

Background

- Hypothermia is induced during cardiac surgery to preserve vital organ function while the patient is on cardiopulmonary bypass
- Core temperature “most closely reflects the temperature of the blood flow through the carotid arteries to the hypothalamus”¹
- Core temperature must be closely monitored during rewarming to prevent hyperthermia
- Standard practice is to measure a patient’s core body temperature through the bypass circuit, an upper body peripheral location and a lower body peripheral location
- There is often a significant discrepancy in the upper body and lower body temperatures
- It is imperative to know which core temperature location surrogate will provide the most accurate representation of core body temperature in the pediatric population

Collecting the Evidence

Evidence Database Search	PubMed, CINAHL, Cochrane Library
Total Electronic Search Yields	21 articles
Search Terms	Pediatrics, cardiopulmonary bypass, temperature monitoring, core body temperature, bladder temperature monitoring, and rectal temperature monitoring
Exclusion Criteria	Adult patients, studies occurring postop in the ICU
Number Included	8 articles
Number Excluded	13 articles
Evidence Critique Tool	Johns Hopkins Nursing Evidence-Based Practice Research Evidence Appraisal Tool
Hierarchy of Evidence Tool	Johns Hopkins Nursing Evidence-Based Practice Research Evidence Appraisal Tool
• Level 1	8 articles
Clinical Experts	2 expert opinions

Clinical Practice Question

In pediatric patients undergoing cardiopulmonary bypass (P), is bladder temperature monitoring (I), compared with rectal temperature monitoring (C), more accurate in measuring core body temperature (O) during the intraoperative period (T)

Key Sources of Evidence

Literature Review		
Author(s)	Year	Findings
Gabriel Amir, Chandra Ramamoorthy, R. Kirk Reimer, Frank L. Hanley, V. Mohan Reddy	2009	<ul style="list-style-type: none"> • During cooling the deep brain of neonatal pigs cooled to lower temperature faster than the rectal temperature • During rewarming deep brain temperature was significantly higher than rectal temperature and this difference was statistically significant between the two by the end of rewarming
R. A. Rodriguez, H. L. Edmonds Jr, S. M. Auden, E. H. Austin 3rd	1999	<ul style="list-style-type: none"> • Examined the effects of temperature on auditory brain response in infants during cardiopulmonary bypass • Esophageal and bladder sites were more susceptible to temperature variations as compared with tympanic membrane and nasopharynx • Body temperature monitoring underestimates the effect of rewarming on the core brain
F. H. Kern, R. A. Jonas, J. E. Mayer Jr, F. L. Hanley, A. R. Castaneda, P. R. Hickey	1992	<ul style="list-style-type: none"> • 29% of patients had a significantly lower jugular venous oxygen saturation (JvO2SAT) during cardiopulmonary bypass • A low JvO2SAT suggests a higher level of cerebral metabolism and cerebral uptake of oxygen • The most likely cause of a low JvO2SAT is inadequate cerebral cooling • Study monitored rectal and tympanic temperatures

Clinical Expertise	
Expert	Findings
Greg Matte, CCP, LP, FPP Boston Children’s Hospital	<ul style="list-style-type: none"> • Rectal temperature monitoring used • Core body temperature is primarily monitored through the bypass venous return circuit – less focused on peripheral temperatures • Rectal probes are inexpensive
Bradley Kulat, CCP, LP, FPP Ann & Robert H. Lurie Children’s Hospital	<ul style="list-style-type: none"> • Bladder temperature monitoring used • Institution decided to standardize practice between the ICU and OR and choose bladder temperature monitoring

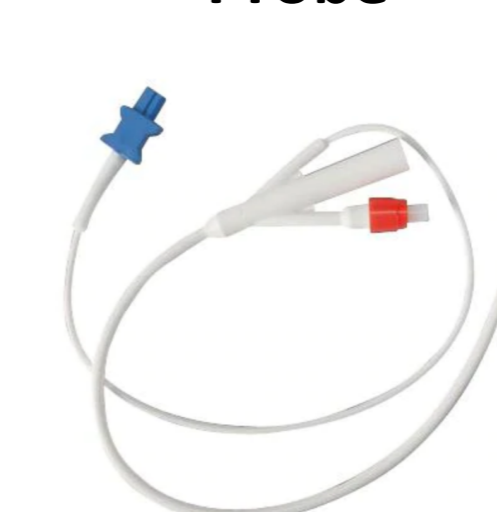
Critical Appraisal of the Evidence

- Few studies have examined differences in temperature monitoring sites and how they reflect core body temperature during the intraoperative period in pediatrics
- 7 studies used rectal temperature monitoring in their studies
 - 5 examined the adequacy of rectal temperature monitoring compared to brain temperature and concluded rectal temperature is not an adequate reflection of brain temperature in pediatrics
 - 2 used rectal temperature monitoring as a standard of practice
- 1 study examined the use of bladder temperature monitoring in the operating room and found it to be more susceptible to changes in core body temperature
- The expert opinions were based upon the standard of practice of 2 different pediatric cardiac surgery programs and were not evidence based
 - 1 institution used rectal temperature
 - 1 institution used bladder temperature

Translating Evidence into Practice

This literature review highlighted that rectal temperature monitoring may not be the most accurate representation of core body temperature however, there is insufficient evidence to support a practice change. A quality improvement initiative is warranted to examine which mode of temperature monitoring is more reflective of core body temperature in pediatrics.

Bladder Temperature Probe



Rectal Temperature Probe



References



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