

Poster presentation

## CMR assessment of normal aortic bioelastic function in children

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### Introduction

The bioelastic properties of the aorta may serve as pathogenesis markers in cardiovascular disease. Aortic distensibility and aortic pulse wave velocity (PWV) are two parameters closely tied to the bioelastic function of the aorta. Quantification of these parameters by CMR is accurate and reproducible and could help to identify early cardiovascular disease in asymptomatic patients. However, normal values for healthy children are lacking.

### Purpose

To establish reference values of aortic distensibility and PWV in healthy children using CMR

### Methods

Twenty-four heart-healthy children (age  $9 \pm 3.6$ , range 2.3-17.8 years) were examined using a 3.0 T MRI scanner (Achieva 3.0 TX-series, Philips Medical Systems). We performed gradient echo cine MRI (FOV  $280 \times 224$  mm, voxel size  $1.88 \times 1.94 \times 6$  mm, TR = 4.4 ms, TE = 2.5 ms, flip angle:  $15^\circ$ ) and phase-contrast MRI (FOV  $270 \times 270$  mm, voxel size  $1.64 \times 1.4 \times 7$  mm, TR = 4.4 ms, TE = 2.7 ms, velocity encoding (VENC) = 200 cm/s). Aortic distensibility was calculated for four levels of the thoracic aorta according to the following formula: Distensibility =  $(A_{max} - A_{min})/[A_{min} \times (P_{max} - P_{min})]$ ; A = cross-sectional aortic lumen area, P = blood pressure. Aortic flow measurements in the ascending and proximal descending

aorta were used to assess PWV in the aortic arch. PWV was calculated as the ratio of the distance between the ascending and proximal descending aorta and the time delay of the distal flow curve compared to the proximal flow curve.

### Results

Table 1 shows the reference values for distensibility and PWV. Within this group there were no correlations of distensibility and PWV with age. The values for PWV in children were not significantly different ( $p = 0.33$ ) from the

**Table 1: Reference values for aortic distensibility and pulse wave velocity level 1 = at the isthmus of the aorta, level 2 = above the diaphragm**

| Parameters  | Values (mean $\pm$ SD) |
|---|------------------------|
| <b>Distensibility (<math>10^{-3}</math> mm Hg<sup>-1</sup>)</b> |                        |
| -ascending aorta  | $11.9 \pm 6.22$        |
| -aortic arch  | $9.83 \pm 3.92$        |
| -descending aorta (level 1)                                     | $9.88 \pm 5.79$        |
| -descending aorta (level 2)                                     | $10.93 \pm 5.47$       |
| <b>PWV (m/s)</b>  | $3.26 \pm 0.53$        |

mean of  $3.49 \pm 0.80$  m/s reported previously for young adults ( $25 \pm 2$  years). The study provided 90% power at the 0.05 significance level to detect a 0.5 m/s difference of PWV. Similar observations applied to distensibility in children and young adults, (Table 1).

### Conclusion

This study provides reference values for aortic distensibility and pulse wave velocity in children between their 3<sup>rd</sup> and 18<sup>th</sup> year of life. These data may serve as a reference for the early detection of pathological changes of the aorta in cardiovascular disease.

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