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Warming Blankets and Patient Harm

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Introduction

In August 2017, following news coverage of a pediatric patient's death associated with use of a warming blanket, the Pennsylvania Patient Safety Authority received inquiries about patient harm associated with these devices. In response, analysts queried the Pennsylvania Patient Safety Reporting System (PA-PSRS) database for reports of patient safety events involving warming blankets.

Methods

Analysts queried the PA-PSRS database for events containing the following terms: warming blanket, warmed air blanket, water blanket, circulating water, warming device, warmer, and Bair Hugger (including misspellings). The database was searched for event reports from the beginning of the PA-PSRS reporting program in July 2004 through August 2017. Analysts reviewed each of these events individually to identify event reports resulting in harm or potential harm associated with the use of warming blankets and exclude reports of warming blankets/devices mentioned incidentally.

For this article, the term "warming blanket" or "warming device" includes any powered devices (e.g., forced air warming blankets, circulating water blankets, resistive heating blankets) and excludes warmed blankets (i.e., blankets warmed in a heating cabinet).

Results

Pennsylvania hospitals reported 278 events from July 2004 through August 2017 resulting in harm or potential harm to patients associated with the use of warming blankets. Of these, 11 events (4%) were reported as Serious Events resulting in harm up to and including death. Preliminary review of all events revealed thermal injury to be the most frequently reported patient harm (36%; n = 100). Examples of patient harm or potential harm identified in event reports include hyperthermia, hypothermia, skin tears, and/or irritation from adhesives, and equipment problems.

The following are examples of events reported to PA-PSRS that describe each of these types of harms.*

Thermal Injuries

Patient put on warming blanket in the evening. An hour and a half later, the tubing to blanket was found disconnected and was reconnected. Skin checked every 30 minutes with temperature checks. Patient off blanket after five hours. Upon repositioning patient in the morning, patient found to have a large blister on the left medial aspect of shin.

When the patient was moved after appendectomy, it was discovered that the patient had been lying directly on top of the warming blanket. The patient's skin was very red and a small reddened area was noted on the right buttock. No blistering noted.

Hyperthermia

The adult patient, who is unresponsive and unable to orient at baseline, had a temperature of 94.5°F [34.7°C] in the morning and a forced-air warming blanket was placed. That evening, the patient was found to have temp of 106.1°F [41.2°C]. The warming blanket was removed and the patient was packed with ice. The patient remained unresponsive with shallow respirations and their temperature decreased through the evening, reaching 100.5°F [38.1°C] late that night, and 98.8°F [37.1°C] the following morning.

The patient's rectal temperature probe reading was 37.2°C [99.0°F]. The forced-air warming blanket settings were adjusted to maintain a temperature of 36-37°C [96.8-98.6°F]. The patient was noted to be tachycardic, with elevated blood pressure and reddened skin. The axillary temperature was found to be 39.5°C [103.1°F]. The rectal temperature probe cable connected to the monitor was then replaced and found to match the axillary temperature. Cable sent to biomedical engineering.

Hypothermia

At the end of the surgical procedure, it was discovered that the warming blanket [sic] had been set to 40° Fahrenheit instead of Celsius so the patient was being cooled instead of warmed during the case. The lowest temperature recorded during the case was 34.7°C. Patient was taken to the intensive care unit postoperatively.

The patient's temperature was reported to be 97.1°F [36.2°C] when last checked in the post-anesthesia care unit after the forced-air warming blanket was removed. When the patient reached the intensive care unit, rectal temperature was 95.4°F [35.2°C], and the patient was confused and lethargic. Another warming blanket was obtained and placed on patient with temperature and vital sign monitoring every 30 minutes. The patient's temperature returned to normal after two hours. In the future, patients should remain in the post-anesthesia care unit for 30 to 60 minutes after the warming blanket has been removed to confirm they are maintaining their core body temperature prior to transfer.

Skin Tears and/or Irritation from Adhesives

Upon removal of the warming blanket, a skin tear was noted across the patient's chest from the adhesive strip on the blanket.

During the preoperative time-out, the nurse reported that the patient had an allergy to adhesive and that it blistered the skin. During the procedure, the warming blanket adhesive was placed directly on the skin and adhesive bandages were used. The patient's skin became red, irritated, and developed blisters.

Equipment Problems

The surgical procedure was underway when an unusual smell was noted in the operating room. The nurse anesthetist identified sparks and smoke coming from the warming blanket. The device was removed from the room immediately. The heating source was not connected to the patient at the time, and the patient was not harmed.

The warming blanket was turned on during the surgical procedure and water was heard dripping on the floor. The warming blanket connections were checked and found to be correctly connected. The water was found to be dripping from blanket itself and presumed to be due to a hole in the blanket. The warming blanket and sheets against the patient's skin were wet and could not be removed during the procedure.

* The details of the PA-PSRS event narratives in this article have been modified to preserve confidentiality.

Discussion

Warming blankets apply heat to the body through convection (i.e., forced-air warmers or circulating water devices), or direct-contact thermal conduction (i.e., low voltage electrical current passed through a material that produces heat).[1] These devices are most commonly used to warm patients in the perioperative setting, and forced-air warming is the most commonly used modality.[1] Because of this, guidelines for warming-blanket use are included in protocols for preventing and treating hypothermia in the perioperative care setting.[2-9] However, literature and guidelines for use of these devices in other care settings are lacking.[10,11]

Patients with disordered central temperature control may be at greater risk of developing hyperthermia while being treated with warming devices.

Risk Reduction Strategies

The following risk reduction strategies can prevent patient harm associated with the use of warming blankets.

- Provide education to all clinicians caring for patients with hypothermia about clinical indications for, and proper use of warming blankets.[5,7]
- Establish protocols for the use of warming blankets that are consistent with evidence-based guidelines and manufacturers' guidelines for device use.[12]
- Ensure that all clinicians operating warming blankets are trained in their proper use, including interventions required to adequately monitor the patient and prevent harm.[4,7]
- Consider using warming blankets only in clinical-care areas where body temperature and clinical condition can be monitored continuously (i.e., intensive care unit, operating room, postanesthesia care unit, emergency department).[10,11]
- Closely monitor and carefully assess patients treated with warming blankets who are unable to communicate their comfort level.[2]
- Use a consistent method and anatomical site to directly measure or estimate core body temperature in patients being treated with warming blankets every 15 to 30 minutes, or continuously when possible.[2,6,8,13]
- Take steps to prevent thermal injury as specified in manufacturer's guidelines for device use. For example—
    - Place a sheet between the patient's skin and all-vinyl circulating water blankets[14]
    - Ensure that the hose is always connected to the blanket when using forced-air warming devices[12,13]
    - Do not position patients on top of direct-contact thermal conduction blankets that are designed to cover patients[15]

Conclusion

Pennsylvania hospitals have reported patient safety events resulting in harm or potential harm to patients associated with the use of warming blankets. Hospitals seeking to prevent these adverse events are encouraged to adopt hospital-wide risk reduction strategies consistent with perioperative guidelines for preventing and treating hypothermia and manufacturers' guidelines for device use and preventative maintenance.

Notes

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