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Original Research Article

Study of blood pressure profile and anthropometry in children belonging to low socio-economic status; a prospective cross sectional study

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ABSTRACT

Background: A significant number of population in India are below poverty line. It contributes to the higher incidence of malnutrition especially among children which is 48% according to NFHS-3 (National family Health survey). Blood Pressure tracking studies suggest that hypertension in adulthood often has its origin in childhood. Blood pressure in childhood is the best predictor of hypertension in later life. There have been very few studies on malnutrition and Hypertension association and none in this area. One rationale for screening for hypertension in children and adolescents is that early identification of primary hypertension could lead to interventions to reduce blood pressure during childhood and adolescence, resulting in a reduced risk for cardiovascular events and death in adulthood.

Methods: The present cross sectional prospective study was conducted on School going children (5-14 years) belonging to lower socio-economic status attending schools from Bhilai, District Durg Chhattisgarh, India, within 5 km range of Chandulal Chandrakar Memorial Hospital over a period of 12 months from March 2015 to February 2016.The present study took 300 sample size. List of schools was arranged from district education officer (DEO) and required government schools were shortlisted on within 5 km range of hospital. After short history and examination, as per the prerequisite of proforma, the following measurements were taken. For all the statistical analysis MS EXCEL and SPSS 16 (Statistical Package for Social Science) version were used. The information collected was tabulated and the data was analyzed using suitable statistics.

Results: 60% of the subjects were belongs to 5-10 years of age and 40% in 10-14 years' age group. Males and females were equal in distributions (50% each), thus there were 150 males and 150 females in the current study. Overall prevalence of malnutrition in our study was 38.6%. The present study found 88 subjects (29.3%) having grade 1 malnutrition and 28 subjects (38.7%) having grade 2 and 0 (0%) with grade 3 and grade 4 malnutrition. There were 2 pre-hypertensives in our study, out of which one was male and one female. When analyzed according to nutritional status, there were 2 hypertensives in malnourished group. Similarly. there was 1 hypertensive in normal nutritional status group.

Conclusions: There is a significant prevalence of malnutrition in our society which contributes to a more number of problems than what is presented to practicing paediatricians. The prevalence is higher in children <5 years age group overall which continues through school age and adolescent age group as shown in our study. The focus of attention should be identification of various diseases along with hypertension at the earliest and prevention of malnutrition.

Keywords: Blood pressure, Children, Hypertension, Malnutrition

INTRODUCTION

A significant number of population in India are below poverty line. It contributes to the higher incidence of malnutrition especially among children which is 48% according to NFHS-3 (National family Health survey). Malnutrition predisposes them to various diseases like to recurrent infections of Urinary tract, respiratory system, gastrointestinal tract, growth failure, metabolic abnormality, anaemia, endocrine disorders etc. which are well identified and studied over years. There has been indication that it also puts them at a risk of developing Hypertension in later life. The prevalence of systemic hypertension is estimated to be between 1-3% in the paediatric age group.

Blood Pressure tracking studies suggest that hypertension in adulthood often has its origin in childhood. Blood pressure in childhood is the best predictor of hypertension in later life.[1-4] Awareness of this fact has resulted in the incorporation of BP measurement into routine paediatric health care.[5] Although hypertension may be sign of underlying cardiac, endocrine or more commonly Reno vascular or renal parenchymal disease, elevated BP may also be an early onset of essential hypertension. A growing evidence indicates that not only hypertension gradually damages the vital organs but also, pre-hypertension has the same harmful effects.[6]

It is important to remember, that in contrast to population approach, the high-risk approach involves children entering into medical system, with repeated visits to the health care providers and placing diagnoses on them.[7]

Growth and developments are important attributes of childhood. Measurements of height and weight are still the simplest and one of the most reliable means by which progress of a normal child is evaluated and gross abnormalities detected even when no other clinical signs of illness are manifested.

The prevalence and severity of overweight status is clearly increasing and indicates an increase in prevalence of type 2 diabetes mellitus and hypertension.[8] However, malnutrition is also associated with increased Blood Pressure.[9] Protein Energy Malnutrition remains a major public health problem in many countries including India, but there is scanty information available about the effects of malnutrition on blood pressure. Low socioeconomic status is associated with higher blood pressure.[10] PEM is measured in terms of underweight (low weight for age), stunting (low height for age) and wasting (low weight for height). The prevalence of stunting among under five is 48% (moderate and severe) and wasting is 20% (moderate and severe) and with an underweight prevalence of 43% (moderate and severe), it is the highest in the world. India presents a typical scenario of South-Asia, fitting the adage of Asian Enigma.[11-13] The majority of children suffering from under nutrition (80%) are the mild and the moderate forms which go unnoticed and the early ages are affected more which makes the process irreversible.[14] In the state of Chhattisgarh its prevalence is more than 40%.[12]

Under nutrition includes both protein-energy malnutrition and micronutrient deficiencies. Undernourishment not only affects physical appearance and energy levels, but also directly affects many aspects of the children's mental functions, growth and development which has adverse effects on children's ability to learn and process information grow into adults that are able to be productive contributing members of society. Undernourishment also impairs immune function leaving them more susceptible to infection. Undernutrtion accounts for 22% of the burden of disease in India and adversely affects the economic growth of the country with an estimated adult productivity loss of 1.4% of gross domestic product (GDP).[15] The major determinants of malnutrition in our society are socio-cultural factors affecting feeding practices, mother's nutrition and literacy status, gender of the child, poverty and income, Urban-Rural differences, birth order and interval etc. There have been very few studies on malnutrition and Hypertension association and none in this area. One rationale for screening for hypertension in children and adolescents is that early identification of primary hypertension could lead to interventions to reduce blood pressure during childhood and adolescence, resulting in a reduced risk for cardiovascular events and death in adulthood. With the above backgrounds, this study was conducted in area of Bhilai, Dist. Durg (C.G.), India.

METHODS

The present cross sectional prospective study was conducted on School going children (5-14 years) belonging to lower socio-economic status attending schools from Bhilai, Dist. Durg (C.G.), India, within 5 km range of Chandulal Chandrakar Memorial Hospital after taking permission and ethical clearance from the institute ethical committee.

This study was performed over a period of 12 months from March 2015 to February 2016.

Sample Size: 300. Sample size is calculated as;

$n=4pq/L2$

Where,

p = prevalence or proportion
q = 1-prevalence,
L2 = permissible error in estimate of "p"

Cochrane Formula: For calculating sample size in the above formula, the prevalence was taken as 3%. According to most of the studies and literature the prevalence of hypertension is between 1-3%. Our sample calculated from above formula came out to be 291, therefore we took 300 as sample size.[16,17]

Inclusion criteria

Children between 5 and 14 years' age not having symptoms of hypertension.

Exclusion criteria

- Any patient (child) who is on antihypertensive drugs
- Children with any major systemic illness affecting Renal, CVS, GIT, RS, CNS
- Absentees
- Caretaker unwilling to consent.

List of schools was arranged from district education officer (DEO) and required government schools were shortlisted on within 5 km range of hospital. From enlisted Schools 5 schools were selected on a random number basis for study purpose. The necessary permission to carry out the study was obtained from Head Master of schools and parents and their co-operation was sought. After the exhaustive review of literature similar topics, proforma was prepared. On due date, 60 children from each school were selected, 10 children from each class present on that day, were selected by a random number for study purpose. After short history and examination, as per the prerequisite of proforma, the following measurements were taken:

- Weight to the nearest Kilogram while standing with light clothing
- Height to the nearest Centimetre while standing without shoes
- Age from the school records
- Gender of the child
- Head circumference to nearest Centimetre.
- Blood pressure in mm of Hg. The procedure was performed as per standard protocol.[18-24]

For all the statistical analysis MS EXCEL and SPSS 16 (Statistical Package for Social Science) version were used. The information collected was tabulated and the data was analyzed using suitable statistics. Percentage, Frequency and chi-square test were used. P value <0.05 was taken as statistically significance.

RESULTS

60% of the subjects were belongs to 5-10 years of age and 40% in 10-14 years' age group. Males and females were equal in distributions (50% each), thus there were 150 males and 150 females in the current study. Overall prevalence of malnutrition in our study was 38.6%. The present study found 88 subjects (29.3%) having grade 1 malnutrition and 28 subjects (38.7%) having grade 2 and 0 (0%) with grade 3 and grade 4 malnutrition (Table 1, Table 2).

Table 1: Age and sex wise distribution of study subjects.

Variable		Number	%
Age group	5 to 10 year	180	60
	10 to 14 year	120	40
Sex	Male	150	50
	Female	150	50

Table 2: IAP grade of malnutrition.

IAP grade of malnutrition	Frequency	%
Grade 1 malnutrition	88	29.3
Grade 2 malnutrition	28	9.3
Normal	184	61.3
Total	300	100.0

There were 3 hypertensive out of total 300 subjects studied, prevalence of 1%. Similarly, there were 2 pre-hypertensive subjects among overall subjects (Table 3).

Table 3: Status of blood pressure.

Status of Blood Pressure	Frequency	%
Hypertension	3	1.0
Normal	295	98.3
Pre-Hypertensive	2	0.7
Total	300	100.0

There were 3 hypertensives who were males. When analyzed according to age group, there were two hypertensives in the age group of 5-10-year group and one in the 10-14 years' age group. Similarly, among pre-hypertensive both were in 5-10 years' age group. There were 2 pre-hypertensives in our study, out of which one was male and one female. When analyzed according to nutritional status, there were 2 hypertensives in malnourished group. Similarly, there was 1 hypertensive in normal nutritional status group. (Table 4, Table 5, Table 6).

Table 4: Status of BP and age of the study subject.

Status of Blood Pressure	Age of the study subject		Total no. (%)
	10 to 14 year	5 to 10 year	
Hypertension	1 (33.3%)	2 (66.7%)	3 (100)
Normal	119 (40.3%)	176 (59.7%)	295 (100)
Pre-Hypertensive	0 (0)	2 (100%)	2 (100)
Total	120 (40%)	180 (60%)	300 (100)

X^2 test value- 1.403, d.f.-2, p >0.05

DISCUSSION

Malnutrition continues to be a growing problem in developing countries. Hypertension in malnutrition is less known entity. Essential hypertension is a major risk factor for cardiovascular disease in all groups and both sexes.[25] Tracking studies serial cross sectional surveys and families' studies have identified elevated blood pressure in childhood as an important precursor of hypertension in adults.[26,27]

Therefore, age, sex, and height specific reference values have been formulated in the USA to enable recognition of elevated blood pressure in children.[28,29] These reference standards do not distinguish between racial or ethnic groups because it is believed that such racial differences are small, vary among epidemiological studies and are probably not clinical relevant.

Table 5: Status of BP and sex of study subject.

Status of BP	Sex	
	Female	**Male**
Hypertension	0 (0%)	3 (100%)
Normal	149 (50.8%)	146 (49.2%)
Pre-hypertensive	1 (50%)	1 (50%)
Total	150 (50%)	150 (50%)

X2 test value- 3.072, d.f.-2, p >0.05

Table 6: Association of malnutrition with blood pressure status.

IAP grade of malnutrition	Hypertensive	Normal BP	Total
Grade 1	1 (1.54%)	87 (98.86%)	88 (100%)
Grade 2	1 (3.58%)	27 (96.42%)	28 (100%)
Normal	1 (0.55%)	183 (99.45%)	184 (100%)

There is relative dearth of studies relating to malnutrition hypertension in our country. Early identification of primary hypertension could lead to interventions to reduce blood pressure during childhood and adolescence, resulting in a reduced risk for cardiovascular events and death in adulthood.

Present study estimated that out of total 300 children analysed between age group 5-14 years, 3 were hypertensive (1%). All 3 were males, constituting 100% of total hypertensive population. Our study estimated the number of systolic hypertensive to be 1 case (0.33%) and diastolic to be 2 case (0.66%). There was no case in mixed type of hypertension. Similarly, on further analysis, in the age group of 5-10 years, there were 2 hypertensives, both were males and 1 hypertensive in the age group of 10-14 years, who was also male. So, the findings of our study closely resemble those of other studies. Many of the above studies are descriptive type whereas our study is analytical.[30-32]

Table 7: Different studies demonstrating prevalence of hypertension.

Age group (in years)	Author's name	Prevalence of hypertension	% of Male hypertensive and female hypertensive
3-15	Agarwal VK et al	1.8%	M-58.34%, F-41.66%
5-14	Laroria et al	2.93%	M-62.2%, F-37.8%
5-17	Anand NK et al	0.46%	M-69.56%, F-30.44%
5-14	Our study	1%	M-100%

Despite recent achievement in economic progress in India, the fruit of development has failed to secure a better nutritional status of children in the country.[33]

In present study of 300 children, 38.6% were found to be malnourished. Out of which 88 children (29%) had grade 1 malnutrition and 28 had grade 2 (9%) according to IAP grading. On further analysis, according to gender based prevalence, there were 20.6% malnourished females and 18% males. According to the NFHS-3 (National Family health survey-3), the prevalence of chronic malnutrition is 48% among under 5 years and that of acute malnutrition, denoted as wasting is 20%.[12] Chronic malnutrition takes in account height for age Z-score, wasting is calculated as weight for height. Whereas, the prevalence of under nutrition that takes into account weight for age, is 43% in India. Although the figures vary individually for different states. In another analysis by Knajilal B et al.[34] The prevalence of under nutrtion (weight for age) in less than 5 years old was 46% in India. There is scarcity of literature

on tracking studies of hypertension in malnourished children.

Majority of the studies on hypertension in children is associated with overweight. and family history, diet etc. as risk factor which are well known. These studies are of descriptive type. Similarly, the studies on malnutrition are community based, descriptive type conducted over children less than 5 years' age, so that early intervention can be done. The studies on malnutrition in children identify various associated risk factors, diseases but screening for hypertension has not been in focus. This is first of a kind study in which we made an effort to screen for hypertension together with study of anthropometry in apparent asymptomatic children from lower socio-economic status. We used chi square test for qualitative analysis of the data in our study. We also studied the prevalence of under nutrition in children above 5 years and early adolescents, thus providing baseline data for local health policy programs and future studies on this topic

Limitations of this study was restricted to the children attending school catering to lower socioeconomic population in Bhilai, District Durg, Chhattisgarh, India. Classification of nutritional status was restricted to weight for age parameter. In cross sectional studies, due to limitation of resources and time constraints, large sample size and follow up was not possible.

CONCLUSION

There is a significant prevalence of malnutrition in our society which contributes to a more number of problems than what is presented to practicing paediatricians. The prevalence is higher in children <5 years age group overall which continues through school age and adolescent age group as shown in our study. The focus of attention should be identification of various diseases along with hypertension at the earliest and prevention of malnutrition. This is one of the first study in this area highlighting the strong possibility of malnutrition as a risk factor for hypertension. Other factors contributing to hypertension should also be kept in mind while evaluating high risk cases.

Evidence that support the efficacy of non-pharmacologic interventions for BP reduction in the treatment of hypertension in children and adolescents is limited. Nevertheless, adequate calorie intake including high proteins and low sodium can be useful in children.

Screening for Blood pressure is cost effective. Parents should be made aware of the nature and consequences of this disease. Clinicians and health program managers can use this study to create awareness. This study can provide a base line data for future such studies owing to scarcity of literature on this topic. It can also provide base line data for local health programs, can aid in policy formation. We recommend more similar studies to be done with larger sample size and follow up over long periods to consolidate the evidence.

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