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Poster Abstracts: Clinical MRS

312. Determination of Normal Left Atrial and Left Ventricular Diameters by Cardiovascular Magnetic Resonance Imaging Using TrueFISP: Comparison to Two-Dimensional Echocardiograhy

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Established normal values are necessary for the identification of pathological cardiac diameters as determined by cardiovascular magnetic resonance (CMR) and important for follow-up studies. We have compared normal diameters for left atrium (LA) and ventricle (LV) between two-dimensional echocardiography (Echo) and CMR using TrueFISP in subjects with no cardiac pathology.

Methods: 24 patients (pts) with no cardiac pathology (12 women, 12 men, age 16–77 yr, mean age 51.8 ± 15.6 yr) were investigated using a CMR imager (Magnetom, Siemens, Erlangen, Germany) and underwent Echo (Hewlett Packer Sonos 2500, Andover, Massachusetts, USA). CMR images were acquired by trueFISP using the horizontal (HLA) and vertical (VLA) long axis plane to measure left atrial (LA) diameters (LAED), left ventricular inferior wall thickness (LVIW), left ventricular enddiastolic (LVEDD) and endsystolic (LVESD) diameters and interventricular septal wall thickness (IVS). LA diameter was also measured in the LV outflow tract view (LVOT). Same diameters were measured by Echo and compared to CMR data.

Results: LVEDD was different between men and women in CMR ($p = 0.0450$). For Echo gender specific differences were present in LVEDD ($p = 0.0423$), LVESD ($p = 0.0298$) and LVHIT ($p = 0.0083$).

LVEDD was 0.2 cm and LAED 0.8 cm smaller with CMR compared to Echo when measured in LVOT ($p \geq 0.001$). LVEDD was 0.8 cm larger when measured in the VLA by CMR.

When LAED was measured in VLA, it was 0.8 cm larger in CMR compared to Echo ($p = 0.000$).

For CMR normal values were determined: LVEDD 3.8–5.6 cm (Mean 4.6 ± 5 cm, Median 4.5 cm), LVESD 2.0–3.3 cm (Mean 2.6 ± 4 cm, Median 2.6 cm), LVIWT 0.5–1.3 cm (Mean 0.9 ± 0.2 cm, Median 0.9 cm), IWST 0.6–1.3 cm (Mean 1.0 ± 0.2 cm, Median 0.9 cm), LAED-HLA 3.6-5.7 cm (Mean 4.4 ± 0.6 cm, Median 4.5 cm), LAED-VLA 3.5–5.4 cm (Mean 4.5 ± 0.5 cm, Median 4.5 cm), LAED-LVOT 2.3–3.6 cm (Mean 2.8 ± 0.4 cm, Median 2.8 cm).

Conclusions: There is a good correlation between CMR using TrueFISP and Echo in LA and LV diameters. Diameters measured by CMR as well as by Echo were within the normal ranges, standardized by Echo. We have validated normal ranges of LA and LV diameters for CMR.

313. Determination of Normal Gender-Specific Right and Left Ventricular Volumes and Ejection Fraction by Cardiovascular Magnetic Resonance Imaging Using TrueFISP

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Established normal values are necessary for the identification of pathological cardiac volumes and ejection fractions as determined by cardiovascular magnetic resonance imaging. We have established gender-specific

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normal values for the gradient-echo sequence trueFISP in subjects with no cardiac pathology. Age is not taken into account in these normal values, because we found no age-related differences in volumes or ejection fraction.

Methods: 39 patients with no cardiac pathology (18 women, 21 men, age 16–77 yr, mean age 51.8 ± 15.6 yr) were investigated using a cardiovascular magnetic resonance imager (Magnetom, Siemens, Erlangen, Germany). Eighteen patients (46%) were aged under 50 and 21 (54%) over 50. Images were acquired by trueFISP using the standard short-axis method, the heart being imaged from the base (atrioventricular ring) to the apex at in sections of 10 mm thickness (8–11 sections). The endocardium and epicardium were delineated and the left ventricular mass n = 25), and end-diastolic volumes (EDV), end-systolic volumes (ESV), stroke volumes (SV), and ejection fractions (EF) for the right and left ventricles were determined with commercially available software (Argus, Siemens).

Results: Left ventricular EDV was 55–128 ml (median 106 ml, mean 111.7 ± 26.9 ml) in men and 57–106 ml (median 90.5 ml, mean 91.2 ± 17.6 ml) in women ($p = 0.0002$); ESV was 17–29 ml (median 29.0 ml, mean 31.1 ± 12.4 ml) in men and 14–26 ml (median 26.0 ml, mean 26.9 ± 9.7 ml, $p = 0.4296$) in women; SV was 35–124 ml (median 80.0 ml, mean 80.3 ± 20.4 ml) in men and 41–97 ml (median 61.5 ml, mean 64.2 ± 12.9 ml, $p = 0.0032$) in women; and EF was 56–82% (median 74.0%, mean 71.8 ± 7.3%) in men and 60–83% (median 72.5%, mean 70.9 ± 7.2%, $p = 0.6722$) in women. The relative mass of the left ventricle was 53.2 ± 11.9 g; in women it was 45.3 ± 8.7 g (range 37–54 g) and in men 60.5 ± 9.7 g (range 51–70 g), $p = 0.0006$. The volumes were not found to be related to age ($p = 0.2070$). In the right ventricle, the EDV was 68–197 ml (median 125 ml, mean 130.2 ± 26.5 ml) in men and 62–156 ml (median 85.5 ml, mean 91.8 ± 24.1 ml) in women ($p = 0.0002$); ESV was 26–75 ml (median 50.0 ml, mean 50.2 ± 11.8 ml) in men and 13–66 ml (median 28.0 ml, mean 32.3 ± 13.9 ml) in women ($p = 0.0002$); SV was 41–122 ml (median 77.0 ml, mean 79.6 ± 17.6 ml) in men and 42–68 ml (median 58.5 ml, mean 59.5 ± 12.0 ml, $p = 0.0002$) in women. The right ventricular EF was 53–75% (median 61.0%, mean 61.3 ± 4.8%) in men and 55–82% (median 65.0%, mean 65.9 ± 7.0%) in women ($p = 0.0318$). These volumes were also found to be unrelated to age ($p > 0.05$).

Conclusions: The ranges derived for right and left ventricular volumes and left ventricular mass with trueFISP define reference values associated with normal ventricular function. Patients with values outside these ranges can therefore be identified as having some form of cardiac pathology. The normal ranges are gender-specific, but not age-specific. The normal values derived here with trueFISP are smaller than those established for the FLASH sequence.

314. Impact of Papillary Muscles and Trabeculations in Ventricular Volume and Ejection Fraction Assessed by Cardiovascular Magnetic Resonance Using TrueFISP

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Cardiovascular magnetic resonance (CMR) is an accurate tool to determine right- and left ventricular volumes and ejection fractions. The current standard short axis technique though is time consuming and thus often not feasible in daily routine, because papillary muscles and trabeculations have to be marked and their volumes subtracted from the total ventricular volume. To reduce calculation time we evaluated the volumetric data that included papillary muscle and trabecular volumes and compared the outcome to the results of the standard technique.

Methods: 30 patients (17 healthy, 13 with coronary heart disease) were examined with CMR (trueFISP). Right- and left ventricular volumes and ejection fractions were calculated using the standard short axis technique and then again without subtracting papillary and trabecular volumes. Both methods were compared and deviations of ventricular volumes and ejection fractions were calculated in dependency on the standard technique and coronary heart disease.

Results: Statistically significant differences were found in right- and left ventricular stroke volumes ($p = 0.003$ and 0.011 respectively). No significant difference was found in right ventricular end-diastolic volumes ($p = 0.865$) as well as in right- and left ventricular ejection fractions ($p = 0.525$ and 0.192 respectively). Except for differences in left ventricular end diastolic volumes, there was no difference in the results of healthy subjects when compared to those of patients with coronary heart disease.

Conclusions: Although systematic differences were found when papillary and trabecular volumes are not subtracted, these differences are small and may not be of clinical relevance in healthy patients and in patients with coronary heart disease. Not subtracting these structures enable a faster determination of right- and left ventricular volumes and ejection fractions without compromising the accuracy of the standard short axis technique.