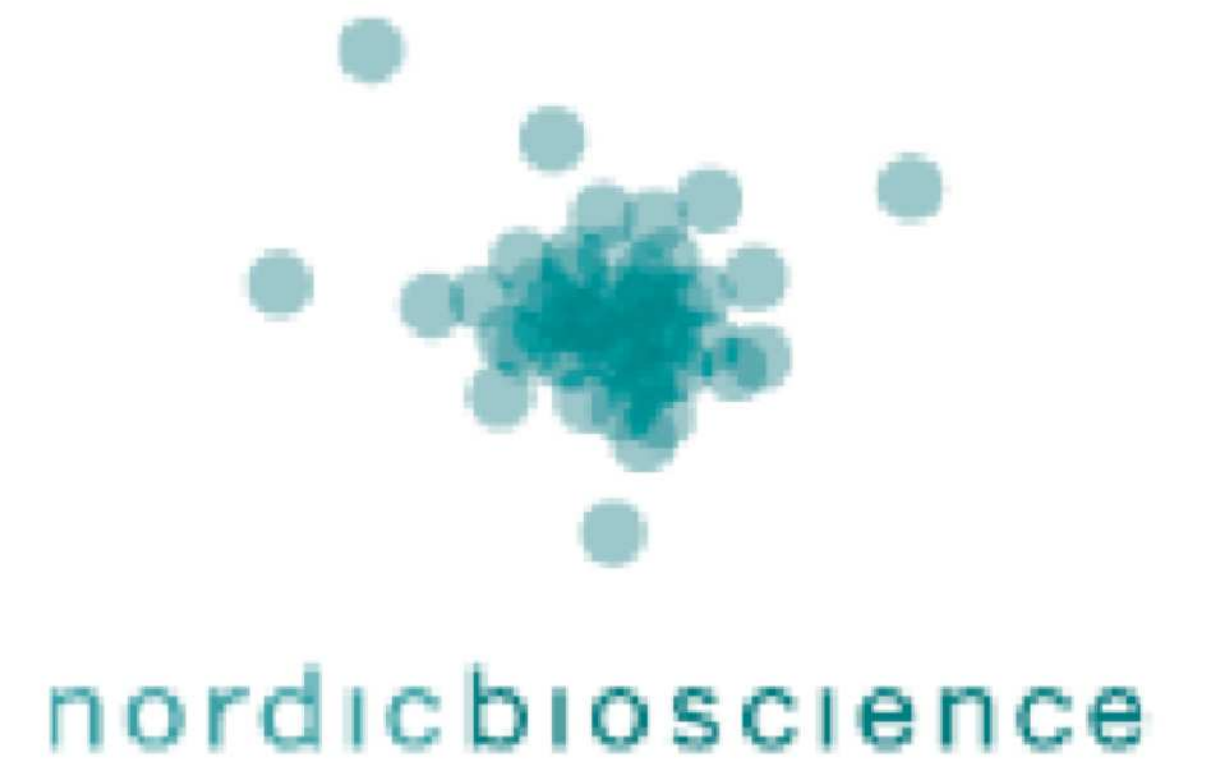


Growth Patterns for atherosclerotic calcifications

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Summary

- Growth patterns are based on simple geometric statistics from matched calcifications.
- The growth patterns are evaluated on 103 subjects in a 8.5 year study.
- Growth patterns can give new insight into the progression of atherosclerosis.

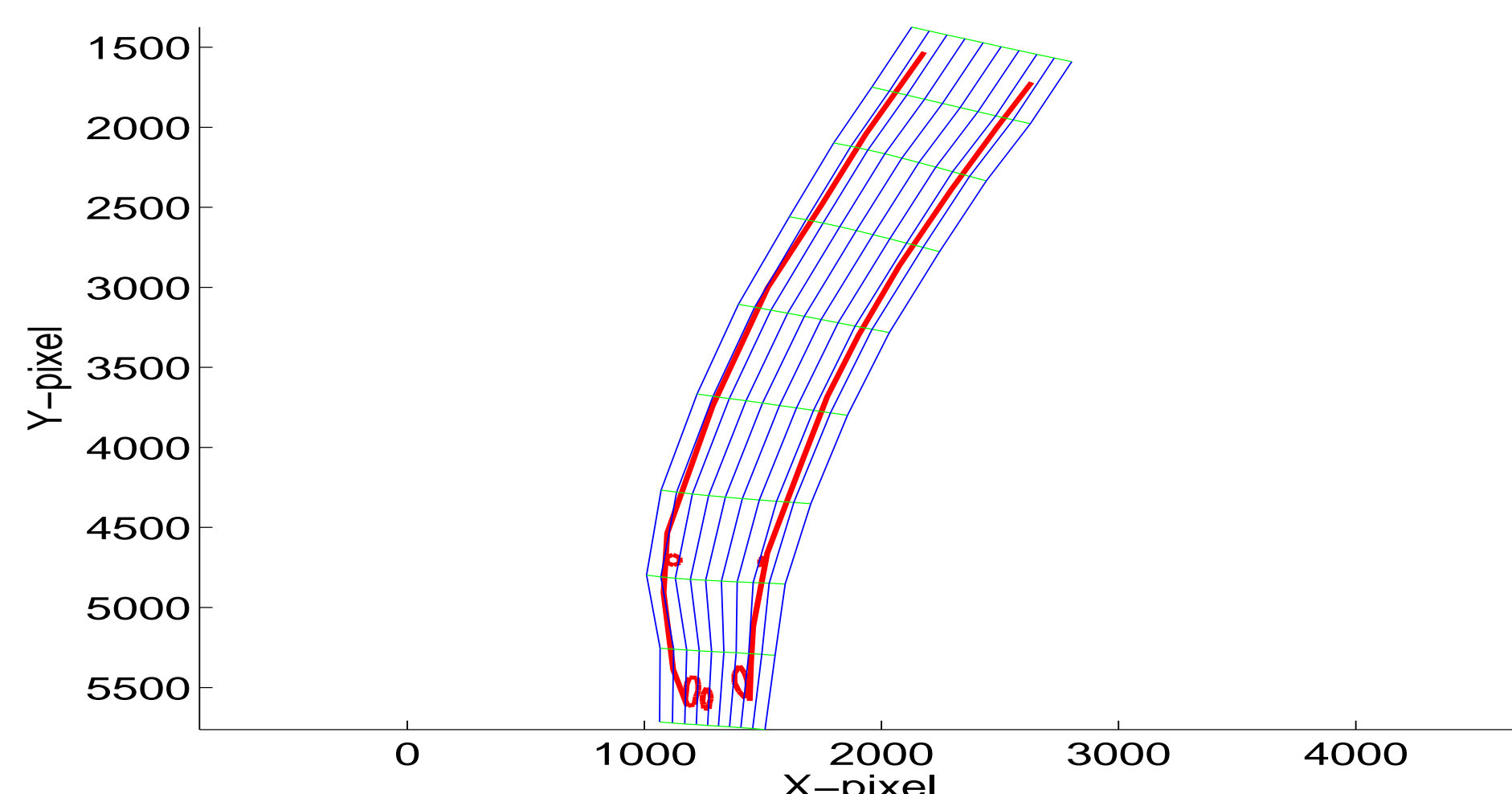
Motivation

80.000.000 people in the United States have one or more forms of cardiovascular disease (CVD). Abdominal aortic calcifications (AACs) detected by the lateral lumbar aorta are markers of atherosclerosis and independent predictor of CVD mortality and morbidity. AACs are detectable in X-ray images. X-rays are suitable for large scale clinical studies and routine screening, due to the low cost, fast examination time and the relative low radiation dose. We believe that growth patterns of AACs may provide useful information of the progression of atherosclerosis.

Method

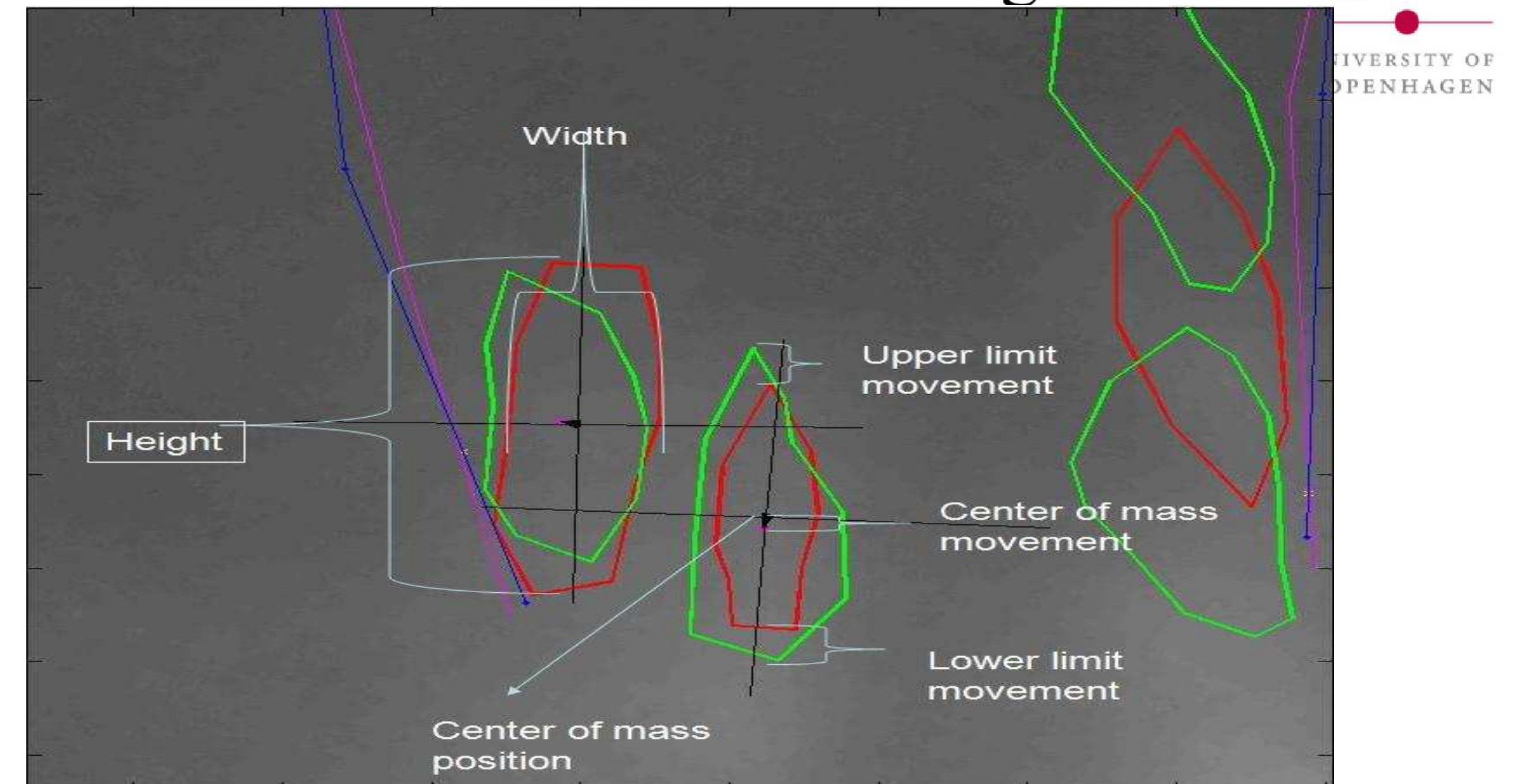
The longitudinal images for the same patient are registered with thin plate spline registration and the calcifications are matched using area overlap.

The growth patterns are derived based on an idealized aorta coordinate system, which captures the curvature of the aorta:



Our growth patterns consisted of simple geometric descriptors:

collaborating with



Blue represent the baseline aorta and magenta the registered follow-up aorta. Red represent baseline calcifications and green follow-up calcifications. The calcifications to the left are one-to-one correspondent matches. Only one-to-one correspondent matches are used for deriving the growth patterns. The height, width, movement of the lower/upper limit and the center of mass are measured based on the local idealized aorta coordinate system (in black).

Results

We have been able to match 38 % of the calcification as one-to-one correspondent matches. The calcifications grew 21 % in width and 41 % in height in average. The calcifications grew both in height and width, but the growth in height was greater. The center of mass was moved 0.60 mm downstream the aorta and the upper and lower limit was moved 0.59 mm upstream and 1.85 mm downstream respectively.

Conclusions

The growth patterns from large scale population is a new approach towards measurements of changes in individual atherosclerotic calcifications. The asymmetry in growth patterns suggest differences in microscopic environments close to the existing calcifications. Growth patterns of individual calcifications could be a new and effective marker of disease progression.

Key Publications

- Lene Lillemark et al., Growth patterns of abdominal atherosclerotic calcified deposits (AAC) from lumbar lateral X-rays, 2008, In review.