Abdominal-Pelvic Scanning Parameters Revisited: A Case for Z-Axis Reduction in Patients With Right Lower Quadrant Pain

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Purpose

• Routine CT abdomen/pelvis scans in ED patients presenting with right lower quadrant pain and high clinical suspicion for appendicitis customarily begin above the dome of the diaphragm and hence include significant portions of the lung bases, upper abdomen and often breast tissue.

• We seek to determine whether CT abdomen/pelvis scans in ED patients presenting with right lower quadrant pain and high clinical suspicion for appendicitis can be safely abbreviated to begin at a more inferior level to minimize the effective radiation dose to the patient without omitting significant incidental findings.
Methods

• CT abdomen/pelvis scans of 119 consecutive ED patients with right lower quadrant pain at an urban community teaching hospital were reviewed.

• Scans were performed on a GE Lightspeed 4-slice scanner or Phillips Brilliance 64-slice scanner with current modulation. No iterative reconstruction package was used.

• For each scan with an available dose report, the dose length product was recorded. An abdominal tissue weighting factor of 0.015 was used for calculation of the effective radiation dose.

• Z-axis measurements were recorded from the superior start of the exam to the top of each vertebral body down to L2.

• The scans were reviewed for incidental findings and their locations were mapped on sample scout and axial images. The incidental findings were also graded (no follow-up, imaging follow-up, requiring intervention) using ACR white paper guidelines on incidentalomas 1,2.
Results

119 Total Scans

69 scans performed on GE Lightspeed 4-slice
- 55 scans with available dose reports
  - Average effective dose = 19.5 mGy
- 14 scans without dose reports

50 scans performed on Phillips Brilliance 64-slice with current modulation
- 20 scans with available dose reports
  - Average effective dose = 13.1 mGy
- 30 scans without dose reports
Results

- A total of 30 incidental findings were made above the L2 vertebral body.
- Per ACR white paper guidelines, 26 of these findings did not require additional imaging follow-up, additional imaging was suggested for 3 of these findings, and 1 right adrenal metastasis was found in a patient with previously undiagnosed NSCLC.
Results

- Incidental finding not requiring imaging follow-up
- Incidental finding for which follow-up imaging is suggested
- Adrenal metastasis in patient with NSCLC
For the two breast lesions (arrows), no ACR white paper recommendations were available. Recommendation was given for follow-up imaging with mammogram.

An adrenal metastasis (arrow head) was found in a patient with previously undiagnosed NSCLC. This patient also had findings of appendicitis on his scan.
Results

- Beginning the scan at the top of the L2 vertebral body instead of the dome of the diaphragm, as is customary, would reduce the Z-axis scan dimension by 12.9 cm on average, which corresponds to an average reduction of 30.3% in the Z-axis.

- The absolute effective dose reduction for scans using the 4-slice GE Lightspeed would be 5.9 mGy.

- The absolute effective dose reduction for scans using the 64-slice Philips Brilliance with current modulation would be 4.0 mGy.

- Overall percentage reduction in effective dose would be 30.3% regardless of scanner type.
Discussion

• The only clinically significant incidental finding above L2 in this study was a NSCLC adrenal metastasis in a patient with previously undiagnosed disease.

• Given that this patient also had imaging evidence of appendicitis it is unlikely that the metastasis was accounting for the patient’s symptoms.

• A previous study of 1,049 incidentally found adrenal masses in patients with no prior history of cancer found no malignant lesions. This suggests that the metastatic adrenal lesion found in our study is likely coincidental as well as incidental.
Discussion

• We acknowledge that there are various etiologies of right lower quadrant pain other than appendicitis, including referred pain from other parts of the abdomen.

• A previous study\(^4\) evaluating 1,571 abdominopelvic CT’s performed for suspected appendicitis found an alternative diagnosis in 469 (31.6\%) cases.

• We believe that some of these diagnoses (mid to distal ureterolithiasis, adnexal pathology, lower abdominal diverticulitis, etc.) will still be detectable if the scan began at the L2 vertebral body.

• Thus, depending on clinician experience and clinical suspicion with regards to location of pathology, an abbreviated scan may still prove fruitful in providing a diagnosis.
Conclusion

• These results make an intriguing case for Z-axis reduction in ED patients with high clinical suspicion for appendicitis.

• By reducing the Z-axis scan dimension to begin at the top of L2, overall radiation exposure to the patient decreases.

• While this will also reduce detection of pathology in the lower chest and upper abdomen, our results suggest that the majority of incidental findings in this subset of patients are of little clinical significance and most likely unrelated to patient’s symptoms.

• In addition to radiation dose reduction, beginning the CT examination at the top of L2 would also reduce unnecessary follow up examinations, and resultant clinician and patient anxiety.
References


