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Research Article

The accuracy of temporal versus nasopharyngeal temperature measurement

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ABSTRACT:

Background and objectives: Temporal artery method is a new method ofbody temperature measurement used in recent years, which is fast, safe and comfortable, but its accuracy is questionable. The aim of this study was to determine the accuracyof temporal artery temperature measurement compared with nasopharyngeal method.

Materials and Methods: This cross-sectional study was conducted on 200 patients admitted to Bushehrhospitals. In all samples, body temperature was measured with both nasopharyngeal and right and left temporal artery methods.

Results: The mean temperature in the temporal artery method had 0.2°C difference from nasopharyngeal method.There was a significant correlation between right artery and nasopharyngeal methods (p=0.000, r=0.864) and the left artery and nasopharyngeal methods (p=0.000, r=0.855). ROC curve showed the most appropriate fever point in temporal artery method at 37.7°C, with 94.4% sensitivity, 75% specificity and 86.5% accuracy.

Conclusion: The temporal artery method is an accurate, fast, comfortable, and safe method for adults, compared with nasopharyngeal method. The findings of the present studysupport thetemporal artery method as a practical standard for body temperature measurement.

INTRODUCTION

To assess the patients' response to treatment, body temperature is usually measured and determining the body temperature accurately and correctly is the key to diagnosis and treatment. Several studies showed that the measurement of body temperature is one of the important methods of diagnosis of diseases (1).Body temperature can be measured from different sites, including oral, axillary, rectal, pulmonary artery, esophagus, pharynx (throat), bladder, ear canal (tympanic), and temporal artery (1, 2).Each method of body temperature measurement has advantages and disadvantages, so choosing the ideal method or site of measurement should reflect the core body temperature, be fast and easy to use, and be healthy, noninvasive, patient-friendly and cost-effective (3, 4).Nasopharyngeal temperature is, like pulmonary artery and rectal, the gold standard method reflecting core body temperature, but is difficult and requires expensive probes and monitor and is only applicable in hospitalized patients in special care unit or under general anesthesia and hypothermia (5).A new methodof measuring body temperature is temporal artery

thermometer, a noninvasive,fast, accurate, and easy method in the clinical setting, suitable for all ages (8-11). Some studies have reported temporal artery temperature an available index of the core body temperature with minimal confounding factors (1, 12, 13). It is argued that the blood of the temporal artery originates from the external carotid and comes straight from the heart and center of the body and has a relatively high and constant blood flow and may thus represent the core body temperature (14-16).Various studies have compared the temporal artery temperature with different parts of the body and have investigated its correctness and accuracy. A study by Baoursky and colleagues to determine the accuracy of temporal than rectal temperature in children showed that the right and left tympanic temperature in children is highly correlated with rectal temperature (r=0.85), (p=0.01) (17). In 2013, Eisler and colleagues also showed significantly higher temporal artery temperature than axillary temperature (8). The study by Car et al. in 2011 reported the correlation between the temporal and rectal artery at 77% (13) and none of the new researches reported sensitivity and specificity of the temporal artery temperature (1). Greens and Fleischer stated in 2001 that temporal artery temperature isconsiderably less than temporal and rectaltemperature andreported the correlation between the temporal temperature with tympanic and rectal temperature73 and 83%, respectively (2).The significance of speed and accuracy of body temperature measurement, especially in children and hospitalized adults, who cannot keep the thermometer and require body temperature controlling during the whole 24 hours and need a method to reduce nurses' work volume, time, and human resources, makes the use of temporal artery thermometer as an alternative to more invasive methods in clinical practice.Thus, considering the significance of replacing temporal artery method with more invasive methods and due to the controversies among studies, the researchers of the present study tried to compare two methods of temporal artery thermometer with nasopharyngeal method.

MATERIALS AND METHODS:

The present cross-sectional and descriptive-analytic study included all patients admitted to intensive care units of Persian Gulf Martyrs hospitals of Bushehr. Inclusion criteria consisted of age over 17 years and lack of any problems, wounds or surgery on the frontal, temporal, nose, throat and axillary areas.

After obtaining permission from the Ethics Committee and written consent from the patients and device calibration, temperature was measured by temporal artery and nasopharyngeal methods and demographic characteristics of patients were recorded in a checklist.Measurement of left and right temporal arteries was performed by infrared thermometer (Beurer 6-IN-1 FT65 model) with cleaning temporal region of the patient at the site of arterial pulse, and placing the thermometer on the area for 2-3 seconds.Nasopharyngeal temperature measurement was performed by placing and fixing a disposable plastic cover on the thermometer's tip (Alborz bf model) and inserting it to 5-8 cm of the pharynx through the nose. Then, the fixed value displayed on the monitor was recorded.Room temperature was also measured by thermometer placed on the wall and was recorded.

STATISTICAL ANALYSIS:

Using SPSS software version 21, to display qualitative data, number and percentage and to display the quantitative data, mean and standard deviation were used. Pearson (or Spearman) correlations coefficients were used to show body temperature recorded by two methods.ROC curve and 95% confidence intervals were calculated for measuring body temperature by the left and right temporal artery method. Measuring body temperature with nasopharyngeal method was used as the gold standard in this calculation. Chi-square test was used to compare the area under the curve.To calculate the best cut-off point for the diagnosis of fever "Youden index" was used, and sensitivity, and specificity were calculated at this point.[Youden Index= (Sensitivity + Specificity) – 1]To show the degree of agreement between the

right and left temporal artery, kappa coefficient was used.

RESULTS:

In this study 33 participants (16.5%) werefemale, and 167 (83.5%) were male. The mean age of patients was 37.34 ± 17.82 years. Mean and standard deviation body temperature by nasopharyngeal method were 37.04 ± 0.83, the mean body temperature by the right temporal method 37.21 ± 0.65, and left temporal 37.11 ± 0.70. The mean difference of body temperature by Nasopharyngeal and temporal artery method was 0.2°C.

Room temperature was minimum 35°C and maximum 21°C with mean of 27.575 and a standard deviation of 2.36.

Among 200 patients, 36 patients (18%) were diagnosed with fever by the gold standard (nasopharyngeal) method.The Spearman correlation coefficient results showed a correlation between different methods of body temperature measurements between the nasopharyngeal and right temporal artery methods p=0.000, r=0.864 and between the nasopharyngeal and the left temporal artery method p=0.000, r=0.855. Also, Spearman correlation coefficientsshoweda correlation between the right and left temporal arteriesr=0.92 (p=0.001). The highest correlation was between the right and left temporal method (r=0.92, p=0.000) and the lowest correlation was between nasopharyngeal and left temporal artery. (p=0.000, r=0.855).

To determine the best cutoff for the detection of fever, 37.7°C was calculated by using the right temporal artery. Using this cut-off point, sensitivity of this method was calculated 86% with a specificity of 85%, and the best cutoff for the detection of fever, using the left temporal artery was calculated 37.7°C. Using this cut-off point, the sensitivity of this method was calculated 94.4% with a specificity of 75%. Measurement accuracy in both right and left temporal arteries were86.5% and 85.5%, respectively.

Also by using ROC curve for each right and left temporal artery methods, the maximum amount of area under the curve, as an indicator of health, wascalculated 0.947 and 0.942, respectively, with standard error of 0.0002.The results showed no significant difference between the sensitivity, specificity, and area under the ROC curve in both right and left temporal artery methods (p=0.06), (X^2=0.8003).

According to Kappa coefficients,the agreement between right and left temporal artery method was 64 with p=0.000.

Table 1: Sensitivity and specificity, accuracy, positive and negative predictive values of different temperature measurement methods compared with nasopharyngeal using ROC curve

P value	Accuracy	negative predictive values	positive predictive values	Specifity	Sensitivity	Fever cutoff point	Measurement method
0.000	86.5	97.2	58.1	75	94.4	37.5	Righttemporal artery method
0.000	85.5	96.5	56.3	85	84	37.7	Lefttemporal artery method

DISCUSSION:

The results of the association between temporal artery and nasopharyngeal temperature showed a good correlation between the two methods. In the study by Car and colleagues (2011), a coefficient of r=0.77 has been reported (3). Hakim Oghlu (2012) has described a strong correlation between the temporal artery and nasopharyngeal method andhas introduced this thermometer an appropriate alternative to the invasive temperature measurements (4). Another study by Bahoursky (2012) has reported a Spearman correlation of 0.85 between the temporal artery and rectal method in newborns (5).The results of the present study showed the body temperature difference of 0.2°C between the nasopharyngeal and temporal

artery method. In the study by Car (2009) there was no difference between body temperature by rectal and temporal artery methods in children. The study by Eisler et al (2013) on comparison of the temporal artery method and axillary mercury glass temperature, there was a significant difference in children between the mean temperatures of the temporal artery and nasopharyngeal methods (p=0.07) (1).Perhapsthis difference showed close results of the two methods of temperature measurement in these studies. Also, no statistically significant differences was found between right and left temporal artery temperature that is consistent with the study by Bahoursky 2012 (5).

Based on these results, each of the left and right arteriescan be used to measure the body temperature. However, in the study by Li and colleagues (2012) on determining the accuracy of temporal artery measurement as a non-invasive thermometer, a statistically significant difference was reported between the temporal artery and rectal methods (p=0.006) (6).Mean temporal artery temperature was higher than rectal method that was inconsistent with the results of the present study; this difference might be due to the small number of samples (n=34) in his study (6).

In this study, temporal artery with a cutoff of 38°C had a low sensitivity and specifity, but by changing the cutoff to 37.5°C, the sensitivity and specifity increased.

Thus, this change in cutoff caused the number of the febrile patients diagnosed by nasopharyngeal method, be correctly diagnosed by temporal artery method. Accordingly, in a study by the Greens and Fleischer in 2001 for determining the accuracy of the temporal temperature as a non-invasive method of measurement,a sensitivity of 66% and specificity of 96% have been reported (2). There are no other similar study reportingthe sensitivity, specificity, and cut-off point of temporal artery method.Kappa coefficient between temporal artery and nasopharyngeal temperature was 62%. In the study by Car et al (2009), the agreement between temporal and rectal method was reported 94.5%; this difference can be due to the differences in the study population and small number of samples in Car's study.

Comparing the measurement site of body temperatureshould take into account the safety, speed, and comfort of the patient and the medical team. As temporal artery thermometer has these properties, it is suitable for intubated anesthetized patients and patients in other hospital wards.

CONCLUSION:

The results of the present study indicated that this new method is sensitive to the body temperature changes and significantly shows the increase or decrease in core body temperature; thus, in cases of limited use of nasopharyngeal method, measuring the temperature by temporal artery with a calibrated device can be replaced, considering the small (0.2°C) difference of the nasopharyngeal and temporal artery methods. In addition, measuring the body temperature by temporal artery is a noninvasive, fast, healthy, and cost-effective method and can measure the body temperaturewithin 2-3 seconds and has practical advantages compared to invasive methods andcan be used in different cases of the patients.

The study showed that further studies are needed to compare the body temperature measurement by temporal artery with other methods that are used in clinics and hospitals and in different patients in different circumstances.

SUGGESTIONS:

Due to the limited sample size in the intensive care unit, it is suggested that similar studies be conducted in other wards and other populations and use other types of thermometers as well as different methods of measurement.

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REFERENCE

1. Al-Mukhaizeem F, Allen U, Komar L, Naser B, Roy L, Stephens D, et al. Comparison of temporal artery, rectal and esophageal core temperatures in children: Results of a pilot study. Paediatrics & child health. 2004;9(7):461.
2. Imani R, Salehi S, Habibian R, Sadeghi B, HATAMIPOUR K. Comparative Study of Measuring Body Temperature by Mercury and Digital Thermometer. 2009.
3. Jahanpour, F., Azodi, P., & Zare, N. (2015). A Comparative Study on Temperature Accuracy between Tympanic, Rectal, and Axillary Sites. Iranian Journal of Medical Sciences, 33(1), 49-53.
4. van Staaij BK, Rovers MM, Schilder AG, Hoes AW. Accuracy and feasibility of daily infrared tympanic membrane temperature measurements in the identification of fever in children. International journal of pediatric otorhinolaryngology. 2003;67(10):1091-7.
5. Naeini AE, Nazari E, Naeini SE. Body Temperature using Oral Mercury Thermometer in Comparison to Infrared Tympanic Thermometer. JIMS. 2011;28(117):1140-45.
6. Jahanpour, Faezeh, et al. "Comparison of tympanic thermometry accuracy with rectal and axillar methods in children." (2006): 152-159..
7. Haddad L, Smith S, Phillips KD, Heidel RE. Comparison of temporal artery and axillary temperatures in healthy newborns. Journal of Obstetric, Gynecologic, & Neonatal Nursing. 2012;41(3):383-8.
8. Suleman M-I, Doufas AG, Akça O, Ducharme M, Sessler DI. Insufficiency in a new temporal-artery thermometer for adult and pediatric patients. Anesthesia & Analgesia. 2002;95(1):67-71.
9. Pompei F, Pompei M, editors. Noninvasive temporal artery thermometry: physics, physiology, and clinical accuracy. Defense and Security; 2004: International Society for Optics and Photonics.
10. Carr EA, Wilmoth ML, Eliades AB, Baker PJ, Shelestak D, Heisroth KL, et al. Comparison of temporal artery to rectal temperature measurements in children up to 24 months. Journal of Pediatric Nursing. 2011;26(3):179-85.
11. Pompei M. Temperature assessment via the temporal artery: Validation of a new method. Exergen Corporation. 2002;9:26.
12. Greenes DS, Fleisher GR. Accuracy of a noninvasive temporal artery thermometer for use in infants. Archives of pediatrics & adolescent medicine. 2001;155(3):376-81.
13. Bahorski J, Repasky T, Ranner D, Fields A, Jackson M, Moultry L, et al. Temperature measurement in pediatrics: a comparison of the rectal method versus the temporal artery method. Journal of pediatric nursing. 2012;27(3):243-7.
14. Aysegül Isler RA, Serife Tutar Güven, Sema Günay. Comparison of temporal artery to mercury and digital temperature
measurement in pediatrics. International Emergency Nursing. 2013.
15. Sahin SH, Duran R, Sut N, Colak A, Acunas B, Aksu B. Comparison of temporal artery, nasopharyngeal, and axillary temperature measurement during anesthesia in children. Journal of clinical anesthesia. 2012;24(8):647-51.
16. Lee G, Flannery-Bergey D, Randall-Rollins K, Curry D, Rowe S, Teague M, et al. Accuracy of temporal artery thermometry in neonatal intensive care infants. Advances in Neonatal Care. 2011;11(1):62-70.