March 2013

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Saudi J Kidney Dis Transpl 2013;24(2):408-412

Saudi Journal of Kidney Diseases and Transplantation

Renal Data from Asia – Africa

Prevalence of Hypertension in Healthy School Children in Pakistan and Its Relationship with Body Mass Index, Proteinuria and Hematuria

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ABSTRACT. To determine the prevalence of high blood pressure (BP) in healthy school Pakistani children and its association with high body mass index (BMI), asymptomatic hematuria and proteinuria, we studied 661 public school children and measured their body weight, height and BP and urine dipstick for hematuria performed on a single occasion. Hypertension (BP >95th centile) and pre-hypertension (BP >90th centile) were defined based on the US normative BP tables. Overweight and obesity were defined according to the World Health Organization (WHO) classification of BMI. The mean age of the children was 14 ± 1.3 years. The mean BMI was 18.5 ± 4.3 kg/m^2. The majority (81.8%) of the children were found to be normotensive (BP <90th centile). Pre-hypertension was observed in 15% and hypertension in 3% of the children. Overweight was observed in 7.7% and obesity in 1% of the children. The independent risk factors for hypertension and pre-hypertension were age of the child (RR 1.2 95% CI 1–1.4), gender (RR 2.0 for being female 95% CI 1–4.4), BMI >25 (RR for BMI b/w 25–30 = 2.6, RR for BMI >30 = 4.3), positive urine dipstick for proteinuria (RR = 2.3 95% CI 0.7–7.7) and positive urine dipstick for hematuria (RR 1.0 95% CI 0.2–8.3). Hypertension in children is strongly correlated with obesity, asymptomatic proteinuria and hematuria. Community based screening programs for children should include BP recording, BMI assessment and urine dipsticks analysis and approach high-risk groups for early detection and lifestyle modifications.

Introduction

Increased cardiovascular morbidity and mortality has been identified over the past decade in the Pakistani population.[1] According to the demographic survey of Pakistan (1992–2003), deaths due to cardiovascular disease have increased from 2.5% to 13.8%. Cardiovascular health has roots in childhood.[2,3] Hypertension in Asians occurs at a lower BMI as compared with those of other ethnic backgrounds.[4] The World Health Organization has considered the need to have different BMI normograms for Asian children due to the higher percentage of fat and greater abdominal obesity in Asians compared with other ethnic groups.[5]

Recently, an increasing trend in BMI around adolescence has been identified and is being

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strongly correlated with high systolic blood pressures.[6-10] This trend has been blamed upon changes in teenage lifestyle, such as lack of physical activity and consumption of fast food and culture of videogames and computer games as a leisure time activity.[8]

Reviews of obesity from Asia have shown variable prevalence of overweight, ranging from 10% to 18% in South Asian countries and from 10% to 30% in the more affluent Middle Eastern countries,[11] and prevalence of childhood obesity and hypertension is underestimated in Pakistan and India.[12]

Apart from the high BMI, kidney disease has long been known to be a harbinger for hypertension. Therefore, mass school urine screening programs have been recommended to identify children with hematuria and proteinuria and detect chronic renal disease in its early stage.[13] There is little data on the prevalence and impact of asymptomatic hematuria and proteinuria in children from south Asian countries. A survey of school children in Pakistan has shown a prevalence of proteinuria of 3.3% and a significant association between high blood pressure values and proteinuria.[14]

The aim of the present study was to study the prevalence of high blood pressure (BP) in healthy school Pakistani children and how much is the association of elevated BP values with BMI and asymptomatic hematuria and proteinuria.

Patients and Methods

We studied 661 public school children. Measurement of body weight, height and BP and urine dipstick for hematuria was performed on a single occasion in each child. Parents were notified in advance by a letter sent by the school that blood pressure, weight and urine screening would be performed at the school. Parents were provided with a form that was to be signed and returned if the parents did not want their child to participate.

Standard procedures for the measurement of blood pressure were used in each of the studied children. Three blood pressure measurements were obtained by trained personnel on the right arm in the sitting position, and standard mercury sphygmomanometers were used, with appropriate cuff sizes. Systolic blood pressure was measured at the first appearance of a pulse sound (Korotkoff phase 1) and diastolic blood pressure at the disappearance of the pulse sound (Korotkoff phase 5). We used the average of the three measurements from each subject for analysis. Pre-hypertension was defined as resting systolic and/or diastolic BP values between the 90th and 95th percentiles and as hypertension if the readings equaled or exceeded the 95th percentile according to gender, age and height, based on the US normative BP tables.[15]

Standing height was measured with the shoes removed and the child facing away from the wall, with the heels, buttocks, shoulders and head touching the wall and the child looking ahead and the external auditory meatus and lower margin of the orbit aligned horizontally. An average of three measurements was recorded to the nearest 0.1 cm. Weight was recorded using a digital weighing scale (Tanita) that was calibrated daily. Weight was recorded to the nearest 0.1 kg and an average of three measurements was used for analysis. Overweight children were defined according to the WHO classification of BMI (body mass index calculated as weight in kg/height in m^2). Children were defined as overweight if their BMI was between 25 and 30 and obese if BMI was >30.[6]

Samples of urine were analyzed using urine dipstick for hematuria and proteinuria. Positive reactions were based on color change corresponding to color chart provided by the test strip's manufacturer (AMES, Bayer reagent strips-Bayer, Berkshire, UK).

Statistical Analysis

Descriptive statistics were calculated as the mean and standard deviation for continuous variables and proportions for categorical variables. Multiple logistic regression was performed to determine the factors independently associated with hypertension. Statistical significance was accepted at P <0.05, and all analyses were carried out using SPSS version 16.0.

Table 1. Relationship between BMI and blood pressure in healthy school children.

Systolic BP percentile	Cut offs for BMI (n = 661), n (%)			
	< 25	25–29	≥30	Total
<90	505 (93.3%)	32 (5.9%)	4 (.7%)	541
90-95	84 (84.0%)	13 (13.0%)	3 (3.0%)	100
>95	13 (65.0%)	6 (30.0%)	1 (5.0%)	20
Total	602 (91.1%)	51 (7.7%)	8 (1.2%)	661

Results

A total of 661 children had a mean age of 14 ± 1.3 years. The mean BMI was 18.5 ± 4.3 kg/m^2. The mean systolic BP was 112 ± 13 mmHg and the mean diastolic BP was 74 ± 8.5 mmHg. The majority (81.8%) of the children were found to be normotensive (BP <90th percentile). Pre-hypertension was seen in 15% and hypertension in 3% of the children. Overweight was observed in 7.7% of the children and obesity was observed in 1%.

Most (14%) of the pre-hypertensive children had normal BMI for age (>25%). However, among the children with BMI >30 (obese), 37.5% children were pre-hypertensive and 12.5% were hypertensive (Table 1).

Asymptomatic proteinuria and hematuria were detected in 31 (4.7%) and eight (1.2%) children, respectively. The independent risk factors for hypertension and pre-hypertension were age of the child (RR 1.2 95% CI 1–1.4), gender (RR 2.0 for being female 95% CI 1–4.4), BMI >25 (RR for BMI 25–30 = 2.6 and RR for BMI >30 = 4.3), positive urine dipstick for proteinuria (RR = 2.3, 95% CI 0.7–7.7) and positive urine dipstick for hematuria (RR 1.0, 95% CI 0.2–8.3) (Table 2).

Discussion

The results of our study, performed in healthy urban school children, showed a prevalence of overweight as 25.5% and obesity as 3%. This is similar to the trend observed in Iranian and Chinese children.[8] However, a difference is observed when this pattern of BMI is compared with Western data. In Chinese children, tendency toward overweight is reported to occur in preadolescence, whereas higher BMI is seen in American children at a later age of adolescence.[4] These differences can be attributed to socioeconomic and environmental differences.[5]

In our study, hypertension was related to the BMI status, and this observation is almost similar to Western data, which have demonstrated a strong correlation of blood pressure to obesity in children irrespective of ethnicity.[16,17] Furthermore, our results support the evidence of systolic hypertension as being strongly associated with a positive urine dipstick for hematuria and proteinuria. Recently, the concept of association of urine changes with hypertension, obesity and diabetes has been discussed with emphasis on non-invasive and economical screening tests.[18,19] Proteinuria due to obesity

Table 2. Multiple logistic regression analysis to determine factors independently associated with hypertension in children.

Risk factors	RR	95.0% CI for RR	
		Lower	Upper
Age of the child	1.2	1.0	1.5
Sex			
Male	1		
Female	2.0	1.0	4.4
BMI			
<25	1		
25–29	2.6	1.4	5.0
30)	4.3	1.0	18.0
Proteinuria (positive)	2.3	0.7	7.7
Hematuria (positive)	1.0	0.2	8.3

has been documented to improve after normalization of BMI in adolescents.[20] Accordingly, lifestyle modifications with increased physical activity, restricted caloric and sodium intake can help reduce cardiovascular morbidity in adulthood.

Another important finding in our study was that a large number of children with normal BMI also had high values of BP; this is similar to the results observed by others.[13,14,21] Thus, BP measurements should not be restricted to overweight and obese children.

Asymptomatic hematuria and proteinuria may be the first sign of occult renal disease. The underlying causes may be serious disorders requiring a renal biopsy.[22,23] However, most of the studies on asymptomatic hematuria and proteinuria, and its underlying causes, have been done in East Asia, particularly in Japan. There are limited number of studies on screening and long-term outcome of children with asymptomatic hematuria and proteinuria from other parts of Asia.

The limitation of this study is that measurements of BP and urine examination were performed on a single occasion. Ideally, the BP should be recorded on three separate occasions; this could have a deviation from real estimation of the true prevalence. Urine dipstick was used to detect hematuria and proteinuria, which has been reported to have good sensitivity and specificity, but there are chances of a false positive or false negative result.[24-26]

Pediatric obesity and its consequences are undertreated. Interventions should focus on nutrition, physical activity, reduced television viewing and behavioral modification. Unless successful interventions and prevention strategies are instituted at the local and national levels, cardiovascular disease in adults will increase as the current population of overweight children and adolescents become adults.

We conclude that hypertension in children is strongly correlated with obesity, asymptomatic proteinuria and hematuria. Community-based screening programs for children should include BP recording, BMI assessment and urine dipsticks analysis and approach high-risk groups for early detection and lifestyle modifications.

Acknowledgment

Dr. Farah Qamar received a training grant D43TW007585 from the Fogarty International Center, National Institutes of Health (USA).

References

1. Barbara Denis KA, Lilin She, Azhar Faroqi, et al. High rates of obesity and cardiovascular disease risk factors in lower middle community in Pakistan: Metroville health project. J Pak Med Assoc 2006;56:267-72.
2. Khuwaja AK, Fatmi Z, Soomro WB, Khuwaja NK. Risk factors for cardiovascular disease in school children - a pilot study. Pak Med Assoc 2003;53:396-9.
3. Sharif I, Blank AE. Relationship between child health literacy and body mass index in overweight children. Patient Educ Couns 2010;79:43-8.
4. Tuan NT, Adair LS, He K, Popkin BM. Optimal cutoff values for overweight: using body mass index to predict incidence of hypertension in 18 to 65 year old Chinese adults. J Nutrit 2008;138:1377-82.
5. WHO expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 2004;363:157-63.
6. Fuiano N, Luciano A, Pilotto L, Pietrobelli A. Overweight and hypertension: Longitudinal study in school-aged children. Minerva Pediatr 2006;58:451-9.
7. Muntner P, He J, Cutler JA, Wildman RP, Whelton PK. Trends in blood pressure among children and adolescents. J Am Med Assoc 2004;291:2107-13.
8. Kelishadi R, Pour MH, Sarraf-Zadegan N, et al. Obesity and associated modifiable environmental factors in Iranian adolescents: Isfahan Healthy Heart Program - Heart Health Promotion from Childhood. Pediatr Int 2003;45:435-42.
9. Pearson TA, Mensah GA, Alexander RW, et al. Markers of inflammation and cardiovascular disease: application to clinical and public health practice: a statement for healthcare professionals from the Centers for Disease Control and Prevention and the American Heart Association. Circulation 2003;107:499-511.
10. Luma GB, Spiotta RT. Hypertension in children

and adolescents. Am Fam Physician 2006;73: 1558-68.
11. Kelishadi R. Childhood overweight, obesity, and the metabolic syndrome in developing countries. Epidemiol Rev 2007;29:62-76.
12. Ghaffar A, Reddy KS, Singhi M. Burden of non-communicable diseases in South Asia. BMJ 2004;328:807-10.
13. Park YH, Choi JY, Chung HS, et al. Hematuria and proteinuria in a mass school urine screening test. Pediatr Nephrol 2005;20(8): 1126-30.
14. Jafar TH, Chaturvedi N, Hatcher J, et al. Proteinuria in South Asian children: prevalence and determinants. Pediatr Nephrol 2005; 20(10):1458-65.
15. National High Blood Pressure Education Program Working Group on Hypertension Control in Children and Adolescents (1996) Update on the 1987 Task Force Report on high blood pressure in children and adolescents: A working group report from the National High Blood Pressure Education Program. Pediatrics 98:649–658.
16. Chiolero A, Madeleine G, Gabriel A, Burnier M, Paccaud F, Bovet P. Prevalence of elevated blood pressure and association with overweight in children of a rapidly developing country. J Human Hypert 2006;21(2):120-7.
17. Khuwaja AK, Fatmi Z, Soomro WB, Khuwaja NK. Risk factors for cardiovascular disease in school children-a pilot study. J Pak Med Assoc. 2003;53(9):396-400.
18. Sidhu S, Marwah G, Prabhjot. Prevalence of overweight and obesity among the affluent adolescent school children of Amritsar, Punjab. Coll Antropol 2005;29(1):53-5.
19. Shen WW, Chen HM, Chen H, Xu F, Li LS, Liu ZH.. Obesity-related glomerulopathy:Body Mass Index and proteinuria. Clin J Am Soc Nephrol 2010;5:1401-9.
20. Fowler SM, Kon V, Ma L, Richards WO, Fogo AB, Hunley TE. Obesity-related focal and segmental glomerulosclerosis: Normalization of proteinuria in an adolescent after bariatric surgery. Pediatr Nephrol 2009;24:851-5.
21. Vessey JA, Ben-Or K, Mebane DJ, et al. Evaluating the Value of Screening for Hypertension: An Evidence-Based Approach. J School Nursing 2001;17 :44-9.
22. Bergstein J, Leiser J, Andreoli S. The clinical significance of asymptomatic gross and microscopic hematuria in children. Arch Pediatr Adolesc Med 2005;159:353-5.
23. Hisano S, Ueda K. Asymptomatic haematuria and proteinuria: Renal pathology and clinical outcome in 54 children. Pediatr Nephrol 1989;3:229-34.
24. Mariani AJ, Luangphininth S, Loo S, Scottolini A, Hodges CV. Dipstick chemical urinalysis: An accurate cost-effective screening test. J Urol 1984;132:64-6.
25. Schumann GB, Greenberg NF, Henry JB. Microscopic look at urine often unnecessary. JAMA 1978;239: 13-4.
26. Simpson E, Thompson D. Routine urinalysis. Lancet 1977;2:361-2.