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Prevalence and Significance of Incidentally Noted Dilation of the Ascending Aorta on Routine Chest Computed Tomography in Older Patients

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Objective: The aim of this study was to determine the prevalence of incidental ascending aortic dilation and its significance over time in 55- to 80-year-olds undergoing routine computed tomographic scans.

Methods: Chest computed tomography reports for 64,092 patients who met the inclusion criteria were used to determine the prevalence of incidental ascending aortic dilation (4-5 cm) and, when possible, aortic growth rates. A chart review was performed to identify any aortic complication or intervention.

Results: The prevalence of incidental aortic dilation was 2.7% (671/24,992 patients). Of the 327 patients with aortic dilation and follow-up studies (mean, 3.4 years), only 3.7% (n = 12) demonstrated interval growth (mean of 0.9 mm/y). No patient underwent prophylactic surgery or intervention on the basis of aortic size or growth rate. One patient developed a type A dissection.

Conclusions: Current guidelines for yearly surveillance imaging of aortic dilation could be revised to increase the follow-up interval and/or improve risk stratification to better identify the small subset of patients most likely to have disease progression.

Key Words: aortic dilation, surveillance imaging, incidental findings

(J Comput Assist Tomogr 2014;00: 00–00)

The discovery of incidental thoracic abnormalities will become increasingly more common with the commencement of lung cancer screening in the United States.^{1–4} Although incidental imaging findings occasionally lead to the early detection of potentially deadly disease and immediate treatment, many are of limited clinical significance but result in follow-up studies that substantially add to health care cost and patient anxiety.^{4,5} Incidental dilation of the ascending aorta falls into this category, with increasing prevalence in recent years, likely because of increased detection by more widespread use of imaging.⁶ Potentially deadly complications such as aortic dissection or rupture are rare, but guidelines recommend yearly imaging for surveillance.^{7–9}

Aortic dilation in an older screening population is typically an indolent disease with very few resultant deaths.^{10,11} There are important exceptions where disease progression is more common, notably in patients with connective tissue disease, aortic valve disease, or family history of aortic dissection. In the absence of such conditions, yearly imaging surveillance is recommended for ascending aortic dilation in the 4- to 5-cm range.^{7,11} These guidelines are based on previous studies showing the following: (1) the upper limit of normal for aortic diameter in adults is 4.0 cm¹²; (2) aortic dilation rarely leads to death when diameters are less than 6.0 cm, with more frequent complications beyond this point;

and (3) ascending aortic growth rates are small, averaging approximately 0.1 cm/y.^{10,11,13}

We conducted a study to determine the prevalence of incidentally noted dilation of the ascending aorta and its significance over time in 55- to 80-year-olds. The objective was to evaluate the impact of current guidelines for management and follow-up imaging of this condition when identified on routine chest computed tomography (CT) in older patients.

MATERIALS AND METHODS

Patient Selection

Waiver of informed consent was obtained for this retrospective, Health Insurance Portability and Accountability Act-compliant study. A total of 88,171 chest CT scans performed on 31,963 patients aged 55 to 80 years at our institution during a 14-year period (January 1, 2000, to December 31, 2013) were identified through an electronic search of our radiology information system using Illuminate (Softk Solutions Inc, Prairie Village, Kan) (Table 1). Patient demographic information, examination type (eg, non-contrast enhanced vs contrast enhanced), and the radiology report were obtained as part of the search. Patients were excluded if they had an aortic aneurysm measuring greater than 5 cm, known/repaiored aortic aneurysm or dissection, aortic valve repair or congenital abnormality, mycotic aneurysm, or history of connective tissue disease such as Marfan and Ehlers-Danlos syndromes. Examinations were also excluded if they were obtained at an outside hospital and uploaded into our system or if they were obtained solely for an image-guided procedure.

Data Analysis

After these exclusions, the prevalence of reported ascending aorta dilation (4-5 cm in diameter) was determined. For patients with at least 2 CT scans of the same type (non-contrast enhanced or contrast enhanced) 6 months apart or longer, chest CT reports were reviewed to determine whether there was interval aortic growth reported. Any reported increase in aortic size was then confirmed by 2 independent reviewers using orthogonal measurement of the ascending aorta.^{12,14} A comprehensive chart review was also performed to assess for disease progression and/or vascular intervention.

RESULTS

Prevalence of Aortic Dilation

From the initial search of 85,171 relevant CT examinations on 31,963 patients, 21,097 examinations and 6971 patients were excluded, leaving 64,092 examinations on 24,992 patients meeting the inclusion criteria. Of the 64,092 examinations, 32,594 were performed on men (50.9%) and 31,498 were performed on women (49.1%). The mean and median ages were 66 and 65 years old, respectively. Half of the patients were studied for diagnosis or

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TABLE 1. Study Population

	No. Patients	Percentage*
Initial search	31,963	—
Met inclusion criteria	24,992	78.2%
Dilated ascending aorta	671	2.7%
Serial studies	327	48.7%
Interval growth†	12	3.7%
Aortic complication	1‡	0.15%

*Refers to the percentage of patients included from the previous row.

†Mean growth rate of 0.9 mm/y.

‡Type A dissection 1 year after incidental note was made of a 4-cm ascending aorta. The number 671 is used as the denominator for percentage calculation.

follow-up of malignancy, with the remainder split between the following groups: evaluation of pulmonary embolism, infection, nodules, and interstitial lung disease. Two thirds of the scans were contrast enhanced. Of the 24,992 patients included in the study, 671 patients (2.7%) had reported dilation of the ascending aorta in the 4- to 5-cm range.

Follow-up

Of the 671 patients with a dilated ascending aorta, 327 (48.7%) had serial CT examinations of the same type (ie, non-contrast enhanced or contrast enhanced) within the 14-year examination period, with a mean length of follow-up of 3.4 years (Fig. 1). Of these 327 patients, 12 (3.7%) had confirmed growth of the ascending aorta, with a mean length of follow-up of 5.0 years. The mean growth rate was 0.9 mm/y, with a range of 0.2 to 2.2 mm/y. Of these 327 patients, 222 were men (67.9%) and 105 were women (32.1%); 182 were 65 years or younger (55.7%) and 145 were older than 65 years (44.3%). Overall, the likelihood of having incidental dilation of the thoracic aorta and documented interval growth was 0.05% (12/24,992). No elective surgery or intervention was performed on the basis of aortic size or growth. A single aortic complication occurred in the cohort: 1

patient developed a type A dissection 1 year after an incidental note was made of an ascending aortic diameter of 4.0 cm.

DISCUSSION

Incidentally noted dilation of the ascending aorta was found in 2.7% of the patients 55 to 80 years old undergoing routine chest CT examinations. Of the patients with aortic dilation and follow-up imaging, the vast majority had stable aortic dimensions, with a small group (3.7%) demonstrating modest aortic growth rates of 0.9 mm/y. No patient in the cohort studied underwent prophylactic surgery or intervention on the basis of aortic size or growth rate.

Yearly surveillance imaging is recommended for patients with dilated ascending aortas (>4 cm), with surgery recommended at thresholds of 4.5 to 5.5 cm depending on concomitant factors including aortic valve disease, connective tissue disorder, or history of familial aortic dissection.⁷ In the absence of those risk factors, aortic dilation is a relatively indolent disease in the elderly.^{10,11} The purpose of yearly surveillance imaging is to (1) identify patients with rapid aortic growth rates (ie, >5 mm/y) and/or (2) identify patients at or approaching the 5.5-cm threshold for surgical intervention.^{8,9} Our study suggests that yearly CT surveillance, however, is too frequent and unlikely to identify progressive aortic disease in a cost-effective or efficient manner. Given the absence of growth in the majority of patients in our cohort, and slow growth rates in the remainder of the group, which are equal to or slower than those of small (≤4 cm) abdominal aortic aneurysms, the 2–3 year screening interval that has been proposed for small abdominal aortic aneurysms seems reasonable for ascending aortic dilation without other risk factors.^{15,16}

The management of incidental imaging findings such as ascending aortic dilation will become increasingly important as screening for and surveillance of malignancy become more common.⁴ The prevalence of 2.7% that we found for incidental dilation of the ascending aorta, which is similar to other reports (2.3%),¹⁷ could substantially impact health care spending when applied to large screening populations (eg, >7 million patients for lung cancer screening).² Yearly and indefinite surveillance imaging could result in hundreds of thousands of follow-up studies.

FIGURE 1. Percentage of patients studied with incidentally noted dilation of the ascending aorta, follow-up studies, and interval growth for a mean of 3.4 years.

On the basis of our single-center analysis, however, surveillance imaging in its current form is unlikely to impact aortic disease–related morbidity or mortality.

The 1 patient in our cohort with clear disease progression (type A dissection) had an ascending aortic diameter of 4.0 cm 1 year earlier. This highlights the challenges of evaluating risk for aortic disease progression—aortic dissection is a very rare event, in the range of 30 cases per 1 million individuals per year¹⁸—and the limitations of using aortic dimensions alone. The single case reflects the findings of prior work that show that the majority of cases of aortic dissection occurs at diameters lower than the common surgical threshold of 5.5 cm.¹⁹ It suggests that a better approach is needed for identifying the small subset of patients with dilated aortas who are at imminent risk for aortic catastrophe. Advanced imaging may be of use, with new functional and molecular imaging techniques revealing previously unseen drivers of disease such as abnormal hemodynamics and vascular inflammation.²⁰

Our study is limited to a single academic center. Radiology reports were relied upon for most of the imaging data, and thus, the prevalence of aortic dilation may have been underreported. However, we believe that the reporting of aortic dilation at our institution reflects the norm among radiologists. Not all patients had serial imaging, but there was no relevant selection bias that we are aware of for those who did have follow-up studies. We focused on ascending aortic dimensions, rather than on the entire thoracic aorta, but did so because ascending aortic aneurysms are the most common and measurements here are best studied and commonly used for screening.^{8,12} The patients included were not necessarily smokers, and for populations of smokers such as those undergoing lung cancer screening, vascular disease may be more common than in our cohort.

In conclusion, incidental note of ascending aortic dilation is relatively common in older patients undergoing routine CT scans. The vast majority of patients demonstrates stable aortic dimensions over time. No patient underwent prophylactic surgery or intervention on the basis of aortic size or growth rate. Current guidelines for yearly surveillance imaging of ascending aortic dilation could be revised to increase the follow-up interval and/or improve risk stratification to better identify the small subset of patients most likely to have disease progression.

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