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BLOOD PRESSURE VARIATION IN CHILDREN AT 5 MINUTE INTERVAL FOR IDENTIFICATION OF WHITE COAT HYPERTENSION

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Abstract

White-coat hypertension is a condition when a person's blood pressure tends to increase only when they are at the doctor's office. In children, blood pressure between the 90th and 95th percentile is labelled as pre-hypertension and above the 95thcentile it is classified as hypertension. The difference between 90th and 95th centiles for both systolic and diastolic blood pressure is only 4 mm of Hg.

Methods: Children between ages 5 to 10 years admitted in the children ward of Shri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India from February to April 2020 included in the study. We record blood pressure by oscillometer 4 times a day, over 4 days of hospital stay and each time two readings were taken at 5 minute intervals.

Results: During 4 days of hospital stay blood pressure varied widely. In addition second reading of BP were always less than the first reading BP, but second readings data also varied widely just as first readings.

Conclusion: White coat' hypertension is the phenomenon where BP is exaggerated by act of measuring BP. This is initiated by anxiety. Children are particularly susceptible and distressed by the circumstances of hospitalization, stranger anxiety and fear to painful intervention. We should take multiple readings before reach a conclusion of hypertension.

Key words: Blood pressure, White-coat Hypertension, Ambulatory BP, Hypertension

Introduction

Hypertension is identified using statistically derived norms based on gender, age and height. In children, BP below the 90th centile is considered normal, that between the 90th and 95th percentile is labeled as pre-hypertension and above the 95th centile it is classified as hypertension (1). In the 'Fourth Report on High BP in Children' the difference between 90th centile (normal BP) and 95th centile (abnormal BP) is only 4 mm of Hg both for diastolic and systolic BP for children between 5 and 10 years of age (1). A 4 mm error in the recording of BP can result in a child with a normal BP being labeled as hypertensive and visa versa.

The margin for error in BP recordings is therefore extremely narrow. However BP in an individual fluctuates quite widely. In a study of ambulatory BP in 5 year old children, the 75th percentile for day time BP was about 17 mm of Hg higher than the 75th percentile at night (2).

When children are admitted to the hospital for other illnesses, it is usually the first time that they have their blood pressures recorded. This is particularly a bad time to identify hypertension because of the anxiety associated with the illness with which they are admitted.

The term white-coat hypertension defines a clinical condition in which the patient has BP levels that are above the 95th percentile when measured in a physician's office or clinic, whereas the patient's average BP is below the 90th percentile outside of a clinical setting.

The present study being undertaken to look at the variability of blood pressure in individual children during hospitalization given that this is the context in which hypertension is often noted.

Material and Methods

A longitudinal observational study of the children admitted to Shri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India from February to April 2020 was undertaken. Children between the ages of 5 years and 10 years were eligible for the study if they were not suffering from a disease that affect BP and were not on medication that alters the BP. BP measurement were noted four times a day as a part of routine care. On each occasion the BP was recorded a second time as recommended by the American Heart Association (3).

Sample size calculation

We calculated that BP will have to be measured in 30 children to calculate the mean BP with 95% confidence, with a margin of error of 4, given that standard deviation of systolic BP at 7 years is 11. To allow for drop-outs due to early discharge from the hospital, we studied 32 children. We thus selected to take 32 readings per child over 4 days.

Data collection and Statistical Analysis

Blood pressure was measured at 9 am, 12 noon, 3 pm and 6 pm and at each of these occasions, two readings were taken 5 minutes apart, with child lying in bed in a comfortable position. Blood pressure was measured in the right upper limb using a 9 cm BP cuff. The same oscillometer was used in all children through the entire study. The blood pressure cuff size was selected based on the suggestion given in the 'Fourth Report' (1).

The comparison of normally distributed continuous variables (1st readings and 2nd readings) of SBP and DBP was performed using Student's t test. $P<0.05$ was considered statistically significant.

Results

The ages of the children were evenly distributed. Out of 32 children 22 was boys and 10 was female. It is said that the second BP readings taken at one sitting is likely to be closer to real BP. The mean value of 1st pressure was higher than the mean of 2nd readings. The largest difference was seen in a child who had a 15 mm Hg difference between first and second readings and lowest difference was 2 mm of Hg. For DBP the difference was 7 mm Hg in one individual who had the highest difference and 0 mm Hg difference was seen in one child. When examining the 2nd readings in different sittings, the variation of SBP range from 13 mm to 39 mm and for DBP range from 6 mm to 37 mm Hg suggesting that there was little difference in the tendency for fluctuations even if only second readings were noted. The differences are shown in table 1.

Table1: Comparison of 1st readings and 2nd readings (at 5 minute interval)

Patients	1st Reading Mean SBP	2ndReading Mean SBP	P value	1st Reading Mean DBP	2ndReading Mean DBP	P value
1	109.81	104.75	0.082	65.88	62.38	0.154
2	102.75	100.25	0.242	59.25	57.25	0.251
3	105.69	101.44	0.062	59.50	58.13	0.279
4	114.31	111	0.116	69.56	66.81	0.151
5	113.38	109.75	0.127	70.38	68.00	0.270
6	109.06	106.06	0.228	66.06	62.94	0.123
7	113.56	109.44	0.025*	70.06	67.19	0.038*
8	88.25	85	0.246	55.25	53.63	0.516
9	103.38	100.31	0.288	67.06	63.63	0.179
10	110.44	104.75	0.008*	62.81	59.88	0.013*
11	113.44	108.19	0.011*	66.56	64.06	0.091
12	112.38	108.5	0.011*	68.38	66.5	0.185
13	108.56	103.06	0.007*	68.13	65.31	0.008*
14	107.00	102.75	0.039*	63.38	60.56	0.054
15	106.13	101.81	0.057	66.13	63.13	0.051
16	106.69	102.62	0.025*	64.88	62.44	0.148
17	125.31	122.5	0.193	75.94	74.5	0.521
18	102.88	100	0.057	62.44	60.69	0.237
19	104.13	99.81	0.034*	61.31	59.25	0.017*
20	108.06	104.13	0.069	65.81	62	0.004*
21	117.44	112.44	0.010*	76.13	71.44	0.017*
22	108.25	104	0.058	66.56	62.87	0.032*
23	107.69	104.63	0.061	62.50	60.37	0.106

24	113.75	104.69	<0.001*	72.31	67.06	0.021*
25	117.06	111.19	0.063	77.00	69.94	0.002*
26	120.19	114.31	0.029*	69.25	69	0.920
27	127.19	125.12	0.493	79.00	78.38	0.810
28	111.63	108.54	0.564	67.69	72.06	0.738
29	115.63	110.56	0.064	70.75	67.88	0.282
30	108.63	104.75	0.132	68.50	65.31	0.263
31	120.06	115.63	0.026*	68.69	66.44	0.12
32	116.56	102.69	0.312	72.25	69.56	0.203

 # - each patient only 16 readings were taken, * - p values are significant
SBP – systolic blood pressure, DBP – diastolic blood pressure, SD – standard deviation

Discussion

'White coat' hypertension is the phenomenon where BP in adults is exaggerated by act of measuring BP by the doctor. This is initiated by anxiety about hypertension rather than the seeing of a white coat. The present has been done in hospitalized children. Children are particularly susceptible and distressed by the circumstances of hospitalization, stranger anxiety and fear to painful intervention (4). We anticipate that 'White coat' hypertension may have a role to play in the readings we have noted.

As such caution is required in interpreting their result. However it is appropriate that their measurement is taken in the hospitalized setting as discussed in introduction. BP is not routinely measured in community and many cases of hypertension in children were identified during hospital stay for an unrelated illness. If hypertension is falsely identified either because of anxiety associated with hospitalization or by the chance recording of high blood pressure because of the wide variance in BP seen in children it has serious consequences for duration of hospitalization, expenses of investigations and for repeated visits to the hospital for re-examination of BP and possibly an unnecessary medication. Hence the study during hospital stay has clinical relevance.

This finding has important clinical implication in how we identify children having hypertension and select children for antihypertensive medication.

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