ED Screening to Identify Abdominal Aortic Aneurysms in Asymptomatic Geriatric Patients

PHILIP SALEN, MD, SCOTT MELANSON, MD, AND DOMINICK BURO, DO

Although more than 5% of the geriatric male population is thought to have an abdominal aortic aneurysm, no study has evaluated the ability of ED physician sonographers to screen for this condition. The purpose of this study was to evaluate whether a screening program to sonographically identify abdominal aortic aneurysms would result in increased identification of this potentially lethal disease. This prospective clinical study used a convenience sample and was performed in a community teaching hospital ED. Hemodynamically stable male patients ≥65 years of age presenting for reasons other than back, flank, or abdominal pain were eligible. After obtaining informed consent, patients underwent bedside ultrasound of the abdominal aorta by EPs. All participating physician sonographers met SAEM credentialing recommendations for performing sonography. The maximal transverse diameter of the aorta was measured at each of three locations: proximal, mid, and distal aorta. All patients with aortic diameters ≥3.0 cm were confirmed by formal ultrasound in the radiology department. Over a 12-month period, 103 subjects were enrolled in the study. ED physician sonographers identified eight patients with abdominal aortic diameters ≥3.0 cm. Abdominal aortic aneurysm was confirmed in 6 of 8 subjects, yielding a positive predictive value of 75%. An EP sonographic screening program can identify abdominal aortic aneurysms in asymptomatic men older than 65 years of age. (Am J Emerg Med 2003;21:133-135. Copyright 2003, Elsevier Science (USA). All rights reserved.)

Abdominal aortic aneurysm (AAA) is the tenth leading cause of death in older men.[1] An infrarenal aortic diameter of 3 cm or more is used to define an AAA. Although aortic rupture can occur once a diameter of 3 cm has been reached, it rarely occurs at smaller diameters.[2] Population-based studies have demonstrated that the incidence of AAA in the male population greater than 65 years of age is 5% to 7%. Most patients diagnosed with AAAs are entirely asymptomatic, and the aneurysm is discovered incidentally on physical examination or on a radiologic study performed for other reasons.[2] One preventive strategy to decrease the mortality of AAA is a screening program aimed at identifying asymptomatic individuals. With ultrasonography, it is feasible to screen populations at risk of AAA.[1,3,4] Ultrasound has been reported to be as accurate as computed tomography and more accurate than angiography in measuring aneurysmal diameter[5]; it is virtually 100% sensitive in detecting AAA provided that a technically adequate study can be obtained.[2] Most published cost-effectiveness analyses have judged ultrasound screening for AAA in men older than 65 years to be beneficial and associated with costs per year of life saved that are acceptable by current standards.[3]

The purpose of this study was to evaluate whether a screening program to sonographically identify AAA in asymptomatic men older than 65 years would increase early detection of a potentially lethal disease.

METHODS

This study, after institutional review approval, used a prospective convenience sample of ED patients treated at St. Lukes Hospital, Bethlehem, PA, which is a community hospital with an EM residency that treats over 45,000 patients per year. All hemodynamically normal male patients older than 65 years presenting for reasons other than back, flank, or abdominal pain were eligible for inclusion in the study after informed consent was obtained. Patients were excluded from the study if they had a clinical condition precluding examination, weighed more than 114 kg, had a known AAA or previous AAA repair, or if they had signs or symptoms suggestive of AAA. Participating sonographers were EP residents or attendings who had met SAEM recommended guidelines for credentialing (40 hrs didactic instruction and had completed 150 ultrasound examinations) and who had also done at least 25 abdominal aortic ultrasounds that had been reviewed by a credentialed ED sonographer.[6] After the abdomen was examined for the presence of a mass, the EP sonographer performed an ultrasound examination of the aorta with a PIE Scanner 200 (Maastricht, The Netherlands) using a 3.5-MHz curvilinear array transducer. B-mode imaging was used to scan the aorta from the diaphragm to the aortic bifurcation in both sagittal and transverse planes. The maximal transverse aortic diameter was measured at each of three locations: the proximal, mid, and distal aorta (Fig 1). Images were printed and saved on a data form and assessed for adequacy by a senior EP sonographer (SM). If the clinician was unable to visualize the entire aorta, the scans were labeled indeterminate. If the maximal aortic diameter was greater than 3 cm, the subject was scheduled for a formal ultrasound by the radiology department. Patients with negative bedside ultrasound examinations underwent no further evaluation for AAA. Patients and physicians were not reimbursed for their participation in this study; patients were not billed for the ED ultrasounds. Descriptive statistics were used.

RESULTS

Over 12 months, 103 subjects ranging in age from 65 to 93 years were enrolled. ED physician sonographers identi-

From St. Lukes Hospital, Bethlehem, PA.
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Address reprint requests to: Philip Salen, MD, St. Lukes Hospital, 801 Ostrum St., Bethlehem, PA 18015. E-mail: salenp@slhn.org
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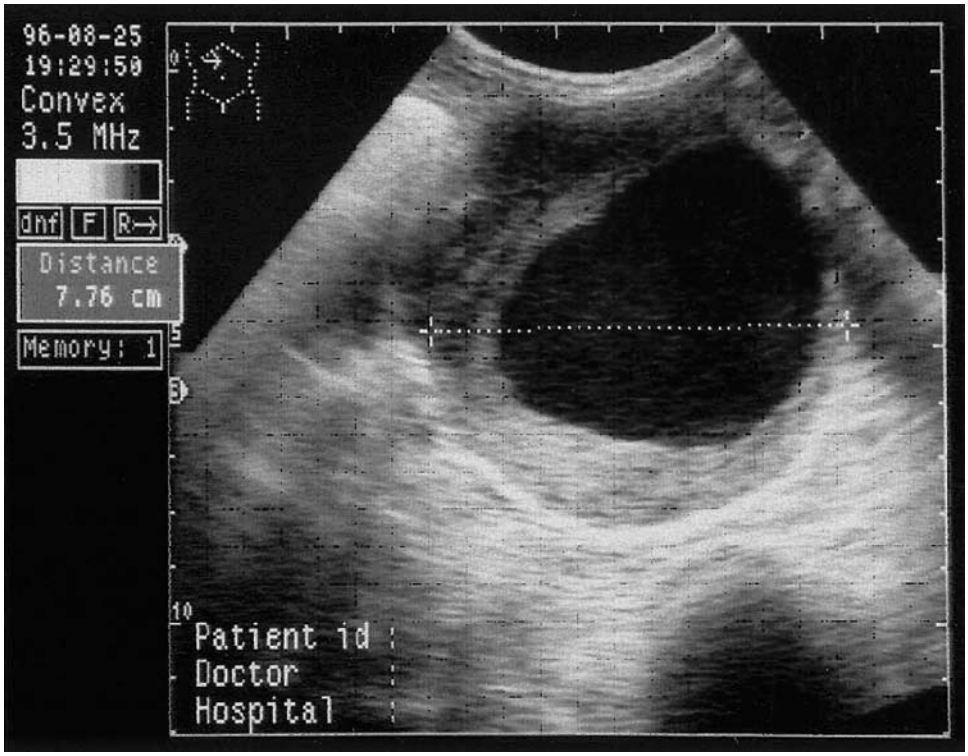

FIGURE 1. A 7.76 cm abdominal aortic aneurysm.

fied eight subjects as having maximal aortic diameters greater than 3.0 cm. One patient was excluded from the study after a pulsatile abdominal mass was sonographically identified at bedside that was confirmed to be an AAA with a >5.0-cm diameter. Of these 8 subjects, 6 were confirmed to have maximal aortic diameters ≥3.0 cm on follow-up sonograms by the radiology department, yielding a positive predictive value of 75% (6 of 8). Table 1 documents the differences between EP performed aortic sonograms and the radiology department scans. There were two false-positive ED physician sonograms in which physicians overestimated the aortic size by 0.4 cm and 1.0 cm, respectively (Table 1). When compared with radiology department ultrasound, EPs underestimated the aortic size in 2 subjects, overestimated the size in 5, and were identical once. The mean discrepancy was 0.1 cm. In 3 of 103 subjects (2.9%), the EP sonographer did not sufficiently identify the aorta to make a measurement of the aorta. Of those subjects evaluated in this study, 47% had atherosclerosis, 23% had peripheral vascular disease, and 1.3% had a family history of AAA. Of patients with sonographically identified AAAs, 75% had atherosclerosis, 38% had peripheral vascular disease, and none had a family history of AAA.

TABLE 1. Patients Found on ED Ultrasound to Have a Maximal Aortic Diameter >3.0 cm

BUS (cm)	RAD (CM)	Δ(cm)
3.4	3.0	+0.4
3.8	3.4	+0.4
5.3	5.3	0
4.7	5.6	−0.9
3.5	4.0	−0.5
3.7	3.0	+0.7
3.1	2.7	+0.4
3.0	2.0	+1.0

Abbreviations: BUS, bedside ultrasound; RAD, radiology department ultrasound.

DISCUSSION

The incidence of AAA is low in the general population, yet AAA is an important cause of morbidity and mortality in the elderly and is responsible for an estimated 15,000 deaths per year in the United States. Once ruptured, the mortality of AAA is greater than 80%, whereas elective repair before rupture occurs has a mortality rate of less than 5%. A necessary step in the reduction of mortality of AAA is to increase the detection of asymptomatic AAA. Screening high-risk patients is potentially life-saving and cost-effective. An AAA can be found in 5% of elderly men (older than 65 yrs) and in an even higher percentage of patients with peripheral vascular disease or atherosclerotic disease. A family history of an AAA is a strong risk factor, and those with an affected first-degree relative have a 20-fold increased risk of an AAA developing.[2] Physical examination is unreliable in the detection of AAA; when the physical examination is suspicious for an AAA, the aorta often proves to be of normal size and even large AAAs might not be easily palpable.[2] An abdominal bruit is found in only 5% to 10% of patients with AAAs.[2]

With the incorporation of sonography into the diagnostic armamentarium of EPs, it is reasonable to consider ultrasound screening for asymptomatic but high-risk patients in the ED. We chose to examine men ≥65 years and to determine whether the historically reported incidence of 6% in patients older than 65 had asymptomatic AAAs. AAAs

can be difficult to palpate if the aneurysm is small or the patient is obese. Most aneurysms discovered in screening programs are small and cannot be detected on physical examination.[2] We found that 6% of our cohort had asymptomatic AAAs.

This study adds credence to other investigations that both symptomatology and physical examination are unreliable tests in the detection of AAA, especially when the AAA is less than 5 cm in size. Only patients who had no symptoms suggestive of AAA and who had no physical examination findings consistent with AAA were included in the study. This study demonstrates that trained ED physician sonographers are capable of sonographically identifying the abdominal aorta and can detect relatively small AAAs, although aortic size was overestimated, leading to false-positive results in 2 cases. Furthermore, the demonstration that EPs can identify AAAs in asymptomatic patients who do not have palpable masses suggests that EPs might be able to accurately screen hypotensive patients with abdominal pain and elderly patients with unexplained back, flank, or abdominal pain.

LIMITATIONS AND FUTURE CONSIDERATIONS

We made no effort to confirm the presence or absence of AAA in those in whom ED sonographers did not detect AAA; thus, the sensitivity and negative predictive value of EP bedside ultrasound cannot be determined from our data. Additionally, the absolute accuracy of EP sonographic scanning cannot be generalized from our data. Our patient cohort is relatively small and represented a convenience sample. Because a characteristic of ultrasonography is that it is more operator-dependent than other diagnostic modalities, it is more prone to technical and interpretation errors. A future trial examining EM physician sonographic screening for AAA should include confirmation of all positive and negative sonographic screening examinations.

CONCLUSION

An EM sonographic screening program for AAA in asymptomatic men older than 65 years identified AAA in a convenience cohort with an incidence rate comparable to that found in other AAA screening studies.[1,3,4] EPs can successfully sonographically identify AAA in asymptomatic men as part of an AAA screening program.

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