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Case Image

Silent Cerebral Microembolism during Coronary Artery Bypass Graft Surgery

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CLINICAL IMAGE

A 62 year-old man with known coronary artery disease underwent a three-vessel CABG after a positive exercise tolerance test revealed reversible ischemic changes. Transcranial Doppler ultrasonography (TCD) and transesophageal monitoring (TEE) were used intraoperatively for monitoring of high-intensity transient signals (HITS), representing both gaseous and particulate cerebral emboli. Non-pulsatile flow was initially seen in the proximal middle cerebral arteries on TCD while the patient was on bypass (Video). Although the single aortic cross clamp technique was used to reduce aortic arch manipulation and release of solid microemboli from the aortic wall, release of the clamp allowed introduction of multiple gaseous microbubbles into the left ventricle and aorta as seen by TEE (Figure 1, Video). This shower of microbubbles was then detected in the proximal middle cerebral arteries as HITS by TCD monitoring (Figure 2, Video). Post-operatively, the patient did not demonstrate a detectable neurologic deficit.

DISCUSSION

It has been shown previously that cerebral microembolism during cardiopulmonary bypass may negatively impact cognition in the post-operative period [1-3]. For this reason, intraoperative monitoring of HITS by TCD has been used to define the amount of cerebral microembolism that occurs during CABG [1,3]. TCD monitoring is able to detect both air and particulate microemboli as they enter the intracranial circulation, and TEE has emerged in the past decade as a tool to assess the intra-cardiac microembolic load during surgical and peri-operative procedures [4]. Although

Figure 1 TEE demonstrating left ventricular and aortic root microbubbles (arrows).

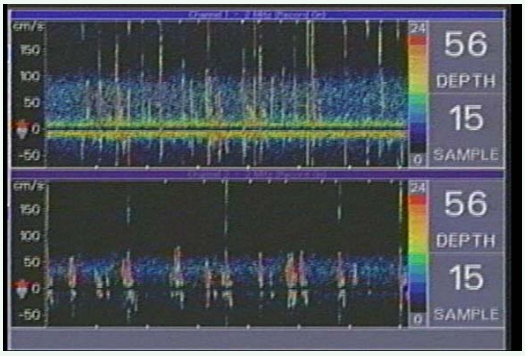
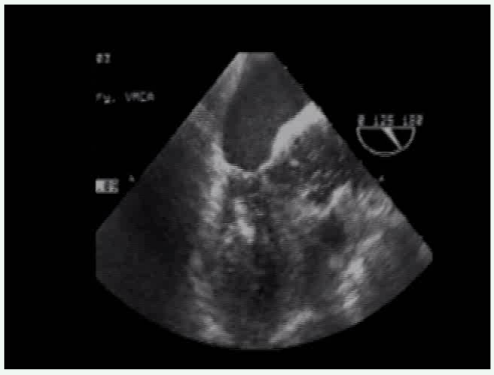


Figure 2 TCD demonstrating cerebral microemboli in the left (top) and right (bottom) middle cerebral arteries.



Video 1 Gaseous microbubbles entering the left ventricle and aortic root during bypass are seen with TEE monitoring. TCD initially shows non-pulsatile flow, with subsequent cerebral microembolism in both middle cerebral arteries after release of the aortic clamp.

an overall reduction of cerebral microemboli with the use of proximal aortic anastomosis and membrane oxygenators has occurred, further improvements in peri-operative technique can be achieved with the use of TEE and TCD [1,2,5,6]. For example, intraoperative TCD monitoring of perfusionist interventions during the course of CABG can provide feedback information regarding microembolic load and lead to real-time adjustment to reduce gaseous microemboli introduced into the heart chambers [1,6]. It may also lead to further logistical improvement in the use of bypass, such as changing the position of aortic cannula placement in order to reduce cerebral microemboli [7]. However, large studies have yet to be completed to show whether such intervention can improve clinical outcomes.

TEE and TCD monitoring allow the detection of silent cerebral microembolism during CABG. This case illustrates how monitoring can clarify the impact of intraoperative technique on the microembolic process.

DISCLOSURES

The authors of this study have no disclosures and attest that they have full control of the design of the study, creation of images and videos, and production of the written report.

REFERENCES

1. Martin KK, Wigginton JB, Babikian VL, Pochay VE, Crittenden MD, Rudolph JL. Intraoperative cerebral high-intensity transient signals and postoperative cognitive function: a systematic review. Am J Surg. 2009; 197: 55-63.
2. Newman SP, Harrison MJ. Coronary-artery bypass surgery and the brain: persisting concerns. Lancet Neurol. 2002; 1: 119-125.
3. Clark RE, Brillman J, Davis DA, Lovell MR, Price TR, Magovern GJ. Microemboli during coronary artery bypass grafting. Genesis and effect on outcome. J Thorac Cardiovasc Surg. 1995; 109: 249-257.
4. Shanewise JS, Cheung AT, Aronson S, Stewart WJ, Weiss RL, Mark JB, et al. ASE/SCA guidelines for performing a comprehensive intraoperative multiplane transesophageal echocardiography examination: recommendations of the American Society of Echocardiography Council for Intraoperative Echocardiography and the Society of Cardiovascular Anesthesiologists Task Force for Certification in Perioperative Transesophageal Echocardiography. Anesth Analg. 1999; 89: 870-884.
5. Scarborough JE, White W, Derilus FE, Mathew JP, Newman MF, Landolfo KP; Neurological Outcome Research Group. Combined use of off-pump techniques and a sutureless proximal aortic anastomotic device reduces cerebral microemboli generation during coronary artery bypass grafting. J Thorac Cardiovasc Surg. 2003; 126: 1561-1567.
6. Borger MA, Feindel CM. Cerebral emboli during cardiopulmonary bypass: effect of perfusionist interventions and aortic cannulas. J Extra Corpor Technol. 2002; 34: 29-33.
7. Müllges W, Franke D, Reents W, Babin-Ebell J, Toyka KV. Reduced rate of microembolism by optimized aortic cannula position does not influence early postoperative cognitive performance in CABG patients. Cerebrovasc Dis. 2003; 15: 192-198.

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