An evaluation of tympanic thermometry in a paediatric emergency department

A S El-Radhi, S Patel

Background and objectives: The consequences of missing fever in children can be grave. Body temperature is commonly recorded at the axilla but accuracy is a problem. This study aimed to evaluate the accuracy of a tympanic thermometer in the paediatric emergency setting.

Method: In a total of 106 infants, the body temperature was measured in the daytime with an infrared tympanic thermometer, and at the axilla with an electronic thermometer and at the rectum (gold standard for measurement of body temperature). Fever was defined as a rectal temperature of 38.0 ˚C or greater, axillary temperature of 37.5 ˚C or greater, and tympanic temperature of 37.6 ˚C or greater. The temperature readings at the three sites were compared statistically.

Results: There was a greater correlation of the tympanic measurement with the rectal measurement than the axillary with the rectal in both febrile and afebrile infants. The mean difference between the tympanic and rectal measurements was lower than that between the axillary and rectal measurements in both groups of infants (tympanic 0.38 ˚C and 0.42 ˚C, and axillary 1.11 ˚C and 1.58 ˚C, respectively). Tympanic measurements had a sensitivity of 76% whereas axillary measurements had a sensitivity of only 24% with rectal temperatures of 38–38.9 ˚C.

Conclusion: Tympanic thermometry is more accurate than measurement of temperature with an electronic axillary thermometer. It is also quick and safe, and thus it is recommended in the paediatric emergency setting.

RESULTS

For all infants, the tympanic measurement correlated more closely with the rectal \( r = 0.87, p = 0.0005 \) than the axillary measurement with the rectal \( r = 0.69, p = 0.0005 \). In afebrile infants (rectal temperature <38.0°C; \( n = 58 \)), tympanic measurement was closer to the rectal measurement (mean difference 0.38 ˚C, range 0.25–0.50 ˚C) compared with the axillary measurement to the rectal measurement (mean difference 1.11 ˚C, range 0.92–1.31 ˚C). Axillary measurement from three infants recorded temperatures of less than 35.0 ˚C, but these infants had a normal body temperature by rectal and tympanic measurements. In febrile infants also (defined as rectal temperature of 38.0 ˚C and greater; \( n = 48 \)), tympanic measurements correlated more closely with the rectal \( r = 0.83, p < 0.0005 \) than the axillary measurements with the rectal \( r = 0.67, p < 0.0005 \). The mean difference between the tympanic and rectal measurements was 0.42 ˚C (range 0.27–0.58 ˚C) and axillary to rectal measurements was 1.58 ˚C (range 1.37–1.80 ˚C).

The sensitivity of tympanic measurements to detect fever was 76% with rectal temperatures of 38–38.9 ˚C (the remaining 24% cases of "insensitivity" were measured in those with rectal temperature of 38.0–38.3 ˚C) and 100% with higher temperatures. The sensitivity of axillary measurement to detect fever was only 24% with rectal temperatures of 38.0–38.9 ˚C and 89% with higher temperatures. Tympanic thermometry was five times faster than measuring temperature with an electronic thermometer at the axilla. This could
lead to savings in time when nursing time for performing temperature measurement is considered.

DISCUSSION

Our findings are consistent with other reports such as a review of 19 studies from 1989 to 1994 which concluded that tympanic measurements had moderate to strong correlation with oral, rectal and, core temperatures. Tympanic thermometry has many potential benefits, particularly for a busy paediatric emergency setting. The technique is quick, safe, does not require the removal of clothing, easy to use without the risk of cross infection, and is not influenced by environmental temperature.

The sensitivity of tympanic measurements to detect fever was significantly higher than that of axillary measurements. The reason why tympanic thermometer could not achieve a higher sensitivity at rectal temperatures of 38.0–38.9 °C may be due to poor technique such as not targeting the eardrum, which emits the infrared energy, or to a small size of the external auditory canal in relation to the size of the scan probe. The latter reason may explain why some reports have shown lower accuracy of tympanic measurements in younger compared with older children.

Fever being missed in a high percentage of children due to measurement at the axilla could have serious consequences regarding investigations and treatment.

CONCLUSION

Tympanic thermometry is a practical method of measuring temperature in children in the emergency setting. It is more accurate than the method of measurement with an electronic axillary thermometer, and it is recommended because of its potential benefits.

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