Does Epiaortic Scanning Help with Outcomes?

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Upon completion of this session, the participant should be able to:

- State the perioperative complications that occur due to aortic atherosclerosis
- Describe the role of epiaortic scanning in influencing outcomes

Introduction

The importance of aortic atherosclerotic plaques to the development of strokes has not always been recognized. Carotid artery plaques and thrombus formation due to atrial fibrillation have been widely accepted risk factors for almost 50 years. However, as recently as 1989, more than 40% of cerebral infarctions were still listed as “of undetermined cause.”(2) Visualization of atherosclerotic plaques in the aortic arch using TEE helped to identify another important source of cerebral embolism.(3) Today, it is recognized that aortic arch plaques ≥4 mm are at high risk for embolization and are the second biggest risk factor for embolic stroke after atrial fibrillation.(4)

Limitations of TEE

Unfortunately, identification of aortic arch plaques by TEE cannot assess the total atherosclerotic burden in a patient. TEE has an inherent blind spot in the distal ascending aorta due to bronchial interposition. As much as 40% of the length of the ascending aorta cannot be seen.(5) The proximal arch is also poorly visualized. This is particularly problematic in cardiac surgery, since these areas are typical sites for aortic cannulation and cross-clamping. Direct surgical palpation of these areas is not helpful either, as this generally detects less than 50% of clinically relevant atherosclerotic plaques.(6) Intraoperative scanning of the ascending aorta using 2D ultrasound was first reported in the late 1980’s.(7) Since that time, several studies have been published demonstrating the superiority of epiaortic scanning to TEE for the detection of complex atheromatous plaques in the ascending aorta during cardiac surgery.(8-10)
Epiaortic Scanning

The American Society of Echocardiography released guidelines for a comprehensive epiaortic examination in 2008.(11) Using either a phased array or linear array probe in a sterile sheath, the surgeon interrogates the aorta in short axis from just distal to the sinotubular junction up to the innominate artery origin. Then, by turning the probe 90°, the proximal arch is seen in long axis. Because use of a phased array transducer requires a 1cm stand-off to prevent reverberation artifact, it is often difficult for the gloved surgeon to distinguish where the notch on the probe is. It should be remembered that the SVC will be to the right of the aorta, despite whatever side of the screen it is displayed on.

Atherosclerotic plaques will appear as thickening within the lumen of the aorta. When they are identified, the thickness should be measured and any mobile components noted.
Grading System

There have been several grading systems used to communicate the severity of the atherosclerotic plaques. This is obviously important for research and risk stratification purposes. It appears that identification of plaques $\geq 3$mm and those $>5$mm or mobile is important with respect to clinical outcome. (12)

Although originally applied to plaques identified by TEE, the system by Katz et al is still commonly used in the intraoperative setting with epiaortic scanning as well. (13)

Application of Epiaortic Scanning in Cardiac Surgery

Identification of aortic plaques is important from a prognostic standpoint. Davila-Roman et al studied almost 2000 patients undergoing cardiac surgery. Those with moderate (Katz grade III) or severe (Katz IV or V) disease had significantly reduced neurological event-free survival. See graph at right. (14) All-cause mortality also increased as atherosclerosis severity increased.

Obviously the goal of identifying high-grade disease is to somehow alter management in the hopes of decreasing the risk of an embolic event. The list of surgical alterations varies in order of conservative (altering cannulation/cross-clamp site) to very aggressive (replacing the aorta under hypothermic arrest). It currently remains unclear what strategy is best.

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**The Katz grading system of plaque severity**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Definition</th>
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<tbody>
<tr>
<td>I</td>
<td>Normal to mild intimal thickening</td>
</tr>
<tr>
<td>II</td>
<td>Severe intimal thickening without protruding atheroma</td>
</tr>
<tr>
<td>III</td>
<td>Atheroma protruding 3 to 5 mm into lumen</td>
</tr>
<tr>
<td>IV</td>
<td>Atheroma protruding $&gt;5$ mm into lumen</td>
</tr>
<tr>
<td>V</td>
<td>Any thickness with mobile component</td>
</tr>
</tbody>
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**Possible management options in high grade ascending aortic atherosclerosis. From(1)**

- Minimize aortic manipulation
- Change aortic cannulation (femoral or axillary)
- Avoid proximal anastomoses (all arterial grafts)
- Avoid aortic crossclamping (hypothermic fibrillatory arrest)
- Off-pump CABG (using “no touch” technique)
- Alternate aortic cannula (low turbulence or deployable filter)
- Aortic atherectomy under DHCA
- Replace aorta under DHCA
Key Points

- Atherosclerotic plaques represent a major source of embolism, and a significant contributor to stroke post-cardiac surgery
- TEE cannot adequately visualize the distal ascending aorta or proximal aortic arch, which are commonly manipulated during surgery
- Epiaortic scanning overcomes TEE’s blind spot and is complimentary in plaque identification
- A variety of surgical modifications can be done when significant plaques are identified
References