A COMPARISON OF METHODS OF THERMOMETRY IN CRITICALLY ILL CHILDREN

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Current Clinical Practice

- **Tympanic thermometer (TT)**
  - Time taken: approx 3secs
  - Age group: More than 6 months
  - Location: Hospital-wide
  - Invasive: No

- **Rectal thermometer (RT)**
  - Time taken: Continuous monitoring
  - Age group: All ages
  - Location: Pediatric Intensive Care Unit (PICU) only
  - Invasive: Yes

Proposed Clinical Practice

- **No-contact temporal thermometer (NTT)**
  - Time taken: 0.5secs
  - Age group: All ages
  - Location: Hospital-wide
  - Invasive: No
Core temperature measurement (‘Gold standard’ - Invasive)

Pulmonary artery
• Highly invasive

Bladder
• Risk of urethral trauma and urinary tract infections

Esophageal / Nasopharyngeal
• Highly invasive

Rectal (RT)
• Discomfort, causes emotional distress and risk of rectal injuries

Peripheral temperature measurement (Non-invasive)

No-contact temporal thermometry (NTT)
• Measures temporal artery temperature

Axillary thermometry
Comparison of the temporal artery and rectal thermometry in children in the emergency department

327 children, age less than 24 months
Sites: rectal and temporal artery (temporal scanner and sensor touch – both of which are contact methods)

Correlation between rectal and temporal artery thermometry is not significant
Temporal thermometry cannot substitute rectal thermometry


Estimating core temperature in infants and children after cardiac surgery: a comparison of six methods

19 postoperative cardiac patients, age group not specified
Sites: pulmonary artery (PA), bladder, nasopharyngeal, rectal, tympanic and axillary

Significant differences seen between PA temperature and those from rectal, tympanic and axillary
No significant difference in temperatures between PA compared with bladder PA compared with nasopharyngeal
Mean differences from PA temperature in decreasing order: bladder, nasopharyngeal, rectal, axillary and tympanic methods

NULL HYPOTHESIS

There is no difference between (NTT-RT) and (TT-RT).

NTT – No-contact temporal thermometer
RT – Rectal thermometer
TT – Tympanic thermometer
Research design: Comparative descriptive study

Settings: KK Women’s and Children’s Hospital, Singapore

Target population: PICU patients, age more than 6 months to 16 years old

Sampling method: Convenience sample

Sampling size: 50 participants
Patients admitted to PICU
4 trained PICU nurses
1) Screen
   Age from more than 6 months to 16 years old
   Impaired forehead and anal skin integrity
   External head and cold source (e.g. warmer, bandage, cold compress)
3) Consented
   Temperature readings were performed independently and according to manufacturers' recommendations
5) Data analysis
   SPSS VERSION 14
50 participants were recruited. One was excluded from analysis due to incomplete data. Temperature was taken using each of the 3 methods (TT, NTT and RT) at 8 distinctive time points respectively. 95% confidence intervals and p-values were calculated after adjusting for the cluster effects by the use of robust standard errors.

Age of participants: 6.7 months to 16 years old with a mean age of 5.8 years (40.8% male and 59.2% female).

Mean difference of (TT-RT): -0.1°C (p value=0.01); 95% confidence interval (-0.24, -0.03)

Mean difference of (NTT-RT): 0.2°C (p value=0.049); 95% confidence interval (0.001, 0.35)

The difference in mean between TT and NTT was -0.3°C (p value<0.001); 95% confidence interval (-0.45, -0.17)

TT has a stronger correlation with RT compared to NTT (R² = 0.5 vs. 0.3)
NTT overestimate the core temperature by a mean of 0.2°C
TT underestimate the core temperature by mean of 0.1°C
There is statistically significant difference observed between the means of (NTT-RT) and (TT-RT), with p value of <0.001
15.6% of NTT readings were found to have under or over-read RT readings by greater than 1°C as compared to 4.3% of TT readings
Therefore, with such a difference, it is clinically not acceptable to use NTT

Limitations:
Repeated measurements were done on the same patient
This is a pilot study to determine the feasibility of use of NTT in the clinical setting, the sample size may be underpowered.

Clinical implication:
In a unit where temperature readings are important determinants in a child’s diagnosis and treatment plan, NTT cannot be recommended as an alternative mode of temperature measurement from this study.

