The BSCI radiation dose audit 2016-2017: final analysis

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Radiation doses for cardiac CT

- scientific literature
  - +++ references
  - few multi-centre surveys
    - PROTECTION I (2010), II (2010) and III (2012) national data
- first UK survey carried out by BSCI in 2014
  - 50 centres, 1341 CCTA exams

<table>
<thead>
<tr>
<th>parameter</th>
<th>median value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>28 kg/m²</td>
</tr>
<tr>
<td>HR</td>
<td>60 bpm</td>
</tr>
<tr>
<td>exam DLP</td>
<td>209 mGycm</td>
</tr>
</tbody>
</table>
BSCI dose audit 2016-2017

- **aims:**
  - evaluate effect of improvements in practices and technology on radiation dose
  - gather new data on
    - timing of acquisition
    - dependence of radiation dose on BMI
  - determine right dose for right patient
BSCI dose audit 2016-2017

• questionnaire sent out Oct 2016
  – completed at scanner side for each individual exam
  – ≥ 50 CCTA exams
• data analysed locally
  – instructions provided
• data collection period closed May 2017
Results

- data on 46 scanners (50 in 2014)
  - 29 (20) centres completed own detailed analysis
- 36 centres carried out > 50 CCTA exams
  - in 2014, 28 centres carried out >20 CCTA exams

<table>
<thead>
<tr>
<th>% patients given beta blockers</th>
<th>BMI kg/m²</th>
<th>HR bpm</th>
<th>exam DLP mGycm</th>
</tr>
</thead>
<tbody>
<tr>
<td>median of centre medians 2016/17</td>
<td>65 (48-77)</td>
<td>28 (27-28)</td>
<td>60 (58-61)</td>
</tr>
<tr>
<td>median of centre medians 2014</td>
<td>69 (59-80)</td>
<td>28 (27-29)</td>
<td>60 (58-62)</td>
</tr>
</tbody>
</table>
Results

- BMI and HR normally distributed
- exam DLP skewed distribution
  - shift toward lower doses
Results

• coronary CTA data filtered according to ECG gating technique
  – 32 (19) centres with at least 20 exams in one category included

<table>
<thead>
<tr>
<th></th>
<th>prospective, no padding</th>
<th>prospective, with padding</th>
<th>retrospective, with mA pulsing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016/17 median exam DLP mGycm</td>
<td>130 (93-170) n=32</td>
<td>182 (133-234) n=15</td>
<td>353 (319-453) n=3</td>
</tr>
<tr>
<td>2014 median exam DLP mGycm</td>
<td>119 (92-173) n=11</td>
<td>257(245-283) n=5</td>
<td>321 (256-381) n=5</td>
</tr>
</tbody>
</table>

• 94% exams performed at end diastole

n= number of centres
Results

- coronary CTA data for standard-sized patients with BMI 25 - 31kg/m\(^2\) filtered according to heart rate
  - 36 (19) centres with at least 8 exams in one category included
Results

- coronary CTA data for patients with HR 55-65 bpm filtered according to weight / BMI
  - 39 (n/a) centres with at least 8 exams in one category included

<table>
<thead>
<tr>
<th>BMI kg/m²</th>
<th>small</th>
<th>medium</th>
<th>large</th>
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<tbody>
<tr>
<td>≤ 25</td>
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<tr>
<td>25 &lt; BMI &lt; 31</td>
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<td></td>
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<tr>
<td>≥ 31</td>
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<table>
<thead>
<tr>
<th>weight kg</th>
<th>≤ 70</th>
<th>70 &lt; weight &lt; 90</th>
<th>&gt; 90</th>
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<tbody>
<tr>
<td>small</td>
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<tr>
<td>large</td>
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2017
Discussion

• 18% decrease in median exam DLP
• 29% decrease in median exam DLP for prospective gating with padding
  – x 1.4 DLP without padding (x 2.2 in 2014)
  • confusion about terminology?
  • less padding used?
• 94% exams performed at end diastole
• very little data for retrospective gating
• less variation in median exam DLP with HR
• median exam DLP varies with BMI as expected
Next steps

• publication of national DRL for CCTA
  – as part of larger PHE initiative
    • agreed in principle
    – proposal: 320 mGycm based on 2014 audit
    – c.f. 370 mGycm (prospective), 970 mGycm (retrospective) proposed for France*

• publication of 2016-2017 audit

Acknowledgements

- BSCI committee
- CT Users Group
- radiographers, radiologists and physicists in UK cardiac CT scanning centres