Original Research Article

A hospital based observational study to assess the BP and serum lipid profile stunted children in the age group of 1–5 years

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Abstract

Background: Coronary artery disease (CAD) has been delineated as the greatest epidemic humanity has ever faced. It takes a tremendous toll in premature sickness, disease, and death, which have a major economic impact on the person and upon the health care delivery system. Accounting nearly 80% of all cardiac morbidity, CAD is now the major cause of morbidity and mortality throughout the world. In most countries, it accounts for 30% of all deaths.BP and lipid profile play important role in coronary artery disease. **Materials and Methods:** The present study was conducted in Nalanda Medical College and Hospital Patna, Bihar India. The study comprised 90 stunted children. History and physical examination were recorded in a pretested pro forma. BP was recorded with a sphygmomanometer with proper cuff. A 4-h fasting blood sample was collected for analysis of serum lipid profile.
Results: Among the cases,in the stunted children, there were 56 (62.22%) males and 34 (37.78%) females. The mean age of the stunted children was 35.333±5.79 months and 39.10±3.80 months, respectively. The mean height of the stunted children was 83.74±2.899 cm.The prevalence of elevated BP 25.56% of children had elevated SBP and DBP and 74.44 children was normal BP. The mean serum triglyceride was significantly higher and mean high-density lipoprotein was significantly lower in the case group.**Conclusion:** The BP and lipid profile metabolic changes associated with stunting pose a threat for future cardiovascular disease. Early detection and prevention of stunting and its consequences will decrease the risk of cardiovascular morbidity and mortality in futurelife..

Keywords: Blood pressure, Lipid profile, Risk of cardiovascular disease, Stunting

Introduction

Coronary artery disease (CAD) has been delineated as the greatest epidemic humanity has ever faced[1]. It takes a tremendous toll in premature sickness, disease, and death, which have a major economic impact on the person and upon the health care delivery system. Accounting nearly 80% of all cardiac morbidity, CAD is now the major cause of morbidity and mortality throughout the world. In most countries, it accounts for 30% of all deaths[2]. Dyslipidemia, hypertension, poor eating habits, sedentary lifestyle, constitute ideal conditions for the development of CAD. For the primary prevention of coronary artery disease in adulthood, detection of dyslipidemia must begin early, followed by appropriate interventions to reduce it. Therefore, blood lipid profile in children should be screened as early as possible to detect dyslipidemia and management should involve the adoption of healthy lifestyles, reduction of total and saturated fat consumption and encouragement of physical activity.As per the Global Nutrition Report, 2018, childhood stunting signifying chronic undernutrition in early life, is a significant globalhealthissue,affecting 149 million children under 5 years of age[3]. Stunting is largely the irreversible outcome of inadequate nutrition, infections, and lack of psychosocial care during the first 1000 days of a child's life. Children with stature deficit lose the potential for physical growth; have reduced neuro-developmental and cognitive function and increased risk of metabolic alterations. These alterations include poor glycemic control, HTN,and altered lipid profile that pose a risk of cardiovascular disease in future life[4].To bring about a primary prevention of CAD in adulthood,

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identification and detection of these risk factors and intervention must begin at an early age[5].Blood pressure (BP) measurement is a necessary part of the physical examination of children[6,7].The most obvious statement about children's BP is that it is not taken seriously[7].There is a lack of awareness of hypertension in children, with a common belief that measurement of BP in infants and children is difficult and time consuming, with results usually normal[8]. This study aims to assess the BP and lipid profile in stunted children in the age group of 1–5 years.

Material and methods

Study design

The present observational study was conducted in the department of Pediatrics, Nalanda Medical College and Hospital Patna, Bihar India among total of 110 children in the age group of 1–5 years.

Inclusion and exclusion criteria

Parents were counseled about the study and those children whose parents consented for the study were included in the study.Children with diseases such as nephrotic syndrome, chronic glomerulonephritis, chronic renal failure, endocrinopathies (family history of diabetes), and cardiopathies, overweight and obese children,and children with moderate-to-severe malnutrition were excluded from the study.

Sample size

The final study population comprised 90 stunted children in the age group of 1-5 year. Details of the study were submitted to and approved by the ethical committee.

Methodology

In all children, the measurements, clinical examination, and blood sampling were done in the presence of mothers or guardians with proper consent. The BP, weight and height of randomly selected, cooperative children were measured. An aneroid sphygmomanometer with standardized calibrations was used to measure the BP. The cuff covered two thirds of the right upper arm. Phase 1 and phase 5 of the Korotkoff sounds were used to determine the systolic and the diastolic BPs, respectively. The children's BP was taken in the school setting with the children relaxed and in the sitting position. BP measurements were done in the morning. Three consecutive readings were taken and the average BP calculated. Weight and height were measured with a stadiometer, with the children's shoes off. BP values were compared to those of the American Academy of Pediatrics guidelines for high BP in children, 2017whichrelated BP to age, gender, and height. Children with BP <90^{th}percentile; >90^{th} percentile to <95^{th} percentile; >95^{th} percentile to 95^{th} percentile +12 mmHg, and >95^{th} percentile +12 mmHg were considered to have normal BP, elevated BP, Stage I HTN, and Stage II HTN, respectively[9]. Blood samples were collected aseptically through venipuncture after 4 h of fasting, from children for the estimation of lipid profile. Estimation of the following was done for the assessment of lipid profile, namely, serumtotal cholesterol (TC), serum triglyceride (TG),serum high-density lipoprotein (HDL),and serum low-density lipoprotein (LDL) cholesterol. Serum lipid profile estimation was done by calorimetric method.Values for lipid profiles were considered as per lipid profile norms in the Indian children[10].

Results

In the stunted children, there were 56 (62.22%) males and 34 (37.78%) females. The mean age of the stunted childrenwas 35.333±5.79 months and 39.10±3.80 months, respectively. The mean height of the stunted children was 83.74±2.89 cm. The mean SBP and DBP in the stunted children were 101.4±2.06mmHg and 60.38±3.109 mmHg as shown in (Table 1).The distribution of parameters of lipid profile among the stunted children is shown in (Table 3). In the stunted children, 25.56% of children had elevated SBP and DBP and 74.44 children was normal BP. The prevalence of elevated BP in stunted children shown in (Table 2).

Table 1: Clinico-demographic profile of the study population

Variables	Mean±SD
Mean SBP (mm of Hg)	101.4±2.06
Mean DBP (mm of Hg)	60.38±3.109
Mean age (Years)	3.21±1.14
Mean Height (cm)	83.74±2.89
Gender	N (%)
Male	56 62.22 %
Female	34 37.78 %

SBP: Systolic blood pressure, DBP: Diastolic blood pressure

Table 2: Prevalence of elevated BP in the study population

Stunted children	N	% age
Normal BP (<90thpercentile)	67	74.44
Elevated BP (≥90th–<95thpercentile)	23	25.56
Total	90	100.00%

Table 3: Distribution of lipid profile of the study population

Lipid profile	Mean value of lipid profile (mg/dl)
TC (mg/dl)	144±12.86
LDL (mg/dl)	94.16±9.11
HDL (mg/dl)	34.12±5.88
TG (mg/dl)	102.88±14.22

TC: Total cholesterol, TG: Triglyceride, LDL: Low-density lipoprotein, HDL: High-density lipoprotein

Discussion

The study of lipid profile and BP in stunted children may help in anticipation, prevention, and understanding the cardiovascular risk factors associated with growth retardation in children. In the stunted children, out of 90.23(25.56) children had elevated BP.Thus; a significant proportion of stunted children has elevated BP. This is similar to the studies done by Febba et al. and Sawaya et al. and lower than the results obtained by Sesso et al[11-13]. Febba et al. found that nutritional stunting is associated with high angiotensin- converting enzyme activity in childhood that may contribute to higher BP in these children[11] Sesso et al[13]found that 42% of children had elevated BP and 29% of children had BP≥95th percentile which were remarkably greater than those in controls (2%) (p<0.001).The studies of Lauer and Clarke and Bao *etal*.have shown that adult BP is correlated with childhood BP and that adult essential HTN and cardiovascular diseases begin in childhood [14,15]. Thus, the high prevalence of elevated BP (diastolic) in thisstudy is a relevant finding.In the present study, a mean total cholesterol 144±12.86,TG=102.88±14.22,HDL=34.12±5.88, and LDL= 94.16±9.11were seen in the stunted children. There is scarce literature on lipid profile among stunted Indian children. Khalil *et al*[10] studied the lipid profile of normal Indian children (3–12 years) and found the mean plasma cholesterol level as 134.5±27.1 mg/dl, mean TG 91.1±29.85 mg/dl, mean HDL 34.15±13.05 mg/dl, and mean LDL 80.1±21.65 mg/dl. No significant difference was noted between the two sexes.In a similar study, Chandar*et al*. found that healthy Indian male children (1–4 years) have mean TC, HDL, LDL, and TG levels of 137.0±20.02 mg/dl, 51.8±14.17 mg/dl, 69.1±25.43 mg/ dl, and 77.7±20.80 mg/dl, respectively. The mean values of same parameters in the study in female children were 126.0±22.04mg/ dl, 46.8±13.66mg/dl, 66.4±18.92 mg/dl, and 63.0±12.82mg/dl, respectively [16]. The mean cholesterol and HDL levels found in the present study were higher than those observed by Khalil *et al*[10]. However, the HDL levels were lower than those observed by Chandar *et al*[16]. The TG level in the present stunted children (102.88±14.22) was similar to that of Khalil *et al*. and higher compared to that found by Chandar*et al*[16], while the level of LDL found in the present study (94.16±9.11) which was similar to the study of Khalil *et al*[10] and Chandar *et al*[16]. The lipid levels found in this study may be representative of the local pediatric population of the same age group. However, various confounding factors could not be excluded. Compared to thenormal value , the lipid profile in the stunted children was characterized by higher TG, LDL, and cholesterol levels and lower HDL levels. Florĕncio *et al*. found that individuals with short stature had higher levels of serum TC, LDL, and TG than adults with normal height[17]. A high prevalence of dyslipidemias (87%) represented by elevated TG level and low HDL level was seen in the present stunted children. This finding is consistent with similar studies on stunted children by Veiga *et al*. and Alves *et al*[18,19]. Veiga *etal*. found that almost all children(98.9%)with chronic undernutrition(aged between 12 and 71 months) had dyslipidemia characterized by the predominance of low HDL levels (86.1% of the children) together with hyper triglyceridemia [18].Similarly, Alves *et al*. found higher TG and low HDL in children from 1 to 6 yearswith moderate-to-severe stunting[19].The study by Rohrer *et al*.found that both increased TG levels and low HDL level are correlated, and low HDL is caused by acceleration in catabolism and not by a decrease in the synthesis of these particles[20]. The increased TG level observed among stunted children may be due to the fact that malnourished children have

decreased body mass, which leads to a reduction in the amount of LDL,favoring a lower clearance of circulating TG[21].

Conclusion

The BP and lipid profile metabolic changes associated with stunting pose a threat for future cardiovascular disease. Early detection and prevention of stunting and its consequences will decrease the risk of cardiovascular morbidity and mortality in future life. The need for monitoring of BP in malnourished children for timely detection of HTN should be emphasized. Malnutrition should be more often recognized as a factor associated with increased BP in childhood. Awareness and early intervention such as lifestyle and dietary modification will help to prevent this risk.

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