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Education & Clinical Resources

Clinical Evidence Summary

Patient Temperature Management

This Clinical Evidence Summary was developed to provide a synopsis of the current clinical literature and study data specific to products available in the United States for ***Patient Temperature Management***.

Optimizing clinical outcomes includes patient temperature management, whether 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] Options exist for patient temperature management. 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 recommended the implementation of strategies to prevent or treat hypothermia for all patients undergoing surgery, during all phases of perioperative care, including preoperative. Strategy selected should be a collaborative decision based on patient specific factors, type/duration of surgical procedure and planned anesthesia, patient positioning, use of pneumatic tourniquet or intermittent pneumatic compression device, equipment constraints, and potential for adverse events. A combination of active or active and passive methods may be used.[4]

In 2019, the Enhanced Recovery After Surgery (ERAS) Society recommended maintaining normal body temperature peri- and post-operatively through pre-warming followed by active warming during surgery.[4] Use of forced-air warming (FAW) is not recommended for patients undergoing total hip or knee arthroplasty due to some evidence showing an increased risk of infection.[5]

Summary

- Active body surface warming (ABSW) prevents hypothermia in the perioperative period, and its use is recommended by multiple professional societies.
- Methods for ABSW include conductive, convective and reflective strategies.
- No evidence supports superiority of one ABSW method over another.
- Mixed evidence exists regarding the impact of forced-air warming (FAW) on surgical site infection due to disruptions in unidirectional downward laminar flow in the operating room.
- ERAS Society recommends against FAW methods for patients undergoing total hip or knee arthroplasty.
- The American Heart Association recommends TTM following ROSC after cardiac arrest, as it improves mortality and neurological function.
- TTM has been used to minimize neurologic injury in adults with stroke, and in neonates with hypoxic-ischemic encephalopathy.

Also in 2019, the Association of Surgical Technologists recommended perioperative warming of the surgical patient via forced-air warming, circulating-water device and/or conductive/resistive devices (heating pads, warming mattresses and energy transfer pads).[2] The chosen method should include both passive and active warming, be based on patient factors, planned surgical procedure, and patient position—without impeding access to both the surgical and intravenous access sites.[2]

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]

- A 2014 literature review of 10 experimental studies compared airflow disruption and microbial contamination for forced-air warming (FAW) against that of other warming devices. Two studies involved

human subjects, and one included retrospective hospital surgical infection rates. Only one retrospective study found an increased infection rate when FAW was used, but causative variables were not isolated, and differences in prophylaxis antibiotic regimens existed. Most studies were biased due to affiliation with manufacturers. The review found insufficient evidence to suggest delaying or discontinuing forced-air warming. Authors advised some form of patient warming must be used; FAW if that is the only warming method, or substitute with other effective methods, if available.[13]

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.

- 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. Engaging with your surgeons, anesthesiologists and critical care physicians in the value analysis process may be beneficial and would assist in ensuring compliance in this category.

Product Features

This category has a number of suppliers with various features available on each system. HealthTrust members have exclusive access to a product features document found within the contract package on the Member Portal. If you do not have access to the Member Portal, contact your local supply chain administrator or HealthTrust Account Manager to request a copy of product features document.

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