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Which thermometry is more comfortable for children

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Abstract
Temperature measurement procedure being a routine task in inpatient hospital setting takes up a significant proportion of the nurse's time. A quick measurement with least disturbance would be better tolerated. To assess and compare the comfort of temperature measured by tympanic membrane thermometry and temporal artery thermometry with reference to the axillary thermometry among children. Temperature of 300 children between the age group of 2-6 years was assessed and compared by using digital axillary thermometer(Omron MC-246), infra red tympanic membrane thermometry (infinity check FDIR-V1) and infra red temporal artery thermometry (infinity check FDIR-V1). More than half (53%) of children were in age group of 4-6 years and majority (69%) of the children were male. The mean comfort experienced during the use of temporal artery thermometry with standard deviation (41.5 + 9.0) was more closer to the axillary thermometry. Temporal artery thermometry is better option for children as compared with digital tympanic membrane thermometry with reference to digital Axillary thermometry.

Keywords: Axillary Thermometry, Tympanic Membrane Thermometry, Temporal Artery Thermometry, Children

1. Introduction

The temperature measurement is a simple and easy to learn task, but interpreting the measurements and incorporating it into ongoing care and assessment require knowledge, problem – solving skills, critical thinking and experience.[1] The goal of measuring body temperature is to approximate the core temperature, which is the temperature of the blood that bathes the temperature-regulating centre in the hypothalamus.[2]Many anatomical sites and devices have been used to measure the body temperature like mercury thermometer ,digital thermometer, tympanic membrane sensors , liquid crystal skin contact thermometers etc[3] . but the best site is still a matter of controversy whichever technique used it should be simple, quick, reliable, safe and reproducible [2] .The use of the mercury thermometer has been phased out because of potential health problems associated with mercury.[4]

The measurement of temperature/ fever via the rectal route was the "gold standard".The temperature measurement by rectal site determines core body temperature, this method results in stress in children and their parents because the parents are afraid of hurt and sexual abuse of their children. Measuring rectal temperature in children is awkward, unpleasant and not without numerous risks.[5]The newer and more convenient modes of measurement of temperature/fever have spawned over the past decade many studies are conducted regarding the most accurate and reliable method for measuring temperature in children.[6]

Digital Thermometers, have evolved as a result of technological advancements in clinical thermometry. This is due to the fact that digital thermometers are considered faster, economical, and safer option.[7]The temperature measurement by digital axillary thermometer provides some advantages, but the child must be undressed and the arm should be immobile for at least 5 minutes. Axillary measurements are found to be as accurate as rectal measurements. However, there are several disadvantages, axillary measurement requires supervision in case displacement occurs and it takes longer than rectal or oral measurement (5 minutes) which is not cost effective with regard to nursing time [8]

The tympanic thermometer can detect temperature within a few seconds by directing the tip of the instrument towards the tympanic membrane.Parents and nurses rated tympanic thermometers as being more favourable in terms of ease, speed, cleanliness and safety than oral or rectal thermometers.[9]

The temporal artery thermometers offer all the advantages of axillary and tympanic membrane thermometry. Temporal artery thermometer carries the advantage of being safer, as blind introduction of the instrument in one of the body part is not required. This route is rapid, delivering data in seconds, and is well tolerated in infants and children.

It may be more accurate in children than adults, who have a thicker layer of skin over the temporal artery, which has an impact on temperature results.[10]

Material and methods

300 children 2-6 years of age attending outpatient department, admitted in paediatrics ward and paediatric intensive care unit of selected hospital were included using Non probability Purposive sampling technique. The three instruments used were digital Axillary thermometer (omraon MC-246), infrared Tympanic membrane thermometer (infinity check FDIR-V1) and infra red temporal artery thermometer (infinity check FDIR-V1). To identify the comfort experienced during the use of these instruments Modified Comfort Scale was used for children.It is a 5 point scale adopted from Ambuel and colleagues (1992) with areas in alertness, calmness, crying, facial expression and movement. Each category is scored from1 to 5. It is categorized as comfortable (Less than 50%), Moderately comfortable (Between 50-75%) and Discomfortable (More than 75%). The minimum score is 5 and maximum possible score is 25.

Inter- rater reliability was calculated to check internal consistency of the modified comfort scale for children and the range calculated came out to be for axillary thermometry is 0.85, temporal artery thermometry is 0.83 and for tympanic membrane thermometry is 0.89 where as the accepted range is between 0.6-1.

Data Collection Procedure

The child was made comfortable sitting on the chair or on the bed (paediatric ward and paediatric intensive care unit). Parents were allowed to stay with the child during the procedure. Baseline level of comfort was not assessed before the temperature measurement but child was made comfortable Video (starting point 2:30 minutes and ending point was 4 minutes) was made for 30 seconds each time the temperature was measured. After the procedure the child was left comfortable. The averagetime spent on each subject was 4 minutes. Everyday temperature measurement procedure was done on 10-15 subjects approximately. The level of comfort experienced during the use of the thermometers was calculated after watching the video using the modified comfort scale for children.

Results and discussion

In present study, there was no statistical difference (p=0.15) in the level of comfort experienced during the use of temporal artery thermometry and axillary thermometry. These findings are consistent with the Lee .G et al (2011)[11] which concluded that there was no statistical difference between the temporal artery and axillary temperatures (p=0.81). It was concluded that the use of temporal artery thermometry appears to be acceptable approach for noninvasive temperature measurement, which causes less discomfort in pediatric population. These findings are also consistent with the study conducted by Greenes DS et al. (2001)[10] to compare the tolerability of the Temporal Artery thermometry with that of the tympanic and while taking rectal thermometers as a reference. Discomfort scores, using a standardized scale, were assessed by trained observers after each temperature measurement was made. The study concluded that discomfort scores with Temporal Artery thermometry were significantly lower (P =.007). The Temporal Artery thermometry is more accurate and better tolerated than the tympanic thermometry in infants.

Tables and figures

Out of 300 children more than half (53%) of children were in age group of 4-6 years. (69%) of the children were male and most (90%) of the children were selected from the outpatient department.

Table 1: Range, Mean, Median and Standard deviation of comfort experienced during the use tympanic membrane thermometry and temporal artery thermometry with reference to the axillary thermometry among children

N=300

level of Comfort	Range	Mean + S.D	Median
Axillary thermometry	32-80	41.9 + 8.1	40
Temporal artery thermometry	28-88	41.5 + 9.0	40
Tympanic membrane thermometry	32-92	43.6 + 9.3	44

Data in the Table 1 showed that the mean comfort experienced during the use of temporal artery thermometry with standard deviation (41.5 + 9.0) was almost same as axillary thermometry, whereas, the mean comfort experienced during the use of tympanic membrane thermometry with standard deviation (43.6 + 9.3) was more than the mean comfort experienced during the use of axillary thermometry.

Table 2: Mean, Mean Difference, Standard Deviation of Difference, Standard Error of Mean Difference and 'z 'value of comfort experienced during use of tympanic membrane and temporal artery thermometry with reference to the axillary thermometry among children

Level of Comfort	Mean	MD	SD D	SE MD	Z value	P value
Temporal artery thermometry	41.5	0.4	7.1	0.7	1.0	0.155 NS
Axillary thermometry			41.9			
Tympanic membrane thermometry	43.6	1.6	7.3	0.7	3.9	0.000*
Axillary thermometry			41.9			

df (298) = 1.96 ** Highly Significant (p<0.05) NS Significant (p>0.05)

Data presented in table 2 showed that the mean comfort (41.5) experienced during the use of temporal artery thermometry and the mean comfort (41.9) experienced during the use of axillary thermometry has the difference of 0.4. The computed "z" value of 1.0 was found not to be significant at 0.05 level of significance. Thus, the use of temporal artery thermometry does not vary with the comfort experienced during the use of axillary thermometry

Table 3: Correlation between the comfort experinced during the use of tympanic membrane thermometry and temporal artery thermometry with reference to axillary thermometry among children

N=300

Correlational matrix		Axillary	Tympanic membrane	Temporal artery
Comfort	Temporal artery	0.662*	0.721*	
	Axillary		0.661*	0.662*

df (298) =0.113 *Significant (p<0.05)

Table 3 also shows that the computed coefficient correlation between the comfort experienced during the use of tympanic membrane thermometry and temporal artery thermometry was 0.661, 0.662 respectively which suggest a moderate correlation , which is found to be statistically significant at 0.05 level of significance . Thus, comfort experienced during the use of axillary thermometry has significant correlation with comfort experienced during the use of tympanic thermometry and temporal artery thermometry.

The tabulated F value in ANNOVA came out to be for horizontal df (df=2) and vertical df (df=897) at o.o5 level of significanceThe calculated F value (4.575) is greater than tabulated F value (2.99) at0.05 level of significance (p<0.05). Thus, there is statistical difference between the comfort experienced during the use of tympanic membrane thermometry and temporal artery thermometry with reference to the axillary thermometry.

Chi square value showing association of level of comfort experienced during the use of tympanic membrane thermometry and temporal artery with reference to the axillary thermometry with sample characteristics. Digital axillary thermomery and tympanic membrane thermomery was found to be significantly associated with the age of the children whereas, temporal artery thermometry was found to be significantly associated with the setting of taking the temperature.

Conclusion

In health centres and hospitals, nurses are responsible for measuring body temperature accurately and it is important to take into account the kind of thermometer and the sites of the body used for taking the measurement. Temperature measurement is essential in clinical practice. It is a vital assessment parameter to determine the presence or absence of fever in young children. Despite the fact that temperature measurement in children seems so simple, a wide variety of devices are available to record temperature from the body, ear or skin. Each method of temperature measurement in children have their strengths and weaknesses, choices should be made by the nurses to prefer the thermometer which has ease of application, safety and absence of potential risks and better tolerability in children.

Therefore, comfort experienced during the use of temporal artery is closer to the axillary thermometry than the comfort experienced during the use of tympanic membrane thermometry. Thus, it can be concluded from the study that, Temporal artery thermometry is better option for children.

Appendix -1

Section –I

Code no.: ...... Demographic data sheet

Instruction: kindly give the appropriate response of the items related to the study.

1. Age of the child (years)
1.1 2-3
1.2 3-6
2. Gender
2.1 Male
2.2 Female
3. Setting of taking the temperature
3.1 Outpatient department
3.2 Paediatrics ward
3.3 Paediatric intensive care unit
4. Diagnosis of the child

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