6. Screening for Abdominal Aortic Aneurysm

RECOMMENDATION

There is insufficient evidence to recommend for or against routine screening of asymptomatic adults for abdominal aortic aneurysm with abdominal palpation or ultrasound.

Burden of Suffering

Approximately 8,700 deaths from abdominal aortic aneurysm (AAA) were reported in the U.S. in 1990,[1] but undiagnosed ruptured aneurysms are probably responsible for many additional cases of sudden death in older persons. Once rupture occurs, massive intraabdominal bleeding is usually fatal unless prompt surgery can be performed. A review of six case-series including 703 cases of ruptured aneurysm estimated that only 18% of all patients with ruptured AAA reached a hospital and survived surgery.[2] The large majority of deaths from AAA occur in older men and women; men over 60 and women over 70 accounted for 95% of all deaths from AAA in a recent report.[2] Approximately 0.8% of male deaths and 0.3% of female deaths among persons over 65 years of age in the U.S. were attributed to AAA in 1990.[1]

An aneurysm is usually defined as a focal dilation of the aorta at least 150% of the normal aortic diameter.[3] Given a normal aortic diameter in older men of 2 cm (range 1.4–3.0 cm),[4] an aortic diameter above 3 cm usually indicates an aneurysm. The pathogenesis of aneurysms is not completely understood, but well-established risk factors for AAA include increasing age, male gender, and family history of aneurysms.[3] The male to female ratio for death from AAA is 11:1 between ages 60 and 64 and narrows to 3:1 between ages 85 and 90.[5] Other possible risk factors include tobacco use, hypertension, peripheral vascular disease, and presence of peripheral arterial aneurysms.[3,6–8] In populations over age 60, estimates of prevalence range from 2% to 8% and increase with age.[8–10] A recent community study in England screened nearly 9,000 men and women aged 65–80 with ultrasound: 7% of men and 1% of women had an aneurysm at least 3 cm in diameter.[11] Among all patients, only 0.6% had aneurysms 5 cm or larger, and only 0.3% had aneurysms of 6 cm or more.[11] There are

only limited data on the incidence of new aneurysms in a previously screened population. In one study, 189 men who had a normal ultrasound at age 65–66 years were rescreened 5 years later; only 2 (1%) had an aortic diameter greater than 3 cm.[12]

Few aneurysms less than 4 cm in diameter will rupture.[2,13,14] Overall, 3–6% of aneurysms greater than 4 cm in diameter will rupture annually,[14,15] but the rate of rupture is directly related to the size of the aneurysm. The natural history of most aneurysms is one of gradual enlargement; growth rates have been estimated to average 0.2 cm/year for aneurysms under 4 cm, and 0.5 cm/year for those over 6 cm.[8]

Efficacy of Screening Tests

Two tests, palpation of the abdomen during physical examination and abdominal ultrasound, have been seriously advocated as screening tests for AAA. Other tests that can detect aneurysms—plain radiographs of the abdomen, computed tomography (CT), and magnetic resonance imaging (MRI)—are either not sensitive enough or are too expensive to be practical for screening in asymptomatic populations.

The accuracy of physical examination in detecting AAA is not completely known. Large aneurysms are easier to detect than small ones, and it is easier to detect aneurysms in thin people. Estimates of the sensitivity of physical examination in detecting AAA range from 22% to 96%.[17,18] The high sensitivity obtained in series of preoperative cases probably represents the preponderance of large aneurysms in this population. Lederle reported a sensitivity of 50% and a positive predictive value of 35% in a high-risk population screened in an internal medicine clinic (9% prevalence of AAA).[19] Four of five aneurysms greater than 5 cm diameter in this series were detected by palpation. In contrast, Allen reported a 22% sensitivity, 94% specificity, and positive predictive value of 17% in a population with a 5% prevalence of aneurysms.[17] No large-scale community-based studies of screening for AAA by physical examination have been reported.

Ultrasound is an extremely sensitive and specific test for AAA of all sizes, at least in cases where the diagnosis and size of the aneurysm can be confirmed at surgery. Reported sensitivities range from 82% to 99%, with sensitivity approaching 100% in some series of patients with a pulsatile mass.[16] In a small proportion of patients, visualization of the aorta will be inadequate due to obesity, bowel gas, or periaortic disease. Although ultrasound screening is noninvasive and relatively simple, compliance with invitations to be screened has been variable (50–64% attendance) in community screening trials.[7,11] Diagnostic abdominal ultrasound is currently expensive in the U.S. ($100–$175 per examination), but screening for AAA alone could probably be performed much more quickly and cheaply.[2]

Effectiveness of Early Detection

No prospective or retrospective controlled trials of screening for AAA that include outcome data have yet been reported. A pilot trial in England that offered screening at random to older subjects has enrolled 15,000 men and women, but it may not have sufficient power to prove a benefit in mortality.[8] The difficulty of identifying all deaths caused by AAA, combined with varying compliance with screening, may make it difficult to conduct definitive controlled trials of AAA screening.[8,20]

Surgical resection and repair with an artificial graft is a very effective treatment for AAA. Among 13 large case-series of surgery for nonruptured aneurysms published since 1980, overall surgical mortality was 4% (range 1.4–6.5%); mortality during emergency surgery for rupture is much higher, averaging 49% (range 23–69%).[3] Mortality after elective surgery is often due to underlying cardiovascular disease in patients with AAA. If the patient survives the immediate postoperative period, long-term survival is comparable to similar persons without aneurysms, but late postoperative complications (graft infection, graft occlusion, and aortoenteric fistula) may result in additional deaths and morbidity.[3] The high prevalence of cardiovascular disease in patients with AAA and competing causes of morbidity and mortality in older patients may diminish the benefit of detecting asymptomatic aneurysms in older populations. Of 124 patients aged 65–80 who had large aneurysms detected in a community screening program, 27% were deemed unfit for surgery or died of other causes before surgery.[11] In recent series, up to 40% of patients undergoing surgery for nonruptured aneurysms had died within 6 years after surgery, primarily due to coronary heart disease or stroke.[3,21]

Risk of elective surgery must be balanced against the risk of rupture of an untreated aneurysm, which is directly related to aneurysm size. Most vascular surgeons currently recommend surgery for asymptomatic aneurysms 5 cm or larger, since the risk of rupture (25–41% over 5 years) is substantially higher than risks from surgery.[3] While more aggressive management of smaller aneurysms (4–5 cm) has been recommended by some,[22] others have suggested that asymptomatic, slow-growing aneurysms under 6 cm can be successfully followed by serial ultrasound.[2,11] A large community-based screening program, which employed this conservative strategy over 8 years, observed two cases of rupture among 29 subjects with aneurysms 5–5.9 cm, for a rate of 1.5%/year.[11,23] A model fitted to data from 13 studies of untreated aneurysms supports a relatively low risk of rupture in aneurysms less than 6 cm; estimated annual rates of rupture for aneurysms 4–4.9, 5–5.9, 6–6.9, and over 7 cm were 1%, 3%, 9%, and 25%, respectively.[2] These data, which are based largely on incidentally detected cases, may not reflect accurately the prognosis of asymptomatic aneurysms discovered by routine ultra-

sound screening. Furthermore, decisions to forgo surgery in patients with larger aneurysms were likely to have been influenced by factors (e.g., age, comorbidity, lack of symptoms) that may have independently influenced the risk of rupture. Trials are currently ongoing to determine the optimal management of patients with AAA that are 4–5.4 cm in size.[24]

Recommendations of Other Groups

The Canadian Task Force on the Periodic Health Examination[7] concluded that there was poor evidence to include or exclude screening for AAA in the periodic health examination of asymptomatic individuals. They noted that targeted physical examination may be considered prudent for men over 60, however, and that ultrasound screening could be considered in selected high-risk men over 60: smokers with other risk factors for AAA (hypertension, claudication, family history, or other vascular disease).

Discussion

No prospective or retrospective controlled trials of screening for AAA have yet been reported that include data on mortality or other clinical outcomes. At present, the only effective intervention available for patients with aneurysms is major abdominal surgery. Until further data are available from population-based screening trials, it is uncertain whether the projected benefit from preventing ruptured aneurysms is sufficient to justify the costs of widespread screening and the potential risks from increased surgery. While there is general consensus that resection is indicated for incidentally discovered, large aneurysms (6 cm or larger), these are relatively uncommon in the general population; the appropriate management of smaller (4–5 cm) aneurysms remains controversial. Data from older case series may not be a reliable guide to the natural history of asymptomatic aneurysms discovered by ultrasound. For many older patients with small aneurysms, the risk of dying from coronary heart disease or stroke is much higher than the risk from ruptured AAA.[21]

The benefits of routine screening will depend on other parameters that merit further research: the proportion of clinically important aneurysms that are detected without screening; the sensitivity and specificity of abdominal palpation for detecting AAA in the primary care setting; risk factors for rapid growth or rupture of AAA; and long-term morbidity of patients undergoing elective surgery. Patient compliance with recommendations for follow-up or surgery will also directly influence the ability of screening to prevent ruptured aneurysms.

A recent cost-effectiveness analysis compared different screening protocols in a high-risk population of men between 60 and 80 years of age.[25] The authors concluded that a single screen for AAA by abdominal palpa-

tion might be considered cost-effective, but it would be of small clinical benefit (average increase in life expectancy of 0.002 year). A single screen with ultrasound was at the high end of the cost range that might be considered cost-effective ($41,550/year of life gained), and repeat screening was not cost-effective. They noted that, due to the variable quality of the available data, screening for AAA could prove to be very cost-effective or could actually cause a net harm. If low-cost screening ultrasound were available (vs. $150 average charge for diagnostic ultrasound in the U.S.), ultrasound screening would be much more cost-effective, and preferable to physical examination.[25]

CLINICAL INTERVENTION

There is insufficient evidence to recommend for or against routine screening for abdominal aortic aneurysms with abdominal palpation or ultrasound ("C" recommendation). Recommendations against routine ultrasound screening in the general population may be made on other grounds, such as the low prevalence of clinically significant AAA and the high cost of screening. Although direct evidence that screening for AAA reduces mortality or morbidity is not available in any population, clinicians may decide to screen selected high-risk patients, due to the significant burden of disease and the availability of effective surgical treatment for large aneurysms. Men over age 60 who have other risk factors (e.g., vascular disease, family history of AAA, hypertension, or smoking) are at highest risk for AAA and death due to ruptured aneurysms. Screening is not indicated for patients who are not appropriate candidates for major abdominal surgery (e.g., those with severe cardiac or pulmonary disease). If screening is performed, it is not certain whether ultrasound or abdominal palpation is the preferred test. Abdominal palpation is less expensive but also less sensitive than ultrasound. Cost-effectiveness analysis suggests that repeat examination of individuals with a previous normal ultrasound is not indicated.[24]

The draft of this chapter was prepared for the U.S. Preventive Services Task Force by Paul S. Frame, MD, and David Atkins, MD, MPH.

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