

Multi-contrast MRI assessment of Abdominal Aortic Aneurysm (AAA) composition

Citation for published version (APA):

Dam, van, E. A., Rutten, M. C. M., & Vosse, van de, F. N. (2004). *Multi-contrast MRI assessment of Abdominal Aortic Aneurysm (AAA) composition*. Poster session presented at Mate Poster Award 2004 : 9th Annual Poster Contest.

Document status and date:

Published: 01/01/2004

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

Multi-contrast MRI assessment of Abdominal Aortic Aneurysm (AAA) composition

Evelyne A. van Dam, Marcel C.M. Rutten, Frans N. van de Vosse

Eindhoven University of Technology, Department of Biomedical Engineering

Introduction

Rupture risk analysis of abdominal aortic aneurysms requires knowledge of the composition of the AAA vessel wall which is preferably acquired non-invasively. Multi-contrast MRI is a successful method to classify calcium, fibrous tissue and lipid rich tissue in the carotid vessel wall. It is based on combining T1, T2 [1] and diffusion weighted images [2]. In this research the ability of multi-contrast MRI to determine the composition of the AAA vessel wall is studied.

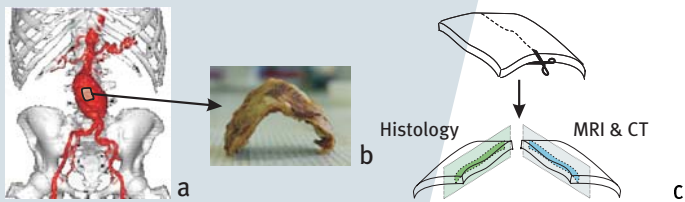


Figure 1: Abdominal Aortic Aneurysm (a) and tissue used for histology and MRI (b). The available AAA tissue was divided in two. One half provided the histological coupe, the other was used for MR and CT imaging (c)

Materials & Methods

AAA tissue was obtained from patients treated with conventional repair surgery. To determine its composition histological samples and μ CT and multi-contrast MR images of the same specimen were used (Figure 1). Histology is used as a golden standard for tissue classification, but since it is decalcified in the staining process CT is needed for validation of calcified regions in the tissue.

The T1, T2 and diffusion weighted gray values were mapped to the red, green and blue channel respectively to give a color representation of the MR data.

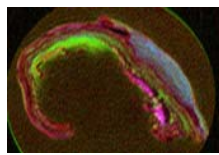


Figure 2: Color representation of the MR data

MR imaging was performed with a 6.3T scanner with a Varion imaging console. The T1, T2 and diffusion weighted images and a μ CT scan were made at the position depicted in figure 1c. K-means clustering is used for image analysis (figure 4).



Figure 3: The μ CT image with tissue contour indicated in red (a) and the histological image where yellow is collagen, red is fibrin or muscle, blue is mucine and black is elastin (b)

Results

The calcified region in the μ CT-image agrees with the signal void expected at the calcified region in the MR images. The regions that can be distinguished by color in the RGB representation of the MR data are classified as different clusters. The fibrin and collagen areas are distinguished in the clustered image. The densely packed area and the loosely packed area of muscle cells appear different in MR (yellow, orange, figure 4, clustered image).

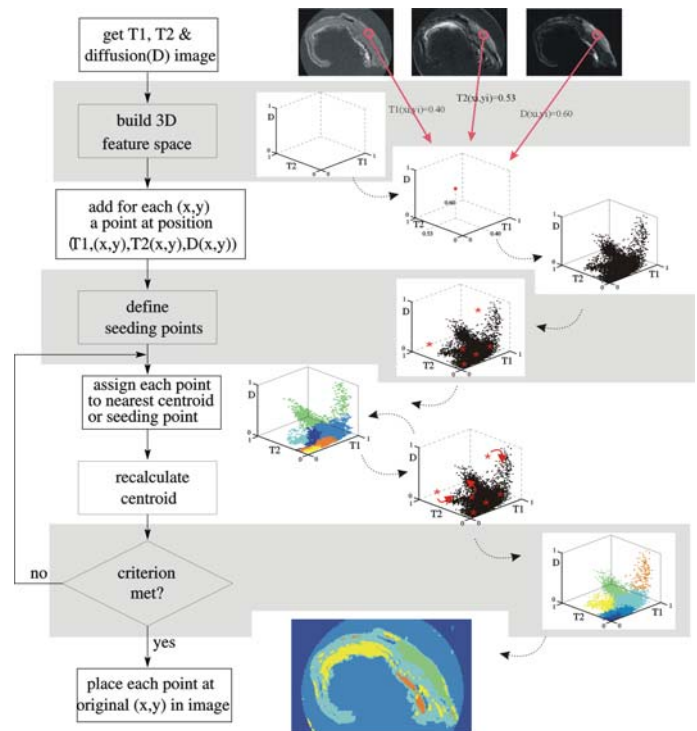


Figure 4: Flowchart of k-means clustering algorithm. MR data is converted to a 3D feature space and K-means clustering is applied resulting in an image in which each pixel is assigned to one of 6 clusters

Discussion

The differences between areas in the color representative of the MR data show that multi contrast MRI can be used for classification of the tissue. The clustering algorithm results are satisfying, but only tested for one sample. Reproducibility needs to be shown. The clustered image does show good agreement with histology, so multi-contrast MR is a promising tool in characterisation of AAA tissue.

References:

- [1] Shinnar et al. (1999) *Art Thromb Vasc Biol*, 19, 2756-2761
- [2] Clarke et al. (2003) *Mag Res Med*, 50, 1199-1208