Preoperative Transthoracic Echocardiography in Abdominal Aortic Aneurysm

A New Thermometer

Daniel Muñoz, MD, MPA; Joshua A. Beckman, MD, MS

Abdominal aortic aneurysm (AAA), a common condition estimated to affect 4% to 7% of adults older than the age of 65 years, will likely remain a common clinical problem given the evolving demographics of the United States and world populations. The adverse clinical significance of AAA, as well as the ramifications should rupture ensue, have been well established. In the United States alone, AAA rupture is responsible for an estimated 10,000 deaths per year. Although rupture carries mortality exceeding 90%, perioperative mortality associated with a surveillance-based approach with endovascular or surgical elective repair is <3%.6

In stable patients undergoing elective AAA repair, perioperative morbidity and mortality have been favorably affected by a transition from traditional open surgical repair to an increasing reliance on endovascular repair of the abdominal aorta (EVAR). Recent national data indicate that >70% of AAA cases lend themselves to an endovascular approach.4 Despite technical advances in reducing short-term 30-day (ie, perioperative) risk, by 2 years, the mortality trend in this patient population is similar independent of repair technique and remains disappointingly high.5 From clinicians’ recognition of the natural history, efforts have emerged to improve the method and manner of risk assessment in patients slated for elective EVAR to mitigate this risk. Indeed, the diagnosis of AAA is associated with a higher risk of death from causes other than aneurysmal disease in patients diagnosed in the prerupture setting.6 Ideally, improvements in risk assessment would offer opportunities for risk reduction and enhanced patient outcomes specific to this population.

The approach to risk assessment and modification in the pre-EVAR setting has traditionally focused on the examination of conventional cardiovascular risk factors, particularly given historic evidence that many post-EVAR complications were and are cardiovascular in nature.7-9 Risk prediction that relies exclusively on atherosclerotic risk factors has inherent limitations of specificity, including in the specific scenario of AAA and EVAR. However, the causes of death stretch beyond current risk assessment models’ ability to predict outcomes post-EVAR. To date, the evidence in support of additional testing to reduce intermediate and long-term morbidity and mortality is limited.

In this issue of Circulation: Cardiovascular Imaging, O’Driscoll et al10 seek to extend previous work on risk assessment by evaluating the prognostic value of transthoracic echocardiography (TTE) in patients slated for elective EVAR. Using a retrospective cohort design, the authors studied 273 consecutive patients undergoing elective EVAR between January 2008 and September 2010. All patients were enrolled at a single tertiary care center in the United Kingdom and each patient underwent a comprehensive TTE in the weeks before elective EVAR. The primary outcome assessed was long-term all-cause mortality with a mean follow-up of 3.2 years. For each patient, data were collected to comprehensively characterize their demographic characteristics, clinical comorbid history, current medications, and baseline laboratory values (including complete blood count, renal function, lipid profile, troponin, and C-reactive protein). In addition, data were captured on a broad array of TTE parameters for each enrolled patient. Multivariable-adjusted Cox proportional hazard models were used in the assessment of predictors of all-cause mortality.

Seventy-eight deaths occurred during the overall study period, with a mean time to death of 15 months. Of the 78 deaths, only 1, attributed to a myocardial infarction in a 91-year-old subject, occurred in the perioperative setting, with 9 additional deaths occurring in the first 30 days after EVAR. As described by the authors, after accounting for demographics, clinical history, medications, and laboratory measures, 3 TTE indices—of 26 reported—were found to be significant predictors of long-term outcome (ie, mortality). These indices included: dilated tubular ascending aorta (hazard ratio [HR], 5.6; 95% confidence interval [CI], 2.77–11.33), presence of mitral regurgitation (HR, 8.13; 95% CI, 4.09–12.16), and reduced left ventricular ejection fraction (HR, 0.96; 95% CI, 0.93–0.98). Non-TTE factors predictive of mortality included: younger age (HR, 0.97; 95% CI, 0.95–0.99) and presence of diabetes mellitus (HR, 1.46; 95% CI, 1.24–1.89). Further examination of patients with mitral regurgitation revealed a step-wise pattern, with both mild mitral regurgitation (HR, 4.84; 95% CI, 2.8–13.92) and moderate/severe mitral regurgitation (HR, 7; 95% CI, 3.52–13.92) each qualifying as predictors of mortality. On the basis of their analysis, the authors report that echocardiography provides key long-term
prognostic information in patients undergoing elective EVAR, with TTE indices appearing more important than standard risk factors at predicting outcome. They conclude, “Transesophageal echocardiography provides important long-term prognostic information in patients undergoing EVAR… and may serve as a useful tool for guiding clinical management.”

Using a carefully collected and analyzed data set from a single center, O’Driscoll et al20 have provided informative insights into the assessment of long-term risk assessment in patients slated to undergo elective EVAR. We congratulate the authors for taking this first step into AAA risk assessment. The parameters identified provide a significant hazard and suggest that an AAA population segment is at particular risk of death. However, the unresolved question is a particular risk of death from what? Like a thermometer, a TTE in this setting indicates illness but not its cause. The unclear pathogenesis of the heightened mortality limits the value in this setting indicates illness but not its cause. The unclear pathogenesis of the heightened mortality limits the value.

When possible, excluded preoperative deaths (DREAM and EVAR 1). AAA indicates abdominal aortic aneurysm; DREAM, Dutch-Randomized Endovascular Aneurysm Management; EVAR, endovascular aortic repair; NA, not applicable; and OVER, Open Versus Endovascular Repair.

We applaud the investigators for beginning the process of intermediate-term risk assessment in patients with AAA. We think further efforts are worthwhile and necessary now that perioperative outcomes are excellent and the causes of the death over time are broad.5 We look forward to prospective studies, more granular data, and treatment recommendations on the basis of the findings. At this time, we would recommend clinically driven use, rather than routine use, of TTE—at least until there is evidence that we can provide more targeted treatment advice to our patients.

Disclosures
None.

References

Table. Long-Term Outcomes After EVAR for AAA: Causes of Death

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>UK Small Aneurysm Trial, 714 Deaths</th>
<th>OVER Trial, 146 Deaths</th>
<th>DREAM Trial, 57 Deaths</th>
<th>EVAR 1 Trial, 248 Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aneurysm related</td>
<td>51 (7.1%)</td>
<td>10 (6.8%)</td>
<td>0 (0.0%)</td>
<td>28 (11.3%)</td>
</tr>
<tr>
<td>Cardiovascular (not related to aneurysm)</td>
<td>335 (46.9%)</td>
<td>39 (26.7%)</td>
<td>16 (28.1%)</td>
<td>94 (37.9%)</td>
</tr>
<tr>
<td>Cancer</td>
<td>156 (21.8%)</td>
<td>39 (26.7%)</td>
<td>18 (31.6%)</td>
<td>60 (24.2%)</td>
</tr>
<tr>
<td>Pulmonary disease</td>
<td>NA</td>
<td>20 (13.7%)</td>
<td>6 (10.5%)</td>
<td>25 (10.1%)</td>
</tr>
<tr>
<td>Other</td>
<td>131 (18.3%)</td>
<td>38 (26.0%)</td>
<td>17 (29.8%)</td>
<td>41 (16.5%)</td>
</tr>
</tbody>
</table>

When possible, excluded preoperative deaths (DREAM and EVAR 1).


**Key Words:** Editorials ◼ abdominal aortic aneurysm ◼ aorta ◼ echocardiography ◼ endovascular repair ◼ mortality
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doi: 10.1161/CIRCIMAGING.116.004505

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