The role of Angio-CT in Interventional Oncology

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Disclosure

Speaker name: Michael Moche

I have the following potential conflicts of interest to report:

☐ Consulting
☐ Employment in industry
☐ Stockholder of a healthcare company
☐ Owner of a healthcare company
☐ Other(s)

☒ I do not have any potential conflict of interest
Gold standards in IO

percutaneous

transarterial

3D

Realtime

soft tissue

limited realtime

vessel

2D with limited soft tissue
Angio-CT ≠ Angio + CT

- Common Co-ordinate System
- Quick switching
- Automatic image overlay
- Collision prevention
Intra-arterial CT-Angio with minimal CM

Coeliac injection of 15 ml diluted CM

➢ 1:5 = 3 ml
Instant fusion of i.a. CT-Angio with live fluoro

• Courtesy: Dr. B. Odisio, MD Anderson Cancer Center, Houston, US.
Accurate targeting for superselective treatment
Hybrid approach

Single slice with aortic injection of 15 ml contrast 1:10 = 1.5 ml
Do we need CT like images?

J Vasc Interv Radiol. 2007
Usefulness of cone-beam volume CT with flat panel detectors in conjunction with catheter angiography for transcatheter arterial embolization.
Kakeda et al.

AJR Am J Roentgenol. 2009
Impact of a unified CT angiography system on outcome of patients with hepatocellular carcinoma.
Toyoda et al.

„In 42 of the 52 lesions (81%), cone-beam CT provided additional useful information for therapeutic decision making or TACE compared with DSA."

Significant survival benefit

n = 182
(p = 0.0093)
Do we need CT like images?

Lucatell et al Radiol Med 2019
„Sequential dual-phase cone-beam CT is able to intra-procedurally predict the one-month treatment outcome of multi-focal HCC, in course of degradable starch microsphere TACE.“

O`Connor et al. Cardiovasc Intervent Radiol. 2020
Feasibility of Yttrium-90 Radioembolization Dose Calculation Utilizing Intra-procedural Open Trajectory Cone Beam CT.
Do we need CT like images?

J Vasc Interv Radiol. 2017
The Role of Cone-Beam CT in Transcatheter Arterial Chemoembolization for Hepatocellular Carcinoma: A Systematic Review and Meta-analysis (18 studies).
Pung et al.

“CB- CT …should be considered as an adjunct tool to DSA during TACE of HCC.”

CB - CT

Angio - cCT
CB-CT vs conventional CT

Coverage and Artifacts

Am J Roentgenol. 2008
Visualization of hypervascular liver lesions During TACE: comparison of angiographic C-arm CT and MDCT. Meyer et al.

- liver not be visualized completely in 2/3 of the pat.
- Significant more Artifacts

<table>
<thead>
<tr>
<th>Segments</th>
<th>MDCT</th>
<th>C-Arm CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of resected liver segments</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Segments incompletely covered by imaging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In both phases</td>
<td>0</td>
<td>8 (7)</td>
</tr>
<tr>
<td>In one phase</td>
<td>6 (5)</td>
<td>8 (7)</td>
</tr>
<tr>
<td>Segments completely covered by imaging in both phases</td>
<td>111 (95)</td>
<td>101 (86)</td>
</tr>
</tbody>
</table>

Classification of Artifacts

<table>
<thead>
<tr>
<th>Classification of Artifacts</th>
<th>MDCT</th>
<th>C-Arm CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (A1)</td>
<td>115 (98)</td>
<td>68 (58)</td>
</tr>
<tr>
<td>Minor (A2)</td>
<td>2 (2)</td>
<td>21 (18)</td>
</tr>
<tr>
<td>Moderate (A3)</td>
<td>0</td>
<td>28 (24)</td>
</tr>
<tr>
<td>Major, not diagnostic (A4)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

\[ p^a = 0.042 \]

\[ p^b = 0.017 \]
## CB-CT vs conventional CT

<table>
<thead>
<tr>
<th></th>
<th>CB-CT</th>
<th>cCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrast resolution</td>
<td>5-10 HE</td>
<td>1 HE</td>
</tr>
<tr>
<td>Contrast dilution</td>
<td>1:1</td>
<td>1:10</td>
</tr>
<tr>
<td>Spatial resolution</td>
<td>max. 2000$^2$</td>
<td>512$^2$</td>
</tr>
<tr>
<td>Temporal resolution</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>CM Phase</td>
<td>single-double</td>
<td>multiple</td>
</tr>
<tr>
<td>Single slice imaging</td>
<td>difficult</td>
<td>easy</td>
</tr>
<tr>
<td>Speed incl. prep</td>
<td>90 sec</td>
<td>20 sec</td>
</tr>
<tr>
<td>Breath hold</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Post-processing</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>Scan range - coverage</td>
<td>fixed</td>
<td>flexible</td>
</tr>
<tr>
<td>FoV</td>
<td>max. 30cm</td>
<td>~50cm</td>
</tr>
<tr>
<td>Isocentering</td>
<td>tricky</td>
<td>easy</td>
</tr>
<tr>
<td>Dose</td>
<td>high</td>
<td>ca. 40% of CB-CT$^1$</td>
</tr>
</tbody>
</table>

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1 Piron et al. Cardiovasc Intervent Radiol. 2019 Radiation Exposure During Transarterial Chemoembolization: Angio-CT Versus Cone-Beam CT.
„CT-guidance is native“

Make CT-guidance enhanced with Angio-CT

Single slice CT with intraaortic injection (dual head HP-injector)
20ml contrast dilution 1:10 = 2ml
Take home points

- CT-like imaging is crucial for i.a. IO
- Increase in targeting & safety & workflow
- cCT superior to CB-CT (IQ, FOV, Speed, reduction of CM)
- Hybrid procedures
- CM enhanced single slice CT-guidance

Thank you!
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