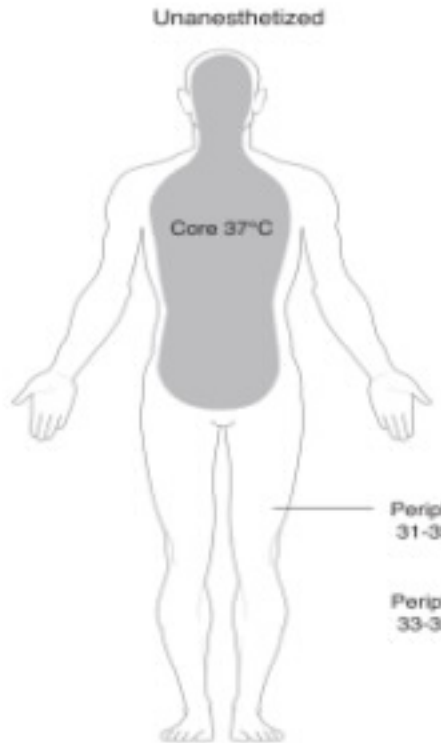




Infant hypothermia: core temperature $<36.0\text{ }^{\circ}\text{C}$

Anesthetic Effects



Core temperature represents the temperature of the deep thoracic, abdominal, and central nervous system tissues

Figure 1. Redistribution of core
Reprinted with permission from /



core temperature

skin temperature

鼓膜

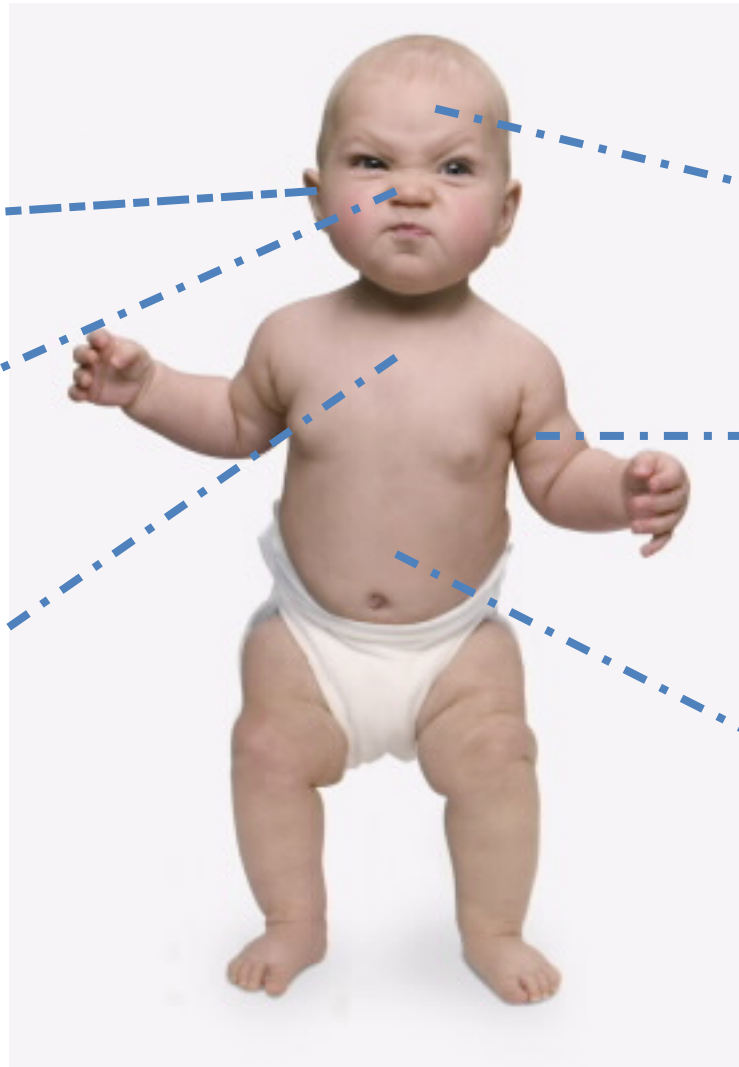
鼻咽腔

食道

前额

腋下

腹部



1

accuracy of separate
correction factor models for
estimating core temperature

2

assess the sensitivity and
specificity of these methods
for detecting hypothermia

- ✓ aged 0–36 months
- ✓ scheduled for elective lower abdominal surgery (hernia repair, removal of peripheral skin lesions, orchiopexy, hydrocele repair, or circumcision)
- ✓ ASA I or II
- ✓ undergo standardized general anesthesia

Oral dose acetaminophen 20mg/kg

Midazolam 0.5mg/kg



Propofol 2~4mg/kg

Sevo 4~8%



Cuffed endotracheal tube
Laryngeal mask

Ambient temperature : $22.3 \pm 1.5^{\circ}\text{C}$

relative humidity : $26 \pm 6\%$

Patients aged **6 months or less** were warmed using a forced-air blower blanket underneath set at 38.0°C



1

inserted at a depth equivalent to the distance between the tragus and the nares of each patient

2

over the carotid artery at the exact location of the maximal carotid pulse by palpation

3

pit on the arm along the mid-axillary line

4

along the mid-clavicular line, one finger's breadth below the rib cage

Modeling group

(28)

$$X_0 = T_{\text{naso}} - T_{\text{sk}}$$

$$X_0 = \beta_0 + \beta_1[\text{Body mass}] + \beta_2[\text{Body surface area-to-mass ratio}] + \beta_3[\% \text{bodyfat}] + \beta_4[\text{heating blanket}]$$

Validation group

(20)

$$T_{\text{naso_pred}} = T_{\text{sk}} + C_f$$

Table 1 Participant characteristics for modeling (MG) and validation (VG) participant groups

| | MG (n = 28) | VG (n = 20) |
|---|----------------|----------------|
| Age (weeks) | 78 ± 50 | 65 ± 44 |
| Body mass (kg) | 11.2 ± 3.9 | 9.7 ± 3.1 |
| Height (cm) | 72.4 ± 28.2 | 74.2 ± 15.1 |
| 1 BSA (m ²) | 0.49 ± 0.14 | 0.45 ± 0.11 |
| 2 Body fat (%) | 22.9 ± 3.8 | 23.0 ± 3.0 |
| Air temperature (°C) | 22.2 ± 1.4 | 22.4 ± 1.3 |
| Relative humidity (%) | 27 ± 6 | 26 ± 6 |
| Hypothermia ($T_{nasal} < 36.0^{\circ}\text{C}$)* | 10 (36%) | 7 (35%) |
| Heat blanket used | 11 (39%) | 8 (40%) |
| Duration of surgery (min) | 46.6 ± 23.4 | 33.8 ± 11.7 |

1 Body surface area = $(W^{0.425} \times H^{0.725}) \times 0.007184$

2 Body fat percentage

$$T_{\text{naso_pred}} = T_{\text{sk}} + C_f$$

$$C_f(T_{\text{sk_carotid}}) = +0.52$$

$$C_f(T_{\text{sk_abd}}) = +0.076[\text{body mass (in kg)}] + 0.02$$

$$C_f(T_{\text{sk_axilla}}) = +0.081[\text{body mass (in kg)}] - 0.66$$

欧洲鼻咽腔温度与实测温度的差值

Table 2 Mean bias and 95% limits of agreement (LOA) for estimates of T_{naso} in the validation group (VG) using skin temperature over the abdomen ($T_{\text{sk_abd}}$), axilla ($T_{\text{sk_axilla}}$), and carotid artery ($T_{\text{sk_carotid}}$), and C_f values derived from MG

| | $T_{\text{sk_abd}}$ | $T_{\text{sk_axilla}}$ | $T_{\text{sk_carotid}}$ |
|--|----------------------|-------------------------|--------------------------|
| All participants | | | |
| Bias | -0.05°C | -0.06°C | +0.03°C |
| 95% LOA | +1.02 to -1.07°C | +1.21 to -1.28°C | +0.53 to -0.50°C |
| Percent of points within $\pm 0.5^\circ\text{C}$ | 75.4% | 66.1% | 93.2% |
| Normothermic ($T_{\text{naso}} > 36.0^\circ\text{C}$) | | | |
| Bias | -0.14°C | -0.04°C | +0.03°C |
| 95% LOA | +0.84 to -1.12°C | +1.22 to -1.30°C | +0.54 to -0.49°C |
| Percent of points within $\pm 0.5^\circ\text{C}$ | 86.6% | 67.1% | 92.7% |
| Hypothermic ($T_{\text{naso}} < 36.0^\circ\text{C}$) | | | |
| Bias | +0.18°C | -0.12°C | +0.04°C |
| 95% LOA | +1.33 to -0.98°C | +1.20 to -1.44°C | +0.52 to -0.45°C |
| Percent of points within $\pm 0.5^\circ\text{C}$ | 45.5% | 61.8% | 93.9% |

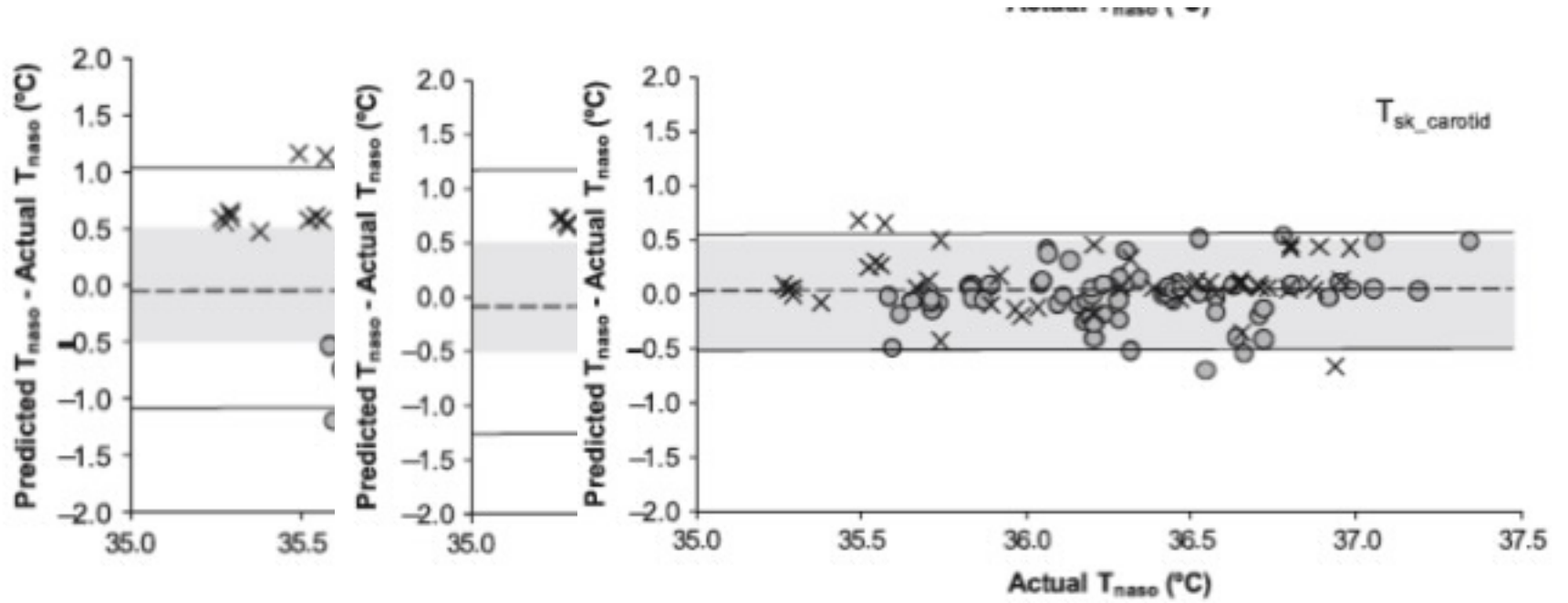
Heating blanket

| | | | |
|---|---------------------|---------------------|---------------------|
| Bias | +0.04°C | -0.04°C | +0.10°C |
| 95% LOA | +1.42 to -1.38°C | +1.45 to -1.50°C | +0.60 to -0.50°C |
| Percent of points within $\pm 0.5^\circ\text{C}$ | 63.3% | 59.2% | 93.9% |

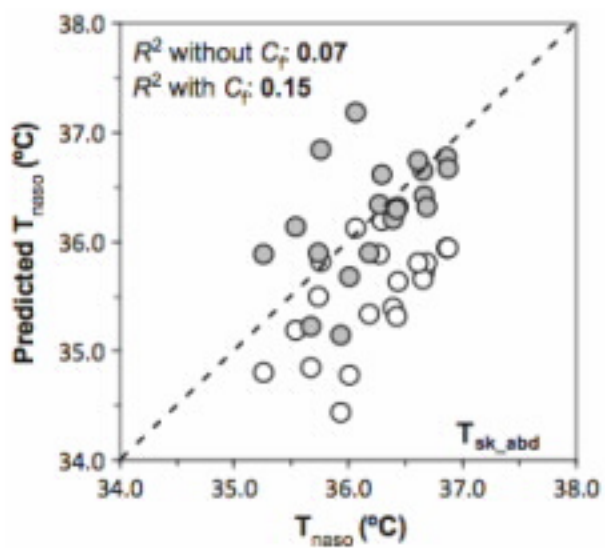
No heating blanket

| | | | |
|---|---------------------|---------------------|---------------------|
| Bias | -0.10°C | -0.08°C | -0.02°C |
| 95% LOA | +0.68 to -0.89°C | +1.03 to -1.19°C | +0.46 to -0.50°C |
| Percent of points within $\pm 0.5^\circ\text{C}$ | 84.1% | 71.1% | 92.8% |

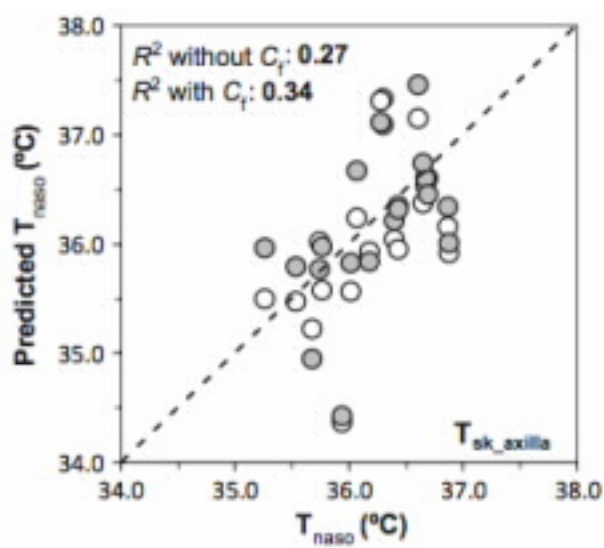
Bland-Altman 测量方法一致性分析



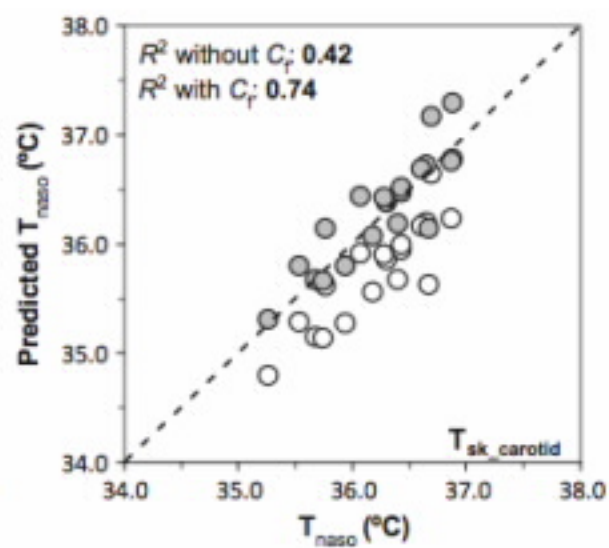
拟合优度检测



Abdomen



axilla



carotid

R^2 : 确定系数

ORIGINAL ARTICLE

Skin temperature over the carotid artery provides an accurate noninvasive estimation of core temperature in infants and young children during general anesthesia

Ollie Jay^{1,2}, Yannick Molgat-Seon¹, Shirley Chou^{2,3,4} & Kimmo Murto^{2,4,5}

skin temperature measured over the carotid artery, when employed with a fixed correction factor of $+0.52^{\circ}\text{C}$

{ 少
窄 (35.2~37.9)

{ Carotid artery
Modeling group/validation group