Screening for Abdominal Aortic Aneurysm

Recommendation Statement

U.S. Preventive Services Task Force

This statement summarizes the U.S. Preventive Services Task Force (USPSTF) recommendations on screening for abdominal aortic aneurysm (AAA) and the supporting scientific evidence, and updates the 1996 recommendations contained in the *Guide to Clinical Preventive Services,* second edition.[1] Explanations of the ratings and of the strength of overall evidence are given in Appendix A and Appendix B, respectively. The complete information on which this statement is based, including evidence tables and references, is included in the summary of evidence,[2] evidence synthesis,[3] and in the cost-effectiveness analyses review[4] on this topic, available on the USPSTF Web site (www.preventiveservices.ahrq.gov). The recommendation statement, summary of evidence, and cost-effectiveness analyses review are also available in print from the Agency for Healthcare Research and Quality (AHRQ) Publications Clearinghouse (call 1-800-358-9295, or e-mail ahrqpubs@ahrq.gov). The recommendation is also posted on the Web site of the National Guideline Clearinghouse™ (www.guideline.gov).

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Summary of Recommendations

The USPSTF recommends one-time screening for abdominal aortic aneurysm (AAA) by ultrasonography in men aged 65 to 75 who have ever smoked. **B recommendation.**

The USPSTF found good evidence that screening for AAA and surgical repair of large AAAs (5.5 cm or more) in men aged 65 to 75 who have ever smoked (current and former smokers) leads to decreased AAA-specific mortality. There is good evidence that abdominal ultrasonography, performed in a setting with adequate quality assurance (ie, in an accredited facility with credentialed technologists), is an accurate screening test for AAA. There is also good evidence of important harms of screening and early treatment, including an increased number of surgeries with associated clinically significant morbidity and mortality, and short-term psychological harms. Based on the moderate magnitude of net benefit, the USPSTF concluded that the benefits of screening for AAA in men aged 65 to 75 who have ever smoked outweigh the harms.

The USPSTF makes no recommendation for or against screening for AAA in men aged 65 to 75 who have never smoked. **C recommendation.**

The USPSTF found good evidence that screening for AAA in men aged 65 to 75 who have never smoked leads to decreased AAA-specific mortality. There is, however, a lower prevalence of large AAAs in men who have never smoked compared with men who have ever smoked; thus, the potential benefit from screening men who have never smoked is small. There is good evidence that screening and early treatment lead to important harms, including an increased

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number of surgeries with associated clinically significant morbidity and mortality, and short-term psychological harms. The USPSTF concluded that the balance between the benefits and harms of screening for AAA is too close to make a general recommendation in this population.

The USPSTF recommends against routine screening for AAA in women. **D recommendation.**

Because of the low prevalence of large AAAs in women, the number of AAA-related deaths that can be prevented by screening this population is small. There is good evidence that screening and early treatment result in important harms, including an increased number of surgeries with associated morbidity and mortality, and psychological harms. The USPSTF concluded that the harms of screening women for AAA outweigh the benefits.

Clinical Considerations

- The major risk factors for AAA include age (being 65 or older), male sex, and a history of ever smoking (at least 100 cigarettes in a person's lifetime). A first-degree family history of AAA requiring surgical repair also elevates a man's risk for AAA; this may also be true for women but the evidence is less certain. There is only a modest association between risk factors for atherosclerotic disease and AAA.
- Screening for AAA would most benefit those who have a reasonably high probability of having an AAA large enough, or that will become large enough, to benefit from surgery. In general, adults younger than age 65 and adults of any age who have never smoked are at low risk for AAA and are not likely to benefit from screening. Among men aged 65 to 74, an estimated 500 who have ever smoked—or 1,783 who have never smoked—would need to be screened to prevent 1 AAA-related death in the next 5 years. As always, clinicians must individualize recommendations depending on a patient's risk and likelihood of benefit. For example, some clinicians may choose to discuss screening with male nonsmokers nearing age 65 who have a strong first-degree family history of AAA that required surgery.
- The potential benefit of screening for AAA among women aged 65 to 75 is low because of the small number of AAA-related deaths in this population. The majority of deaths from AAA rupture occur in women aged 80 or older. Because there are many competing health risks at this age, any benefit of screening for AAA would be minimal. Individualization of care, however, is still required. For example, a clinician may choose to discuss screening in the unusual circumstance in which a healthy female smoker in her early 70s has a first-degree family history for AAA that required surgery.
- Operative mortality for open surgical repair of an AAA is 4% to 5%, and nearly one-third of patients undergoing this surgery have other important complications (eg, cardiac and pulmonary). Additionally, men having this surgery are at increased risk for impotence.
- Endovascular repair of AAAs (EVAR) is currently being used as an alternative to open surgical repair. Although recent studies have shown a short-term mortality and morbidity benefit of EVAR compared with open surgical repair, the long-term effectiveness of EVAR to reduce AAA rupture and mortality is unknown. The long-term harms of EVAR include late conversion to open repair and aneurysmal rupture. EVAR performed with older-generation devices is reported to have an annual rate of rupture of 1% and conversion to open surgical repair of 2%. The conversion to open surgical repair is associated with a peri-operative mortality of about 24%. The long-term harms of newer generation EVAR devices are yet to be reported.
- For most men, 75 years may be considered an upper age limit for screening. Patients cannot benefit from screening and subsequent surgery unless they have a reasonable life expectancy. The increased presence of comorbidities for people aged 75 and older decreases the likelihood that they will benefit from screening.
- Ultrasonography has a sensitivity of 95% and specificity of nearly 100% when performed in a setting with adequate quality assurance. The

absence of quality assurance is likely to lower test accuracy. Abdominal palpation has poor accuracy and is not an adequate screening test.

- One-time screening to detect an AAA using ultrasonography is sufficient. There is negligible health benefit in re-screening those who have normal aortic diameter on initial screening.
- Open surgical repair for an AAA of at least 5.5 cm leads to an estimated 43% reduction in AAA-specific mortality in older men who undergo screening. However, there is no current evidence that screening reduces all-cause mortality in this population.
- In men with intermediate-sized AAAs (4.0–5.4 cm), periodic surveillance offers comparable mortality benefit to routine elective surgery with the benefit of fewer operations. Although there is no evidence to support the effectiveness of any intervention in those with small AAAs (3.0–3.9 cm), there are expert opinion-based recommendations in favor of periodic repeat ultrasonography for these patients.

Discussion

By definition, an AAA is present when the infrarenal aortic diameter exceeds 3.0 cm.[5] Large AAAs are associated with approximately 9,000 deaths annually in the United States.[6] The prevalence of AAAs found in population-based ultrasonography screening studies from various countries is about 4% to 9% in men and 1% in women.[7–12] The prevalence of an AAA greater than 5.0 cm in men aged 50 to 79 is estimated to be 0.5%.[13] Almost all deaths from ruptured AAAs occur in men older than 65; most AAA-related deaths occur in men younger than 80; and most AAA-related deaths in women occur when they are older than 80.[14,15]

The strongest risk factor for the rupture of an AAA is maximal aortic diameter.[16,17] The natural history of clinically apparent AAAs of 5.5 cm or more is difficult to determine, since most large aneurysms are surgically repaired. Results of 1 study showed that 1-year incidence rates of rupture were 9% for AAAs of 5.5 to 5.9 cm; 10% for AAAs of 6.0 to 6.9 cm; and 33% for AAAs ≥ 7.0 cm.[18] A rapid rate of aneurysm expansion (> 1.0 cm/year) is commonly used in making decisions about the elective repair of AAAs < 5.5 cm; however, the predictive value of expansion as an index of rupture risk is less clear.[19]

The major risk factors for AAA include male sex, a history of ever smoking (defined in surveys as 100 cigarettes in a person's lifetime), and age 65 or older. Other lesser risk factors include family history, coronary heart disease, claudication, hypercholesterolemia, hypertension, cerebrovascular disease, and increased height.[3] Factors associated with decreased risk include female sex, diabetes mellitus, and black race.

Screening abdominal ultrasonography in asymptomatic individuals is an accurate test, with 95% sensitivity and near 100% specificity.[20,2] The USPSTF review identified 4 randomized controlled trials (RCTs) of screening for AAA; these RCTs predominantly screened white men aged 65 and older.[2,3] A good-quality RCT of 67,800 white men aged 65 to 74 was conducted to evaluate screening for AAA.[8] Screening was performed by ultrasonography and surgery in men with AAAs greater than 5.4 cm. The study showed AAA-related mortality was reduced by an average of 42% (95% CI, 22%–58%) in the screened population compared with the non-screened population; the absolute reduction in AAA-specific mortality was 0.14% (0.33% in the non-screened group and 0.19% in the screened group).[3]

A fair-quality RCT selected 15,775 white men and women aged 65 to 80 from family medical practices.[21] This was the only one of the 4 RCTs that studied women. The prevalence of AAA in women was one-sixth of that in men. The incidence of AAA rupture was the same in the screened and control groups of women. This trial lacked adequate power and reported a non-statistically significant 41% reduction in AAA-related mortality in screened men and no reduction in AAA-related mortality in screened women. A fair-quality hospital-based RCT of 12,658 men aged 65 to 73 showed a 69% statistically significant reduction in AAA-specific

mortality.[22] Another RCT was population-based and included 38,704 men aged 65 to 83. After 5 years of follow-up, 18 men in the group invited to be screened, and 25 in the control group, died of causes associated with AAA (odds ratio [OR], 0.72 [95% CI, 0.39–1.32]). In a subgroup analysis, there was a statistically significant reduction in AAA-related mortality in men aged 65 to 75, but not in older men.[23] A meta-analysis of these trials showed a relative risk reduction of 43% in AAA-related deaths by screening for AAA, although there was no change in all-cause mortality.[2,3]

Death from AAA rupture after negative results on a single ultrasound scan at age 65 is rare. Studies have shown that the incidence rate for new AAAs in a period of 10 years is low, ranging from 0% to 4%; none of the incident AAAs exceeded a diameter of 4.0 cm.[15,24–26] Based on these studies, negative results on a single ultrasound examination around the age of 65 appear to virtually exclude the risk for future AAA rupture or death.

Two randomized trials showed no statistically significant mortality benefit from immediate surgical repair compared with frequent surveillance for intermediate-sized AAAs (4.0–5.4 cm).[27,28] Additionally, about 39% fewer AAA-related surgical repairs needed to be performed in the surveillance group.

Two randomized trials reported that the 30-day mortality rate for EVAR was significantly reduced compared with open surgical repair (about 1.5% vs 4.5%, respectively).[29,30] While there are short-term mortality and morbidity benefits of performing EVAR compared with open surgical repair, the magnitude of long-term potential harms is not well known. Long-term potential harms of EVAR may occur because of device failure, which could cause bleeding into the aneurysmal sac around the device or from retrograde flow into the aneurysmal sac through collateral blood vessels. These events may require late conversion to open repair or may lead to aneurysmal rupture. Studies of the EUROSTAR (EUROpean collaborators on Stent-graft Techniques for abdominal aortic Aneurysm Repair) registry report an annual rupture rate of 1% and conversion to open repair at an annual rate of 2%, with a 24% peri-operative mortality rate for the conversion.[31,32]

Although open surgical repair remains the only proven intervention that leads to decreased AAA mortality in the long term, there are major harms associated with this procedure. One study showed in-hospital mortality rates for patients undergoing open repair to be 4.2%.[33] The complication rate of elective surgery is about 32% and includes myocardial infarction, respiratory failure, renal failure, ischemic colitis, spinal cord ischemia, and prosthetic graft infections.[3]

There is a short-term impact of AAA screening on quality-of-life measures. Those testing positive for AAA initially had more anxiety and lower physical and mental health scores (measured by the Short Form-36) than those testing negative. Those who underwent surgery, compared with those receiving continued surveillance, had slightly lower Short Form-36 scores but higher self-rated health scores 3 months after surgery. These negative psychological measures returned to normal levels within 12 months after screening or surgery.[8]

The USPSTF review of 4 relevant cost-effectiveness studies of AAA yielded an estimated cost-effectiveness ratio of population-based AAA screening (compared with no screening) that is in the same range as that of other cost-effective preventive services.[4]

The pathogenesis of AAA formation is complex and multifactorial; more studies are needed to clarify AAA's natural history of formation and expansion. A number of areas require further study, including the lack of a strong association between AAA and atherosclerotic disease; the prevalence and natural history of AAA in women; the efficacy of screening and treatment in nonwhite male populations; the efficacy and periodicity of surveillance of small AAAs (3.0–4.0 cm); and the long-term efficacy of EVAR as an alternative to open surgical repair, especially for AAAs less than 4.0 cm. There also is a need for a high-quality, cost-effectiveness analysis of AAA screening conducted from the U.S. societal perspective.

Recommendations of Other Groups

The Society for Vascular Surgery and the Society for Vascular Medicine and Biology recommend screening all men aged 60 to 85 for AAA; women aged 60 to 85 with cardiovascular risk factors; and men and women aged 50 and older with a family history of AAA. These groups further recommend the following courses of action after screening: no further testing if aortic diameter is less than 3.0 cm; yearly ultrasonographic screening if aortic diameter is between 3.0 to 4.0 cm; ultrasonography every 6 months if aortic diameter is between 4.0 to 4.5 cm; and referral to a vascular specialist if aortic diameter is greater than 4.5 cm.[34]

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Appendix A
U.S. Preventive Services Task Force Recommendations and Ratings

The Task Force grades its recommendations according to one of 5 classifications (A, B, C, D, I) reflecting the strength of evidence and magnitude of net benefit (benefits minus harms):

A. The USPSTF strongly recommends that clinicians provide [the service] to eligible patients. *The* USPSTF *found good evidence that [the service] improves important health outcomes and concludes that benefits substantially outweigh harms.*

B. The USPSTF recommends that clinicians provide [the service] to eligible patients. *The* USPSTF *found at least fair evidence that [the service] improves important health outcomes and concludes that benefits outweigh harms.*

C. The USPSTF makes no recommendation for or against routine provision of [the service]. *The* USPSTF *found at least fair evidence that [the service] can improve health outcomes but concludes that the balance of benefits and harms is too close to justify a general recommendation.*

D. The USPSTF recommends against routinely providing [the service] to asymptomatic patients. *The* USPSTF *found at least fair evidence that [the service] is ineffective or that harms outweigh benefits.*

I. The USPSTF concludes that the evidence is insufficient to recommend for or against routinely providing [the service]. *Evidence that [the service] is effective is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.*

Appendix B
U.S. Preventive Services Task Force—Strength of Overall Evidence

The USPSTF grades the quality of the overall evidence for a service on a 3-point scale (good, fair, poor):

Good: Evidence includes consistent results from well-designed, well-conducted studies in representative populations that directly assess effects on health outcomes.

Fair: Evidence is sufficient to determine effects on health outcomes, but the strength of the evidence is limited by the number, quality, or consistency of the individual studies, generalizability to routine practice, or indirect nature of the evidence on health outcomes.

Poor: Evidence is insufficient to assess the effects on health outcomes because of limited number or power of studies, important flaws in their design or conduct, gaps in the chain of evidence, or lack of information on important health outcomes.

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