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Original Article

The influence of stressor on blood pressure in school children

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ABSTRACT

Background Physical and psychological stress such as child anxiety, can increase blood pressure.

Objective To evaluate the role of vein puncture as a stressor causing alteration of blood pressure in school children.

Methods This study was a descriptive, pre and post test study as a part of a screening study on primary school children at Cibubur subdistrict in East Jakarta. Blood pressure was measured before and after a vein puncture procedure in 449 children. Nine children were excluded because of incomplete data.

Results The increase of systolic blood pressure was found in 121 (27.5%) subjects, decrease in 42 (9.5%), and no change in 227 (63%). Diastolic blood pressure increased in 123 (28.0%) subjects, decreased in 38 (8.6%), and did not change in 279 (63.4%). The increase of both systolic and diastolic blood pressure was found in 61 (13.8%), increased systolic with no change of diastolic in 58 (13.2%), and increased systolic with decreased diastolic in 2 (0.5%) children. Decreased systolic with increased diastolic was found in 2 (0.5%) subjects, decreased systolic with no change of diastolic in 26 (5.9%), and decrease of both systolic and diastolic in 14 (3.2%) children. No changes in both systolic and diastolic blood pressure were found in 195 (44.3%); no change in systolic with decreased diastolic blood pressure was found in 22 (5.0%) children.

Conclusion In most of the school children, vein puncture procedure did not cause alteration on blood pressure **[Paediatr Indones 2003;43:35-37].**

Keywords: *vein puncture, blood pressure, school children*

Blood pressure in normal children varies with age, sex, height, and weight. After birth, the systolic and diastolic blood pressure increase gradually. Systolic blood pressure stabilizes during the first year of life, followed by a gradual increase during the remainder of childhood and adolescence. Diastolic blood pressure shows a gradual decline and then rises slowly during the first year of life, remains stable relatively until the 5 years of age, and increases gradually throughout childhood and adolescence. Heavier and/or taller children generally have higher blood pressure than leaner and smaller children of the same age. In children and adolescents, systolic and diastolic blood pressure during sleep is approximately 10% lower than during the day. Blood pressure increases during exercise and mental stress which are identified as important predictors of subsequent blood pressure levels in adolescents and young children.[1,2] Treiber *et al* reported the relation of hostility and increase of blood pressure.[3] Transient elevation of blood pressure particularly in crying or apprehensive child is common.[1] Children are usually in anxious condition when they are faced with vein puncture procedure. Anxiety, a psychological or mental stressor, may increase blood pressure. Some literatures reported the relationship between mental stress and blood pressure, but to this point we could not find any literatures about the relation of vein puncture procedure and the increase of blood pressure in children.[4]

The aim of this study was to evaluate the role of vein puncture as a stress factor in altering blood pressure in school children.

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Methods

This study was a descriptive, pre- and post test study, as a part of a screening study in third, fourth, and fifth grade children in primary schools at Cibubur sub district, East Jakarta. These primary schools consisted of 3 public schools and 1 private school. The study was a part of an integrated study for school children. Informed consents were requested from parents before the study. The procedure of this study was explained at the start to all students. Routine procedures such as anamnesis and physical examination were performed including blood pressure measurement and vein puncture procedure for blood laboratory examination. After vein puncture, blood pressure was measured again. Blood pressure was measured on the right arm after sitting quietly for a few minutes. Blood pressure cuffs had to cover at least two third of the upper arm, with bladder encompassing most of the circumference of the arm without overlapping.

Criteria of normal blood pressure and hypertension were based on The Task Force on Blood Pressure Control in Children. It was recommended that systolic and diastolic blood pressure below the 90 percentile for age and sex are considered as normal; at 90 to 95 percentile as high normal; and greater than 95 percentile as hypertension. Changes for at least 10 mmHg in systolic and diastolic blood pressure were considered significant.

Results

Blood pressure examination was performed in 449 children, consisted of 217 boys and 232 girls. Nine children were excluded because of incomplete data. None of the children in this study had hypertension.

Table 1. Blood pressures of the children after vein puncture procedure

NO.	Systolic	Diastolic	Total	%
1.	Increase	Increase	61	13.8
2.	Increase	No change	58	13.2
3.	Increase	Decrease	2	0.5
4.	Decrease	Increase	2	0.5
5.	Decrease	No change	26	5.9
6.	Decrease	Decrease	14	3.2
7.	No change	Increase	50	13.6
8.	No change	No change	195	44.3
9.	No change	Decrease	22	5.0
TOTAL			**440**	**100**

Table 1 shows blood pressure of the children after the vein puncture procedure was done. Although systolic and diastolic blood pressure increased in 121 (27.5%) and 123 (28.0%) children respectively, there were no children with hypertension before and after the vein puncture procedure.

Discussion

The prevalence of hypertension in childhood is not clearly defined depending on the criteria of hypertension used. The prevalence of hypertension in children is probably between 1-3%. Fixler *et al* reported that increased systolic and diastolic blood pressure in school children were 1.2% and 0.3%.[7] Rames *et al* reported that the prevalence of hypertension in school children was 1%. In this study, there was no hypertension in 440 children, probably due to small participants.

Many factors can influence the increase of blood pressure in children including physiological stress, but it is uncertain whether physical activity can increase blood pressure or not.[1,4,7,9] Klesges *et al* reported that physical activity is not related to blood pressure in preschool children because the children are not engaged in the type of activity causing a cardiovascular benefit to accrue. The relation of activity and cardiovascular risk depends on age, and this does not occur in children because of the inability of children to do aerobic activity.[12] In infancy, blood pressure rises during feeding, upright position, and sucking.

Psychological or mental stress can increase blood pressure through the influence of the sympathetic system. Hyperactivity of the sympathetic system plays a significant role in the pathogenesis of increased blood pressure in children.[1,2,4] Blood volume is shifted from peripheral to central area, CO increases, total peripheral resistance remains unchanged, thus blood pressure rises. Intestinal salt and water absorption increase, renal sodium reabsorption increases, and glomerular filtration rate decreases. When there is an acute environmental stress, hormonal system is activated. The sympathetic system activates the renin-aldosteron system, and pituitary is stimulated to increase its release of ACTH and vasopressin.[4]

Lesser degree of excitement including mental arithmetic and playing electronic games can increase blood pressure. Depression can stimulate the pituitary-adrenal

axis to release glucocorticoid and cathecholamines.[5]

The influence of stressors on blood pressure increase can be evaluated by comparing blood pressure before and after the stressors occur. Unfortunately, in this study, we have no data of the children's blood pressure before the study. The explanation of the study procedures, physical examination including blood pressure measurement, and vein puncture procedure are believed as psychological or mental stressors for the children. After the study procedures were finished, it was hoped that the children were in quiet condition and so the blood pressure would return to normal condition or lower than that of the first examination. In this study, systolic and diastolic blood pressure decreased in 42 (9.5%) and 38 (8.6%) children respectively. Most of the children showed no changes in systolic and diastolic blood pressure. No change in systolic blood pressure was seen in 277 (63%) children and diastolic blood pressure in 279 (63.4%). This was probably caused by the disappearance of psychological stressor effect in children. Systolic blood pressure increased in 121 (27.5%) children while diastolic blood pressure increased in 123 (28%) children. In our opinion, the increase happened because the children were still in the influence of psychological stressor effect and this effect would disappear in a few minute and yet it is uncertain how long the stressor effect would disappear.

We concluded that in most school children, psychological stressor does not alter the blood pressure.

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