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PATIENT SAFETY NETWORK

Abdominal Aortic Aneurysm Screening

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Case Objectives

- Describe risk factors associated with abdominal aortic aneurysm.
- Identify patient populations meeting criteria for screening.
- Understand that elective surgical repair should be offered to patients with acceptable surgical risk when they meet size criteria for intervention.
- Realize that endovascular repair is associated with lower perioperative morbidity and mortality compared to open repair but that long-term survival is similar with both techniques.
- Recognize that a ruptured abdominal aortic aneurysm carries a very high mortality risk.

The Case

A 76-year-old man with history of coronary artery disease (status post prior coronary artery bypass grafting), severe heart failure, diabetes, hypertension, and an extensive smoking history was admitted to the hospital with worsening shortness of breath. As part of his medical evaluation, he underwent a transthoracic echocardiogram that demonstrated severe aortic stenosis, felt to be the likely cause of his shortness of breath and worsening heart failure. The cardiology team was consulted and recommended cardiac catheterization to further assess the patient's condition. However, when the interventional cardiologist performed the catheterization, she could not advance the catheter and an aortogram revealed that the patient had an abdominal aortic aneurysm (AAA) measuring almost 9 cm in diameter.

Given the size of the AAA and the high risk of rupture, the patient was sent emergently for surgical repair. His postoperative course was complicated by multiple strokes, a myocardial infarction requiring repeat catheterization, and a catheter-associated urinary tract infection. He was discharged from the hospital to a skilled nursing facility several weeks after surgery. Because of his multiple comorbid medical conditions, he was deemed not to be a candidate for aortic valve replacement. He died 5 months later in hospice care.

The Commentary

Commentary by Jeffrey Jim, MD, MPHS

The patient in this case was incidentally found to have an abdominal aortic aneurysm (AAA) while undergoing evaluation for severe aortic stenosis. An aneurysm is defined as dilation of a blood vessel to greater than 50% above its normal size. In most adults, a diameter of greater than 3 cm in the abdominal aorta is considered to be an aneurysm. Various risk factors (such as age, male gender, and smoking history) are associated with the development of AAA. It is well accepted that one of the most important risk factors for rupture is aneurysm diameter, with a larger diameter (particularly those above 5.5 cm) conferring a higher risk of rupture. Without repair, ruptured AAAs are nearly always fatal.

Since most patients with AAA are asymptomatic and aneurysms frequently expand in size over time, considerable work has been undertaken to develop appropriate screening strategies. Although the patient described in this case had known risk factors for AAA, he did not undergo appropriate screening. Screening for AAAs carries the potential benefit of identifying large aneurysms that are at risk for rupture, and facilitating treatment before this often fatal complication. However, screening also results in the diagnosis of smaller aneurysms that are unlikely to rupture and may lead to unnecessary procedures and cause psychological distress for patients. With these challenges in mind, the United States Preventive Services Task Force published AAA screening recommendations in 2014 (1), which include:

- One-time screening ultrasound in men ages 65 to 75 years who have ever smoked.
- Selective screening in men ages 65 to 75 years who have never smoked.
- Evidence is insufficient to assess screening for women ages 65 to 75 years who have ever smoked.
- No screening for women who have never smoked.

In the United States, Medicare covers one-time ultrasound screening in patients with a family history of AAA or in males age 65 to 75 who have smoked at least 100 cigarettes.(2) Ultrasound is recommended as the preferred imaging modality for aneurysm screening and surveillance.(3) The sensitivity and specificity of ultrasound for aneurysm detection approaches 100%. Furthermore, ultrasonography has no associated inherent risks. The sole use of physical examination (abdominal palpation) is unreliable in the diagnosis of an AAA, particularly in those with smaller aneurysms (4) However, in thin patients and larger aneurysms, the sensitivity of physical examination approaches 100%.(5) Palpation of an AAA is safe and has not been reported to precipitate rupture. Guidelines from the Society for Vascular Surgery suggest referral to a vascular surgeon at the time of initial diagnosis of an AAA. Unless the aneurysm has reached the size threshold for elective repair, it is recommended to continue imaging surveillance as follows (3): 10-year interval for aortic diameter greater than 2.5 cm but less than 3 cm; 3-year interval for AAA between 3.0 cm and 3.9 cm; 12-month interval for AAA between 4.0 cm and 4.9 cm; and 6-month interval for AAA between 5.0 cm and 5.4 cm.

As the guidelines illustrate, the patient in this case should have been screened for the presence of AAA. In men age 65 or older, screening for AAAs has been shown to be effective in reducing aneurysm-related mortality and aneurysm rupture.(6) Long-term follow-up also suggests that screening results in a small but convincing reduction in all-cause mortality.(7) However, the available literature shows no benefit of one-time screening in women, and there is limited evidence on the benefits of repeat AAA screening or targeted screening approaches based on risk factors for AAA. The use of decision support embedded in electronic health records can help facilitate aneurysm detection. There have been reports of successful aneurysm screening programs across large patient populations by targeting patients within the appropriate age range (65 to 75), as well as those with a family history of AAA.(8)

In this case, the patient required emergent surgical repair of his AAA. Surgical treatment of AAA can be accomplished with traditional open surgical repair or endovascular aneurysm repair (EVAR), which involves placement of stent grafts into the vasculature through the femoral arteries. This less invasive approach is associated with lower rates of perioperative mortality and complications, less blood loss, and shorter hospital stays.(9,10) However, EVAR provides no long-term all-cause survival benefit and is associated with higher cost and a greater number of reinterventions.

The goal of treatment of asymptomatic AAA is to prevent future rupture and its associated risk of death. As such, the decision to intervene should carefully balance the risk of rupture against the potential perioperative mortality and morbidity rates associated with surgical repair. Two randomized controlled trials evaluated whether elective open surgical repair of small AAAs improves survival.(11,12) In patients deemed fit for elective surgery, the results did not support early surgical intervention, as survival was not improved by elective repair of aneurysms smaller than 5.5 cm even when operative mortality was low. With the introduction and widespread adoption of EVAR, later trials sought to compare surveillance versus early endovascular repair.(13,14) These studies also did not demonstrate any advantage to early endovascular repair in terms of mortality or rupture rates. As such, current guidelines strongly recommend elective repair for patients with low or acceptable surgical risk and AAAs that are greater than or equal to 5.5 cm. The data for women is less clear, as the above cited trials involved mostly male patients. However, some studies have demonstrated a far higher risk of rupture among women as compared to men during surveillance of small aneurysms.(15) As such, the guidelines provide a weaker recommendation for aneurysm repair in women with AAA between 5.0 cm and 5.4 cm in diameter.

The mortality associated with ruptured AAA (rAAA) may be as high as 90% when patients who die at home or upon arrival to the hospital are taken into account. Despite significant advances in prehospital care and perioperative critical care, the mortality after intervention for rAAA remains over 40% in the United States.(16) The value of early detection and elective treatment prior to rupture is easily appreciated when one notes that the perioperative mortality for elective EVAR is less than 2% and for open aneurysm repair is less than 5%.(3)

The patient in this case should have undergone screening for the presence of AAA when he reached age 65. Unfortunately, he did not receive age-appropriate screening and an enlarged AAA was incidentally found when he was undergoing evaluation for severe aortic stenosis. Given the high risk of rupture, he appropriately underwent emergent surgical repair. However, he had a complicated postoperative course and ultimately his aortic valve could not be replaced. Had he undergone screening earlier, he might well have had a better clinical outcome. This case highlights the importance of screening for AAA in patients with established risk factors.

Take-Home Points

- Screening for abdominal aortic aneurysm with ultrasound should be offered to patients meeting criteria.
- Elective surgical treatment of abdominal aortic aneurysms should be offered to patients with acceptable surgical risk when they meet size criteria for intervention.
- Endovascular aortic aneurysm repair is associated with lower perioperative morbidity and mortality compared to open surgery.
- Long-term survival is similar with both endovascular aneurysm repair and open repair.

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