Prevalence and systemic distribution of early atherosclerosis in a low-intermediate risk adult population

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Purpose

- To examine the burden of asymptomatic atherosclerosis in a population without a high risk of cardiovascular disease (CVD), to determine the yield of a systematic and global test of the presence of atherosclerosis.

- A population-based study was performed in those considered to be at low-intermediate cardiovascular risk to test the hypothesis that:
  - significant silent disease would be present even in those considered to be at low-intermediate risk for CVD;
  - this disease would be randomly distributed, not conforming to a single territory.
Methods and Materials

- 1,528 participants with <20% 10-year risk of cardiovascular disease underwent whole body MRI Angiography (WBMRA).

- The scan was apportioned into 31 arterial segments which were scored according the maximum stenosis within them.

- These scores were then summated and normalized for the number of assessable arterial segments to provide a standardized atheroma score (SAS).
Methods and Materials

- Cardiac MR and WBMRA were performed in an integrated examination on a 32-channel 3T Magnetom Trio (Siemens, Germany).

- Unenhanced MRA “mask” using a 3D TurboFLASH sequence was followed by contrast-enhanced acquisitions after injections 0.5 mmol/ml gadoterate meglumine (Dotarem, Guerbet, France) at a rate of 1.5 ml/s.

- The contrast agent was injected in two rounds, the first for the acquisition of the thorax, neck and calf stations (10 ml), the second for the acquisition of the abdomino-pelvic and thigh vessels (15 ml), both times followed by a 20 ml normal saline flush.

- The mean time between first and second contrast agent injections was 19 minutes, with a total imaging time of 50 minutes.
Results

• Of the 46,903 potentially analyzable segments, 46,601 (99.4%) were interpretable.

• 2,468 segments (5%) demonstrated stenoses within them; these were relatively evenly distributed throughout the body with no focal pattern of distribution.

• 34 participants (2.2% of 1528 participants scanned) had incidental findings on their MRI scan which were considered clinically significant by the reviewing radiologists.
• The coeliac trunk was disproportionately affected by stenosis, in addition to which it was also the vessel with the poorest inter-observer repeatability (Fleiss' kappa=0.66 versus ≥ 0.81 in all the other districts).

• As this stenosis could potentially be either atherosclerotic or secondary to median arcuate ligament compression, the celiac trunk was excluded from the calculation of the SAS score and subsequent analysis.

• The graph shows the incidence of stenoses according to the grade, and of aneurysm.
  • total 1=less than 50% stenosis,
  • total 2=51-70% stenosis,
  • total 3=71-99% stenosis,
  • total 4=occlusion,
  • total >4=presence of aneurysm with or without stenosis.

Results

L=left, R=right, ICA=internal carotid artery, VA=vertebral artery, IN AR=innominate artery, CCA=common carotid artery, SC=subclavian artery, AOR A=aortic arch, THOR AO=thoracic aorta, ABD AO=abdominal aorta, COEL=celiac trunk, SMA=superior mesenteric artery, IMA=inferior mesenteric artery, REN=renal artery, ILIAC=iliac artery, FEM=femoral artery, PROF=profunda femoris artery, POP=popliteal artery, AT=anterior tibial artery, PER=peroneal artery, PT=posterior tibial artery
Results

- 44084 (94.6%) vessels resulted normal;
- 747 (49.4%) out of 1513 participants had at least one stenotic vessel;
- 408 participants (27.0%) had stenoses involving multiple arterial segments.
- The graph shows the incidence of stenotic disease according to the number of segments involved, per patient (celiac trunk excluded).
A multivariable linear regression was performed on the whole population with sex accounted for within the model as an ordinal variable.

SAS strongly correlated with age, heart rate, systolic blood pressure, smoking status and socioeconomic deprivation status (p<0.01 for all).

*Test for significance of coefficient: p<0.01.

Proportion of variability explained by the cardiovascular, demographic and blood markers included in model.

CI=confidence interval, bpm=beats per minute, BMI=body mass index, BNP=brain natriuretic peptide, BP=blood pressure, HDL=high density lipoprotein, LDL=low density lipoprotein, SIMD=Scottish Index of Multiple Deprivation, CVD=cardiovascular disease.
Conclusions

- WBMRA is feasible at a population level and picks up significant vascular disease.

- The systematic nature of its evaluation means that atherosclerotic disease that would be missed by modalities assessing single vascular sites is detected.
References


References


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