evidence for superiority between different types of ABSW, except for pre-warming in the preoperative phase for patients undergoing major abdominal surgery. There was no evidence that ABSW poses significant risk to patients.¹¹
- A 2016 meta-analysis of 11 studies on the use of therapeutic hypothermia (TH) following cardiac arrest, demonstrated decreased mortality and improved neurological outcomes even with expanded use, defined as those patients with non-shockable rhythms, longer downtimes, unwitnessed arrest and/or persistent shock. While guidelines support a target temperature of 33–34°C, no evidence existed to support an optimal hypothermic protocol with a fixed target temperature. Expanded use of TH may be appropriate in patients with good baseline functional status.¹²

Physician Feedback

HealthTrust Physician Advisors from Surgery, Anesthesia and Critical Care specialties provided input into this evidence summary and expertise from their clinical practice.

- Important product features include simplicity of operation, efficacy, accuracy, safety, reusability, rapid time to target temperature, and temperature feedback systems with servo control and gradient temperature changes. Products should address a variety of patient sizes and positions, with the ability to be used as pre-warming in holding areas. Optimal choice of normothermia or TTM device depends on the clinical situation and needs of the patient.¹³
- For TTM, gel pad systems are efficacious, but may have limitations in obese patients and contraindications in patients with burns. Risks may include skin irritation and allergic reactions. Intravascular cooling devices are efficacious and without limitations related to obesity/burns. Central line (CL) placement is required and may delay initiation of therapy. Procedural risks may include infection, deep vein thrombosis, bleeding, pneumothorax related to CL. Temperature feedback systems with servo-controls and gradient temperature changes offer unique features and favorability over cooling blankets, ice packs, or chilled intravenous fluids.
- For perioperative normothermia, FAW and warming contact pads/blankets have similar efficacy. However, concerns were expressed related to the risk of burns with contact pads/blankets as well as FAW when placed outside of intended use. FAW has been shown to increase particulates in the OR, but evidence has not demonstrated an increased wound infection rate.

Considerations

This category includes a multitude of products and suppliers with various features available on each system. Engaging with your nursing staff, surgeons, anesthesiologists, and critical care physicians in the value analysis process may be beneficial and would assist in ensuring the appropriate system is selected based on patient population and requirements.

References

1. Vaity C, Al-Subaie N, Cecconi M. Cooling techniques for targeted temperature management post-cardiac arrest. *Critical Care*. 2015;19:103. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4361155/>
2. Association of Surgical Technologists. AST guidelines for best practice in maintaining normothermia in the perioperative patient. 2019. https://www.ast.org/AboutUs/Surgical_Technologists_Responsibilities/
3. Panchal AR, Bartos JA, Cabana JG, Donnino MW, Drennan IR, Hirsch KG, et al. Part 3: Adult basic and advanced life support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2020;142(16)Suppl 2:S366-S468. <https://www.ahajournals.org/doi/10.1161/CIR.0000000000000916>
4. AORN. The Guideline for Prevention of Hypothermia. AORN eGuideline. July 2019. <https://www.aornguidelines.org/guidelines/content?sectionid=173731777&view=book#221440272>
5. Wainwright TW, Gill M, McDonald DA, Middleton RG, Reed M, Sahota O, et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS) Society recommendations. *Acta Orthopaedica*. 2019; 91:3-19. <https://www.tandfonline.com/doi/full/10.1080/17453674.2019.1683790>
6. World Health Organization. Global guidelines for the prevention of surgical site infection. 2018. Accessed 2.15.21. <https://www.who.int/infection-prevention/publications/ssi-prevention-guidelines/en/>
7. CDC. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection. *JAMA Surgery*. 2017;152(8): 784-791. Accessed 2.15.21. <https://www.cdc.gov/infectioncontrol/guidelines/ssi/index.html>
8. Madden LK, Hill M, May TL, Human T, Guanci MM, Jacobi J, et al. The implementation of targeted temperature management: An evidence-based guideline from the Neurocritical Care Society. *Neurocritical Care*. 2017;27:468-487. <https://pubmed.ncbi.nlm.nih.gov/29038971/>
9. National Institute for Health and Care Excellence. Hypothermia: Prevention and management in adults having surgery. 2016. <https://www.ncbi.nlm.nih.gov/books/NBK554181/>
10. Balki I, Khan JS, Staibano P, Duceppe E, Bessissow A, Sloan EN, et al. Effect of perioperative active body surface warming systems on analgesic and clinical outcomes: A systematic review and meta-analysis of randomized controlled trials. *Anesthesia & Analgesia*. 2020;131(5):1430-1443. <https://doi.org/10.1213/ane.0000000000005145>
11. Madrid E, Urrutia G, Roque I Figuls M, Pardo-Hernandez H, Campos JM, Paniagua P, et al. Active body surface warming systems for preventing complications caused by inadvertent perioperative hypothermia in adults (Review). *Cochran Database of Systematic Reviews*. 2016. Issue 4. Art.No.:CD009016. <https://www.cochranlibrary.com/cdsr/doi/10.1002/14651858.CD009016.pub2/full>
12. Schenone AL, Cohen A, Patarroyo G, Harper L, Wang X, Shishehbor MH, et al. Therapeutic hypothermia after cardiac arrest: A systematic review/meta-analysis exploring the impact of expanded criteria and targeted temperature. *Resuscitation*. 2016;108:102-110. <https://doi.org/10.1016/j.resuscitation.2016.07.238>
13. 2021 Physician Advisor Network: Surgery, Anesthesia and Critical Care specialties. Collected 3/2/21 and 3/16/21.