Prevalence and Incidental Detection Rates of Thoracic Aortic Dilation and Aneurysm Across Computed Tomography Imaging Modalities in a Veteran Population

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ABSTRACT

Background: The prevalence and incidental detection rates of thoracic aortic dilation (TAD) and thoracic aortic aneurysm (TAA) in computed tomography (CT)-based screening programs (eg, low-dose CT for lung cancer screening) are poorly characterized but could inform opportunistic screening strategies.

Methods: In this single-center retrospective cohort analysis, 9409 consecutive chest CT studies for 6795 unique patients at the Milwaukee Veterans Affairs Medical Center in Milwaukee, Wisconsin, were evaluated between January 2023 and January 2025. Radiology reports were reviewed manually. Incidental cases were defined as findings not previously documented in clinical notes or prior imaging. Point prevalence and incidental rates were calculated.

Results: The overall prevalence of TAD and TAA across CT cohorts was 6.1% (95% CI, 5.5%–6.6%) and 1.2% (95% CI, 0.95%–1.5%), respectively. The prevalence of TAD was 8.1% for low-dose CT (95% CI, 7.1%–9.1%), 8.3% for CT without contrast (95% CI, 6.5%–10.1%), and 3.2% for CT with contrast (95% CI, 2.6%–3.9%). The incidental detection rate of TAD was higher for low-dose CT (3.7%) than for CT without contrast (1.9%) and CT with contrast (1.2%).

Conclusions: Thoracic aortic dilation and thoracic aortic aneurysm are common among veterans undergoing clinically indicated chest CT imaging. Integrating opportunistic aortic assessment into existing CT screening programs deserves prospective evaluation to determine its clinical relevance and impact on downstream management.

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BACKGROUND

Thoracic aortic aneurysms (TAAs) are associated with significant morbidity and mortality.[1] The prevalence of thoracic aortic dilation (TAD; aortic diameter > 4.0 cm) and TAA (> 4.5 cm) varies based on the population studied and the presence of risk factors, including advanced age, hypertension, and smoking.[1] Unlike abdominal aortic aneurysms, available evidence does not support population-based screening except in patients with hereditary conditions.[1] There are few reports of the prevalence of TAD/TAA in clinically relevant populations at elevated risk, such as patients undergoing low-dose computed tomography (LDCT) for lung cancer screening.

Integrated dual screening for both lung cancer and TAD/TAA was recently explored in the United Kingdom National Health Service Targeted Lung Health Check (TLHC) program.[2] Among more than 10 000 patients in the TLHC program who underwent LDCT for lung cancer screening, referrals for TAD/TAA were made in 153 patients (1.5%), of whom 136 (1.3%) had findings confirmed by dedicated CT angiography. In another study of more than 36 000 patients undergoing coronary artery calcification (CAC) screening, the prevalence of TAD and TAA was 8.6% and 0.7%, respectively.[3] These studies highlight the potential yield of opportunistic screening for TAD/TAA. We therefore performed a single-center retrospective analysis to determine the prevalence and incidental detection rates of TAD/TAA among veterans undergoing clinically indicated CT imaging for purposes other than aortic evaluation at our institution.

METHODS

This single-center retrospective cohort analysis included consecutive patients undergoing clinically indicated LDCT for lung cancer screening, chest CT without contrast, or chest CT with contrast at the Milwaukee VA Medical Center in Milwaukee, Wisconsin. Indications for CT without contrast (n = 925 scans) included evaluation of pulmonary nodules, pleural plaques, granulomas, and ground-glass opacities (Table 1). Indications for CT with contrast (n = 2745 scans) included evaluation for malignancy, cancer surveillance or staging, or infection (eg, lung abscess or empyema), and CT pulmonary angiography (n = 1664) for suspected pulmonary embolism (Table 1). CT scans ordered for TAD/TAA surveillance and CT angiography of the chest (eg, for suspected aortic dissection) were excluded.

CT imaging reports from January 2023 to January 2025 were analyzed. Radiology reports were reviewed manually for the presence of TAD/TAA. TAD was defined as a maximal thoracic aortic diameter of ≥ 4.0 cm, and TAA was defined as ≥ 4.5 cm, consistent with prior studies and guidelines.[1,3] We manually reviewed the medical records of patients with reported TAD/TAA to determine whether findings were incidental, defined as not previously documented in imaging studies or clinical notes.

Point prevalence was calculated for each CT imaging modality as the number of TAD/TAA cases divided by the total number of unique patients during the study period. If multiple CT scans were obtained from the same patient, only the first CT scan during the study period was used to estimate prevalence. The incidental detection rate was calculated as the number of patients with incidental TAD/TAA divided by the number of unique patients. Three authors (TAJ, WB, JW) performed dual abstraction on a random subset of 101 positive and 102 negative TAD/TAA cases to determine interrater reliability. Interrater agreement was 98% ($\kappa = 0.96$) for the presence or absence of TAD/TAA.

This analysis was performed as part of a larger project assessing the completeness of International Classification of Diseases coding and clinical follow-up of TAD/TAA at our institution and therefore was deemed not to constitute human subjects research by the Institutional Review Board.

Statistical Analysis

We calculated descriptive statistics and performed univariate comparisons across CT imaging modalities using chi square test and 1-way analysis of variance (ANOVA) with Tukey post hoc testing. We report 95% binomial confidence intervals for prevalence and incidental detection rates for each CT imaging modality. Statistical analyses were performed using SAS version 9.4 (SAS Institute Inc).

RESULTS

TAD Cohort Descriptions

Across the entire cohort, 439 veterans had TAD (mean [SD] age, 72.0 [7.8] years; 98% male), including 84 with TAAs (Table 2). Most TADs (96.1%) involved the ascending aorta. The mean [SD] diameter was 4.27 cm [0.26 cm]. Patients with TAD identified on LDCT were significantly younger than those with TAD identified on other CT imaging modalities (69.4 vs 75.8 years; $P < .0001$). Patient sex and aortic diameter did not vary by CT modality.

Table 1. Summary of Total CT Cohort by Index Imaging Modality

	All CT Modalities	LDCT	CT Chest w/out Contrast	CT Chest with Contrast
Total scans	9409	3875	1125	4409
Unique patients	6795	2996	925	2874
Age, mean [SD], years[a]	69 [10.2]	67.6 [7.3]	71.4 [0.6]	69.8 [12.3]
Percent male[a]	93.0%	92.9%	94.2%	92.6%

Abbreviations: CT, computed tomography; LDCT, low-dose computed tomography.
[a]Using only first CT scans during the study period.

Prevalence

The prevalence of TAD and TAA was 6.1% (95% CI, 5.5%–6.6%) and 1.2% (95% CI, 0.95%–1.5%), respectively, across the combined CT cohorts (Table 2). The prevalence of TAD was approximately 8% in both the LDCT (8.1%; 95% CI, 7.1%–9.1%) and CT without contrast (8.3%; 95% CI, 6.5%–10.1%) groups and was significantly higher than in the CT with contrast group (3.2%; 95% CI, 2.6%–3.9%, $P < .05$). The prevalence of TAA was similar across LDCT (1.4%), CT without contrast (1.7%), and CT with contrast (0.8%) (Table 2).

Incidental Detection Rates

The overall incidental detection rates of TAD and TAA across all CT cohorts were 2.4% (95% CI, 2.0%–2.8%) and 0.4% (95% CI, 0.3%–0.6%), respectively (Table 2). The incidental detection rate for TAD on LDCT was significantly higher than those for CT without contrast and CT with contrast (3.7% vs 1.9% and 1.2%, respectively; $P < .05$). The incidental detection rate for TAA on LDCT was similar to that for CT without contrast (0.7% vs 0.5%) and significantly higher than that for CT with contrast (0.14%; $P < .05$).

DISCUSSION

We found a high prevalence of TAD/TAA in veterans undergoing annual LDCT for lung cancer screening (8.1% with TAD, including 1.4% with TAA) and chest CT without contrast (8.3% with TAD, including 1.7% with TAA). We also found that these CT modalities identified small but potentially important numbers of previously unrecognized TAD/TAA. These findings provide estimates of the potential yield of opportunistic screening programs that leverage existing CT imaging. Incidental detection rates for TAD were higher with LDCT for lung cancer screening (3.7%) than with other CT imaging modalities (1%–2%). The higher rate observed with LDCT likely reflects the fact that many

of these studies represented patients' first chest CT examination. It may also reflect a higher risk of aortic aneurysm among smokers,[1] although some recent cohort studies have found no association between smoking status and TAD/TAA.[4,5]

Overall, our prevalence estimates for LDCT and chest CT without contrast are similar to those reported by Khawaja et al, who reported TAD and TAA prevalences of 8.6% and 0.7%, respectively, in more than 36 000 patients (mean age, approximately 60 years) referred for clinically indicated CAC screening in Ohio.[3] The TLHC lung cancer screening program in the United Kingdom included more than 10000 participants who underwent LDCT (median age, 69 years; 34% female; 84% White British) and referred 1.5% of patients for dedicated aortic imaging to evaluate suspected thoracic aortic dilation,[2] a rate that was slightly lower than the incidental detection rate observed in our LDCT cohort (3.7%).

Table 2. Thoracic Aortic Dilation (TAD) and Thoracic Aortic Aneurysms (TAA) by Index Imaging Modality

	All CT Modalities	LDCT	CT Chest w/out Contrast	CT Chest with Contrast
Total no. of patients with TAD[a]	439	260	81	98
Total no. of patients with TAA[a]	84	43	18	23
Age, mean [SD], years[a]	72.0 [7.8]	69.4 [6.5][c]	76.0 [7.5]	75.7 [8.8]
Percent male[a]	98.2	98.1	97.5	99.0
Percent involving ascending aorta[a]	96.1	98.5	90.1	93.2
Aortic diameter, mean [SD], cm[a]	4.27 [0.6]	4.25 [0.24]	4.32 [0.30]	4.29 [0.32]
No. patients with TAD[b]	412	242	77	93
TAD prevalence estimate (95% CI)	6.06% (5.49%–6.63%)	8.08% (7.1%–9.05%)	8.32% (6.54%–10.10%)	3.24% (2.59%–3.88%)[c]
No. of patients with TAA[b]	82	43	16	23
TAA prevalence estimate	1.21% (0.95%-1.47%)	1.44% (1.01%-1.86%)	1.73% (0.89%-2.57%)	0.80% (0.48%-1.13%)
No. of patients with incidental TAD[a]	162	110	18	34
Incidental detection rate TAD[a]	2.38%) (2.02%-2.75%)	3.67%[c] (3.00%-4.34%)	1.95% (1.06%-2.84%)	1.18% (0.79%-1.58%)
No. of patients with incidental TAA[a]	30	21	5	4
Incidental detection rate TAA[a]	0.41% (0.28%-0.60%)	0.70%[d] (0.40%-1.00%)	0.54% (0.07%-1.01%)	0.14% (0.00%-0.28%)

Abbreviations: CT, computed tomography; LDCT, low-dose computed tomography.

[a]TAD/TAA not limited to the first CT scan during the study period.

[b]Using only first CT scans during the study period.

[c]Significant differences ($P < .05$) between CT modalities on analysis of variance (ANOVA).

[d]Significant difference ($P < .05$) between LDCT and CT chest with contrast only.

If opportunistic screening for TAD/TAA were implemented across the entire Veterans Affairs health system, substantial numbers of previously unrecognized cases could potentially be identified. Khawaja et al reported that the risk of TAD/TAA was increased in patients with higher 10-year atherosclerotic cardiovascular disease risk and CAC scores, suggesting a potential benefit of integrating TAD/TAA assessment into CAC screening programs.[3] Prospective studies are needed to determine the clinical relevance and downstream health care utilization associated with integrating opportunistic screening for TAD/TAA into existing CT-based screening programs. Future investigations could also explore the integration of artificial intelligence-based pipelines for automated measurement of thoracic aortic diameter into LDCT for lung cancer screening and other CT-based screening programs.[6,7]

Limitations

This analysis has several limitations. First, it is a single-center cohort, which may limit the generalizability of the findings. Second, we used radiology reports rather than manually reviewing CT images. This approach may have led to underascertainment of TAD/TAA if findings were not documented by the reporting radiologist. Third, although LDCT generally has strong correlation with CT angiography, Ahmed et al found that absolute differences in aortic measurements ranged from -3 to +3 mm.[2] Our findings therefore reflect real-world assessment of thoracic aortic diameter and the prevalence of TAD/TAA in clinically indicated CT imaging performed without electrocardiographically (ECG) gated acquisition and subject to variation in aortic diameter across the cardiac cycle.

CONCLUSIONS

Thoracic aortic dilation and thoracic aortic aneurysm are common among veterans undergoing clinically indicated chest CT imaging. Our findings highlight the potential utility of integrating thoracic aortic diameter measurement and reporting into existing CT screening programs, such as LDCT for lung cancer screening, to improve detection of TAD/TAA. The clinical impact of opportunistic screening for thoracic aortic disease warrants future investigation in larger studies, including prospective cohorts.

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