Routine Screening for Asymptomatic Abdominal Aortic Aneurysm in High-risk Patients Is Not Recommended in Emergency Departments That Are Frequently Crowded

Beatrice Hoffmann, MD, PhD, RDMS, Patrick Um, MD, Edward S. Bessman, MD, Ru Ding, MS, Gabor D. Kelen, MD, and Melissa L. McCarthy, ScD

Abstract

Objectives: The objectives were to examine the feasibility of offering abdominal aortic aneurysm (AAA) screening to consecutive, asymptomatic high-risk patients in a busy emergency department (ED) and to compare the prevalence of undetected AAA among ED patients to the prevalence among similarly aged men from the general population.

Methods: A prospective cohort study was conducted at an academic community ED with an annual census of 58,000 patients. Dedicated study coordinators attempted to approach all consecutive male ED patients >50 years who presented in June–August 2007 during hours of high patient volume. To be eligible, older males had to have a smoking history or a family history of AAA. Patients were excluded if they presented with AAA symptoms, had a previous history of AAA screening or repair, had hemodynamic instability, or had an altered mental status. Study coordinators completed a brief interview with all enrolled subjects to obtain demographic and health information. A credentialed ED provider performed the ultrasound (US) screening exam and documented all findings. The US director reviewed representative images of the sonographic exam for correct visualization and measurement during quality assurance. The ED sonographers also completed a survey regarding their attitudes toward AAA screening in the ED. The primary study outcomes were the feasibility of AAA screening in the ED (screening rate, enrollment rate, US success rate, and providers' opinions) and the prevalence of AAA (aortic diameter of ≥3.0 cm) in the study sample.

Results: During the 12-week study period, the study coordinators successfully approached 96% (700/729) of males > 50 years who were in the ED during study enrollment hours. Of those approached, 278 were eligible (40%), 25% were ineligible, 20% were not at high risk, and for 15% we could not determine risk factor status because of altered mental status. Of the 278 eligible, 196 (70%) underwent an US exam; 10% were not scanned because the providers were too busy, and 20% declined participation. Of those scanned, the ED sonographer was able to completely visualize and correctly measure the abdominal aortas of 71% of subjects. The prevalence rate of AAA in the study sample was 5.7% (95% confidence interval [CI] = 1.9% to 9.6%), similar to reported rates of 6 or 7% in other studies. More than half of the ED sonographers reported that US screening for AAA improved the quality of ED care (58%) and patient satisfaction (63%). However, 47% reported that AAA screening reduced ED efficiency, and 74% felt that the ED was not an appropriate setting for routine AAA screening.

Conclusions: Routine screening for asymptomatic AAA required substantial ED resources for a relatively low success rate of completed screens. The prevalence rate of AAA in our ED sample was not significantly different than prevalence estimates obtained from older men in the general population. ED sonographers reported benefits of screening in terms of improving the quality of emergency care and patient satisfaction, but also reported that it reduced operational efficiency. For EDs that have problems with crowding, we do not recommend implementing a routine screening program for AAA, even among high-risk patients.

ACADEMIC EMERGENCY MEDICINE 2009; 16:1242–1250 © 2009 by the Society for Academic Emergency Medicine

Keywords: health screening, abdominal aortic aneurysm, ultrasound, emergency medicine

From the Department of Emergency Medicine, Johns Hopkins University (BH, PU, ESB, RD, GDK, MLM), Johns Hopkins Bayview Medical Center (BH, ESB), Baltimore, MD.

Received March 2, 2009; revision received May 19, 2009; accepted May 31, 2009.

Presented at the Society for Academic Emergency Medicine annual meeting, Washington, DC, May 2007.

Address for correspondence and reprints: Beatrice Hoffmann; e-mail: bhoffma8@jhmi.edu.

ISSN 1069-6563
PII ISSN 1069-6563583

doi: 10.1111/j.1553-2712.2009.00502.x

Abdominal aortic aneurysm (AAA) is usually an asymptomatic disease process. The most significant risk factors for AAA are male sex, older age, a history of smoking, a family history of AAA, and atherosclerosis.[1–12] The prevalence of AAA is highest among men between the ages of 50 and 79 years (3%–8%) and is the 14th leading cause of death for men aged 55 years and older.[13] AAAs that rupture are associated with a high mortality rate (>50%).[7,14–17] In contrast, there is a much lower mortality rate (3%–6%) associated with elective AAA repair.[7,17,18] One of the mechanisms utilized to detect AAA early and to reduce mortality is ultrasonographic (US) screening. US for AAA is quick, safe, and relatively inexpensive.[19] Several large, randomized controlled trials of older men in the general population have demonstrated significantly lower mortality rates from AAA among men screened compared to those not screened.[2,4,6,7]

Based on this evidence, the U.S. Preventive Services Task Force (USPSTF) recommends a one-time US in males aged 65–75 years with a prior smoking history.[20] In 2007, the Centers for Medicare & Medicaid Services (CMS) instituted a one-time, free US for AAA in men who have smoked and for men and women with a family history of AAA.[21] Other professional groups, such as the American College of Cardiology (ACC) and the American Heart Association (AHA), endorse AAA screening among males at risk who are even younger (≥50 years old).[22,23]

The Society for Academic Emergency Medicine Public Health and Education Task Force (PHTF) stated in 2000 that emergency departments (EDs) should ''provide an opportunity to initiate preventive services for millions of Americans who have no other source for these services.''[24] The PHTF recommended various prevention, screening, and counseling activities for the ED.[24,25] AAA screening of asymptomatic, high-risk patients was not included. However, more and more emergency physicians (EPs) are becoming skilled in US, and the evaluation of the abdominal aorta for aneurysm is within our scope of practice.[26] In fact, studies have found that trained EPs can perform AAA sonography with high diagnostic accuracy.[27–29] If a substantial proportion of ED patients have less access to preventive services, they may have a higher prevalence of undetected AAA compared to their peers in the general population. Thus, screening high-risk, asymptomatic males may be a worthwhile preventive care service to offer in EDs.

To the best of our knowledge, to date there are only two published studies on US screening of asymptomatic, high-risk male patients in the ED.[30,31] The prevalence of asymptomatic AAA in these two studies was 6%–7% based on convenience sampling of patients. Screening is most effective and informative if it is offered to all qualifying patients, rather than to a limited number based on convenience or other unmeasured factors.[32,33] However, offering routine screening for AAA to all high-risk patients may be difficult in EDs that are routinely crowded.[34] The Institute of Medicine's Committee on the Future of Emergency Care in the US Health System recently characterized hospital-based emergency care as ''at the breaking point'' because of the prevalence of crowding in EDs nationwide. Crowding is associated with substantial treatment delays, even among patients with time-sensitive conditions.[34–43] Thus, unless it can be easily conducted and a substantial number of cases can be detected, it is not clear that routine screening in the ED setting for AAA is appropriate.

The objectives of this study were to examine the feasibility of offering AAA screening to consecutive, asymptomatic, high-risk patients in a busy ED and to compare the prevalence of undetected AAA among ED patients to the prevalence among similarly aged men from the general population.

METHODS

Study Design

We used a cross-sectional study design to determine the prevalence of asymptomatic AAA among high-risk males presenting to a single ED during a 12-week period. This study was reviewed and approved by the institutional review board.

Study Setting and Population

The study was conducted at a mid-sized teaching community hospital affiliate located in a large city. The hospital has an acute care inpatient bed capacity of 318 licensed and staffed beds. There are 26 treatment spaces in the main ED, and eight in the adjacent urgent care area. The ED has an annual census of approximately 58,000 visits. Academic faculty, residents, physician assistants, and nurse practitioners staff the ED. The average length of stay is 4.2 and 6.0 hours for patients discharged or admitted, respectively.

Study enrollment occurred between June 1, 2007, and August 24, 2007, during the hours of highest patient volume at the study ED (12PM to 8PM on weekdays and 11AM to 6PM on weekends). We did not enroll subjects 24/7 because we wanted to screen and enroll consecutive patients, and this was only feasible with a dedicated study coordinator. The study coordinators consisted of five students (four medical students and one college student) who were interested in clinical research.

During hours of enrollment, the study coordinators reviewed the ED's patient tracking system and tried to identify all males >50 years of age who were in the waiting room or in a treatment space in the main ED or urgent care area. To be eligible, male patients also had to have a history of having smoked at least 100 cigarettes during their lifetime *or* a family history of AAA and be older than 50 years (AAA risk factors as defined per USPSTF, ACC, and the AHA). Patients were excluded if they were potentially symptomatic for AAA (i.e., presented with symptoms of abdominal, back, or flank pain); had a known AAA or previous AAA repair, had been screened for AAA within the past 5 years; or were medically unstable (e.g., hypotension, respiratory distress, syncope), disoriented, or nonresponsive upon ED presentation. The sonographic screening exam was not billed to the patient.

Study Protocol

Dedicated study coordinators approached and attempted to enroll all eligible patients. All patients who enrolled in the study received a sonographic AAA screening exam by a credentialed ED provider and were interviewed by a study coordinator. ED sonographers documented the clinical results of each US screening they performed, and after study enrollment ended they completed a written survey about conducting AAA screening in the ED.

Prior to the onset of enrollment, the study coordinators completed a half-day orientation and training session to review the details of the study protocol. For the first two study shifts that they worked, the coordinators worked alongside one of the study investigators so that they could observe and become comfortable with enrollment and data collection activities and assure a uniform enrollment process. The study coordinators were responsible for approaching patients, obtaining written consent on those eligible, conducting a brief interview with each subject, identifying a credentialed ED provider who was willing to do the US, and computerizing all study data.

Interview. The study coordinator completed a brief face-to-face interview with the subject at the bedside. The purpose of the interview was to obtain more detailed sociodemographic and health information about each subject. The interview contained questions about demographics, usual source of medical care, medical history, health habits, and health status. Subjects were asked about their race and ethnicity, marital status, educational level, type of health insurance coverage, and usual major activity (working, retired, going to school, etc.). The coordinator also asked each subject to identify the usual place he or she went for care when sick and whether he or she had a primary care physician.

During the interview, subjects were read a list of common medical conditions and asked if a doctor or other health professional had ever told them they had that condition. They reported their weight and height, what age they started to smoke, if they currently smoked, and if so, how many cigarettes per day.

Sonographic Evaluation. The US screening evaluations were performed by one of 20 ED providers who were credentialed for US screening for AAA.[26] These providers included physicians, physician assistants, and nurse practitioners. Prior to the onset of the study, one of the study investigators reviewed the ED providers' schedules to ensure that at least one credentialed provider was working during enrollment hours. After the study coordinator enrolled a subject, he or she would approach a credentialed provider to conduct the US. If the treating provider was a credentialed sonographer, he or she was asked first. Otherwise, any credentialed ED provider working in the ED was approached to complete the US at his or her earliest convenience. The study coordinator would then bring the US machine to the subject's bedside and introduce the ED sonographer to the subject.

The scans were performed on an Aloka SSD-1400 scanner with a 3.5-MHz convex transducer (Aloka, Inc., Wallingford, CT). All scans were printed on Sony black and white thermoprint paper and reviewed for quality assurance (QA) by the US director. The ED providers measured the diameter of both the upper and the lower abdominal aorta in the longitudinal and transverse planes. The largest measurement of each upper and lower abdominal aorta was recorded in centimeters. If the ED sonographer was unable to visualize the entire abdominal aorta, he or she documented that as well. For each subject, the US director (an EP with extensive US training) reviewed the scans and documentation and determined whether the sonographer successfully visualized the entire upper and lower aorta and, if visualized, correctly diagnosed it. The US director reviewed the QA results with a second physician to ensure that the US exams were classified consistently.

The ED sonographer informed the subject of the screening results immediately after completion of the bedside exam. A positive exam was defined as an abdominal aorta that was greater than or equal to 3.0 cm in diameter from outside wall to outside wall. For subjects who screened positive, the ED sonographer followed the recommendations of the Society of Vascular Surgery that are based on the size of the detected AAA. Resources and referrals to the local vascular surgery clinic or general medicine clinic were provided as needed.

Provider Opinion Survey. At the end of the enrollment period, a survey was emailed to the 20 ED providers who had performed at least one US for the study. The purpose of the survey was to obtain their views about AAA screening in the ED and its effect on patient care (i.e., satisfaction, quality, timeliness of care) and ED operations. Two questions had a yes/no response format and the other six questions used a four- or five-level ordinal response format.

Measurements

The primary outcome measures for this study were the feasibility of AAA screening in the ED and the prevalence of AAA in the study sample. Feasibility was assessed by multiple measures including screening success rate, enrollment success rate, US success rate, and provider opinions about AAA screening in the ED. Screening success rate was defined as the proportion of all male patients aged >50 years who were approached for the study. Enrollment success rate was defined as the proportion of all eligible patients who consented and received an US exam. The US success rate was defined as the proportion of exams performed in which the sonographer was able to visualize the entire aorta and correctly measure its size. Finally, feasibility was also assessed by the proportion of providers who reported that AAA screening was a good use of their time, that the ED is an appropriate setting for routine AAA screening, and that they would recommend the implementation of routine AAA screening in EDs. The prevalence of AAA was calculated as the total number of subjects who had an abdominal aortic diameter greater than or equal to 3 cm divided by the total

number of subjects successfully scanned (i.e., entire abdominal aorta and measured correctly).

Data Analysis

The patient and clinical characteristics of the study sample are described by their frequency distribution. The prevalence rate of AAA and 95% confidence interval (CI) are reported for the study sample. The prevalence rate of AAA in the study sample is compared to the prevalence rates obtained from general population and other study samples and considered statistically significant if the 95% CIs do not overlap. We used SAS Version 9.1 (SAS Institute, Cary, NC) for all data analyses.

RESULTS

During the 12-week enrollment period, 729 males older than 50 years presented to the study ED during study hours. The study coordinators were able to successfully approach 96% of patients (see Figure 1). Of the 700 approached, the study coordinators were unable to determine whether 15% of the patients had a smoking history or family history of AAA because of altered mental status, 20% of patients approached had neither risk factor, and 25% were ineligible because they met the predefined exclusion criteria. The most common reasons for ineligibility were the patient presented with AAA symptoms (n = 82) or the patient had undergone previous AAA screening (n = 39) or repair (n = 8). Forty percent (278 patients) of the 700 approached patients were eligible, and 196 of the 278 patients (70%) were successfully enrolled (i.e., consented and received an AAA screening exam). Ten percent of eligible subjects (n = 27) were not scanned because the credentialed ED providers were too busy to perform the exam. Of those scanned, the US success rate was 71% (i.e., the entire abdominal aorta was successfully visualized and measured for 140 subjects). During the study period, the ED spent 16% of its time on ambulance diversion, and experienced a left-without-being-seen rate of 6%.

Table 1 presents the background sociodemographic and health information of the 196 subjects who received an US screening exam. The mean ± SD age of the study sample was 64 ± 11 years. The majority of subjects were white and had health insurance and a primary care doctor. One-third of the subjects were obese. Most of the subjects had been smoking since an early age, and 45% were current smokers. Among them, 60% smoked at least 10 cigarettes per day. Over half of the subjects reported five or more chronic health conditions. The most common conditions reported were hypertension (n = 122), arthritis (n = 97), and depression (n = 64).

Among the 196 who received an US screening exam, ED sonographers were able to completely visualize and measure both the upper (suprarenal) and the lower (infrarenal) aorta on 140 subjects (71%). In 20% of the sample, sonographers were unable to completely visualize the upper portion of the aorta (5%), the lower portion of the aorta (8%), or both the upper and the lower portions (7%). In 70% of the exams, the provider documented that bowel gas completely (25%) or partially (44%) obscured the abdominal aorta. According to the QA review, the ED providers incorrectly measured the abdominal aorta on 16 (8%) subjects. Table 2 displays the size of the abdominal aorta by age for the 140 subjects successfully visualized and measured. Eight study subjects had positive scans, for a prevalence rate of 5.7% (95% CI = 1.9% to 9.6%). None of the subjects

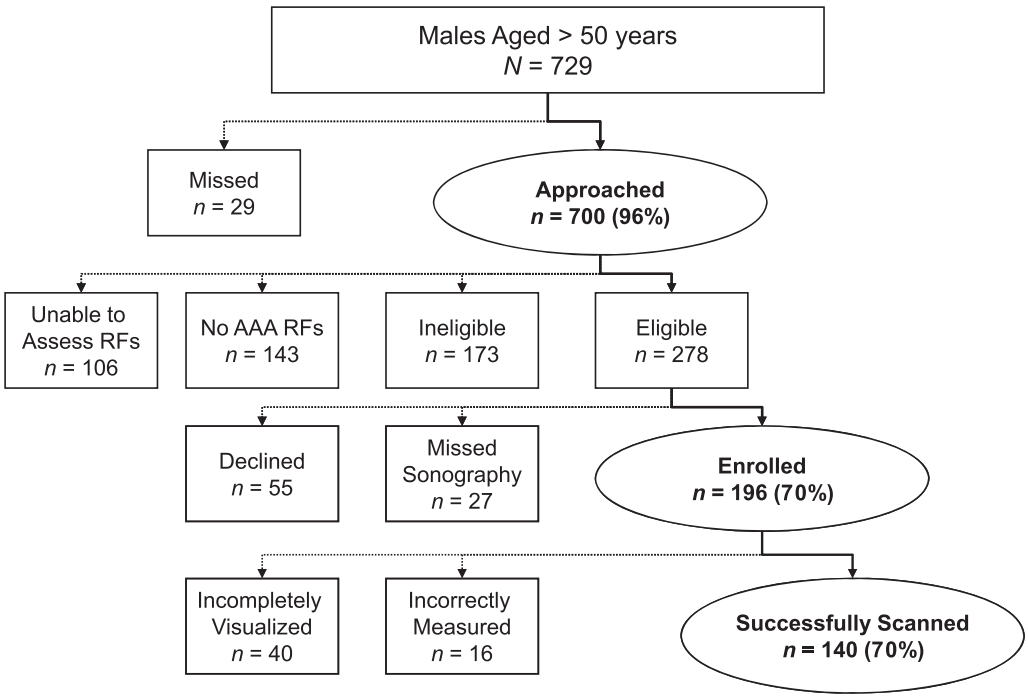

Figure 1. Approaching, enrolling, and ultrasound scanning success rates. AAA = abdominal aortic aneurysm; RF = risk factor.

Table 1
Demographic and Health Information of Enrolled Subjects (*N* = 196)

Characteristic	*n*	%
Age, yr		
51–59	91	47
60–69	45	23
70–79	29	15
80+	31	15
Race*		
White	155	80
Nonwhite	37	20
Education*		
Did not complete high school	79	41
High school graduate	59	30
Some college/college degree	55	29
Marital status*		
Married	90	47
Widowed	28	15
Separated/divorced	51	26
Never married	23	12
Health insurance*		
Self-pay	24	13
Medicaid	16	8
Medicare	57	30
Private	95	49
Usual major activity*		
Working full or part-time	76	40
Retired	83	43
Disabled/other	33	17
Usual place of medical care*		
Doctor's office	79	41
Clinic/health center	57	30
Emergency room	30	15
Hospital outpatient clinic	27	14
Has a primary care doctor*		
Yes	157	81
No	36	19
Number of medical conditions*		
0–1	11	6
2–4	53	28
5–9	107	55
10+	22	11
Family history of AAA*		
Yes	7	4
No	186	96
Body mass index*		
Normal or underweight (0–24.9)	62	32
Overweight (25–29.9)	64	34
Obese (>30)	64	34
Smoked > 100 cigarettes in lifetime*		
Yes	190	98
No	3	2
Age (yr) first started smoking*		
<13	43	22
13–15	59	31
16–18	51	26
19+	40	21
Current smoker*		
Yes	87	45
No	106	55
Number of cigarettes smoked per day*†		
<10	35	40
10–20	27	31
20–30	10	12
30+	15	17

*Fewer than six subjects with missing information.
†Among those currently smoking.

with a positive scan reported having a family history of AAA. The prevalence of AAA among our study sample is similar to large US screening studies that have been conducted on older men in the general population (see Table 3).

Table 2
Size of Abdominal Aorta by Age Among Those With a Successful US Exam* (*n* = 140)

	Size of Abdominal Aorta (cm)					
Age, yr	<3	3.0–3.4	3.5–3.9	4.0–4.4	4.5–4.9	5.0–5.4
51–59	63	0	0	0	0	0
60–64	28	1	1	0	0	0
65–69	11	0	0	0	0	0
70–74	8	0	0	0	0	0
75–79	13	1	0	0	1	1
80–84	4	2	0	0	0	0
85+	5	1	0	0	0	0

US = ultrasound.
*Includes only those subjects where the ED provider was able to visualize and correctly measure both the upper and the lower aorta.

Table 4 displays the results of the AAA screening survey that was administered to all 20 of the ED sonographers who participated in the study. The survey response rate was 95% (19/20). More than half of the respondents felt that US screening for AAA improved the quality of ED care (58%) and had a positive impact on patient satisfaction (63%). Almost three-quarters (74%) of the sonographers felt that AAA screening caused minimal to no delay in care of other ED patients, and 58% felt that it was a good use of their time ''sometimes.'' However, a significant proportion of the ED sonographers reported that the ED was not an appropriate setting for AAA screening (74%), and they would not recommend that other EDs adopt a routine AAA screening program (37%).

DISCUSSION

The results of our study suggest that an ED experiencing frequent crowding is not the appropriate setting for routine AAA screening of asymptomatic, high-risk patients. To successfully identify high-risk patients appropriate for screening required dedicated study coordinators in the ED. Of those approached for screening, the majority (60%) were not ultimately offered an US scan because they were not at risk, their risk could not be determined, or they were ineligible. Among the 278 patients eligible for an US exam, 140 (50%) were successfully scanned. The prevalence of AAA in the study sample was not significantly higher than the prevalence rates of AAA for similarly aged men from the general population. Finally, although more than half of the ED sonographers reported that screening improved patient satisfaction and the quality of emergency care, only one-quarter reported that the ED was an appropriate setting for this preventive care measure.

Hospital-based EDs were initially designed to treat patients with life-threatening illnesses and injuries, but over the years have expanded their services to include the nonemergent, unmet health care needs of people in the community. In addition, more and more people

Table 3
Prevalence Rate of AAA in Study Sample Compared to Prevalence Rates of Other Population-based Samples

Study	Age Range, yr	Positive Scans/Total Successful Scans	AAA Prevalence Rate, % (95% CI)
ED sample	51+	8/140	5.7 (1.9–9.6)
Veterans Affairs' screening study[1]	50–79	5,283/126,196	4.2 (4.1–4.3)
Multicenter aneurysm screening study[11]	65–74	1,333/26,818	5.0 (4.7–5.2)
Chichester County screening study[5]	65–80	178/2,342	7.6 (6.5–8.7)
Western Australia screening study[4]	65–83	875/12,203	7.2 (6.7–7.6)
Viborg County, Denmark, screening study[3]	65–73	191/4,816	4.0 (3.4–4.5)

AAA = abdominal aortic aneurysm.

Table 4
Frequency Distribution of Survey Responses (n = 19)

Question	n	%
Did AAA screening affect the quality of ED care?		
Improved quality (somewhat or greatly)	11	58
Did not affect quality	8	42
Reduced quality (somewhat or greatly)	0	0
Did AAA screening impact patient satisfaction?		
Improved patient satisfaction (somewhat or greatly)	12	63
Did not affect	7	37
Lowered patient satisfaction (somewhat or greatly)	0	0
Did AAA screening delay the care of other ED patients?		
Significant delay	0	0
Moderate delay	5	26
Minimal to no delay	14	74
Did AAA screening impact ED operational efficiency?		
Improved efficiency (somewhat or greatly)	0	0
Did not affect	10	53
Reduced operational efficiency (somewhat or greatly)	9	47
How technically difficult did you find AAA screening?		
Moderately difficult	3	16
Somewhat difficult	11	58
Not at all	5	26
Was AAA screening a good use of your time as an ED provider?		
Yes, always	0	0
Yes, sometimes	11	58
No, rarely or never	8	42
Is the ED an appropriate place for AAA screening of asymptomatic, high-risk individuals?		
Yes	5	26
No	14	74
Would you recommend that EDs adopt a routine AAA screening program?		
Yes	5	26
No	7	37
Neutral on this issue	7	37

AAA = abdominal aortic aneurysm.

either experience problems accessing health care services in the community or find ED care more convenient. All of these factors, coupled with widespread inpatient boarding, have led to frequent periods of crowding in EDs in the United States and other countries. When crowding occurs, there are significant delays in the timeliness of emergency care. Evidence of the negative impact of crowding on the timeliness and other aspects of the quality of emergency care (i.e., safety, effectiveness, efficiency) are rapidly accumulating.[34–43] Under these circumstances, it is not prudent to take on services that are normally outside of our primary mission unless they are cost-effective and do not threaten the operational efficiency of ED care. During the study period, 6% of our patients walked out and 16% of the time the ED went on ambulance diversion as a result of crowding problems. Does it make sense to take on additional, nonemergent care responsibilities when we are already frequently overwhelmed by the routine provision of care activities?

The results of our study do not suggest that routine screening for asymptomatic AAA in the ED is appropriate. If we had not had dedicated study coordinators, we would have offered US screening to very few patients. Even with dedicated coordinators, the providers were unable to conduct the US screening exams on 10% of all eligible patients because of their patient care workload. In addition, a substantial proportion of exams were not successful because the provider was unable to visualize the entire abdominal aorta. In a primary care setting, US screening exams are scheduled ahead of time and patients are instructed not to eat to reduce the likelihood of bowel gas being present, but EDs do not schedule patient arrivals. The ED sonographers reported that bowel gas partially or completely obscured visualization of the abdominal aortas of a substantial number of patients, thus making the exams ineffective.

The prevalence of AAA in our study sample was not significantly different from large, population-based samples of older men in the general population. Although we screened patients at theoretically higher risk (i.e., smoking or family history of AAA) than the other studies (age and sex criteria only), we also included younger men compared to all of the other studies except for the one conducted by the Department of Veterans Affairs, which may have resulted in a lower prevalence rate. We had hypothesized that if ED patients had less access to care than their peers in the general population, then we would find a higher rate of undetected AAA, but this did not occur. EDs that serve a higher proportion of patients without access to primary care may find a higher prevalence rate of AAA than our patient population. However, with advancing age, patients are eligible for Medicare and so access to

care issues may be less of an issue for this specific disease process.

LIMITATIONS

The results of this study must be considered in the context of the following limitations. First, although all participating sonographers had met the American College of Emergency Physicians requirements for credentialing for AAA screening, some of our providers were less experienced than others, and we did not objectively measure or account for interprovider variability with respect to US technique. While the generalizability of the results is probably reflective of the variation in ED providers' sonographic experience, the US success rate would probably have been higher if conducted by only experienced ED US sonographers. Second, we did not obtain a confirmatory imaging study, so the diagnostic accuracy (sensitivity, specificity, etc.) of ED sonographers using bedside US to detect AAA in asymptomatic patients with known risk factors could not be definitively determined from our study. Third, we did not actively follow-up our subjects who had a positive scan. At the time of the ED visit, we told subjects with a positive scan to follow-up with their primary care physicians or a vascular surgeon, depending on the size of the AAA. Follow-up is an important component of an AAA screening program. If an ED implements a routine AAA screening program, ED staff would need to follow-up patients who have a positive scan or communicate the exam results to the appropriate doctor for follow-up. Fourth, we did not collect or attempt to estimate the costs associated with the screening program, so we do not have any quantitative data on the cost-effectiveness of AAA screening in the ED. However, qualitatively, our experience suggests that both the resources required to conduct routine screening in a busy ED and the unintended consequences (reduced operational efficiency) make it prohibitive to most EDs. Fifth, this study was conducted at a high-volume academic ED located in a community environment, so the results may not be generalizable to all EDs. However, we suspect that our results are applicable to other EDs that experience frequent periods of crowding.

CONCLUSIONS

The prevalence rate of abdominal aortic aneurysm in our ED sample was similar to prevalence estimates obtained from older men in the general population. In light of the substantial resources required to offer ultrasound screening to all high-risk asymptomatic patients, the relatively small proportion of patients successfully scanned, and the present difficulties many EDs face with crowding, we do not recommend that EDs implement a routine sonographic screening program for asymptomatic patients at risk of abdominal aortic aneurysm.

The authors thank all of the study coordinators who worked in the ED screening, enrolling, and collecting data for the AAA screening program. The project would not have been possible without their diligence and enthusiasm: they are Joshua Aymond, Curtis Bone, James Matthew Edwards, Yonathan Habtemariam, and Michael Kelen. We also thank all of the physicians and midlevel providers who performed the ultrasound screening exams during their clinical shifts.

References

1. Lederle FA, Johnson GR, Wilson SE, et al., for the Aneurysm Detection and Management (ADAM) Veterans Affairs Cooperative Study Group Prevalence and associations of abdominal aortic aneurysm detected through screening. Ann Intern Med. 1997; 126:441–9.
2. Lederle FA, Johnson GR, Wilson SE, et al. The aneurysm detection and management study screening program: validation cohort and final results. Aneurysm Detection and Management Veterans Affairs Cooperative Study Investigators. Arch Intern Med. 2000; 160:1425–30.
3. Lindholt JS, Henneberg EW, Fasting H, Juul S. Hospital based screening of 65–73 year old men for abdominal aortic aneurysms in the county of Viborg, Denmark. J Med Screen. 1996; 3:43–6.
4. Norman PE, Jamrozik K, Lawrence-Brown MM, Dickinson JA. Western Australian randomized controlled trial of screening for abdominal aortic aneurysm [abstract]. Br J Surg. 2003; 90:492.
5. Scott RA, Wilson NM, Ashton HA, Kay DN. Influence of screening on the incidence of ruptured abdominal aortic aneurysm: 5-year results of a randomized controlled study. Br J Surg. 1995; 82:1066–70.
6. Vardulaki KA, Walker NM, Couto E, et al. Late results concerning feasibility and compliance from a randomized trial of ultrasonographic screening for abdominal aortic aneurysm. Br J Surg. 2002; 89: 861–4.
7. Fleming C, Whitlock EP, Beil TL, Lederle FA. Screening for abdominal aortic aneurysm: a best-evidence systematic review for the U.S. Preventive Services Task Force. Ann Intern Med. 2005; 142: 203–11.
8. Lederle FA, Johnson GR, Wilson SE. Abdominal aortic aneurysm in women. J Vasc Surg. 2001; 34: 122–6.
9. Scott RA, Bridgewater SG, Ashton HA. Randomized clinical trial of screening for abdominal aortic aneurysm in women. Br J Surg. 2002; 89:283–5.
10. Adamson J, Powell JT, Greenhalgh RM. Selection for screening for familial aortic aneurysms. Br J Surg. 1992; 79:897–8.
11. Ashton HA, Buxton MJ, Day NE, et al., Multicentre Aneurysm Screening Study Group. The Multicentre Aneurysm Screening Study (MASS) into the effect of abdominal aortic aneurysm screening on mortality in men: a randomised controlled trial. Lancet. 2002; 360:1531–9.
12. Dock W, Turkof E, Maier A, et al. [Prevalence of abdominal aortic aneurysms: a sonographic screening study.] Rofo. 1998; 168:356–60. [article in German]
13. Centers for Disease Control and Prevention. National Center for Health Statistics. Health Data Interactive. Available at: http://www.cdc.gov/nchs/hdi.htm. Accessed Mar 1, 2009.

14. Korhonen SJ, Ylönen K, Biancari F, Heikkinen M, Salenius JP, Lepäntalo M, Finnvasc Study Group. Glasgow Aneurysm Score as a predictor of immediate outcome after surgery for ruptured abdominal aortic aneurysm. Br J Surg. 2004; 91:1449–52.
15. Leo E, Biancari F, Nesi F, et al. Risk-scoring methods in predicting the immediate outcome after emergency open repair of ruptured abdominal aortic aneurysm. Am J Surg. 2006; 192:19–23.
16. Tambyraja AL, Lee AJ, Murie JA, Chalmers RT. Prognostic scoring in ruptured abdominal aortic aneurysm: a prospective evaluation. J Vasc Surg. 2008; 47:282–6.
17. Dueck AD, Kucey DS, Johnston KW, Alter D, Laupacis A. Long-term survival and temporal trends in patient and surgeon factors after elective and ruptured abdominal aortic aneurysm surgery. J Vasc Surg. 2004; 39:1261–7.
18. Brown LC, Thompson SG, Greenhalgh RM, Powell JT, UK Small Aneurysm Trial Participants. Fit patients with small abdominal aortic aneurysms (AAAs) do not benefit from early intervention. J Vasc Surg. 2008; 48:1375–81.
19. American Medical Association (eds). Medicare Resource-Based Relative Value Scale 2009: The Physician's Guide. Chicago, IL: American Medical Association, 2009.
20. U.S. Preventive Services Task Force. Screening for abdominal aortic aneurysm: recommendation statement. Ann Intern Med. 2005; 142:198–202.
21. Library of Congress. Screening Abdominal Aortic Aneurysms Very Efficiently (SAAAVE) Act, a provision of S.1932, Deficit Reduction Act of 2005, also known as Budget Reconciliation. The law became effective January 1, 2007.
22. Kent KC, Zwolak RM, Jaff MR, et al. Screening for abdominal aortic aneurysm: a consensus statement. J Vasc Surg. 2004; 39:267–9.
23. Hirsch AT, Haskal ZJ, Hertzer NR, et al. ACC/AHA 2005 guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic): a collaborative report. Circulation 2006; 113:e463–654.
24. Babcock Irvin C, Wyer PC, Gerson LW. Preventive care in the emergency department, Part II: Clinical preventive services–an emergency medicine evidence-based review. Society for Academic Emergency Medicine Public Health and Education Task Force Preventive Services Work Group. Acad Emerg Med. 2000; 7:1042–54.
25. Rhodes KV, Gordon JA, Lowe RA. Preventive care in the emergency department, Part I: Clinical preventive services–are they relevant to emergency medicine? Society for Academic Emergency Medicine Public Health and Education Task Force Preventive Services Work Group. Acad Emerg Med. 2000; 7:1036–41.
26. American College of Emergency Physicians. ACEP emergency ultrasound guidelines-2008. Policy statement. American College of Emergency Physicians Web site. Available at: http://www.acep.org/workarea/showcontent.aspx?id=32878. Accessed Feb 20, 2009.
27. Tayal VS, Graf CD, Gibbs MA. Prospective study of accuracy and outcome of emergency ultrasound for abdominal aortic aneurysm over two years. Acad Emerg Med. 2003; 10:867–71.
28. Kuhn M, Bonnin RL, Davey MJ, Rowland JL, Langlois SL. Emergency department ultrasound scanning for abdominal aortic aneurysm: accessible, accurate, and advantageous. Ann Emerg Med. 2000; 36:219–23.
29. Knaut AL, Kendall JL, Patten R, Ray C. Ultrasonographic measurement of aortic diameter by emergency physicians approximates results obtained by computed tomography. J Emerg Med. 2005; 28:119–26.
30. Salen P, Melanson S, Buro D. ED screening to identify abdominal aortic aneurysms in asymptomatic geriatric patients. Am J Emerg Med. 2003; 21:133–5.
31. Moore CL, Holliday RS, Hwang JQ, Osborne MR. Screening for abdominal aortic aneurysm in asymptomatic at-risk patients using emergency ultrasound. Am J Emerg Med. 2008; 26:883–7.
32. Rembold CM. Screening ultrasonography for abdominal aortic aneurysm reduced mortality in older men and was cost-effective in the long term [commentary]. ACP J Club. 2007; 147:57.
33. Rembold CM. Number needed to screen: development of a statistic for disease screening. BMJ. 1998; 317:307–12.
34. Institute of Medicine. Committee on the Future of Emergency Care in the United States Health System. Hospital-based Emergency Care: At the Breaking Point. 1st ed. Washington, DC: The National Academies Press, 2006.
35. Derlet RW, Richards JR, Kravatz RL. Frequent overcrowding in U.S emergency departments. Acad Emerg Med. 2001; 8:151–5.
36. Olshaker JS, Rathlev NK. Emergency department overcrowding and ambulance diversion: the impact and potential solutions of extended boarding of admitted patients in the emergency department. J Emerg Med. 2006; 30:351–6.
37. Trzeciak S, Rivers EP. Emergency department overcrowding in the United States: an emerging threat to patient safety and public health. Emerg Med J. 2003; 20:402–5.
38. Weber EJ, Showstack JA, Hunt KA, et al. Are the uninsured responsible for the increase in emergency department visits in the United States? Ann Emerg Med. 2008; 52:108–15.
39. Bernstein SL, Aronsky D, Duseja R, et al. The effect of emergency department crowding on clinically oriented outcomes. Acad Emerg Med. 2008; 15:1–10.
40. Hoot NR, Aronsky D. Systematic review of emergency department crowding: causes, effects and solutions. Ann Emerg Med. 2008; 52:126–36.
41. Pines JM, Hollander JE. Emergency department crowding is associated with poor care for patients with severe pain. Ann Emerg Med. 2008; 51:1–5.

42. Pines JM, Localio AR, Hollander JE, et al. The impact of emergency department crowding measures on time to antibiotics for patients with community-acquired pneumonia. Ann Emerg Med. 2007; 50:510–6.

43. Fee C, Weber EJ, Maak CA, Bacchetti P. Effect of emergency department crowding on time to antibiotics in patients admitted with community-acquired pneumonia. Ann Emerg Med. 2007; 50:501–9.