Improving the non-invasive monitoring of core temperature in infants

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INTRODUCTION:

The accurate measurement of core temperature is an essential aspect of perioperative management in the pediatric population.

Invasive measurements (e.g. esophageal, nasopharyngeal, rectal) are accurate but carry inherent risks .

A need therefore exists for a sufficiently accurate and reliable form of non-invasive thermometry.

PURPOSE:

A)Evaluate the accuracy of non-invasive skin surface temperatures relative to a reference invasive core temperature; and

B)Observe any associations between non-invasive temperature error and body morphology

METHODS:

Participants: 41 pediatric patients undergoing minor surgical procedures (e.g. hernia repair, orchiopexy). The UROP contributed (8 patients) to ongoing data collection.

Instrumentation: Core temperature measured continually in the nasopharynx (T_{naso}); and skin temperature measured at 3 sites: over the carotid artery ($T_{carotid}$), liver (T_{liver}), and axilla (T_{axilla}).

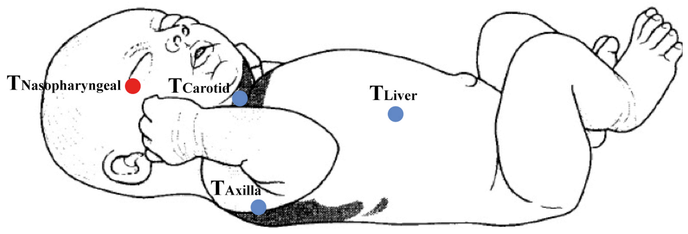

Figure 1. *Temperature monitoring sites*

Table 1. *Subject Characteristics (Means ± SD)*

Age (weeks)	Weight (kg)	Length (cm)	Body Surface Area (m^2)	Body Fat (%)
72.4 ± 42.8	10.6 ± 3.8	77.8 ± 15.7	0.5 ± 0.1	21.6 ± 2.4

NB: n = 38

Analysis: Data was first separated into a non-steady-state (NSS) and steady-state (SS) period (**Figure 2**), the onset of which was defined by a difference between the rate of change of T_{naso} and $T_{carotid}$ being less than ±0.1°C for 3 consecutive mins. The first 21 patients were used as an experimental group to adjust $T_{carotid}$, T_{axilla} and T_{liver} for the other 20 in the validation group (**Figure 4**)

RESULTS:

Compared to T_{naso}, mean error (±SD) was -0.46±0.28°C for $T_{carotid}$; -0.96±0.45°C for T_{liver}; and -0.12±0.50°C for T_{axilla} (**Figure 3**). Adjusting $T_{carotid}$, T_{liver} and T_{axilla} by their respective mean error explained 75%, 40% and 27% of variation in T_{naso} (**Figure 4**).

No significant associations (all P>0.05) were found between body morphology and the error of $T_{carotid}$, T_{liver} or T_{axilla} relative to T_{naso}.

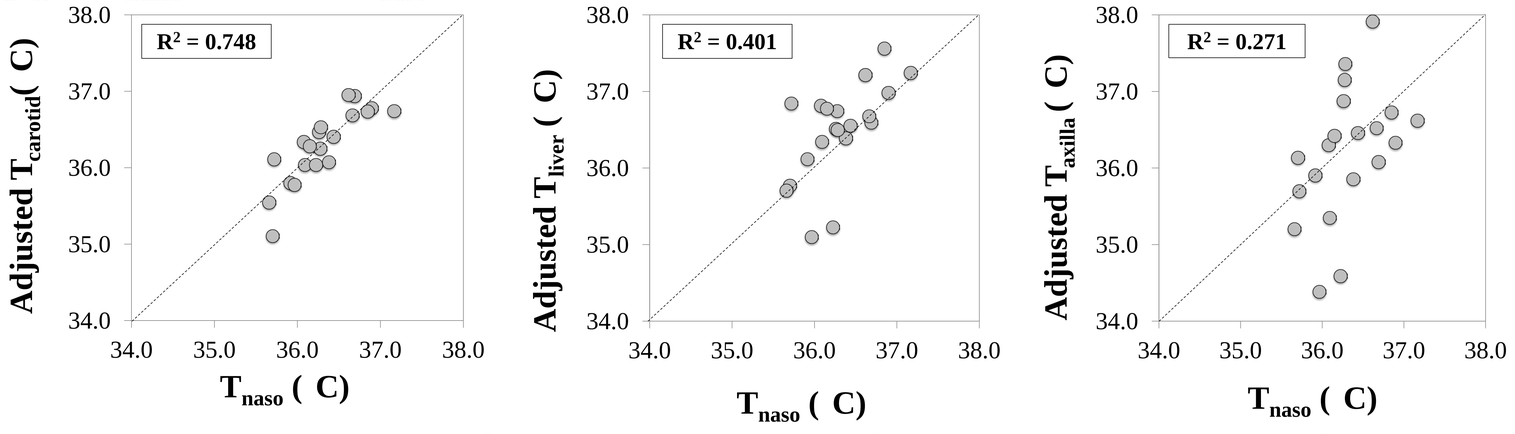

Figure 4. *$T_{carotid}$ adjusted by +0.46 ℃, T_{liver} adjusted by +0.96 ℃ and T_{axilla} adjusted by +0.12 ℃ against T_{naso}*

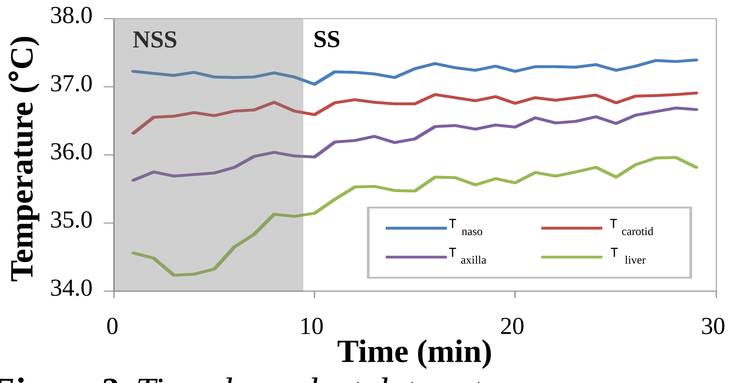

Figure 2. *Time dependent data set*

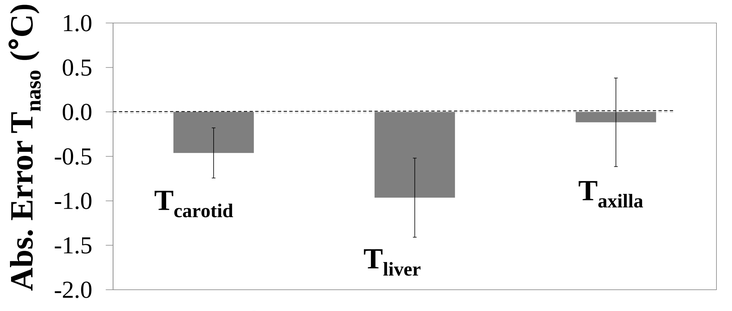

Figure 3. *Error of non-invasive temp. relative to T_{naso}*

CONCLUSIONS:

Skin temperature over the carotid artery potentially provides a reliable prediction of core temperature using a simple correction factor of approximately +0.5°C. Validation against an independent data set is required.

ACKNOWLEDGEMENTS:

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