



Advancing non-invasive temperature monitoring in pediatrics

Mohammadmahdi Moradi¹ · Mohammad Reza Cheraghi²

Received: 7 January 2025 / Accepted: 11 February 2025 / Published online: 4 March 2025
© The Author(s) under exclusive licence to Japanese Society of Anesthesiologists 2025

Keywords Temperature monitoring · Perioperative care · Temple Touch Pro (TTP)

To the Editor:

The study by Fujii et al., “Accuracy of non-invasive core temperature monitoring in infant and toddler patients: a prospective observational study” [1] offers valuable insights into non-invasive temperature monitoring in pediatric population. Accurate perioperative temperature management is crucial for improving clinical outcomes [2]. This study marks a significant advancement by demonstrating that Temple Touch Pro™ (TTP) correlates closely with esophageal temperatures. Notably, the authors report that 94% of TTP measurements were within ± 0.5 °C of esophageal temperatures, highlighting the consistency and reliability of TTP in monitoring the pediatric population.

The non-invasive and easy to apply nature of TTP makes it a promising tool not only for peri-operative care but also for use in emergency or prehospital settings, where invasive monitoring may not be feasible. Its simplicity and effectiveness could be particularly valuable in resource-constrained environments where access to invasive monitoring equipment or trained personnel is limited. By avoiding invasive probes, TTP could significantly enhance the patient experience during awake procedures or postoperative care. Furthermore, while not explored in this study, the user-friendly characteristics of TTP suggest potential applications for home-based monitoring of patients requiring ongoing temperature surveillance. Patients who cannot communicate, such as individuals with low Glasgow Coma Scale scores

and infants, can benefit from home-based monitoring using TTP. This can facilitate fever detection and early intervention in these immunocompromised patients. Pediatric oncology patients recovering from chemotherapy or surgery may also benefit from continuous temperature tracking, as it allows caregivers to detect fever early and manage complications [3].

Also, in children at risk for febrile seizures, real-time continuous temperature monitoring can help parents and caregivers take preventive measures. Advances in wearable temperature monitoring technologies have allowed continuous home-based monitoring that maintain accuracy while offering user-friendly interfaces and wireless smartphone connectivity [4]. Continuous temperature data combined with other physiological parameters, can create digital biomarkers which predicts clinical deterioration or therapeutic responses. Home-based use of this technology supports large-scale epidemiological studies. By providing extensive datasets, researchers can reveal fever patterns, seasonal variations, and environmental or behavioral correlations.

While TTP shows promise for both clinical and home-based applications, further evaluation is needed to address certain limitations. The ability to detect fluctuations in core temperature is crucial [5]. To properly evaluate the dynamic tracking of temperature changes, the study could have benefited from using regression analysis for temporal trends. If the temporal sequence of measurements is available in the dataset, the authors could analyze their data using time-series regression models or similar dynamic tracking methodologies. Also, analyses during scenarios with significant temperature fluctuations could enhance understanding of TTP’s performance under dynamic conditions. Dynamic tracking of core body temperature is essential. It allows for accurate prediction and real-time monitoring of temperature fluctuations during surgery [6]. Such an analysis can provide valuable insights into TTP’s performance even in

This comment refers to the article available online at <https://doi.org/10.1007/s00540-024-03404-7>.

✉ Mohammad Reza Cheraghi
cheraghie.mr@gmail.com

¹ Isfahan University of Medical Science, Isfahan, Iran

² Anesthesiology and Critical Care Research Center, Shiraz University of Medical Sciences, Khalili St, Shiraz, Iran

environments where temperature is strictly controlled, as was the case in this study.

Furthermore, comparisons with other non-invasive methods like SpotOn™ or zero-heat-flux technologies, along with an economic analysis of cost-effectiveness compared to invasive temperature probes, could enhance the relevance of TTP in the real-world clinical decision-making [7, 8].

Overall, this study provides valuable insights and sets the stage for broader applications of non-invasive temperature monitoring technologies, potentially transforming pediatric perioperative care.

References

1. Fujii T, Takakura M, Taniguchi T, Nishiwaki K. Accuracy of non-invasive core temperature monitoring in infant and toddler patients: a prospective observational study. *J Anesth*. 2024;38(6):848–54.
2. Sessler DI, Pei L, Li K, Cui S, Chan MTV, Huang Y, Wu J, He X, Bajracharya GR, Rivas E, Lam CK. Aggressive intraoperative warming versus routine thermal management during non-cardiac surgery (PROTECT): a multicentre, parallel group, superiority trial. *Lancet*. 2022;399(10337):1799–808.
3. te Poele EM, Tissing WJ, Kamps WA, de Bont ES. Risk assessment in fever and neutropenia in children with cancer: what did we learn? *Crit Rev Oncol Hematol*. 2009;72(1):45–55.
4. Kakarmath SS, de Redon E, Centi AJ, Palacholla R, Kvedar J, Jethwani K, Agboola S. Assessing the usability of an automated continuous temperature monitoring device (iThermonitor) in pediatric patients: non-randomized pilot study. *JMIR Pediatr Parent*. 2018;1(2): e10804.
5. Bindu B, Bindra A, Rath G. Temperature management under general anesthesia: compulsion or option. *J Anaesthesiol Clin Pharmacol*. 2017;33(3):306–16.
6. Bi Y, Fečér T, Mathisen HM, Stenstad LI, Skogås JG, Kiss G, Cao G. Modeling of body temperature for perioperative patients in the operating room. *Energy Build*. 2024;328:115203.
7. Hart D, Rischall M, Durgin K, Donoghue M, Pham T, Wyatt T, Stang J, DeVries P, Driver B. Non-invasive zero-heat-flux technology compared with traditional core temperature measurements in the emergency department. *Am J Emerg Med*. 2020;38(11):2383–6.
8. Schell-Chaple HM, Liu KD, Matthay MA, Puntillo KA. Rectal and bladder temperatures vs forehead core temperatures measured with SpotOn monitoring system. *Am J Crit Care*. 2018;27(1):43–50.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.