

High blood pressure in school age children

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الخلاصة

الأهداف: بيان نسبة ارتفاع ضغط الدم والعوامل المسببة لهذا الارتفاع لدى تلاميذ المدارس الابتدائية وكذلك بيان نسبة الحالات الغير مشخصة سريرياً.

الطريقة: تم إجراء دراسة مقطعية على تلاميذ المرحلة الابتدائية في محافظة النجف الاشرف. شملت الدراسة (٣٢٣) تلميذ (٤٨% ذكور، ٥٢% إناث) تتراوح أعمارهم بين ٩ - ١١ سنة، استغرقت الدراسة مدة ثلاثة أشهر (شهر آذار ٢٠٠٩ وحتى شهر مايس ٢٠٠٩)، تم قياس ضغط الدم بجهاز قياس الضغط الزئبقي لكل طالب ويتم إعادة قياس الضغط ثلاث مرات وفي ظروف مختلفة في حالة وجود ارتفاع في ضغط الدم وكذلك تم قياس وزن وطول التلاميذ وقياس مؤشر كتلة الجسم وتم الحصول على المعلومات المطلوبة عن كل تلميذ عن طريق توزيع أوراق استبيانهم على مجموع التلاميذ لتتم من قبل ذويهم. واستعمل في هذه الدراسة رسوم بيانية خاصة لضغط الدم والوزن ومؤشر كتلة الجسم.

النتائج: تبين أن نسبة ارتفاع ضغط الدم لدى اطفال المدارس الابتدائية هي ٥.٥% وجميعهم غير مشخصين سريرياً ولا يشكون من أي أعراض ولا يتلقون أي علاج وكانت نسبة السمنة بين التلاميذ ٩.٦%. وكان ٣٨.٩% من التلاميذ المصابين بالسمنة لديهم ارتفاع في ضغط الدم.

خاتمة: أثبتت الدراسة وجود علاقة معتد بها إحصائياً بين معدلات ارتفاع ضغط الدم وارتفاع مؤشر كتلة الجسم وأكدت الدراسة أهمية قياس ضغط الدم وبشكل دوري وذلك لان جميع الأطفال المصابين بارتفاع ضغط الدم غير مشخصين سريرياً.

Abstract

Objectives: to determine the percentage of high blood pressure (prehypertension & hypertension) as well as to address some epidemiological variables that contributes to high blood pressure in school age children.

Methods: a cross sectional study was conducted on 323 (46.4% boys ,53.6% girls) primary school students aged (9-11 years) selected from primary schools in Najaf city center during the period from March 2009 till May 2009. The Blood pressure was measured on at least three separated occasions using standardized sphygmomanometers with appropriate cuff size. Weight and height of all children were measured and body mass index calculated. A questionnaire paper was sent with the student to be filled out by parents (all the parents were educated). Special charts for blood pressure, body weight & body mass index were used in the study.

Results: high blood pressure (prehypertension & hypertension) was found in 5.5% of students all of them were undiagnosed & not receive any medications, Obesity was reported in 9.6% of Studied & 38.9 % of them have high blood pressure.

Conclusion: there was a significant statistical correlation between hypertension and increasing body mass index & between hypertension & child gender (more in female than male child), the study showed that no one of the students with high blood pressure (prehypertension & hypertension) was previously diagnosed and no one had any symptom & routine measurement of blood pressure for children was recommended.

Introduction

Hypertension affected between 2% and 5% of children and it is become increasingly prevalent due to pediatric obesity epidemics ⁽¹⁾. Several longitudinal studies have

suggested that systemic arterial hypertension (SAH) in adults is a disease that has its beginnings in childhood. Because of the lack of routine examination and the belief that SAH is rare in childhood, many children have failed to receive the diagnosis of hypertension over recent decades. ⁽²⁾

Hypertension is a known risk factor for coronary artery disease (CAD) in adults, and the presence of childhood hypertension may contribute to the early development of CAD. Reports show that early development of atherosclerosis does exist in children and young adults and may be associated with childhood hypertension ⁽³⁾. Left ventricular hypertrophy (LVH) is the most prominent clinical evidence of end-organ damage in childhood hypertension. Data show that LVH can be seen in as many as 41 percent of patients with childhood hypertension. Patients with severe cases of childhood hypertension are also at increased risk of developing hypertensive encephalopathy, seizures, cerebrovascular accidents, and congestive heart failure. Based on these observations, early detection of and intervention in children with hypertension are potentially beneficial in preventing long-term complications of hypertension. ⁽⁴⁾ The causes for increase in blood pressure are attributed to obesity, change in dietary habits, decreased physical activity and increasing stress ⁽⁵⁾. The development of a national database on normative blood pressure levels throughout childhood has contributed to the recognition of elevated blood pressure in children and adolescents ⁽⁶⁾. Pediatric hypertension may be secondary to another disease process or it may be essential hypertension. Secondary hypertension is more common in children than in adults, and common causes of hypertension in children include renal disease, coarctation of the aorta, and endocrine disease. However, as with adults, the majority of children and adolescents with mild to moderate hypertension have primary hypertension in which a cause is not identifiable. ^(7, 8)

Definition of hypertension: Hypertension is defined as an average systolic BP (SBP) and/or diastolic BP (DBP) that is $\geq 95^{\text{th}}$ percentile for gender, age and height on ≥ 3 occasions.

- Prehypertension in children is defined as average SBP or DBP levels that are $\geq 90^{\text{th}}$ percentile but $< 95^{\text{th}}$ percentile.
- Adolescents with BP levels $\geq 120/80$ mm Hg should be considered prehypertensive.
- Stage I hypertension is diagnosed if a child's BP is greater than the 95^{th} percentile but less than or equal to the 99^{th} percentile plus 5 mm Hg.
- A child is classified as having stage II hypertension if their BP is greater than the 99^{th} percentile plus 5 mm Hg.
- If the systolic and diastolic classifications cause a discrepancy, the child's condition should be categorized by using the higher value.

Adapted from the guidelines on definition of hypertension in the Fourth US Task Force Report on Hypertension ⁽⁴⁾.

Subjects & methods:-

A cross sectional study was carried out on (323) students from primary schools; aged 9–11 years. four primary schools were selected randomly in Najaf city center only, from a period of March 2009 to May 2009. Through a questionnaire filled by parents, data were collected regarding age, sex, demographic & health information including parental education, family history of hypertension, consanguinity among parents, parental occupation, History of UTI, medications used, family history of renal problems, past medical history of the student, any systemic complaint by the student as

headache, vomiting, recurrent fever, abdominal pain, burning in micturition, attendance to school (regular or not) and school performance. For all students; weight was measured to nearest 100 gm after removal of shoes, jacket, heavier clothing and pocket content using electronic machine and height to nearest 0.5 cm using body meter were recorded. Blood pressure was recorded throughout daily school attendance during the 3 months study in a quiet setting with the students in a sitting position. The midpoint between olecranon and acromion was identified, the arm circumference was measured at that point and appropriate cuff size was determined by bladder width covering 40% of circumference or two thirds of upper right arm, the position of right arm was adjusted so that the antecubital fossa was at the same level of heart. Systolic BP was calculated with appearance of 1st Korotkoff sound while diastolic BP was deduced with the disappearance of sound. High pressure repeated in three occasions and the child was examined clinically for any physical findings. All BP figures were matched against age, gender and height (the normative values are based on the National High Blood Pressure Education Program: The Fourth Report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescent)⁽⁵⁾. The student considered to be hypertensive if systolic blood pressure and/or diastolic blood pressure is $\geq 95^{\text{th}}$ percentile for age, gender, and height level & prehypertensive if systolic & \ or diastolic blood pressure is $\geq 90^{\text{th}}$ percentile but $<95^{\text{th}}$ percentile. Body mass index was calculated by using the formula⁽⁹⁾

$$\text{BMI} = \text{weight (kg)} / \text{height (m)}^2$$

It was determined for each student using pediatric normative data based on age and gender. Over weight was defined when BMI at 85th – 95th percentile, obesity was defined when BMI exceeding 95th percentile based on a growth charts available from the center for disease control and prevention (CDC)⁽¹⁰⁾.

Statistical analysis: Statistical analysis through chi-square, logistic regression test was employed using SPSS software, P value < 0.05 was regarded statistically significant.

Results:-

323 primary school children were randomly selected from primary schools in Najaf city 150(46.4%) of them were boys and 173(53.6%) were girls. Their Age ranged from 9-11 years. Family history of hypertension was found in 115(35.6%), history of UTI was found in 21 (6.5%), parental consanguinity found in 146(45.2%). 18(5.5%) of student was found to have high blood pressure (hypertension and prehypertension), 8(2.5%) of student was found to be hypertensives (i.e. systolic and/or diastolic blood pressure $\geq 95^{\text{th}}$ percentile for age, gender and height on more than 3 occasions), 10(3.4) was found to be prehypertensives (i.e. average systolic or diastolic blood pressure $>90^{\text{th}}$ percentile but $<95^{\text{th}}$ percentile), 305(94.4) were normotensive according to charts adapted with permission from national high blood pressure education program working group on high blood pressure in children and adolescents. None of the student with hypertension nor those with prehypertension was diagnosed before. see table (1).

14(77.8%) of student with high blood pressure have their age ranged from 9-10 years, while 4(22.2%) of them have age ranged from 10-11 year, see table (2). 13(72.2%) of student with high blood pressure were female, while 5(27.8%) of student with high blood pressure were male see table (3). 31(9.6%) of student were obese and 73(22.6%) were overweight, 7(38.9%) of the obese student have had high blood pressure and 6(33.3%) of overweight student were had high blood pressure. see table (4). The relation between blood pressure reading and other patient related factors as family

history of hypertension , consanguineous marriage ,history of UTI , medication intake , family history of renal disease ,seen in table (5).

Table 1: Distribution of the students according to blood pressure readings

Blood pressure	Frequency	Percent
normal BP	305	94.4
hypertensive	8	2.5
prehypertensive	10	3.1

Table 2: Age distribution of blood pressure readings

Age (years)		Blood pressure(Bp)		
		Normal(Bp)	High(Bp)	Total
9-10	count	180	14	194
	% within blood pressure	59%	77.8%	60.1%
10 - 11	count	125	4	129
	% within blood pressure	41%	22.2%	39.9%
Total	count	305	18	323
	% within blood pressure	100%	100%	100%

High blood pressure (hypertension and prehypertension)

Table 3: Sex distribution of blood pressure readings

sex		BLOOD PRESSURE		
		normotensive	high BP(pre-HT & HT)	Total
male	Count	145	5	150
	% within blood pressure	47.5%	27.8%	46.4%
female	Count	160	13	173
	% within blood pressure	52.5%	72.2%	53.6%
Total	Count	305	18	323
	% within blood pressure	100.0%	100.0%	100.0%

P value=.095

Table 4 : Relation of blood pressure readings to BMI

BMI	Blood pressure		
	Normotensive n=305	HBP n=18	P value
Over weight n=73 % within blood pressure	67 22%	6 33.3%	0.28
obese n=31 % within blood pressure	24 7.9%	7 38.9%	0.01
normal BMI n=219	214 70.2%	5 27.8%	

BMI= weight (kg)/height (m)²

Over weight defined as (BMI at 85th – 95th percentile)

Obesity defined as (BMI >95th percentile).

Table 5: Relation between blood pressure readings & patient related factors

factors	Total (%)	Blood pressure		
		Normotensive (%) N = 305	High blood pressure (%) N=18	p- value
Family history of HT	115(35.6)	108(34.4)	7(38.9)	0.76
Consanguineous marriage	146(45.2)	136(44.6)	10(55.6)	0.38
Family history of UTI	21(6.5)	21(6.9)	0(0)	0.114
Drug use	37(11.4)	36(11.8)	1(5.6)	0.37

Discussion

The percentage of hypertension among primary school children in Najaf city center in this study is (5.5%), other countries had reported a percentage of ranging from (3.6% to 9.6%). In Jordanian study which was carried out by Jaddou et al in 2001, reported that the percentage of HT was (3.6%)⁽¹¹⁾, while in other studies like in Saudi Arabia (4.8%)⁽¹²⁾, Kuwait (5.1%)⁽¹³⁾, Tunisia (9.6%)⁽¹⁴⁾, These differences may be attributed to variations in methodologies that have been used makes it difficult to compare results and contributes enormously towards the discrepant prevalence between the different studies. Among the methodological variations, the following can be cited: type of sphygmomanometer, positioning of the child, cuff selection criteria, number of measurements made, interval between the measurements and criteria for defining the basal blood pressure levels to be used in defining which individuals were considered hypertensive⁽²⁾. Although the age prevalence rate of HT increased with increasing age ; the blood pressure study show no significant statistical correlation with age PV >0.05 during statistical analysis, probably the number of studied children not enough to meet the PV <0.05 criterion, this is in agreement with other studies carried out in Kuwait

by Saleh et al in 2000⁽¹⁴⁾ and in Brazil⁽²⁾, which also show no significant statistical difference with age.

Other studies showed that BP increases gradually with age ,may be attributed to increase body mass⁽¹⁴⁾ , a number of studies come in line with this relation like those carried in Iraq in Baghdad by Mahmood in 2006 and Murad et al in 2002^(15,16) , and Iraq in Basra by. Nasser 2007⁽¹⁷⁾. Although there is a slight difference between the means of BP readings toward female gender ; the study showed significant statistical correlation with gender during analysis , this is in agreement with studies carried out in Iraq^(15,17) , Ethiopia⁽⁷⁾, Turkey⁽¹⁹⁾, Jordan⁽¹¹⁾ which show a significant statistical effect of gender on BP and reveal that female has more chance for developing HT than male which explained by the physiological changes of puberty where menarche and development of secondary sex characters impose tension and anxiety in girls⁽²⁰⁾ .this study show strong correlation between obesity and overweight with hypertension 27.2% of children with high blood pressure were obese and 72.2%were overweight , this strong correlation was also concluded by study done on Oklahoma city 2006⁽¹⁾, They found that BMI at or above 95 percentile was strongly associated with elevated blood pressure(more or equal to 90th percentile. (Relative risk 3.8 ,95% confidence interval ,5.6-5.4) patient who presented with hypertension and obesity usually presented with unfavorable condition for cardiovascular prognosis including carbohydrate ,lipid metabolism , hyperurecemia ,LVH ,and /or obstructive sleep Apnea syndrome .Hypertension is salt sensitive in obese patient ,the plasma volume and cardiac index are increased ,adequate control in body weight result in substantial decrease in total blood volume, cardiac out put , blood pressure ,and left ventricular mass and disappearance of sleep apnea⁽²¹⁾ .The hypertensives and prehypertensives in this study form 5.5% of the student all of them were undiagnosed before. A study done by .Mathew L, Hansen, case western reserve university, to determine the frequency of undiagnosed hypertension and prehypertension in 3-18 years children shows that 26%of hypertensive children were undiagnosed before ,Diagnosis of hypertension in children is complicated because normal and abnormal blood pressure values vary with age ,sex and height⁽¹⁾ . Identification of elevated blood pressure in children meeting prehypertensive and hypertensive criteria is important because of the increasing prevalence of pediatric weight problems and because the secondary hypertension is more common than adult, requiring identification and appropriate work up .The longer high blood pressure goes undiagnosed, the higher the risk of organ damage, according to researchers ,they added that the problem could be corrected by developing an electronic record-keeping model that would identify children who may develop high blood pressure. Two possible clinician-related factors might explain the low diagnostic rate for hypertension and prehypertension, one was the lack of knowledge of normal blood pressure ranges and other was lack of awareness of a patient's previous blood pressure reading⁽¹⁾

Conclusions

- The percentage of high blood pressure (hypertension & prehypertension) was 5.5% which is within the range of other several countries (3.6%-9.6%).
- All of the students with high blood pressure were undiagnosed before.
- 9.6% of students were obese and there is strong statistical relationship between obesity and high blood pressure.

Recommendations

- Routine examination of blood pressure in children & the school health care services should play a role in early diagnosis of hypertension in school age children
- the physicians should recognize the arbitrary nature of the definition of hypertension and the inevitable errors in blood pressure measurement techniques and, therefore, not base clinical decisions purely on the level of blood pressure.
- Child obesity increases the risk of obesity in adulthood & is associated with CVD risk, so preventive work should begin in early childhood particularly in children of families at high risk for CVD.
- It is advisable to investigate hypertensive child for assessment of target organ damage and recognition of immediate life threatening complications because early intervention is known to be associated with a greater chance of reversibility of the damage that has occurred.

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