Massachusetts General Hospital
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HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Can AI tool handle aortic segmentation and measurements in patients with Scoliosis?

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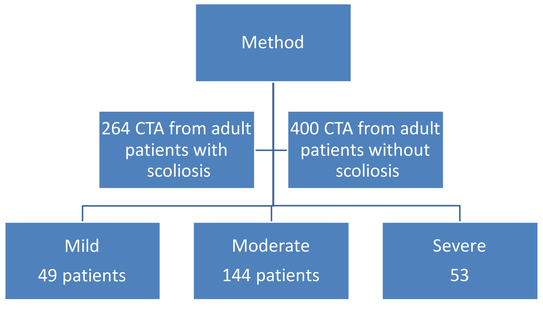
Purpose

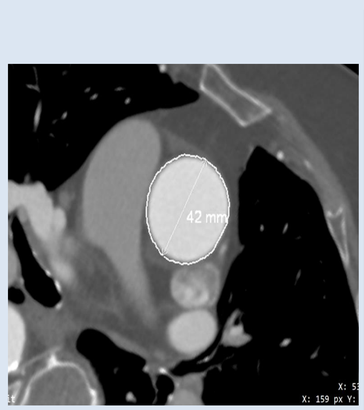
- Aneurysms of the thoracic aorta are less common than those in the abdominal aorta, but they are clinically significant due to the risk of rupture and death. Cases are often discovered incidentally.
- Undetected or missed aortic aneurysms can lead to substantial morbidity, mortality, and medicolegal implications.
- We conducted stress testing on an AI tool for aortic segmentation and measurements using contrast-enhanced CT angiography (CTA) to determine performance bias in patients with scoliosis.
- We anticipate that in patients with severe scoliosis, the AI may not accurately detect the correct measurement of the aorta due to aortic distortion.

Methods

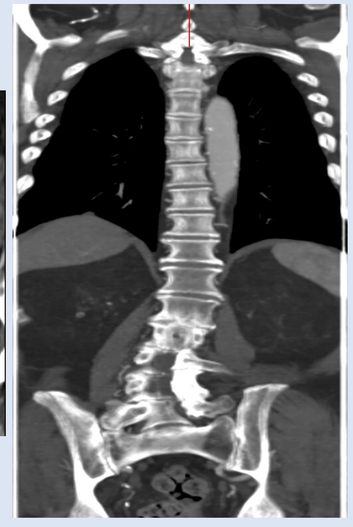


- Based on the manual 3-plane aortic measurements, we classified dataset into normal aorta (NA), aortic ectasia (AE), and aortic aneurysm (AA).
- All de-identified thin-section CT images (1-1.25mm) were processed with the AI tool (Siemens AI Rad Companion) and the outputs were recorded as DICOM captures and CSV file format.
- Data were analyzed to estimate sensitivity, specificity, and area under the curve (AUC) for receiver operating characteristic (ROC) analysis.

Mild Scoliosis

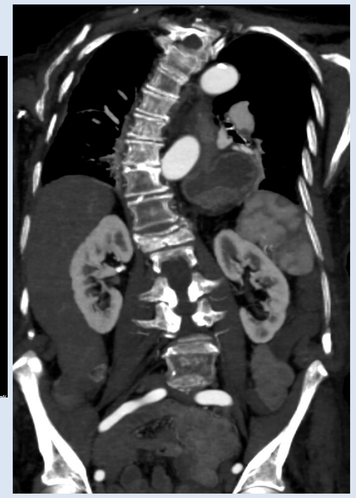


87-year-old female with mild scoliosis (Cobb angle 12.5) with correctly measured maximum aortic dimension of 42 mm by the AI tool.



78-year-old female with mild scoliosis (Cobb angle 18.1) with incorrectly measured maximum aortic dimension of 47 mm by the AI tool (correct measurement was 31 mm).

Severe Scoliosis



85-year-old male with severe scoliosis (Cobb angle 45) with correctly measured maximum aortic dimension of 48 mm by the AI tool.

57-year-old female with severe scoliosis (Cobb angle 53.6) with incorrectly measured maximum aortic dimension of 45 mm by the AI tool (correct measurement was 37 mm).

Results

scoliosis	cases	ATAA+ATAE	DTAA+DTAE
MILD	49	13	13
MOD	144	30	60
SEVERE	53	10	18

- The sensitivity and specificity for ascending AA/AE in patients with mild scoliosis were 0.94, 0.80, and 0.68, and 0.77 in severe scoliosis ($p<0.01$).
- The respective sensitivity and specificity for descending AA/AE in patients with mild scoliosis were 0.54, and 0.78, whereas in patients with severe scoliosis were 0.97 and 0.3.
- The corresponding statistics for patients without scoliosis were 0.88-0.88, 0.74-0.96, and 0.81-97, for AE and AA, respectively.

Conclusion

	AUC	
Cases	ATAA+ATAE	DTAA+DTAE
Mild Scoliosis	0.91	0.84
Severe Scoliosis	0.8	0.67
without scoliosis	0.88	0.81

scoliosis and normal spinal curvature. There is a small but significant drop in performance of the AI tool in aortic measurements in patients with severe scoliosis as compared to those with mild-moderate

Clinical Relevance

Radiologists must be aware of underlying biases in the performance of the AI tool in patients with anatomic variations.