Measuring abdominal aortic diameters in routine abdominal computed tomography scans and implications for abdominal aortic aneurysm screening

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ABSTRACT

Objective: This study aimed to determine the prevalence and relevance of incidental abdominal aortic aneurysm (AAA) on routine abdominal computed tomography (CT) and to audit the performance of radiologists to identify and report AAA.

Methods: A retrospective audit of all abdominal CT scans performed on men and women ≥50 years at Dunedin Public Hospital between January 2013 and September 2014 was carried out. All CT scans for planning of AAA treatment or follow-up were excluded. The maximal anterior-posterior diameter of the infrarenal abdominal aorta was measured in both the sagittal and transverse planes on the picture archiving and communication system. The radiologist reports were analyzed. All detected AAAs were reviewed for clinical relevance.

Results: A total of 3332 scans were performed, of which 86 scans were excluded, resulting in a total cohort of 3246. There were 187 incidental AAAs detected with a prevalence of 5.8%. The prevalence was 8.7% in men and 3.1% in women. Whereas the prevalence increased with age, a significant number were detected in those younger than 65 years, with a prevalence of 1.5%. Of the 187 AAAs, 122 (65%) were reported by radiologists: 100% reporting rate in AAAs ≥50 mm, 87% in AAAs ≥40 to 49 mm, and 52% in AAAs ≥30 to 39 mm. Of these, 15% were specifically recommended for referral to a vascular service. Of the incidentally detected AAAs, 72% were considered to be clinically relevant, which is an overall 4.1% prevalence of AAAs with an ability to benefit. In addition, all 3246 subjects avoided the need for further AAA screening.

Conclusions: There is a high prevalence of AAAs (5.8%) and clinically relevant AAAs (4.1%) detected on routine abdominal CT. As an opportunistic approach, it is a simple and effective way to detect AAAs and to broaden traditional screening criteria to include women and those younger than 65 years in our region. Furthermore, large numbers of subjects with normal aortic diameters are identified who will not need to be screened. Consequently, we consider routine diagnostic abdominal CT to be an important adjunct to national and community AAA screening strategies. (J Vasc Surg 2017;■:1-6.)

Abdominal aortic aneurysm (AAA) is a life-threatening disease that can be treated effectively through surgical intervention if it is detected before rupture. However, detection of AAA can be difficult. Most are asymptomatic, and detection by physical examination of the patient is usually possible only if the aneurysm is large and may already be at high risk of rupture. Screening for AAA saves lives.[1] It can be carried out successfully in large communities and across the population of whole countries.[2] However, it requires structured, dedicated programs to recruit large numbers of subjects and to carry out diagnostic procedures such as abdominal ultrasound, with significant costs. There is currently no policy for AAA screening in most countries, including New Zealand, although awareness of the international research evidence for screening is high.[3]

Increasing numbers of people are having abdominal computed tomography (CT) scans for a variety of reasons and as a consequence have the aorta imaged. Routine abdominal CT scans provide an opportunity for radiologists to measure aortic diameter and to detect asymptomatic incidental AAAs. In these circumstances, incidental AAAs are reported to occur in 1% of abdominal imaging procedures.[4,5] However, they appear to be poorly monitored and inconsistently reported. This is presumably because the aorta may not be the primary focus of a radiologist reporting the scan, especially if there is a small aneurysm or there is more important disease to evaluate elsewhere in the scan. As a result, an AAA may be overlooked and remain undetected. Another implication of abdominal CT is that the report of a normal-sized aorta is reassuring and excludes the need for numerous subjects to participate in any further AAA screening imaging strategy.

In this study, we aimed to determine the prevalence and relevance of AAA on routine abdominal CT and to audit the reliability of the radiologist to identify and report AAA. We also discuss the implication for abdominal CT in AAA screening programs in the community.

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METHODS

A retrospective audit was performed of all abdominal CTs performed on men and women ≥50 years from January 1, 2013, to August 9, 2014. The abdominal CTs were identified in the Dunedin Hospital Radiology Information System and were performed with standard techniques (helical CT, 5-mm slices performed supine, including both contrast and noncontrast studies). The study was approved as a clinical audit by the University of Otago Ethics Committee (Health), and individual consent was not required.

After the removal of 1609 repeated scans, the cohort contained 3332 abdominal CT scans. In addition, scans were excluded on the basis of the following criteria: any abdominal CT scan in which the infrarenal aorta was not completely visualized distal to the renal artery and proximal to the aortic bifurcation (49); and previous AAA repair/abdominal CT scan for workup of intervention of AAA (endovascular or open, 37).

A total of 3246 abdominal CT scans remained to be measured. Two of the authors evaluated the scans using picture archiving and communication system workstations (IDS5 and IDS7; Sectra, Linköping, Sweden). Under standard reporting conditions, the slice of each CT scan showing the maximum infrarenal aortic diameter was identified visually. The field of view was magnified (×3), and axial and sagittal anteroposterior measurements were completed using the electronic caliper tool. The scans were heterogeneous and included both contrast and noncontrast studies.

The CT scans of the entire cohort were measured by S.A. All those with an infrarenal aorta of ≥27 mm as well as 10% of all the scans <27 mm were also measured by R.C. The two observers were blinded throughout the data collection process. Aortas with a diameter of ≥30 mm were deemed to have an AAA. All measurements were taken from the outer adventitia to the diametrically opposite outer adventitia (antipodal point), with the line of measurement passing through the center of the aorta. Measures were compared for quality control using the κ statistic for diagnosis of AAA and Bland-Altmann comparison of aortic size measurement. Where there was discordant measure at the 30-mm cutoff for AAA, the mean value was used and if not, adjudication of a third assessor (A.M.vR.).

Data obtained from the radiology report were patient demographics, the indication for and urgency of the CT scan, and the primary diagnosis determined from the scan. Any reference to aortic size or recommendation for referral to the vascular service was also noted.

The clinical context of each AAA was assessed for the clinical relevance of the AAA diagnosis by reviewing each medical record and subsequent outcome during 2 years (A.M.vR.). The AAA diagnosis was considered to be clinically relevant if the patient could benefit from participating in a surveillance program or proceeding to surgical intervention. Diagnosis was not clinically relevant in the context of uncontrolled malignant disease, frailty, and age, for which future treatment would be an inappropriate option, or when the AAA will not reach 55 mm in the individual's expected lifetime. This was further corroborated with the treating physician or the family practitioner in the community.

ARTICLE HIGHLIGHTS

- **Significance:** The goal of this study was to determine the prevalence of incidental abdominal aortic aneurysm (AAA) on routine abdominal computed tomography (CT) scans and to audit the performance of radiologists to identify and report AAAs.
- **Type of Research:** Single-center retrospective cohort study
- **Take Home Message:** This retrospective review of 3246 abdominal CT scans showed a prevalence of 5.8% for AAAs.
- **Recommendation:** The authors suggest measuring of aortic diameters routinely on abdominal CT scans not only to identify aneurysms but also to document normal aortas that need no further screening.
- **Strength of Recommendation:** 2. Weak
- **Level of Evidence:** C. Low or very low

RESULTS

There were 3246 patients with a mean age at the time of scanning of 70.5 ± 10.8 years (range, 50-98 years). Of the cohort, 1700 patients (52.4%) were female, with an average age of 71.0 ± 11.0 years (range, 50-98 years), and 1546 (47.6%) were male, with an average age of 70.2 ±10.7 years (range, 50-95 years). The mean axial aortic diameter was 21.7 mm (standard deviation, 6.4 mm; range, 11.0-91.2 mm). The size distribution is shown in Fig 1.

There were 187 AAAs detected, resulting in an AAA prevalence of 5.8%. In women, the prevalence of AAA was 3.1%, whereas in men, it was 8.7%. AAA prevalence was lowest in the 50- to 64-year age group at 1.5% and increased with age, being greatest in those >75 years at 11.4% (Table I). The patients with AAA had an average age of 78.5 ± 8.8 years (men, 77.8 ± 9.2 years; women, 80.3 ± 7.7 years), which was significantly greater than that of those with a normal-sized aorta (70.2 ± 10.8 years; $P < .001$). Proportionally more patients with AAA were male; the male to female AAA ratio was 2.6:1.

Whether the scans were done urgently for an acute condition (1373 [42.3% of scans]) or as an elective study (1873 [57.7%]) influenced the prevalence of AAA; urgent scans had an AAA prevalence of 7.2% (99 AAAs) compared with 4.7% (88 AAAs) in the nonurgent ($P = .003$).