Evidence about the determining role of the body height in the characteristics of the aortic augmentation index in childhood

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Introduction

The aortic augmentation index (AIXa) increases with age in adults and the increased AIXa is a strong predictor of cardiovascular morbidity and mortality. The enhanced wave reflection is a well-known phenomenon in infants and children, the waveforms are very similar to those in older adults (Figure 1).

This phenomenon is explained on the basis of differences in the body length by the majority of the authors. However, this hypothesis has not been proved yet directly.

Hypothesis

If the return time (RT) of the first systolic pulse pressure wave is longer, the reflected wave will be positioned lower on the declining slope of the first systolic wave. We supposed that if the increase of the body height is proportional with the rhythm of the changes of the RT, the age dependent decrease of the AIXa is must be due to the increasing RT.

Aim

To determine the reference values of AIXa in a healthy population aged 3–18 years and to find the possible physiological mechanisms of the enhanced aortic pressure wave reflection during infancy and early childhood.

Methods and Subjects

AIXa were measured by a new, validated1,2, non-invasive, occlusive, oscillometric method (Arteriograph, TensoMed Ltd., Hungary) in a healthy population aged 3–18 years with normal BMI and with normal blood pressure (1,802 males, 1,572 females). Smoothed percentile curves of AIXa, body height and RT from 3rd to 97th were determined using LMS method. Results were analyzed by Student’s t-test. To study causal relationships between AIXa and other variables graphical analyses were used.

Results

The physiological changes of AIXa, body height and RT measured in healthy population are shown in Figure 2. The AIXa decreased, while the body height and the RT increased proportionally with age in both genders. The simultaneous changes of the studied parameters (AIXa, body height, RT) were moving together in relation to the age. Furthermore the flattening of these parameters happened exactly in the same age: 14.5 and 13.5 years for the boys and girls, respectively.

From the age of 14 years the AIXa were significantly lower in males than in females (p<0.02), and this difference had become even more pronounced from age of 15 years (p<0.001) (Table 1).

Assessing the background of these differences in AIXa, we have found that the changes of the median of AIXa are exactly identical to the changes of the median of body height and of the changes of the median of RT (Figure 3).

Conclusions

This is the first large population study involving 3,374 healthy subjects aged 3–18 years which describes the physiological changes of AIXa. Our data provide supporting evidence that the pressure waveforms in infants and children are markedly elevated and similar to those with advanced age. This interesting phenomenon can be explained by the smaller body height and the proportionally shorter RT in early age, and their simultaneous change (increase) toward puberty. In children due to the shorter body height (aortic length) the second systolic wave returns earlier, climbs up on the declining shoulder of the first systolic wave, consequently the position of the peak of the second systolic wave and the AIX becomes higher.

References