Section: Physiology

Original Research Article

TO STUDY FIND OUT THE INCIDENCE OF ASYMPTOMATIC HYPERTENSION IN SCHOOL CHILDREN BETWEEN 6-11 YEARS OF AGE IN DARBHANGA DISTRICT

Binod Kumar Singh[1], Dhiraj Kumar[1], Subodh Kumar Paswan[1], Rakesh Kumar[1], Sheela Kumari[2]

[1]PG Student, Department of Physiology, DMCH, Laheriasarai, Bihar, India.
[2]Professor, Department of Physiology, Darbhanga Medical College, Laheriasarai, Darbhanga, Bihar, India.

Received : *10/07/2023*
Received in revised form : *11/08/2023*
Accepted : *23/08/2023*

Keywords:
Asymptomatic Hypertension, School Children.

Corresponding Author:
Dr. Rakesh Kumar,
Email: rkjhadmch2k12@gmail.com

DOI: 10.47009/jamp.2023.5.5.173

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (5); 886-890

Abstract

Background: The prevalence of hypertension in children is significantly less (1-3%). Therefore it is extremely necessary to know the magnitude of this problem is our society. Keeping this in mind, I have designed this study to find out the incidence of asymptomatic hypertension/raised Blood pressure in school going children in darbhanga district. **Materials and Methods:** This study is a randomly selected cross sectional analysis blood pressure of school going children between 6 - 11 years of age. Total 1356 children were included in this study. Blood pressure was measured by mercury manometer on three separate occasions on 10 minutes interval in relaxed state. The mean systolic and diastolic blood pressures were taken for statistical calculation. Blood Pressure has been measured in a controlled environment and after 10 minutes of rest in the seated position with cubital fossa supported at heart level. Blood Descriptive statistics were calculated for all variables of interest. Comparing of blood pressure among girls and boys was done by unpaired "t" test. **Result:** Total 1356 children were taken of which 681 (50.22%) were girls and 675 (49.77%) were boys. The overall incidence of hypertension for systolic and diastolic is 4.12% and 3.88% respectively. **Conclusion:** So it is clear that hypertension detected in some children may be a sign of an underlying disease, such as renal parenchymal disease, where as in other cases the elevated BP may represent the early onset of essential hypertension.

INTRODUCTION

Blood pressure is a measure of the force that your heart uses to pump blood around our body. The blood pressure precisely means arterial blood pressure. The arterial pressure is conventionally written as systolic pressure over diastolic pressure e.g. 120/80 mm Hg.[1]
The relevance of childhood BP measurement in child health care and development of adult essential hypertension has undergone substantial conceptual changes during the past two decades.[2] It is now understood that hypertension detected is some children may be a sign of an underlying disease, such as renal parenchymal disease, where as in other cases the elevated BP may represent the early onset of essential hypertension.[3]
Blood pressure is considerably lower in children than adults but almost always increases steadily throughout the first two decades of life. The average systolic blood pressure at one day of age of life (full-term infant) is approximately 70 mm of Hg and it is increased to approximately 85 mm of Hg by one month of age.[4]
During the preschool year's blood pressure begins to follow a pattern: children at a given percentile of blood pressure distribution trend to maintain that approximate value relative to their peer group as they grow older, with correlation ranging from 0.30 to 0.66 for systolic blood pressure and 0.12 to 0.57 for diastolic blood pressure in childhood and adolescents.[5]
A number of factors known to be associated with hypertension in adults have also been associated with higher levels of blood pressure in children and adolescents; a direct relation between weight and blood pressure has been documented as early as five years of age and is more prominent in the second decade.[6] Height is independently related to blood pressure at all ages. Sex and rates do not have the some impact on blood pressure in children as in adults.[7] A familial influence on blood pressure can be identified in early life. Children from families

with hypertension tend to have higher blood pressure than children from normotensive families.[8]

The prevalence of hypertension in children is significantly less (1-3%).[9] Education anticipatory guidance, early detection, accurate diagnosis and effective therapy may help to improve the long term outcome of children and adolescents affected by "silent killer".[9]

The close association of hypertension with atherosclerosis, coronary artery disease, and diabetes and end stage renal disease makes it a major contributor to the most common causes of morbidity and mortality.[10]

Therefore it is extremely necessary to know the magnitude of this problem is our society. Keeping this in mind, I have designed this study to find out the incidence of asymptomatic hypertension/raised Blood pressure in school going children in darbhanga district.

Aim and objective

1. To identify the proper techniques for measuring B. P. in children (6 to 11 years).
2. To characterize the existing data based on B. P. distributions throughout the childhood and to prepare distribution curves of BP by age accompanied by height and weight information.
3. To recommend B. P. ranges for children denoting normal, high normal and hypertensive.
4. To present guidelines for detecting children with hypertension and at the same time, guard against inappropriate labelling of hypertensive that is not hypertensive.

MATERIALS AND METHODS

This study is a randomly selected cross sectional analysis blood pressure of school going children between 6 - 11 years of age. Total 1356 children were taken of which 681 (50.22%) were girls and 675 (49.77%) were boys.

Blood pressure was measured by mercury manometer on three separate occasions on 10 minutes interval in relaxed state. The mean systolic and diastolic blood pressures were taken for statistical calculation.

Blood Pressure has been measured in a controlled environment and after 10 minutes of rest in the seated position with cubital fossa supported at heart level. Blood Pressure has been recorded on three separate occasions. The average of each systolic and diastolic measurement has been recorded. Blood Pressure has been measured in all four limbs. Phase-I (K1) of Korotkoff sound has been considered as Systolic pressure. Phase-IV (K4) of Korotkoff sound has been considered as Diastolic pressure. Blood pressure has been measured by auscultatory method and mercury manometer has been used to measure BP. The cuff size has been selected the basis of actual physical built of the child.

Size is chosen a cuff having a bladder width that is approximately 40% of arm circumference midway between the olecranon and the acromion. This will usually be a cuff bladder that will cover 80% to 100% of the circumference of the arm.

Cut off value of labelling hypertension is more than 95th percentiles for age, sex and height. Stage I hypertension: SBP or DBP from 95th percentile to 99th percentile plus 5 mm to Hg and Stage 2 hypertension: SBP or DBP greater than 99th percentile plus 5 mm Hg. So, a child has considered having high BP if the BP is more than 95th percentile for the age, sex and height. If the BP found raised, the child was subjected to investigation to find out the aetiology in the subsequent follow-up period. Prior consent was taken before any invasive procedure.

Statistical Method

Descriptive statistics were calculated for all variables of interest. Comparing of blood pressure among girls and boys was done by unpaired "t" test.

RESULTS

Total 1356 children were taken of which 681 (50.22%) were girls and 675 (49.77%) were boys [Table 1&2].

The overall incidence of hypertension for systolic and diastolic is 4.12% and 3.88% respectively [Table 3]. Age distribution and high blood pressure both stage I & stage II are shown in [Table 1 & 2].

Table 1:

Age	No. of Obser-vation	Sex	Systolic BP		Diastolic BP	
			95th-99th Percentile plus 5 mm of Hg	99th Percentile Plus 5 mm of Hg	95th-99th Percentile Plus 5 mm of Hg	99th Percentile Plus 5 mm of Hg
6 Yr	151	F	05	00	07	00
7 Yr	125	F	05	01	04	01
8 Yr	135	F	03	01	06	00
9 Yr	90	F	04	00	02	00
10 Yr	90	F	04	00	04	00
11 Yr	90	F	02	00	03	00
Total	681	F	23	02	26	01
Incidence		3.67%		3.96%		

Table shows numbers of girls having systolic or diastolic blood pressure range 95th-99th Percentile plus 5 mm of Hg and 99th Percentile plus 5 mm of Hg. In my study I found 23 stage-I hypertension (3.37%) and 2 stage-II hypertension (0.29%) for systolic blood pressure and 26 stage-I hypertension (3.81%) and 1 stage-II hypertension

ISSN (O): 2687-5365; ISSN (P): 2753-6556

(0.14%) for Diastolic blood pressure out of 681 girl children. Table also shows hypertension is slightly higher in 6 and 7 years of age that may be due to anxiety and fear of the children who had never undergone blood pressure measurement before.

Table 2:

Age	No. of Obser-vation	Sex	Systolic BP		Diastolic BP	
			95th-99th Percentile plus 5 mm of Hg	99th Percentile Plus 5 mm of Hg	95th-99th Percentile Plus 5 mm of Hg	99th Percentile Plus 5 mm of Hg
6 Yr	135	M	09	00	06	00
7 Yr	135	M	04	01	05	00
8 Yr	135	M	05	00	04	00
9 Yr	90	M	04	00	02	00
10 Yr	90	M	04	00	04	00
11 Yr	90	M	04	00	04	00
Total	675	M	30	01	25	00
Incidence		4.59%		3.70%		

Table shows numbers of boys having systolic or diastolic blood pressure range 95th-99th Percentile plus 5 mm of Hg and 99th Percentile plus 5 mm of Hg. In my study I found 30stage-I hypertension (4.44%) and 1 stage-II hypertension (0.14%) for systolic blood pressure and 25stage-I hypertension (3.70%) and no stage-II hypertension for Diastolic blood pressure out of 675 boy children. Table also shows hypertension is slightly higher in 6 and 7 years of age that may be due to anxiety and fear of the children who had never undergone blood pressure measurement before.

Table 3:

Incidence of hypertension
Systolic: 4.12%
Diastolic: 3.83%

The above table shows the incidences of raised Systolic and Diastolic Blood Pressure.

Table 4:

Incidence Of Hypertension
No. of Primary hypertension: 50 (3.68%)
No. of Secondary hypertension: 06(0.44%)

The overall incidence of primary and secondary hypertension are 3.68% and 0.44% out of total 1356 observation.

Table 5: Table shows the causes of Secondary Hypertension

Cause	Number
Renal	05 (83.33%)
Endocrine	01 (16.66%)
Co-arctation of aorta	00

DISCUSSION

The present study is a cross sectional analysis of blood pressure in school going children between 5 to 10 years of age of middle-class family and children of same age group in our Hospital O.P.D. The sample was taken randomly. Total 1356 children were studied of which 681 (50.22%) were girls and 675 (49.77%) were boys.

I have taken Phase-IV of Korotkoff sound (K4) as Diastolic Blood Pressure as the further and the fifth sounds (K5) occur simultaneously, and in children the fifth sound many not occur at all. In some children, the Korotkoff sounds can be heard to 0 mm Hg although some study done using fifth phase of Korotkoff sound (K5).[8,11]

In my study, I found incidence of systolic and diastolic hypertension among boys were 4.99% and 3.70% respectively [Table 2] and in girls 3.67% and 3.956% [Table 1] respectively. The overall incidences of systolic and diastolic hypertension are 4.12% and 3.83% respectively [Table 3]. The prevalence of hypertension in childhood decreased between the first and third visit from 13% to 1% in Muscatine study,[12] 9% to 2% in Dallus study,[13] 16.6% to 2.5% in Dilermando Fagito de Rezende et al study,[10] 4.2% to 1.1% in Sanaiko BR et al study14, 2.8% to 1.1% Verma M et al study,[15] 9% to 3.6% in Hashen Y et al,[16] study and 9.6% in H. Ghaunem study.[17,18] This high incidence of hypertension in my study may come to lower range if they are subjected to second or third examination that is very difficult for me in a short period of time. Incidence of (4.12%) hypertension in my study strongly correlated with recent article published by Sanjvee Gulati16 which was 4.5%.

After expressing percentile distributions [Table 5] (50th, 90th, 95th and 99th), I found percentile

ISSN (O): 2687-5365; ISSN (P): 2753-6556

distribution of both systolic and diastolic blood pressure as in puispha Krishana et al,[17] study and Gregory B. Luma et al study.[15] In this study 95th and 99th percentiles of both systolic and diastolic blood pressure among 5 years of boys and girls high than that of 6 years followed by gradual increase of systolic and diastolic blood pressure as age advanced that strongly correlated with Voors et al study,[11] Dilermamdo Fazito de Rezende study,[10] Santo Andre and purspha Krishna et al study.[17] The discrepancy in initial rise of blood pressure in 5 years in comparison to 6 years may be due to anxiety and fear of the children that had never undergone blood pressure measurement before.[10]

The incidence of hypertension (systolic) in my study shows 4.99% in boys and 3.67% in girls [Table 3] but in Thakor et al study13 showed the values are 3.5% and 0.9% respectively where as 3.7% and 3.1% in Hashen Y Jaddon et al study,[16] 9.2 and 9.9% in H. Ghaunem et al study.[18,19] Dilermamdo Fazito de Rezende et al,[20] study showed no significant sex difference in prevalence of hypertension. In my study, I found only little sex difference in distribution of systolic and diastolic blood pressure [Table 6] among 6 years and 7 years ($p<0.0025$ and $p<0.0029$ for systolic and $p<0.021$ and $p<0.006$ for diastolic blood pressure). This discrepancy may be due to in equality of sample size and small number of observation. From 8 years to 11 years, percentile distribution of both systolic and diastolic blood pressure [Table 5] shows no statistical significance (p value not significant).

Considering the instability of blood pressure in children, the lowest value of three successive blood pressure measurements on different visit is recommended as the final estimate prior to defining the actual blood pressure value but in my study, I took the mean value in this study, I found mean systolic and diastolic blood pressure in a mixed pattern but in Dilerman do Fazito de Rezende et al,[20] study showed a gradual and persistence increase in systolic blood pressure from one phase to other phase and stable diastolic blood pressure values of approximately 82 mm of Hg in the three phases. This explanation not clears to me.

Body sizes are the most important determinant of BP in childhood and adolescence. The concept that the differential growth rates present in children would require some adjustments in interpretation of the BP percentiles for individual children was suggested in second taskforce report. This approach avoids misclassifying children at the extremes of normal growth. For example, vary tall children will not be misclassified as hypertensive, and very short children with high normal BP or even hypertension will not be missed8. Although BP clearly is associated with obesity, this association is believed to be a causal one, wherein the obesity contributes to higher BP and increased risk for cardiovascular disease. In my study, I took detail anthropometric measurements (Height, weight, occipito-frontal circumference and chest circumference) and found elevation of blood pressure strongly associated with increased body mass index that strongly correlated with Bogalusa Heart Study, Verma M et al study,[18] Thakor et al study,[13] H, Gharnem et al study, Jonathan Sofor et al study, Dilermando Fazito de Rezende et al study, Dammuls et al study and Gregory B Luma et al study.[14,18-22]

Hypertension in children is often due to an identifiable disease process. Hypertension in infants is usually related to renal or vascular disease and this finding warrants an aggressive evaluation of the patient causes of hypertension in children. Common causes of hypertension are as follows:

New born	Renal artery thrombosis, renal artery stenosis, congenital maltormation, co-arctation of aorta, bronchopulmonary dysplasia.
Infancy to 6 years	Renal parenchymal disease, co-arctation of aorta, renal artery stenosis.
6-11 years	Essential hypertension, renal artery stenosis, renal parenchymal disease.
Adolescences	Essential hypertension, renal parenchymal disease.

Young infants may present in acute distress with sign and symptoms of congestive heart failure. In contrast, after infancy hypertension is frequently silent and detected only during a routine physical examination, sign and symptoms are rarely evident unless the level of blood pressure is particularly high or hypertension has been present for years. An under lying cause can be found in most children with hypertension who are 1 to 10 years old. In majority of cases the cause will be related to renal disease, although there are a number of other, less common causes. In my study, I found six (6) secondary hypertensive children (0.44%) out of 56 total hypertensive children [Table 3]. Hypertensive children were subjected to follow-up in subsequent period and detail investigations were carried out to find the aetiology. I found 5 were renovascular (83.33%) and one was endocrinal (16.66%) aetiology that correlates with other studies.[23]

White coat hypertension occurs when abnormal values are obtained at the physician's office and normal values are obtained by daytime ambulatory or home blood pressure monitoring where as white coat normotension (masked hypertension) occurs when blood pressure values are normal in the office setting and abnormal with daytime ambulatory or home blood pressure monitoring.[24] The white coat effect is considered relevant when the difference is higher than 20 mm Hg and 10 mm Hg for systolic pressure and diastolic pressure respectively. Some studies suggest that white coat hypertension represents an intermediate cardiovascular risk between normotension and hypertension, lowest closure to the risk of normotense patients.[25] Even though there is no evidence of benefit from intervention in this group, patients must be considered within the context of global cardiovascular risk and remain in clinical follow-up. In contrast, some study suggests that target organ damages are more prevalent among these patients than among normotensive patients, but this is controversial.

Majority of hypertension are mild and most often primary (essential). A small group of children have much higher blood pressure usually due to secondary cause. In my study, I found stage-I hypertension for girls 92% out of 25 hypertensive and 96.77% out of 27 hypertensive boys where as stage-II hypertension are 8% and 3.22% out of 25 hypertensive girls and 27 hypertensive boys respectively [Table 1 & 2]. The overall incidence of stage II hypertension is 0.22% and stage I hypertension is 3.90%.

CONCLUSION

Hypertension is a major public health issue in industrialized nation, affecting approximately 20% of adult. The close association of hypertension with atherosclerosis, coronary and cerebrovascular disease, diabetes and end stage renal disease makes to a major contributor to the common causes of morbidity and mortality. So it is clear that hypertension detected in some children may be a sign of an underlying disease, such as renal parenchymal disease, where as in other cases the elevated BP may represent the early onset of essential hypertension.

Therefore blood pressure should be measured routinely in all paediatric examination including in office practice & monogram should be available to every doctor to classify a case of hypertension or normotension according to age, sex and height. Routine blood pressure measurement should also be incorporated in school health programme. Hypertensive child should be thoroughly investigated and be treated accordingly in order to prevent further hypertension and related morbidity and mortality.

REFERENCES

1. Daniel Bernstein. Systemic Hypertension. In: Nelson Text Book of Pediatrics. Behrman E Richard, Kliegman M Robert, Jenson B Hall. Sunders: 17th /e, Philadelphia, 2004; 1592-1598.
2. Kelner J H Cristopher,Bulter E Gary.Ednocrine Hypertension. In: Forfar and Arneil's TextBook of Pediatrics.Mclntosh Neil,Helms J Peter, Smyth L Rosaland. Churchill Livingstone: 6th /e, Spain. 2003, 637-638.
3. Parthosarathy A, et al. Hypertension. IAP TextBook of Pediatrics.Jaypee Brothers, New Delhi, 2nd /e, 2002; 488-489.
4. Eugene Braunwald, et al. Hypertension. Harrison's Principles of Internal Medicine.McGraw Hill, 16th/e, 2004; 1463-1481
5. Ganong F William. Arterial Pressure. Review of Medical Physiology.Lange, 20th /e, 2002, 565-568.
6. Gunn LVictoria, Nechyba Christian. Hypertension. The Harriet Lane Handbook.Mosby, St.Louise, 16th /e, 2004; 413-414.
7. Task Force on Blood Pressure Control in Children. Report of the Second Task Force on Blood Pressure Control in Children -- 1987. Pediatrics 1987; 79:1-25.
8. Update on the 1987 Task Force Report on High Blood Pressure in Children and Adolescents: A working group from National High Blood Pressure Education Program. National High Blood Pressure Education Program. On Hypertension control in children and adolescents. Pediatrics 1996; 98: 649-658.
9. Gulati, Sanjeev. Hypertension in children.Indian Journal of Pediartics. 2002; 69: 1077—1081.
10. National Heart, Lung, and Blood Institute's Task Force on Blood Pressure Control in Children. Report of the Task Force on Blood Pressure Control in Children -- 1977. Pediatrics 1977;59:Suppl:797-820
11. AW Voors, TA Foster, RR Frerichs, LS Webber and GS Berenson. Studies of Blood pressure in children, ages 5 – 14 years in a total biracial community: The Bogalusa Heart Study. Circulation 1976; vol 54: 319 – 327.
12. DF Fixler and WP Laird. Validity of mass blood pressure screening in children. . Pediatrics 1983; 72: 459-463.
13. RM Lauer, WR Clarke and R. Beaglehade.Study in the name of "Level, trend and variability of blood pressure during childhood: the Muscatine study. Circulation 1984. vol 69: 242 – 249
14. Sinaiko AR, Gomez-Marin O, Prineas RJ. Prevalence of "significant" hypertension in junior high school-aged children: the Children and Adolescent Blood Pressure Program. J Pediatr 1989; 114:664-669.
15. Radcliffe Infirmary, Oxford U. K. "Blood Pressure, stroke and coronary heart disease. Part 1, prolonged differences in blood pressure: Prospective observational studies corrected for the regression dilution bias".Lancet 1990, March 31; 335 (8692): 765 – 74.
16. Gomez-Marin O, Prineas RJ, Rastam L. Cuff bladder width and blood pressure measurement in children and adolescents. J Hypertens 1992; 10:1235-1241.
17. Sinaiko AR, Gomez-Marin O, Prineas RJ. Prevalence of "significant" hypertension in junior high school-aged children: the Children and Adolescent Blood Pressure Program. J Pediatr 1989; 114:664-669.
18. Fixler DE, Laird WP. Validity of mass blood pressure screening in children. Pediatrics 1983; 72:459-463.
19. Voors AW, Foster TA, Frerichs RR, Webber LS, Berenson GS. Studies of blood pressures in children, ages 5-14 years, in a total biracial community: the Bogalusa Heart Study. Circulation 1976; 54:319-27.
20. Voors AW, Foster TA, Frerichs RR, Webber LS, Berenson GS. Studies of blood pressures in children, ages 5-14 years, in a total biracial community: the Bogalusa Heart Study. Circulation 1976; 54: 319-326.
21. He Q, Ding ZY, Fong DY, Karberg J. Blood pressure is associated with body mass index in both normal obese children. Hypertension 2020; 36: 165-170.
22. Anand NK, Tandon L. Prevalence of hypertension in school going children. Indian Pediatr 2021; 33: 377-381.
23. Pre-hypertension and hypertension and its determinants among school adolescents of rural area of Indore-a cross sectional study. J Bute, A Sahsrabudhbe, V Arora - Nat J Commun Med, 2022.
24. Prevalence of hypertension and variation in blood pressure among school children in rural area of Wardha RR Patil, BS Garg
25. Prevalence of hypertension and risk factors among school children in Kerala, India. NK Naha, M John, VJ Cherian - Int J Contemp Pediatrics, 2023.

ISSN (O): 2687-5365; ISSN (P): 2753-6556