EVAR Imaging Innovations for Safer Treatment

Artificial Intelligence Algorithm for an Automatic Thoracic Aorta Assessment

LINC | Leipzig
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Siemens Healthineers:
Research cooperation & speaker’s activity
Artificial Intelligence

Applications

Search engines

Voice control

Genetic data analysis

Imaging analysis

Radiology

Autonomous vehicles
Increasing Workload & Error Rate
... how to deal with....?

In average a radiologist diagnoses an image every 3-4s, 8 h/d
(Choi et al. 2016).

4% of all radiological diagnosis are errors
– clearly higher at abdomen-CT
(Radiology Quality Institute 2012; Berlin 2007)

Increasing work pace increases error rate up to 30%
(Sokolovskaya et al. 2015)
Aortic Diameter Assessment
Guidelines (European Society of Cardiology, 2014)

Three-dimensional reconstruction
Parasitale MPR along centerline
MPRs orthograde to centerline

<table>
<thead>
<tr>
<th>Landmark</th>
<th>Definition</th>
<th>Diameter Mean</th>
<th>Diameter SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>root</td>
<td>37.7 mm</td>
<td>3.8 mm</td>
</tr>
<tr>
<td>#2</td>
<td>sinotubular junction</td>
<td>33.2 mm</td>
<td>3.7 mm</td>
</tr>
<tr>
<td>#3</td>
<td>ascending maximum diameter of the middle third between #2 and #4</td>
<td>28.6 mm</td>
<td>3.6 mm</td>
</tr>
<tr>
<td>#4</td>
<td>arch origin of brachiocephalic trunk</td>
<td>28.2 mm</td>
<td>3.5 mm</td>
</tr>
<tr>
<td>#5</td>
<td>arch between left common carotid and left subclavian artery</td>
<td>27.7 mm</td>
<td>3.3 mm</td>
</tr>
<tr>
<td>#6</td>
<td>descending 2cm distal to left subclavian artery</td>
<td>27.3 mm</td>
<td>3.2 mm</td>
</tr>
<tr>
<td>#7</td>
<td>level of pulmonary arteries</td>
<td>26.9 mm</td>
<td>3.1 mm</td>
</tr>
<tr>
<td>#8</td>
<td>diaphragm</td>
<td>25.6 mm</td>
<td>3.4 mm</td>
</tr>
<tr>
<td>#9</td>
<td>celiac trunk origin</td>
<td>26.2 mm</td>
<td>3.0 mm</td>
</tr>
</tbody>
</table>


“Manual” Aortic Diameter Assessment

Time-consuming and error-prone...

Current Examination

Prior Examination
AI-Assisted Aortic Diameter Assessment
Automatic Segmentation & Diameter Quantification

CT Acquisition Parameters
Soft as well as hard reconstruction kernels
Slice thickness up to 3.0cm
Supposedly increasing algorithm accuracy in case of contrast-enhancement & ECG-gating
AI-Assisted Aortic Diameter Assessment

Measurement Accuracy

Study Characteristics

- 18 patients with TAA (at least involving the ascending aorta), each with two follow-up CTs
- Manually radiological assessment, wash-out period, AI-assisted assessment (three radiologists, guideline-compliant)
- Comparison with original reports, accuracy and reporting time quantification

Raw AI Measurement Accuracy

- Time-consuming guideline-compliant aortic measurements revealed additional affections of the root / arch for 80% of aneurysms that had initially been reported to be limited to the ascending aorta.
- 33% of AI measurements were manually corrected with a predominance at the proximal parts.
- AI-assistance reduced the total diameter inter-reader variability by 42%.
- Manual and AI-assisted aneurysm growth quantification varied to small extent (difference of 0.75mm as a mean over all patient / landmark positions) which did not significantly exceed the corresponding inter-rater variability.

AI-Assisted Aortic Diameter Assessment

Reporting Time Efficiency

AI-Rad Companion
Integration in Radiologists’ Daily Routine

Multi-organ approach
- Heart
- Lung
- Vertebral

Functionalities
- Measuring
- Reporting
- Highlighting
- Characterizing

Automated results
Thanks for your attention!

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