

How many centimeters and how much time do we need for inserting and holding the rectal thermometer?

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We are not aware of any standardization on thermometer insertion depth and holding time for rectal temperature measurements. Our study is aimed to document the differences of maximal temperature readings at different depths in rectum and the mean time of thermometer placement necessary to reach maximal temperature at each depth. We performed three sequential rectal readings at 2-, 3- and 4- cm depths on each of 30 infants. Temperatures were recorded every 30 seconds until the reading remained constant for 90 seconds (stabilization). We found that all infants, except one, reached a stable rectal temperature within a 2-minute period. There was no statistical significance between the temperature stabilization times at 2-, 3- and 4- cm depths. Mean difference between 2nd and 3rd cm readings was - 0.161; between 3rd and 4th cm was - 0.139. Differences were statistically significant ($p < 0.05$ and $p < 0.001$, respectively). In conclusion, we propose to standardize the rectal temperature measurement as placing the thermometer at 3 cm depth in rectum and holding it there for 2- minute period. It may enable us to interpret the rectal temperature measurements more precisely. This proposal needs further studies based on larger-size sample groups. [Journal of Turgut Özal Medical Center 1(4):260-262,1994]

Key words: Rectal temperature, children

Termometre rektuma kaç santimetre sokulmalı ve orada ne kadar tutulmalı?

Biz rektal ısı ölçümleri sırasında, derecenin rektuma sokulma mesafesi ve orada tutulma zamanı ile ilgili herhangi bir standarttan haberdar değiliz. Çalışmamız rektumda farklı derinliklerde elde edilen maksimal ısı ölçümlerinin farklarını ve herbir derinlikte maksimal ısıya ulaşmak için gerekli olan termometrenin kalış zamanını tesbite yönelik olarak düzenlendi. Çalışmaya yaşları 1-24 ay arasında değişen 30 bebek alındı. Her bir bebek için 2, 3 ve 4 santimetrede ardarda üç ölçüm yapıldı. Isı 90 saniye boyunca sabit kalıncaya kadar her 30 saniyede bir kaydedildi (stabilizasyon). Bir bebek hariç bütün bebeklerde 2 dakikalık bir periyot içerisinde maksimal rektal ısıya ulaşıldı. İki, 3 ve 4 santimetrelik mesafelerdeki ısı stabilizasyon zamanları arasında önemli istatistiksel fark yoktu ($p > 0.05$). İki ve 3 santimetredeki ölçümler arasındaki ortalama fark - 0.161, 3 ve 4 santimetredeki ölçümler arasındaki fark ise - 0.139 °C idi. Farklar istatistiksel olarak önemliydi (sırasıyla, $p < 0.05$ ve $p < 0.001$). Sonuç olarak biz termometreyi rektumda 3 santimetre derinliğe yerleştirerek ve orada 2 dakika boyunca tutarak rektal ısı ölçümünü standardize etmeyi öneriyoruz. Böyle bir standardizasyon rektal ısı referanslarını ve ölçümlerini daha güvenilir bir şekilde yorumlamamızı mümkün kılabilir. Bu düşüncenin doğrulanması daha büyük örnekli gruplara dayalı ileri çalışmaları gerektirmektedir. [Turgut Özal Tıp Merkezi Dergisi 1(4):260-262,1994]

Anahtar kelimeler: Rektal ısı, çocuklar

There are several reports discussing the site at which the body temperature should be recorded. Rectal temperature has been advocated as a reliable indicator of internal temperature^{1,2}. Recent studies

have indicated that the rectal perforation, reported as a complication of rectal temperature measurement, occurs in less than one in two million measurements². Although axillary temperature

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measurement is more hygienic, it has been shown that it is less reliable compared to rectal measurement^{2,3}, and also it has been suggested that no standard number can be used to convert axillary to rectal temperature and vice versa¹. It has been advocated to take the body temperature through rectum, especially in infants¹⁻⁴. However we could not find any standardization on thermometer insertion depth and holding time for rectal temperature measurements in previous reports. Our study is aimed to document the differences of maximal temperature readings at different depths in rectum and mean time of thermometer placement necessary to reach maximal temperature at each depth.

MATERIALS AND METHODS

Thirty children, admitted to Pediatric Clinics of Research Hospital of Atatürk University School of Medicine for various disorders were included in this study. They aged between 1-24 months. Regardless of whether the cases were febrile or unfebrile, the measurements were taken to mimic the routine clinical practice. A glass-mercury thermometer was used for the measurements. The thermometer was tested in a thermostatically controlled water bath by an accurate laboratory thermometer in every morning during the study. All measurements were taken by the same nurse of Pediatric Clinics (FG). Following each measurement, thermometer was sterilized by using benzalconium chloride. The mercury level of thermometer was fallen to 34°C by shaking it before each measurement. Second, 3rd and 4th centimetres from the tip of the thermometer were marked with a waxed pencil. Three consecutive measurements were taken at the 2nd, 3rd and 4th cm depths in rectum for each child. Following the insertion of thermometer, the temperature was recorded in every 30 seconds.

The measurement was ended when temperature remained constant for three consecutive 30-second period (90 seconds), and the temperature recorded at the first of these three observations was accepted as the maximal temperature (temperature stabilization). Maximal temperature measurements were recorded for each depth.

Maximal temperature measurements and the maximal temperature times, which were recorded for each depth, were compared statistically (Friedman's two-way analysis of variance).

RESULTS

Table I shows the mean differences, significance of these differences and the correlations between the temperatures which were taken at 2nd, 3rd, 4th cm depths. These differences were statistically significant and the temperatures in deeper parts of rectum were higher as expected. Also, as shown in Table I, the correlations between the maximal temperatures which were measured in different depths of rectum were highly significant. The correlation coefficients between 2nd and 3rd; 3rd and 4th; 2nd and 4th cm were 0.90, 0.98, and 0.89, respectively. No statistical difference was found between the times to reach the maximal temperature (Table II). In only one of 90 measurements, the time to reach the maximal temperature exceeded 2 minutes (2 minutes and 30 seconds). The increase after the second minute was only 0.1°C in this case.

DISCUSSION

In previous reports, which compared the rectal and the other temperature measurements, it has been shown that the stabilization time of rectal temperature in newborn infants may take as much as

Table I. Mean differences between the maximal temperatures taken at different depths of rectum, significance of these differences, and the correlation coefficients

Depth in rectum(cm)	Mean differences (SD)	Significance of differences	Coefficients of correlations (r)
2 - 3	-0.161 ± 0.156	p<0.05	0.90
3 - 4	-0.139 ± 0.139	p<0.001	0.98
2 - 4	-0.333 ± 0.234	p<0.001	0.89

Table II. Mean temperature stabilization times and the significance of differences

Depth in rectum (cm)	Mean temperature stabilization times* (SD)	Significance of differences	Maximal temperature stabilization time**
2	70 ± 27	p>0.1	2 minutes
3	72 ± 29		
4	70 ± 37		

*: Seconds

** : Except one case

5 minutes⁵⁻⁸. In studies, carried out on children, except newborn infants, the thermometer has been left in rectum for 3 minutes⁴, 4 minutes¹, at least one minute or until the temperature stopped rising², but the temperature stabilization times have not been given in these studies. In this study, we showed that the temperature stabilization occurred in 2 minutes in 89 of 90 (99%) rectal measurement. In the remaining one case, temperature stabilization occurred in 2 minutes and 30 seconds and the increase (0.1°C) was not clinically important. These results suggested that it is enough to left the thermometer in rectum for 2 minutes in children except newborn period. On the other hand, the high correlations between the temperatures taken at 2nd, 3rd and 4th cm makes us enable to take any of them as a standard depth. Also this high correlation, although we did not attempt, may allow to establish a formula by which we may convert one measurement to each other.

We accept that the depth of 3 cm is superior to the depth of 4 cm because of the possible lower risk of rectal perforation, although its rare occurrence, and superior to the depth of 2 cm because it reflects the core temperature better. In addition, in a study carried out on children aged less than 6 months to give reference temperature values, 37.9°C has been found as the upper normal limit at 3rd cm². This value is in accordance with the rectal temperature of \pm 38 °C that is accepted as "fever" in several studies and in clinical practice¹⁻³. It seems suitable to choose 3 cm depth in the rectal temperature measurements.

In conclusion, we propose to standardize rectal temperature measurements by inserting the thermometer into the rectum to a depth of 3 cm and by leaving there for 2 minutes. Such a

standardization will make us enable to evaluate the rectal temperature references and measurements more precisely. We need further studies based on larger-size groups to confirm this proposal.

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