Impact of Incremental Increase in CT Image Noise on Detection of Low Contrast Hypodense Liver Lesions

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### DISCLOSURES

<table>
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<tr>
<th>Dr. Kanal</th>
<th>- NO DISCLOSURES</th>
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<td>Dr. Chung</td>
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<td>Dr. Wang</td>
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<td>Dr. Stewart</td>
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<td>Dr. Shuman</td>
<td>- Administers a grant from GE Healthcare which supports clinical investigation of cardiac CT</td>
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<td>- No support for equipment or salaries</td>
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AIM

• To determine the impact of incremental increases in CT image noise on detection of low-contrast hypodense liver lesions.
50 consecutive clinical liver images acquired at image noise index (NI) of 15
  - 50 images with hypodense liver lesion
  - 50 images without liver lesion

Using a software noise addition tool, three additional image sets were generated for each patient:
  - NI = 17.4 (simulating 75% original dose)
  - NI = 21.2 (simulating 50% original dose)
  - NI = 29.7 (simulating 25% original dose)

After randomization, three readers scored certainty of lesion presence using a 5-point Likert scale

Lesion detection was evaluated by sensitivity analysis against a 90% threshold and by receiver operator curve (ROC)
RESULTS

• Sensitivity > 90% threshold (range 95-98%) for all image sets except the 25% dose (NI 29.7), which dropped to 89%

• Reader $A_z$ values for ROC curves were good for original (100% dose), NI 17.4 (75% dose) and 21.2 (50% dose) images (0.976, 0.973, and 0.96 respectively).

• For NI of 29.7 (25% dose) the $A_z$ decreased to 0.913.
Detection sensitivity was < 90% for lesion size less than 10 mm (85%) only at NI of 29.7 (25% dose)

Similarly, Detection sensitivity was < 90% for lesion to liver contrast less than 60 HU (85%) only at NI of 29.7 (25% dose)
RESULTS

• Original CT image of a hypodense hepatic lesion (NI 15) with 3 additional simulated CT images with added virtual noise (NI 17.4, 21.2, and 29.7) corresponding to 75%, 50% and 25% radiation dose compared with the originally scanned CT image (NI 15; 100% dose).
Conclusions

• This study suggests that there is little loss of detection sensitivity for low contrast liver lesion detectability of CT exams scanned with a NI at least up to 21.2 compared to a NI of 15 – a patient radiation dose reduction of 50%.

• No significant degradation was observed when reader performance was evaluated as a function of lesion size (> 10 mm) and contrast (> 60 HU) at 90% sensitivity.