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Clinical Research

Cardiac Stress Testing during Workup for Abdominal Aortic Aneurysm Repair Is Not Associated with Improved Patient Outcomes

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Background: Cardiac stress testing (CST) is commonly used to help determine whether patients with abdominal aortic aneurysms (AAAs) are better candidates for open versus endovascular repair, although it is unknown whether the use of CST achieves its goal of optimizing patient selection and postoperative outcomes.

Methods: We retrospectively identified 3,635 patients in the Vascular Quality Initiative database (2010−2012) with an AAA $\geq$ 5.0 cm who were candidates for either open or endovascular AAA repair. The Vascular Study Group Cardiac Risk Index (VSG-CRI) was used to stratify patient risk. We applied generalized estimating equations with inverse probability weighting (IPW) to adjust for patient factors and hospital-level CST utilization to evaluate the effect of CST on composite of 30-day major adverse cardiac events or mortality (MACE-M) following AAA repair.

Results: CST was utilized in 1,627 (45%) patients during AAA workup, including 451 of 794 (57%) patients selected for open repair and 1,176 of 2,841 (41%) selected for endovascular repair. After IPW, the use of CST was not associated with the probability of patients receiving open versus endovascular repair (OR: 1.00; 95% CI: 0.77−1.32). As compared to patients without CST during AAA workup, adjusted analyses revealed that CST utilization was not associated with improved MACE or mortality outcomes following AAA repair. Among patients receiving CST, an abnormal CST was not significantly associated with selection of open versus endovascular repair or with postoperative outcomes after adjustment for the VSG-CRI score. Similar results were found for patients with either low or high VSG-CRI scores.

Conclusions: Utilization of CST during workup for AAA is not associated with procedure selection and improved outcomes. Identifying risk factors for individuals who would benefit from preoperative CST before AAA repair will help reduce health care utilization and improve postoperative outcomes.

INTRODUCTION

The preoperative evaluation is critical for patients diagnosed with abdominal aortic aneurysms (AAAs). Anatomical features of AAAs must be thoroughly assessed as well as each patient's physiological status and level of operative risk. This includes evaluating established cardiac risk factors that are known to

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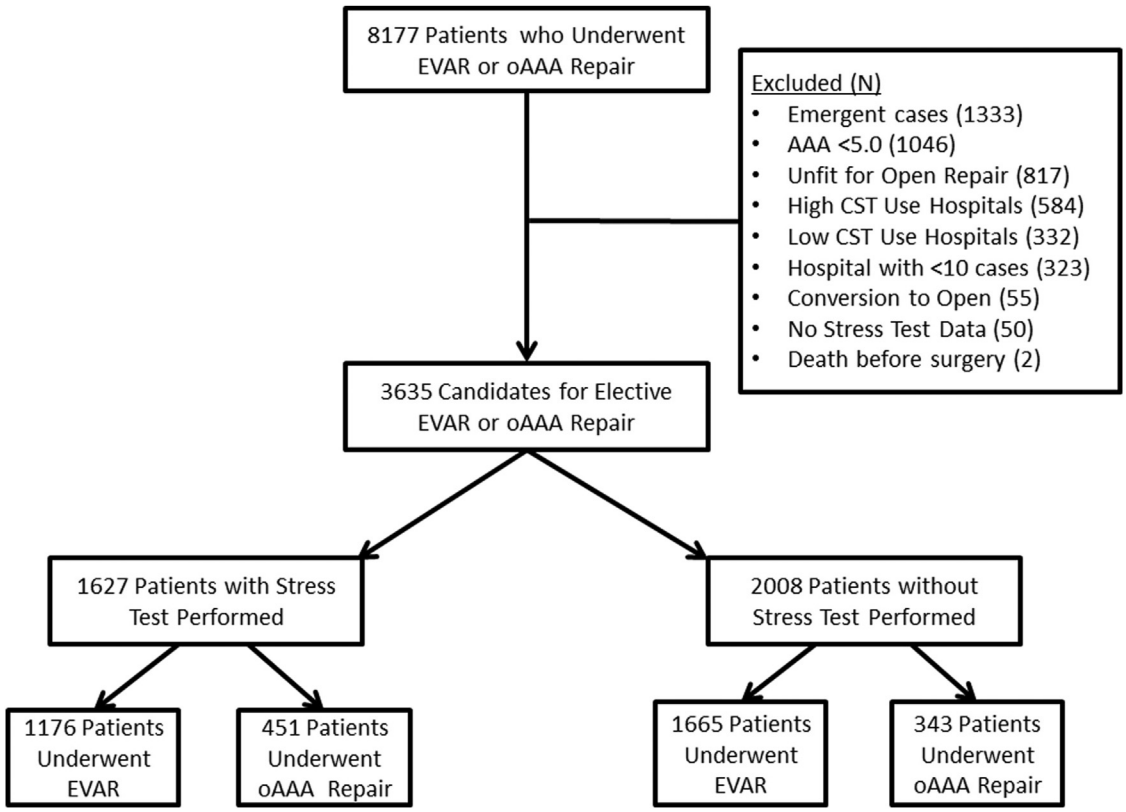

Fig. 1. Selection of patient cohort with AAAs $\geq$ 5.0 cm who were candidates for either EVAR or oAAA. Patients are stratified by whether a preoperative CST was performed and then whether they underwent EVAR or oAAA repair.

increase the risk of having a perioperative complication, as well as physiological reserve across multiple organ systems needed to tolerate major vascular surgery.[1,2] Together, these variables help vascular surgeons to determine whether a patient is a candidate for an open AAA (oAAA) repair or better suited for undergoing endovascular aneurysm repair (EVAR).

Cardiac stress testing (CST) is often used as part of the preoperative evaluation for patients with AAA to assess cardiac risk stratification and guide operative decision-making, although its value is controversial.[3–5] The utilization of CST is predicated on the ability to predict whether patients will have an adverse cardiac event while under perioperative stress and then determine whether patients are better suited for EVAR or oAAA repair.[6] For a patient who is anatomically suitable for either operation, performing a CST may provide sufficient data for a surgeon to recommend either a lower risk operation (EVAR) or a high risk operation (oAAA repair).

The extent to which utilization of CST influences preoperative decision-making for patients with AAA is unclear. We hypothesized that if preoperative CST helps vascular surgeons to optimize patient selection for oAAA versus EVAR, its utility should be expected to improve patient outcomes at hospitals that offer both operations. The present study examined whether preoperative utilization of CST among nationwide Vascular Quality Initiative (VQI) centers improves patient selection for EVAR versus oAAA and consequently reduces adverse cardiac events and mortality outcomes following surgery.

METHODS

Data Source and Patient Population

We used the Society of Vascular Surgery Patient Safety Organization[7] data set to identify all patients who underwent EVAR or oAAA repair at hospitals participating in the nationwide VQI between January 2010 and December 2012. To be included in analysis, all patients needed to have an AAA $\geq$5.0 cm, have data on whether a preoperative cardiac stress test was performed prior to their operation, and be a candidate for either oAAA or EVAR (Fig. 1). For patients who underwent multiple operations, only the first procedure was included in our