

Date: May 8, 2012

Title: The Use of a Warm vs. Room Temperature Irrigation among Pediatric Patients Undergoing Urologic Endoscopy

Clinical Question:

- P (Population/Problem) Among pediatric patients undergoing urologic endoscopy
- I (Intervention) does the introduction of warmed irrigation fluid
- C (Comparison) compared to room temperature irrigation fluid
- O (Outcome) maintain perioperative body temperature in an acceptable range?

Target Population for the Recommendation: Pediatric patients from birth through age 18 years receiving intraoperative irrigation of the genitourinary (GU) system during endoscopic procedures.

Recommendation: It is recommended that pediatric patients undergoing urologic endoscopy receive warmed (38°C/100°F) irrigation to help prevent perioperative hypothermia (Okeke, 2007, [2a]; Moore, Green, Wang, Pandit & Hurd, 1997 [2a]; Kim, Lee, Yang, Song, Koh & Park, 2009, [2a]; Board & Srinivasan, [3a]).

Note: 37°C to 39°C/98.6°F to 102.2°F is the temperature range recurring throughout the literature as optimal for irrigation (Okeke, 2007 [2a]; Kim et al., 2009 [2a], Moore et al., 1997 [2a]; Board & Srinivasan, 2008 [3a]).

Discussion/Summary of Evidence Related to the Recommendation:

A total of nine studies addressed the identified topic under evaluation. Studies evaluated the relationship between irrigation temperature and patient core temperature response. Irrigation was instilled during various endoscopic procedures including transurethral resection, shoulder arthroscopy, percutaneous nephrolithotomy, abdominal laparoscopy and cystoscopy. Core temperatures were monitored pre-, intra- and post-operatively in each case. Findings indicated that patients who received ambient fluids experienced statistically significant decreases in perioperative temperature as compared to the patients who received warmed irrigation fluid (Okeke, 2007 [2a]; Kim et al., 2009 [2a]; Moore et al., 1997 [2a]; Board & Srinivasan, 2008 [3a]).

Six articles directly addressed the impact of warmed irrigation fluid among patients GU procedures including transurethral resection, percutaneous nephrolithotomy, and cystoscopy (Okeke, 2007 [2a]; Mirza, Panesar, Au-Yong, French, Jones, & Akmal, 2007 [4a]; Lloyd, Kirk, Deane, & Kyle, 1992 [4a]; Winter, 1994 [4b]; Meyers & Oh, 1976 [5a]; Nelson & Kinder, 1979 [5a]). Non-GU surgeries were the context of three studies and included shoulder arthroscopy (Board & Srinivasan, 2008 [3a], Kim et al., 2009 [2a]) and gynecologic laparoscopy (Moore et al., 1997 [2a]). Additional outcomes associated with decreased patient temperature during the perioperative period included patient post-operative shivering, patient complaints of feeling cold, and prolonged recovery time.

A limitation of the evidence was the lack of pediatric specific studies. Of the articles reviewed, only two addressed pediatric patients (Meyers & Oh, 1976 [5a]; Nelson & Kinder, 1975 [5a]).

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SUPPORTING INFORMATION

Endoscopic examination of the GU system under anesthesia (e.g., cystoscopy, ureteroscopy and nephroscopy) requires irrigation to aid in visualization. In our institution operating room (OR) supplies, including irrigation fluids, remain in a storage area until needed for a procedure. The storage area is maintained at 20°C/68°F ambient air temperature therefore fluids stored there and subsequently introduced during endoscopic procedures without warming are grossly below body temperature.

Pediatric patients are at higher risk for intraoperative hypothermia (core body temperature less than 36°C/98.6°F) than adults since their regulatory abilities are immature and are less effective (Behrman, Kleigman, & Jensen, 2005 [5]; Tander, Baris, Karakay, Ariturk, Rizalar, & Bernay, 2005 [5]). In addition pediatric patients have a reduced weight-to-body surface-area ratio and greater heat loss from the head as compared to adults, due to a thin skull and scalp (Tander et al., 2005 [5]). Hypothermia in infants is associated with increased mortality and morbidities, including hypoglycemia, respiratory depression, hypoxia, increased wound infection rates, cardiac arrhythmias and coagulation defects (Behrman et al., 2000 [5]; Galante, 2007 [5]). Intraoperative hypothermia is also linked to inhibition of platelet activation, altered medication metabolism, and extended post anesthesia care unit (PACU) stays (Tander, et al., 2005 [5]).

Professional organizations such as Association of periOperative Nurses (AORN) and American Association of PeriAnesthesia Nurses (ASPAN) now include warming of irrigation fluids within their practice guidelines for prevention of intraoperative hypothermia (AORN, 2012 [5], ASPAN, 2009 [5]).

A meta-analysis of outcomes related to intraoperative hypothermia found fewer adverse consequences during the intraoperative period among patients who maintained normothermia. In addition to improved physical outcomes, these results decrease final costs (Brown Mahoney & Odom, 1999 [1a]).

Intentional warming guidelines for irrigation fluids obtained from D. Schmitz of Baxter Healthcare Corporation (personal communication, February 12, 2012 [5]) state irrigation fluids can be warmed in their plastic over-pouches to temperatures not exceeding 40°C/104°F for a period no longer than 14 days.

The warming cabinets used at CCHMC include upper compartment and single compartment controls which include IV and irrigation/blanket mode setting switches, limiting temperature set ranges from 32.2°C to 43.3°C/90°F to 110°F and 43.3°C to 71.1°C/90°F to 160°F respectively to decrease potential for administration of overheated fluids. The controls monitor and regulate the heating of the compartments. The manufacturer states that the control for upper or single compartment ensures a temperature accuracy of $\pm 3^\circ\text{F}$ (Steris Corporation, 2012 [5]).

Definitions:

Normothermia – core body temperature of 36°C to 38°C/98.6°F to 100.4°F

Hypothermia – core body temperature recorded is at or below 36°C/98.6°F

Applicability Issues:

- *Population:* Small patients and pediatric patients undergoing complex and/ or longer procedures are more likely to experience hypothermia as a result of room temperature irrigation. However, the potential for improved outcomes for all pediatric patients leads to the recommendation for warming irrigation fluids for all patients. Additional costs could be incurred to purchase equipment such as warming cabinets to carry out this recommendation.
- *Storage and supply concerns:* The proper temperature and timeframe for storing fluids in a warming cabinet are based on manufacturer guidelines. Institutions will need to ensure that manufacturer guidelines are followed to ensure patient safety. Therefore warming cabinet temperatures will need to be monitored on a daily basis by OR staff and verified by clinical engineering per the institution's routine equipment maintenance schedule. A system for stocking and rotating fluids kept in the warming cabinet will need to be developed, implemented and monitored to ensure that fluid storage duration does not exceed the manufacturer's guidelines.
- *Staff education:* Staff will need to be educated regarding the use of warmed irrigation.
- *Administration of warmed fluids:* Institutions will need to develop a guideline for the proper implementation of this recommendation. Guidelines will need to address the timing of retrieving warmed fluid to minimize time until administration, documentation in the electronic medical record and monitoring of patient temperature.

Outcome or Process Measures:

Temperatures are measured routinely throughout the patient's perioperative visit: pre-op, continuously through the operative procedure, and upon admission to the PACU. Documentation of perioperative temperature fluctuation can be obtained by reviewing the patient's electronic medical record. Verification of temperature of OR warming units to 37.7°C/100°F and irrigation fluids within those units is necessary to maintain patient normothermia and prevent burns by administration of overheated fluids.

Outcome measurements to be considered may include:

- Decreased hypothermia in neonates and/or pediatric patients undergoing extensive endoscopic procedures
- Decreased number of post-operative patients requiring rewarming interventions while in the OR (e.g. Bair hugger, multiple warmed sheets or blankets)
- Decreased number of post-operative patients requiring rewarming interventions (e.g. multiple warmed sheets or blankets) while in PACU
- Decreased number of post-operative patients not meeting PACU discharge criteria due to perioperative hypothermia
- Rate of compliance with use of warmed irrigation fluid as evidenced by 100% of perioperative cases documenting use of warmed irrigation fluid

Search Strategy:

Keywords used: irrigant, irrigating fluid, irrigation, intraoperative hypothermia, normothermia, surgical, cystoscopy, pediatric, endoscopic, intraoperative irrigation, temperature

Databases searched: Cochrane, CINAHL and PubMed.

Filters: English

Limits: None

Date Range: All dates included

Date of last search: 2/2/2012

Listserve contacted included: NACRI and AORN with no response from hospitals/nursing (AORN) boards.

As a result of surgeon (Paul Noh) contact: 15 "academic/university based pediatric urology practices" nationally were contacted, all replied. Of these surgeon groups, eleven currently warm their irrigation fluid.

Relevant CCHMC Evidence-Based Document:

CCHMC Perioperative Services Guidelines, Title: Fluid Storage in Warmer, Effective Date 10/2010, Number G-2 provides description of process for maintaining and monitoring fluids placed in operating room warmers.

Group/Team Members:

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Conflicts of Interest were declared for each team member:

- No financial conflicts of interest were found.
 The following financial conflicts of interest were disclosed:

Note: Full tables of evidence grading system available in separate document

- [Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality](#) (abbreviated table below)
- [Grading a Body of Evidence to Answer a Clinical Question](#)

- [Judging the Strength of a Recommendation](#) (abbreviated table below, dimensions table below)

Table of Evidence Levels (see note above):

Quality level	Definition
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5a or 5b	General review, expert opinion, case report, consensus report, or guideline
5	Local Consensus

†a = good quality study; b = lesser quality study

Table of Language and Definitions for Recommendation Strength (see note above):

Language for Strength	Definition
It is strongly recommended that... It is strongly recommended that... not...	When the dimensions for judging the strength of the evidence are applied, there is high support that benefits clearly outweigh risks and burdens. (or visa-versa for negative recommendations)
It is recommended that... It is recommended that... not...	When the dimensions for judging the strength of the evidence are applied, there is moderate support that benefits are closely balanced with risks and burdens.
There is insufficient evidence and a lack of consensus to make a recommendation...	
<i>Given the dimensions below and that more answers to the left of the scales indicate support for a stronger recommendation, the recommendation statement above reflects the strength of the recommendation as judged by the development group. (Note that for negative recommendations, the left/right logic may be reversed for one or more dimensions.)</i>	
1. Grade of the Body of Evidence	<input type="checkbox"/> High <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Low
<i>Comments:</i>	
2. Safety / Harm (Side Effects and Risks)	Minimal <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Serious
<i>Comments:</i> Verification of appropriate temperature (no over warming) is essential to prevent injury/burn	
3. Health benefit to patient	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Minimal
<i>Comments:</i>	
4. Burden on patient to adhere to recommendation	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Unable to determine <input type="checkbox"/> High
<i>Comments:</i> No patient effort involved	
5. Cost-effectiveness to healthcare system	Cost-effective <input checked="" type="checkbox"/> Inconclusive <input type="checkbox"/> Not cost-effective
<i>Comments:</i> No additional cost to the institution if fluid warmers are already in place, as is true for the CCHMC operating room. No additional cost related to fluid supplies as the irrigation fluid manufacturer substantiated that fluids can be stored in a 100°F warming cabinet for up to 14 days (Baxter Healthcare Corp., 2012 [5])	
6. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates <input checked="" type="checkbox"/> Some concern of directness <input type="checkbox"/> Indirectly relates
<i>Comments:</i> Only two of the studies directly dealt with pediatric patients	
7. Impact on morbidity/mortality or quality of life	<input type="checkbox"/> High <input checked="" type="checkbox"/> Medium <input type="checkbox"/> Low
<i>Comments:</i>	

Copies of this Best Evidence Statement (BEST) and related tools (if applicable, e.g., screening tools, algorithms, etc.) are available online and may be distributed by any organization for the global purpose of improving child health outcomes.

Website address: <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/best.htm>

Examples of approved uses of the BEST include the following:

- copies may be provided to anyone involved in the organization’s process for developing and implementing evidence based care;
- hyperlinks to the CCHMC website may be placed on the organization’s website;
- the BEST may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
- copies may be provided to patients and the clinicians who manage their care.

Notification of CCHMC at EBDMinfo@cchmc.org for any BEST adopted, adapted, implemented, or hyperlinked by the organization is appreciated.

Please cite as: Cincinnati Children's Hospital Medical Center: Best Evidence Statement - The Use of a Warm vs. Room Temperature Irrigation among Pediatric Patients Undergoing Urologic Endoscopy, <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/best.htm>, BEST 134, pages 1-6, May 8, 2012.

This Best Evidence Statement has been reviewed against quality criteria by 2 independent reviewers from the CCHMC Evidence Collaboration.

For more information about CCHMC Best Evidence Statements and the development process, contact the Evidence Collaboration at EBDMinfo@cchmc.org.

Note

This Best Evidence Statement addresses only key points of care for the target population; it is not intended to be a comprehensive practice guideline. These recommendations result from review of literature and practices current at the time of their formulation. This Best Evidence Statement does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this Statement is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.