Dose reduction in dual-energy CT-angiography in patients after endovascular aortic repair - does omitting non-contrast and arterial phase affect the diagnostic accuracy?
Authors

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Purpose

Analysis of the influence of shortened examination protocols on the sensitivity of dual-energy CT in detection of endoleaks and possible radiation effective dose (ED) reduction.
CT scans of 97 patients were enrolled in this study. CT scans were obtained using a dual-energy fast-kVp switching scanner. True Non Contrast (TNC) phase was obtained using single energy, arterial and delayed phase using dual-energy acquisition. Virtual non contrast (VNC) phase was reconstructed from delayed phase. Analysis of the repeatability of endoleak diagnosis by both observers was performed and the sensitivity of shortened study protocols was calculated. The average ED in shortened study protocols was calculated.
Materials and methods

Reading sessions

Endoleak assessment

- I – full triphasic examination – TNC, arterial, delayed
- II - biphasic – VNC, arterial, delayed (2 blinded readers)
- III – monophasic - VNC, delayed (2 blinded readers)

Scanning parameters in TNC and both DECT acquisitions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>TNC</th>
<th>DECT – arterial and delayed</th>
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<tbody>
<tr>
<td>Tube voltage (kV)</td>
<td>120</td>
<td>80-140</td>
</tr>
<tr>
<td>Tube current (mAs)</td>
<td>100-200</td>
<td>360</td>
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<tr>
<td>Pitch</td>
<td>0.984:1</td>
<td>0.984:1</td>
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<tr>
<td>Lamp rotation time (s)</td>
<td>0.6</td>
<td>0.6</td>
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<td>Slice thickness (mm)</td>
<td>0.625</td>
<td>0.625</td>
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During session 2. and 3., the differences between the two readers in number of endoleaks diagnosed were not statistically significant ($p > 0.05$).

In biphasic protocol 53 endoleaks were diagnosed – with 100% sensitivity comparing to triphasic protocol.

In monophasic protocol 44 endoleaks were diagnosed.

Comparing to triphasic protocol, monophasic study has sensitivity of 83.33%, 92.54% specificity, 89.69% accuracy, PPV 83.33%, NPV 92.54% in endoleak diagnosis.
Results

- Calculated mean Effective Dose (ED) of triphasic study was 27.95 mSv.
- Biphasic protocol led to 23.28% of mean ED reduction,
- Monophasic protocol led up to 61.73% mean ED reduction.
Conclusion

- Omission of TNC phase can lead to $\frac{1}{4}$ ED reduction. Omission of both TNC and arterial phase can lead to about 60% dose reduction but with drop in diagnostic accuracy in endoleak detection.