Detecting Fever in Young Infants: Reliability of Perceived, Pacifier, and Temporal Artery Temperatures in Infants Younger Than 3 Months of Age

Deborah Callanan, MD

Objectives: Fever in young infants frequently triggers a laboratory evaluation because of the increased likelihood of serious bacterial infections. Reported fever by methods other than rectal thermometry is of concern. This study evaluates the validity of perceived, pacifier, and temporal artery (TA) temperatures.

Methods: A convenience sample of 200 babies younger than 3 months of age presenting to an emergency department was evaluated for parental perception of fever and with TA, pacifier, and rectal temperatures.

Results: The sensitivity and specificity of perceived and TA detection of fever were similar at 91 and 79, and 83 and 86, respectively. Febrile pacifier readings had a sensitivity of 99, but a specificity of only 46.

Conclusions: Rectal thermometry must remain the standard for infants younger than 3 months of age.

Key Words: fever, thermometer, infants

Fever is considered a significant problem in young infants. The incidence of serious bacterial infection in febrile infants has been reported as 13% for infants younger than 1 month of age and 10% at 1 to 2 months of age.1 Guidelines recommend laboratory evaluation of these infants, although the scope of the investigation may be tempered by clinical judgment.2

Determining which infant has had fever is not as simple as it seems. Baraff2 stated, “children who are afebrile but have a history of fever should be considered to be febrile to the degree reported by history.” Rectal temperatures are the standard on which the studies of infant fever are based. However, it is common in the emergency department (ED) to see infants with reported fever that has been perceived only or by axillary, tympanic, or pacifier thermometry. Axillary and tympanic thermometers are unreliable in young babies.3-6 Pacifier thermometers have had limited testing and seem to require an adjustment that may confuse parents.7-9 A temporal artery (TA) scanner has recently become available for home use, and parents may soon use this because of its noninvasive nature.

The purpose of this study was to determine the reliability of parental perception of fever in young infants and to determine the utility of TA and pacifier thermometers to detect fever in infants younger than 3 months of age.

METHODS

This study was approved by the Institutional Review Board.

Setting

Christus Santa Rosa Children’s Hospital is a 191-bed, inner-city pediatric hospital with an annual ED census of 51,000.

Data Collection

The study population was a convenience sample of 200 infants younger than 3 months of age presenting to triage for any reason between August and October 2000. Written informed consent was obtained by the triage nurse. The parent was asked whether he/she felt the child currently had a fever, and the answer was recorded. Parents were not queried about temperatures taken, so the question was limited to their belief about the child’s temperature at the present time. Temperatures were then taken with the Basis BabyTemp pacifier thermometer (Golden, CO), the Exergen SensorTouch TA thermometer (Watertown, MA), and the WelchAllyn SureTemp rectal thermometer (San Diego, CA). The WelchAllyn is the thermometer used routinely in the ED for the measurement of rectal temperatures. This thermometer had its routine maintenance, but no special calibration was performed. Data were kept in a log and were not available to the clinician except for the rectal temperature, which was also recorded in the patient record.
Data Analysis

The presence of fever was defined as a rectal temperature of 100.4°F or greater. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated for the TA, pacifier, and parents’ ability to detect fever. A linear regression analysis was carried out on the data for the TA thermometer.

RESULTS

Tactile Temperatures

One hundred seventy-nine infants (23 febrile) had data recorded for both perceived and rectal temperatures. Ninety-one percent of febrile infants were correctly identified by the caregivers as being febrile, but 21% of the afebrile infants were also believed to be febrile. Table 1 shows the ability of subjective assessment to recognize fever in this and previous studies.

Pacifier Temperatures

Pacifier thermometry was more difficult to accomplish, with a number of infants unable or unwilling to suck on the pacifier long enough to register an endpoint temperature. One hundred forty-nine pairs of pacifier and rectal temperatures (21 febrile) were available for comparison. The detection of fever by the pacifier thermometer was highly correlated with rectal fever, but many febrile babies were missed. Table 2 summarizes the studies of pacifier thermometers.

TA Temperatures

The TA thermometer is a new noninvasive device that measures temperature as its probe is swept across the forehead. Its advantages include speed, lack of contact with body fluids, and no need for undressing the patient, which make it desirable for use in triage in a busy ED. Unfortunately, TA thermometry both missed febrile infants and classified afebrile babies as feverish. One hundred eighty-seven pairs of TA and rectal temperatures were compared (23 rectal fevers). Two previous studies report its use in the broader pediatric age group. Table 3 summarizes these and the present study.

Figure 1 is a graphic representation of the correlation between rectal and TA measurements.

DISCUSSION

Evaluation of the febrile infant younger than 3 months of age is a much discussed issue. Recommendations range from a full sepsis evaluation for all infants to classification of

<table>
<thead>
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<th>TABLE 1. Accuracy of Perceived Temperatures</th>
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<td>No. Patients</td>
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</tr>
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r, rectal; o, oral; a, axillary.

*Matthews, Storrow of Wilford Hall Medical Center, abstract presented at Texas College of Physicians annual meeting, April 1996.

TABLE 2. Accuracy of Pacifier Thermometer

<table>
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<tr>
<th>No. Patients</th>
<th>Age</th>
<th>Fever</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive Predictive Value</th>
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<td>&lt;36 months</td>
<td>100.4</td>
<td>78*</td>
<td>97*</td>
<td>97*</td>
<td>82*</td>
<td>7</td>
</tr>
<tr>
<td>81</td>
<td>6 days to 2 years</td>
<td>99.6</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>8</td>
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<tr>
<td>100</td>
<td>7 days to 24 months</td>
<td>100.4</td>
<td>72</td>
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<td>97</td>
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<td>8</td>
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<tr>
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<td>48</td>
<td>99</td>
<td>91</td>
<td>92</td>
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</tr>
</tbody>
</table>

*After temperature was adjusted upward by 1.3°F.

Present study.
high-risk and low-risk infants with selective evaluation.\(^2\) Fever is not to be ignored in this age group.

Determining which infants are febrile is not straightforward. Parents frequently report their infants are febrile without taking a rectal temperature. The clinician is faced with the dilemma of how extensive an evaluation should be undertaken based on an equivocal history of fever.

Febrile babies were accurately judged by their families to be febrile prior to thermometry in 91% of cases. Unfortunately, 21% of afebrile infants were also believed to have fever. Previous studies of tactile fever have suggested that it seriously overestimates the presence of fever but rarely misses it,\(^14\) that parental assessment that the child had a fever at home but has no alterations in feeding and behavior and is afebrile and normal in the ED does not need to be categorized as febrile. This is supported by the study of Bonadio et al\(^20\), who found subsequent fever and serious bacterial infection to be rare in infants who had a history of tactile fever but were afebrile on ED presentation.

Rectal thermometry is unpopular with parents, and newer technology tends to be appealing. Parents do not like to take rectal temperatures at home, and many would also prefer their infant’s temperature to be taken another way in the ED. Axillary and tympanic temperatures have previously been reported as inaccurate and cannot be recommended.\(^3–6\)

Pacifier thermometers seem to perform with good specificity in those infants who will suck on them for the required length of time. An infant who had a fever measured by a pacifier thermometer at home should be considered to be febrile. This method of obtaining temperatures is not practical in the ED because of the time required and the large number of infants who will not adequately suck the pacifier.

The new TA thermometer is fast, requires no probe covers or undressing of the patient, and allows minimal contact with a frightened child, making it attractive for triage. However, this study shows that in infants younger than 3 months of age, its accuracy is very similar to merely touching the child. It cannot be recommended for in-hospital use in young infants when treatment decisions may be based on temperature alone. Infants who present to the ED with a history of fever by TA thermometry and are afebrile should be treated in the same manner as infants with a history of perceived fever with rectal temperature measurement and a careful history and physical.

**CONCLUSIONS**

Parents should be taught how to take rectal temperatures in their infants prior to the baby’s discharge from the newborn nursery. No less invasive method has shown sufficient accuracy to detect fever in young infants.
ACKNOWLEDGMENTS

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Joseph Roy helped with the statistical analysis.

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REFERENCES