Validation of Core Temperature Measurement with TEMPLE TOUCH PRO™ Using Body Surface Sensors in Pediatric Surgery

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Background

Intraoperative hypothermia can lead to adverse effects such as shivering, poor wakefulness, coagulopathy, and infection. Children are easily hypothermic due to heat dissipation. Therefore, it is necessary to pay attention to temperature control.

In general, core body temperature is measured by inserting a temperature probe into the body, but since probe insertion is invasive, even if only slightly, non-invasive measurement is ideal. Thus, we will examine the usefulness of TEMPLE TOUCH PRO (hereinafter referred to as TTP, manufactured by MEDISIM LIMITED), a non-invasive continuous measurement device using body surface sensors.

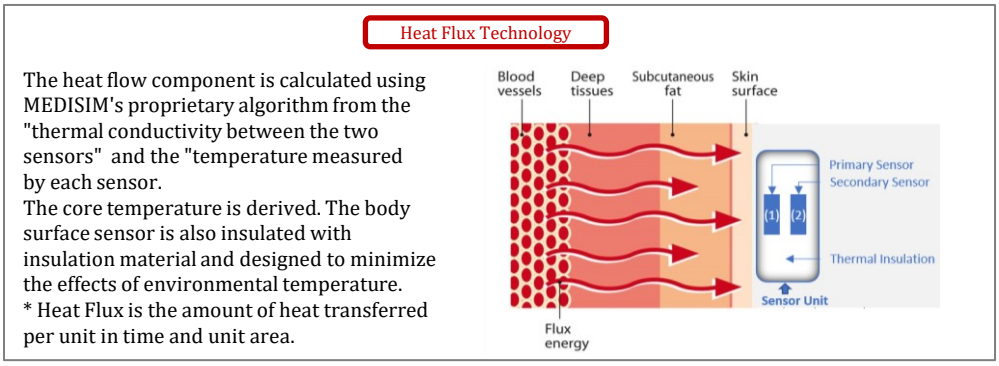

Figure 1: Measurement Method

Figure 2: Example of body surface sensor attachment

Objective

To compare rectal temperature and core temperature measured by TTP during general anesthesia in pediatric patients.

Method

This study was approved by the Bioethics Committee of our hospital (2022-0080).

Subject Patients under 5 years of age who underwent scheduled surgery under general anesthesia. 17 patients underwent core temperature measurement using rectal temperature and TTP.

Method Measured paired values of each core temperature every 5 minutes during surgery were extracted from the anesthesia record. Statistical analysis was performed by Pearson's correlation analysis and Bland-Altman analysis.

Result

Patient background is shown in Table 1.
In all 17 cases, 297 paired values were accumulated and compared.

Correlation analysis (Figure 3) yielded a Pearson correlation coefficient of 0.888, and Bland-Altman analysis (Figure 4) yielded a mean difference between methods (Bias) of 0.42 and 95% limits of agreement (95% LOA) of -0.32–1.16.

Table 1: Case background (n=17)
(Mean ± standard deviation [range], expressed as number of cases)

Age	*2 years 10 months ± 1 year 10 months [0 years 6 months - 5 years 3 months]*
Gender	5 boys / 12 girls
Height	88.9±14.5cm [64.0-112.0cm]
Body weight	12.7±3.8kg [5.2-19.1kg]
Laparoscopic use	8 cases

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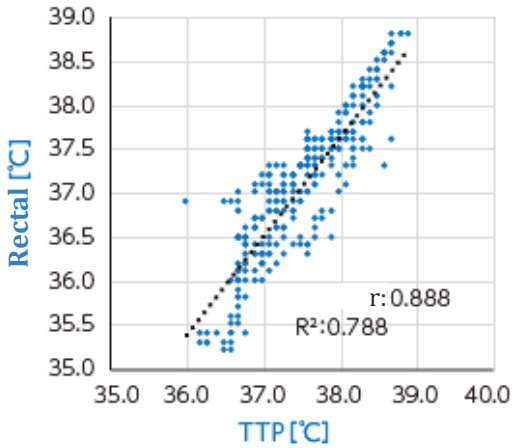


Figure 3: Correlation Analysis

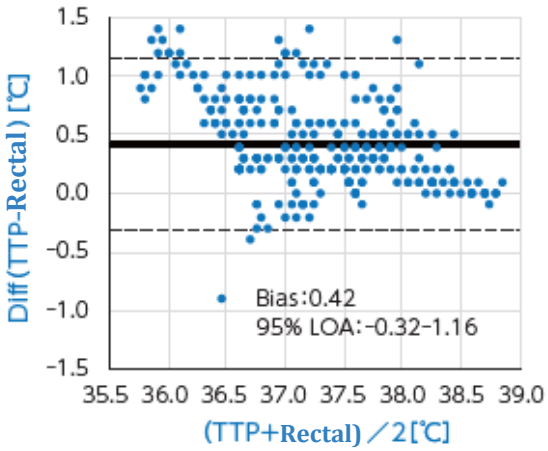


Figure 4: Bland-Altman analysis

The vertical axis in Figure 3 represents rectal temperature and the horizontal axis represents TTP temperature. The vertical axis in Figure 4 represents Diff (TTP - rectal temperature) [°C] and the horizontal axis represents (TTP + rectal temperature)/2 [°C].

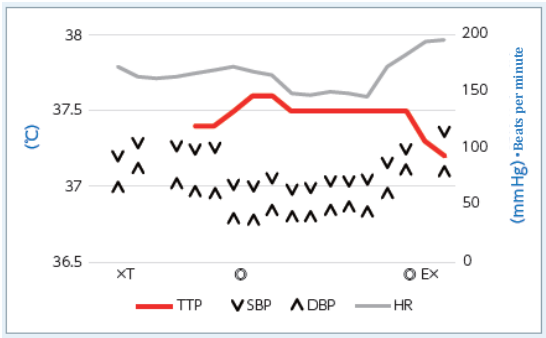
Figure 3 shows a correlation coefficient of 0.888 and R2 of 0.788. Figure 4 shows Bias: 0.42, 95%, LOA: -0.32-1.16.

Discussion

In adult patients, core temperatures by TTP have been reported to agree with pharyngeal and esophageal temperatures. *

TTP was also shown to be in some agreement with rectal temperature in pediatric patients. The mean difference between these temperatures was about 0.4°C, slightly higher than that of the rectal temperature. Since rectal temperatures may be measured slightly lower due to feces or surgical manipulation (e.g., insufflation), TTP is likely to be useful for measuring core temperatures during general anesthesia in children.

*Evron S et al. Evaluation of the Temple Touch Pro, a Novel Noninvasive Core-Temperature Monitoring System. Anesthesia & Analgesia 2017; 125:103-109



X: Start and end of anesthesia
◎: Start and end of surgery
T: Tracheal intubation
E: Extubation
TTP: Temple Touch Pro (core temperature)
SBP/DBP: Systolic/diastolic blood pressure
HR: Heart Rate

Figure 5: Intraoperative vital data transition

A 1-month-old boy (height 47.5 cm, weight 2.7 kg) was born at 38 weeks 0 day, 2367 g, and underwent radical esophagectomy and colostomy on the first day of life with a diagnosis of type C esophageal atresia and cloacal anus. A balloon dilatation of the postoperative esophageal stricture was scheduled under general anesthesia. The anesthesia plan included the problem that the pharyngeal/esophageal temperature monitoring was in the operative field and the rectal temperature monitoring could not be used because of the anal fistula. Insertion of a temperature probe through the colostomy was considered, but the team decided to use noninvasive TTP for continuous temperature measurement. Intraoperative core temperature could be managed within the normal range by TTP (Figure 5).

Facial photos are used with consent.