CORRELATION OF AXILLARY TEMPERATURE WITH RECTAL TEMPERATURE IN CLINICALLY UNSTABLE NEONATES

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ABSTRACT

Objectives: *To test the hypothesis that axillary temperature may not correlate well with rectal temperature in unstable neonates and to compare the predictive value of axillary temperature recording in unstable neonates with that of healthy neonates.*

Methodology: *This cross-sectional and analytical study. Neonates from birth till the age of one month were included in the study. Axillary temperature and rectal temperature were recorded upon arrival to the unit, using digital thermometers.*

Results: *At arrival, 109 neonates were categorized as stable and 117 as unstable. There were no statistically significant differences in their demographic data such as gender, gestational age, postnatal age and weight of the neonates in the two groups. Over all mean axillary temperature was 97.02^{0}F (SD±2.5) and mean rectal temperature was 97.99^{0}F (SD±2.21). The overall correlation between the axillary and rectal temperature was 0.632 (p<0.001). A significant difference (P-value <0.001) in the Pearson correlation (r) between axillary and rectal temperature recording in the two groups was found. A significant difference was also observed in regression lines between the two groups.*

Conclusions: *Axillary temperature measurement is not a reliable method of documenting the arrival temperature in clinically unstable neonates.*

Key Words*: Hypothermia, Correlation, Axillary temperature, rectal temperature.*

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INTRODUCTION

Normal axillary temperature is 36.5-37.5°C. In hypothermia the temperature is below 36.5-degree centigrade[1]. Hypothermia is a worldwide issue across all climates and geographical distribution[2,3]. It is particularly a common clinical problem in newborn nurseries in the developing world in spite of a high environmental temperature[4,5]. It is associated with high degree of morbidity and mortality[6, 7,8].

In the developed world hypothermia has regained importance mainly for its therapeutic role in various conditions like hypoxic ischemic encephalopathy and cardiac surgery[9,10]. Unlike the developed world, in the developing countries even the full term and normal weight neonates are still suffering from the ill effects of postnatal hypothermia mainly due to ignorance in the community and at times in hospitals due to the lack of knowledge about its impact on the newborn infant[11,12].

Generally it is thought that axillary temperature has good correlation with rectal temperature and also can reliably predict rectal temperature in healthy neonate. But it may not be so in sick neonates. This is the basis of our hypothesis. We believe that axillary temperature may not be reliable and a good predictor in those neonates who are hypothermic on admission and are having underlying co-morbid conditions like birth asphyxia, sepsis, pneumonia and meningitis.

This study was conducted with the idea that whether the axillary temperature recordings are as reliable as rectal temperature in clinically unstable neonates. The findings of the study were

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expected to help us to explore a more reliable route of recording the arrival temperature of the newborn infants.

METHODOLOGY

This was a cross sectional and analytical study. Neonates from birth till the age of one month, who were either brought to the Out Patient Department or admitted to our Special Care Baby unit for any minor or major illnesses, were included in the study. All the neonates upon arrival after obtaining an informed consent were immediately examined by the senior most resident/registrar of the nursery. Neonates were categorized as stable (Group A) and Unstable (Group B) depending upon the absence or presence of illnesses like birth asphyxia, neonatal sepsis, meningitis, respiratory distress and physiological derangements like vital signs abnormalities, hypoxia, hypoglycemia, shock, deep jaundice and scleredema. Only clinical criteria for the diagnoses of these illnesses and their categorization as stable or unstable were used[13]. Data regarding period of gestation (premature or full term), postnatal age, birth weight, arrival condition whether stable or unstable and axillary and rectal temperature were recorded. Axillary temperature and rectal temperature were recorded using digital thermometers (separate for axillary and rectal). Digital clinical thermometers from Acon laboratories Inc. (San Diego California USA) were used having the specifications of measurement time of 30 seconds for rectal and 38 seconds for axillary temperature recording and having a range of 32°C (89.6°F) to 42.9°C (109.2°F) with measurement accuracy of ± 0.1°C. In this study temperature recording was done for complete one minute both for rectal and axillary.

To test our hypothesis, we first determine the Pearson correlation (r) between axillary and rectal temperature for each group.For comparing the correlation between two groups, our alternate hypothesis was that the correlation coefficient(r) of clinically unstable neonates well be significantly different than the clinically stable neonates while applying the Z-test. For determining the predictability of axillary temperature for rectal temperature, we first determine the regression lines for each group and then compare the slopes of the regression lines by applying the t-test. For predictability,our alternate hypothesis was that the slopes of the regression line between the clinically stable neonates and clinically unstable neonates would be significantly different.

Data analysis was performed by using statistical package SPSS 15.0. for Windows. Comparison of correlation coefficients (r) and slopes of the regression lines was done with specific formulae given by NCSS (Number Cruncher Statistical Systems (NCSS)in the Calculations section.

RESULTS

A total of 236 neonates were enrolled. Eleven neonates were excluded because of the partly missing data. There were no statistically significant differences in the demographic data such as gender, gestational age, postnatal age and weight of the neonates in the two groups as shown in Table 1. On the bases of arrival status 117 neonates were categorized as unstable and 109 as

Table 1: Demographic Data

S. No	Variable	Arrival Condition		P-Value
		Unstable Group	Stable Groups	
1.	**Gender**			
	Male	75	74	0.548*
	Female	42	35	
2.	**Gestational age**			
	Premature	34	39	0.280*
	Term	83	70	
3.	**Postnatal Age**			
	<1day	46	44	0.475*
	1-3days	25	37	
	4-7days	31	20	
	>7days	15	18	
4.	**Mean Weight (±SD)**	2.56 (±0.75)	2.43 (±0.85)	0.220#

*Pearson Chi-square test p-value # t-test p-value

stable neonates. Over all mean axillary temperature (for both groups) was 97.02 0F (SD±2.5) and over all mean rectal temperature (for both groups) was 97.99^{0}F (SD±2.21. The overall correlation between the axillary and rectal temperature was 0.632 ($p<0.001$).. The mean axillary and rectal temperatures for the two groups are given Table 2. There was significant difference in the Pearson correlation (r) between axillary temperature and rectal temperature for the two groups (P-value = 0.000) (Table 3). The regression lines calculated for each group are given in Figure 1 and 2. There was also very significant difference in the slopes of the regression lines between the two groups (Table 4). The regression coefficient calculated for axillary temperature of the unstable neonates was only R^2=0.26, while in cases of stable neonates it was R^2= 0.61. Simple eye ball testing of the Figures 1 and 2 shows that the slopes of the regression lines in the two groups is quite different.

Table 2: Descriptive Statistics

	Mean	Std. Deviation	Number of Patients(n)
Unstable Group			
Rectal Temperature	97.85	2.09	117
Axillary Temperature	96.75	2.58	
Stable Group			
Rectal Temperature	98.13	2.33	109
Axillary Temperature	97.31	2.40	

Table 3: Comparison of Correlation in the two groups

	Unstable group	Stable group	Absolute Value of Z-test *	P-value
Pearson Correlation (r)	0.490	0.781	4.107	0.000

* Z-test for independent Correlations between the two groups was used.

Table 4: Comparison of the slopes of two regression lines in the two groups

	Unstable group	Stable group	Absolute Value of t-test*	P-value
Slope	0.40	0.76	3.514	0.000

* t-test was used for comparing the slopes of two regression lines.

Table 5: Comparison of Present Study with International Studies

Name of Study	Mean Axillary Temperature	Mean Rectal Temperature	Overall Correlation (r)
Present Study	97.02 ^{0}F	97.99^{0}F	0.632 ($p< 0.001$)
Jordan Study	99.86 ^{0}F	100.58^{0}F	0.920 ($p <0.050$)
Indian Study	99.78^{0}F	99.50^{0}F	0.950 ($p <0.010$)

Figure 1: Arrival Condition: Unstable Group

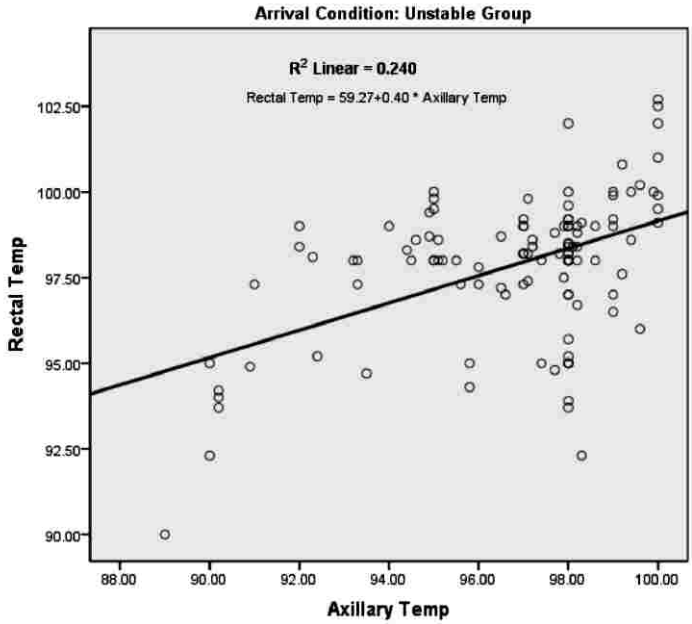
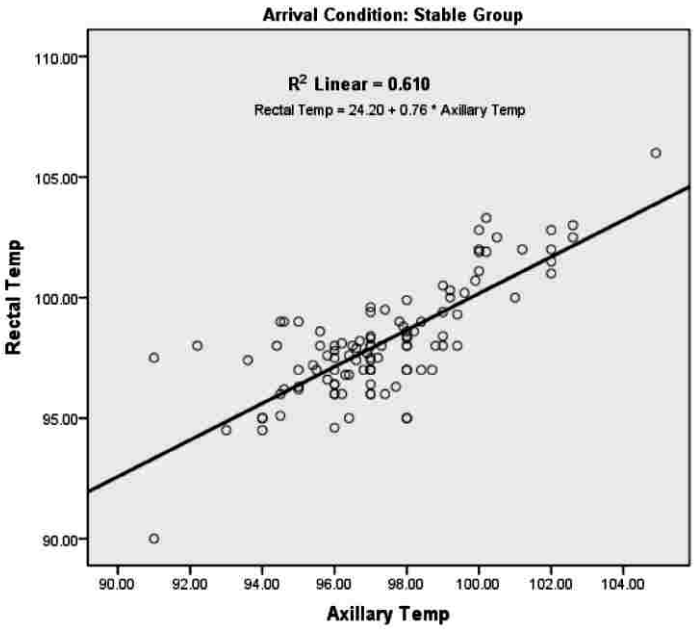


Figure 2: Arrival Condition: Stable Group



DISCUSSION

The baseline characteristics in the two groups like weight, gestational age and postnatal age were similar. We found a significant positive overall correlation between axillary and rectal temperature, which was similar to other international studies[14-17]. However the overall mean axillary, rectal temperature and overall correlation between axillary and rectal temperature measurement in our study was much lower than as reported in studies from Jordan[14] and India[15]. The probable reasons we believe are that the Jordanian study by Haddadin RB and Shamo'on H, was performed on a sample size of 216 with only 20 neonates (i.e. birth to One month age). Their inclusion criterion was mainly children with fever and so they excluded babies who were

hypothermic or premature. Our total sample was bigger and also included hypothermic and premature babies The Indian study[15] included 100 infants with 47% neonates. Unlike our study, they excluded babies who were unwell, sick and hypothermic. When we compare the correlation between axillary and rectal temperatures in each group, we found a very good correlation between the axillary and rectal temperature measurement in either groups. However when the correlation (r) was compared between two groups using SPSS applying Z- test analysis, we found this difference in correlation quite significant. Which means that correlation between axillary temperature and rectal temperature measurement was better in clinically well and stable neonates than clinically unstable, sick neonates.

To get the predictive value of the axillary temperature for rectal temperature in the two groups, linear regression analysis was applied. The regression coefficient (denoted as R^2) was calculated for each group. Student t-test was applied for testing the difference in the slopes of two regression lines obtained for the stable and unstable groups. This difference was highly significant. Which means that predictive value of axillary temperature for rectal temperature in unstable neonates is quiet lower than for clinically stable neonates. The calculated R^2 for unstable group was 0.24 as compare to 0.61 for stable group. Which means that axillary temperature would accurately predicts rectal temperature only 24% of times in clinically unstable and sick neonates as compare to 61% of times in clinically stable and well baby.

Our study supports the results of one of the systematic review by Craig JV and Lancaster, GA, who concluded that the agreement between axillary and rectal temperature measurement is quiet low[18]. They have suggested that further research is needed to establish whether sufficient accuracy can be achieved by measuring temperature at the axilla in neonates.

CONCLUSIONS

Axillary temperature measurement is not a reliable method of documenting the temperature in clinically unstable neonates. Furthermore axillary temperature measurement does not reliably predict the rectal temperature in clinically unstable neonates.

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CONTRIBUTORS

IA conceived the idea and planned the study. QAK, HI, KKK & HR did the data collection. All the authors contributed significantly to the research that resulted in the submitted manuscript.