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(SHORT COMMUNICATION)

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Introducing the A-view endotracheal balloon in cardiac surgery: Guiding the surgeon

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Abstract

Stroke is serious modus for death following cardiac surgery. For twothird it is contributed to unloosend particles from atherosclerotic plaques in the ascending aorta ending up in the brain. Using regular trans esophageal echocardiogram (TEE) does not provide adequate information of the distal ascending aorta due to air in the trachea ('Blind Spot'). The quality of the distal ascending aorta is of great importance to the cardiac surgeon as the aorta is maltreated by inserting a cannula for connection to the heart-lung machine and clamping to provide a bloodless operation field. The mission ahead is to improve real-time diagnostic information of the distal ascending aorta before opening the chest and providing the surgeon the opportunity to execute safe and reliable care. By replacing air in the trachea for the A-View saline filled endotracheal balloon, crucial information is obtained during TEE-imaging of the fully anesthetized cardiac patient. With this information at hand, the anesthesiologist may guide the surgeon to execute the best and safest operation.

Keywords: A-View; Brain injury; Stroke; Cardiac surgery; Imaging technique; Safety

1. Introduction

Cardiac surgery is a highly complex, culture determinative domain. Over the years the concept of safety in cardiac surgery has evolved from merely technical aspects to gradually focusing on non-technical interactions and skills. (1-4) The Safety I concept shifted from 'Who is to blame' to Safety II, emphasizing 'What is the circumstantial contribution". (5) A major step forwards has been made by aiming at preventing events from happening. (2,5) Secondly, culture barriers and years of routine that prevent incorporating new techniques have to be addressed. Although this is a slow and multifactorial process, significant progress has been made. (3) Crucial in the evolvement of 'the change process' is replacing the old solitary 'hero culture' for a multidisciplinary responsibility, fully aiming at the benefit of the cardiac patient.

One of the detrimental complications of heart surgery is the occurrence of brain injury like stroke which has been reported to occur in 3-7% of the cases. (6) A lower incidence of 1.3% was reported in a recent review, solely focused on CABG. (7) Stroke may result in death or a debilitating situation, reduced life expectancy, and high costs in the care process. Other, more subtle manifestations include loss of concentration, character changes, attention deficit, memory loss, or the early occurrence of dementia. The cause for stroke following cardiac surgery is predominately related to particles that embolize from the aorta to the brain. (6) When postoperative stroke does occur in patients undergoing CABG, mortality is tenfold increased. Unfortunately, non-fatal presentations of post-operative cerebral complications are often regarded as 'all in the game' or 'normal' in cardiac surgery.

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Figure 1 The endotracheal A-View balloon catheter

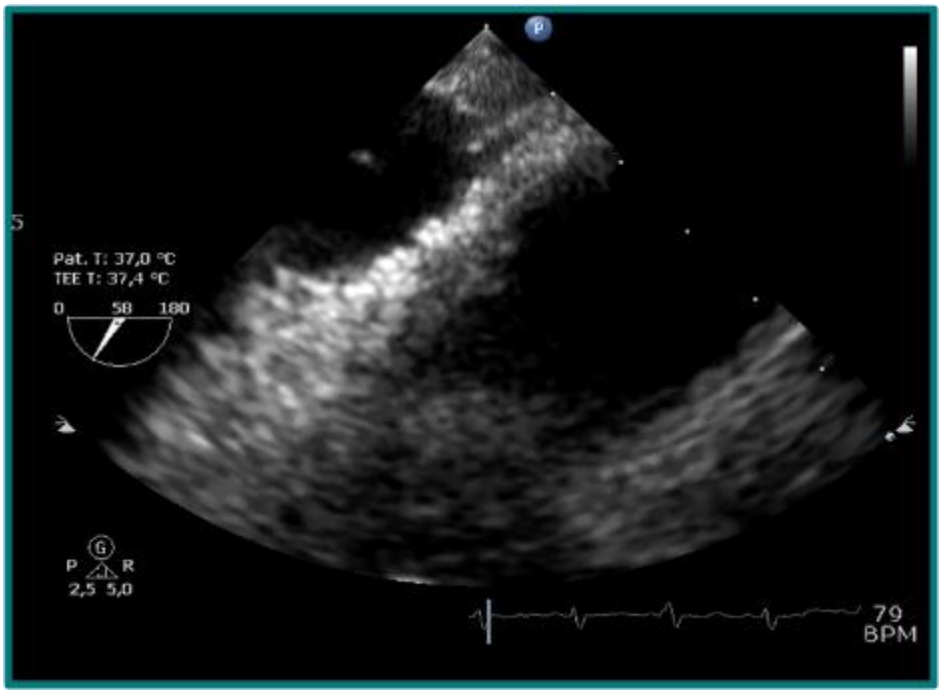

Figure 2 TEE-A-View image of the distal ascending aorta ('Blind Spot') with the A-View balloon inflated in the trachea (upper left), showing (central) the presence of a Grade IV plaque**.**

In order to perform a surgical cardiac procedure, especially when a heart-lung machine is used, it is necessary to 'maltreat' the ascending aorta to a certain extent. Inserting an aortic cannula for connection to the heart-lung machine emphasizes the importance of obtaining information of the quality of aorta first. In most cardiac surgery centers, pre-operative CT- or MRI-scanning of the aorta in patients older than 70-75 years undergoing elective cardiac surgery has become mandatory. However, soft plaques cannot be identified properly, and the information is not procured real-time. Epi-aortic scanning has the disadvantage of opening the chest first and in case of finding a 'hostile' aorta, the sternum may have to be closed without performing the actual procedure. Also, the timing of epi-aortic scanning, just before the moment of cannulation, makes it challenging to adapt the surgical strategy. Wanting to stick to planned and routine procedures, differences in level of competency or experience, team composition, and aspects in behavior and culture elements, may prevent choosing for the safest strategy just prior to the start of the procedure. (9,10) Instead of a no-touch technique, manual 'inspection' by the surgeon's fingers does not only carry a low percentage of sensitivity of twenty percent, but may inflict dislodgement of plaque material, resulting in emboli to the brain, resulting in stroke. Furthermore, unpalpable soft plaques, attached to the inner surface of the aorta, remain undetected in this manner of 'inspection'. (Figure 2.)

For all surgical cardiac procedures, peri-operative endoscopic imaging of the heart and its main vessels is routinely performed using transesophageal electrocardiography (TEE). However, obtaining information of the distal part of the aorta is blocked by air in the trachea and left main bronchus, thus described as the 'Blind Spot'. (8) To overcome the blind spot artefact, surgeons have used earlier mentioned methods to form an idea about the presence, location and extent of atherosclerosis in the distal ascending aorta.

To overcome the air artefact in the trachea and resolving the 'Blind Spot', a saline inflatable A-View balloon was invented. (8, Figure 1.) Its value was demonstrated not only in routine open chest cardiac procedures but also in closed chest transcatheter aortic valve replacement and aortic dissection. Important features for the cardiac surgeon like the exit tear, the re-entry tear, the blood flow in the real- and false lumen, and the possible involvement of the cerebral vessels can be clearly identified. Especially in emergent situations where hemodynamic unstable patients are rushed to OR and CT-scanning is not an option anymore. By using the A-View balloon a 30% reduction in thirty-day propensity-matched mortality was established. (9) Unpublished data have demonstrated that none of these deaths were caused by brain damage. In the trial, surgeons adapted their procedures to their own discretion. Due to these results, a systematic approach was formulated, and a short checklist was introduced to be used just prior to the operation. (10) This short check list systematically addresses the risk-profile of the patient according the EuroSCORE, appointing the most relevant medical features, combined with real-time findings on TEE or TEE-A-View when indicated. Undertaking a randomized control trail between an A-View group and a non-A-View group seems logic, however this may seem rather unethical as a reduced mortality has been demonstrated already in an A-View group. (9) Important to notice for the ever hasty surgeon is that assessing A-View information does not hinder the workflow because it takes only two to three minutes by the anesthesiologist with TEE-experience. With this information at hand, it is suggested to discuss 'the flight-plan', between the anesthesiologist and the surgeon. This means a role change for the surgeon from a routinely executor to a flexible member of the OR-team, guided by crucial and real-time TEE A-View acquired information in pursuit for the safest route and the best patient outcome. (2, 9, 10)

2. Conclusion

Although post operative stroke is multicausal, it is for two third attributed to embolic particles disloged from the ascending aorta. Cardiac surgeons should undertake every possible step in preventing brain injury and improving outcome. It should be realized that a new diagnostic tool, the A-View balloon, contributes crucial TEE-information of the quality status of the distal ascending aorta and arch where merely TEE leaves surgeons with a 'Blind Spot'. Therefore, disregarding the importance and use of A-View endotracheal balloon in cardiac surgery and continue performing operations 'as planned' might not be the best treatment in the evolving area of surgical care.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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