Evaluation of Non-invasive Thermometers in Endoscopy Setting

Authors: Stacie Blake, BSN, RN; Kellie Fries, BSN, RN, PCCN; Lauren Higginbotham, BSN, RN, PCCN; Carol Lorei, ADN, RN, CEN; Michael McGee, ADN, RN, CEN; Robert Murray, ADN, RN; Melissa Priest, BSN, RN; Julie Rangel, BSN, RN, CGRN; Kara Remick-Erickson, MS, BSN, RN; Lise Schneider, MSN, RN, PCCN; Barbara Vodopest, ADN, RN; Aline Moore, MSN, RN, CGRN
Institution: North Kansas City Hospital, North Kansas City, MO

Purpose
The primary purpose of the study was to determine the level of agreement between a clinical reference thermometer (non-disposable oral electronic) and three non-invasive test thermometers:

Figure 1 Temporal artery thermometer

Figure 2 Non-contact infrared thermometer

Figure 3 Disposable oral electronic digital thermometer

In addition, the study was designed to determine if the inclusion of the ear tap step (Figure 4) when using the temporal artery thermometer improves device accuracy.

Figure 4 Ear tap step for the temporal artery thermometer

Background
Disposable and forehead thermometers are often used in patient care to limit hospital acquired infections despite limited testing of device accuracy in adults. Forehead thermometers, particularly the non-contact thermometer, may not be accurate in adults because of anatomical forehead differences between children and adults.

Methods
This study was conducted in a 36 bed endoscopy laboratory. The study used a descriptive, method-comparison design in a convenience sample of elective endoscopy patients. Each subject had temperatures measured once with each temperature device. Device order was randomly assigned for the three non-invasive test devices followed by the reference thermometer.

Data collection by study investigators was completed over a two week period. Differences and limits of agreement were calculated and graphed using the Bland-Altman method, with acceptable levels of bias and precision set a priori at: bias < +0.54° F; precision < +0.90° F.

Results
Bias and precision values in N = 25 afebrile outpatients were within the acceptable range for the temporal artery (Figure 5) and disposable oral (Figure 6) thermometers. The precision for the non-contact infrared thermometer was within the acceptable level (Figure 7), however, bias (0.66° F) exceeded the a priori acceptable level (bias < + 0.54° F).

Bias and precision values were found to be smallest when the ear tap step was not included in inclusion to the ear tap step as recommended by the manufacturer. (Figure 8)

Individual temperature differences between the test and reference thermometers exceeded 1.0° F 4% of the time with the disposable oral electronic thermometer; 32% of the time for the temporal artery thermometer with the ear tap step; 8% of the time for the temporal artery thermometer with no ear tap step; and 40% of the time for the non-contact infrared temperature device.

Findings of this study support the use of both temporal artery and disposable electronic thermometers in afebrile outpatients. Based on our results, the non-contact infrared thermometer is not recommended at this time for clinical use. Additional studies are needed to confirm the bias and precision values of the non-contact infrared thermometer in other patient care situations, particularly in hypothermic and hyperthermic adult patients. In addition, more studies are needed to determine if the ear tap step with the temporal artery thermometer is necessary for improved accuracy. Since this study evaluated only one type of oral disposable and non-contact infrared thermometer, studies of other models of these devices also need to be done.

Conclusions