CASE REPORT

Intraoperative transoesophageal echocardiographic diagnosis and successful management of mycotic aortitis and pseudoaneurysm

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SUMMARY

A 38-year-old intravenous drug using man was scheduled for urgent pericardial window surgery to treat pericardial effusion and tamponade. Transoesophageal echocardiography (TOE) during the procedure revealed a minor residual effusion and an atypical heterogenous thickened appearance of the pericardium and adjoining aortic root. Interrogation of the aortic valve with a 'panning' manoeuvre from the mid-oesophageal aortic valve short axis view showed a small hypoechoic lesion between the right and non-coronary cusp at the level of the sinus of Valsalva. Postoperative high-resolution contrast CT confirmed the anaesthesia TOE findings of a small pseudoaneurysm. The decision was then made to proceed to formal aortic root replacement after 5 days of directed antibiotic therapy and evidence of an increase in aneurysm size to 2.7 cm on repeat CT angiogram. The patient made a good postoperative recovery and was eventually discharged from the hospital 3 weeks after his second operation.

BACKGROUND

Mycotic aortitis is a rare but usually fatal disease. We describe a case of mycotic aortitis and pseudoaneurysm diagnosed during routine intraoperative transoesophageal echocardiography (TOE). Subtle changes detected during a 'panning' manoeuvre from the mid-oesophageal aortic valve short axis view in the aortic root led to early diagnosis, and progress of the disease was monitored with serial ultrasound and radiological imaging, with the decision for definitive surgical management based on the changes observed. Diagnostic criteria for the disease, controversies surrounding timing of surgery and the role of the anaesthetist as an echocardiographer are discussed, and recommendations made.

CASE PRESENTATION

A 38-year-old man with an active history of intravenous drug use was scheduled for the urgent creation of a pericardial window to treat effusion and tamponade. The patient presented with right upper quadrant pain, and was initially admitted to a general surgical unit for suspected cholecystitis. Three days later he deteriorated with high fevers, shortness of breath and worsening oxygen saturation on room air. Serial ECGs were unremarkable except for sinus tachycardia. Transthoracic echocardiography (TTE) showed a moderate pericardial effusion but no evidence of endocarditis or aortic

abnormality, and there was no growth evident in two separate sets of blood cultures. A subsequent chest X-ray and a chest CT demonstrated bilateral pleural effusions and pericardial effusion, and while percutaneous pericardiocentesis did not mitigate cardiac tamponade, it revealed the causative organism to be methicillin resistant *Staphylococcus aureus* (MRSA). The patient was subsequently transferred to the care of the cardiothoracic unit and proceeded to surgery.

The patient was 178 cm tall and weighed 92 kg. Induction and maintenance of general anaesthesia was unremarkable, with 150 mg intravenous ketamine and 100 mg suxamethonium used for induction. The trachea was intubated and the patient kept paralysed with 10 mg of cisatracurium. Marked systolic pressure variation of 35 mm Hg (between 125 and 90 mm Hg) noted preinduction was mitigated to 7 mm Hg postinduction. Intraoperative TOE was performed to confirm adequate clearance of the effusion and as an intraoperative haemodynamic monitor. Pericardial window surgery was successful however the intraoperative TOE findings suggested early mycotic aortitis and pseudoaneurysm formation. Owing to the patient's degree of systemic sepsis and the increased risk of mortality when undergoing prolonged cardiopulmonary bypass in this condition, the surgical team's decision was to trial further directed antibiotic therapy rather than proceed with urgent sternotomy and aortic root replacement.

TOE was repeated by the cardiology team and the diagnosis of mycotic aortitis was confirmed. Pericardial biopsy confirmed the causative organism as MRSA. After 5 days of intravenous vancomycin and rifampicin, the patient remained in the intensive care unit with unchanged inotrope requirements and persistent fluctuating temperatures. Serial TTE examinations of the aneurysm and a repeat CT angiogram demonstrated an increase in aneurysm size to 2.7 cm, leading to the decision to proceed to formal aortic root replacement.

INVESTIGATIONS

Pericardial fluid microscopy and a culture after initial pericardiocentesis identified the causative organism as MRSA. This was confirmed with the fluid and pericardial tissue specimens obtained at the time of the pericardial window procedure. No blood cultures revealed growth throughout the patient's admission.

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Comprehensive intraoperative TOE examination after completion of the pericardial window revealed a minor residual effusion and an atypical heterogeneous thickened appearance of the pericardium and adjoining aortic root. By gently withdrawing the probe in a stepwise manner from the American Society of Echocardiography/Society of Cardiovascular Anesthesia (ASE/SCA) standard mid-oesophageal aortic valve short axis view, sections of the aortic root at the level of the sinuses of Valsalva showed a small hypoechoic lesion between the right and non-coronary cusp (figure 1). Though no flow was demonstrated within the lesion on colour flow Doppler examination, the anaesthesia team remained highly suspicious that the lesion was aneurysmal.

Postoperative high-resolution contrast CT (HRCCT) and three-dimensional reconstruction confirmed the anaesthesia TOE findings of a small pseudoaneurysm at the location described (figure 2 and video 1).

Over the next five postoperative days, serial TTE examinations of the aneurysm and a repeat CT angiogram demonstrated an increase in aneurysm size to 2.7 cm.

Intraoperative TOE examination at the time of reoperation demonstrated a larger aortic root aneurysm with old thrombus and spontaneous echo contrast within the aneurysm cavity, and worsening of the periaortic inflammatory changes (see figure 3). Surgical conditions were adverse with the right atrium and great vessels encased in inflamed tissue; femoral bypass cannulae were required. Aortic root replacement had been planned but the proximal aorta proved impossible to mobilise, so the pseudoaneurysm was excised and the defect patched by anterior mitral valve leaflet homograft.

TREATMENT

After 5 days of intensive care management, directed antibiotic therapy and supportive care, the decision was made to proceed to formal aortic root replacement based on the patient's stagnant clinical state and expanding pseudoaneurysm.

OUTCOME AND FOLLOW-UP

The patient made a good postoperative recovery and was eventually discharged from the hospital 3 weeks after his second

Figure 2 CT angiogram three-dimensional reconstruction performed at day 1 postoperatively. The pseudoaneurysm is seen as a small outpouching between the right and non-coronary sinuses of Valsalva. Asc Ao, ascending aorta; LA, left atrium; PSA, pseudoaneurysm; RA, right atrium; RV, right ventricle.

operation. Six months later he was readmitted with methicillin sensitive *S aureus* sternal soft tissue infection, which was successfully debrided and healed well by secondary intention, and remains well more than 2 years later.

DISCUSSION

Mycotic aortitis is a rare disease that is always fatal if left untreated. Although the term 'mycotic' suggests an exclusively fungal cause, *Mycobacterium tuberculosis*, *Treponema pallidum* and *Salmonella* species¹ were responsible organisms in the pre-antibiotic era; however, currently they are most likely to be *S aureus*, *Streptococcus* species or *Enterococcus* species. Fungal

Figure 1 Intraoperative transoesophageal echocardiography mid-oesophageal aortic valve short axis view showing the early pseudoaneurysm. The lesion appears very briefly within the scanning plane at the beginning of the clip. Also note further thickened tissue around the aortic root and anterior to the right ventricle. AV, aortic valve; LA, left atrium; PSA, pseudoaneurysm; RA, right atrium; RV, right ventricle.

Video 1 CT angiogram three-dimensional reconstruction performed at day 1 postoperatively. The pseudoaneurysm is seen as a small outpouching between the right and non-coronary sinuses of Valsalva.

Figure 3 Intraoperative transoesophageal echocardiography mid-oesophageal aortic valve short axis view during aortic root repair showing grossly enlarged pseudoaneurysm. AV, aortic valve; LA, left atrium; PSA, pseudoaneurysm; RV, right ventricle.

aortitis is more common in the immunosuppressed patient, post-percutaneous coronary intervention² or postcannulation for cardiopulmonary bypass. Intravenous drug users, those with existing aortic prosthesis or existing aneurysms,³ and those with severe atherosclerosis are also at risk.⁴ Pseudoaneurysm formation in mycotic aortitis usually begins with necrotic ulceration of the intima⁴ and if left untreated the aneurysm invariably progresses to rupture or dissection.

Diagnosis is difficult because of the generic nature of presenting symptoms. In most cases the patient presents with high swinging temperatures and migratory abdominal, chest or back pain, but with no apparent cause. Early imaging with echocardiography, HRCCT scanning or MRI provides the most reliable diagnostic yield. TOE features include aortic wall thickening, visualisation of aneurysm and features of dissection—periaortic haemorrhage, false-lumen thrombus or smoke and dissection flap.

Owing to the rarity of the disease, few evidence-based management guidelines exist. Current expert opinion recommends early targeted antibiotic therapy and replacement of the length of the affected aorta.³ Mortality rates are up to 90%⁵ with medical treatment alone and 62% with combined medical and surgical treatments. Early diagnosis and treatment before pseudoaneurysm formation improve mortality to less than 25%.³ If the diagnosis is missed until a mycotic aneurysm ruptures, mortality with combined treatment is higher than 65%.⁶

The decision on timing of surgery is straightforward with the extremes of clinical presentation. Those who present with profound septic shock and grossly dilated aneurysms are operated on emergently, however those with preaneurysm or early aneurysm formation and are clinically stable present a more difficult management situation. Hsu and Lin⁷ in their case series of 32 patients recorded a mortality of 38% where the mean time of presurgical antibiotic therapy was 8 days. Ting *et al*⁶ in their case series of 10 patients reported a 36-month mortality of 20% using an approach where, if the aneurysm was unruptured and the patient was stable, targeted antibiotic therapy was maintained until sepsis was controlled before surgery.

Our approach in this case was to attempt to control sepsis but to intervene when serial echocardiography and imaging revealed a rapid increase in aneurysm size (G Matalanis, personal communication). Unlike true aneurysms, guidelines on when to start

surgery based on pseudoaneurysm size do not exist. Indeed, in Hsu and Lin's⁷ series the mean pseudoaneurysm size at operation was 4.5 cm, with mortality rates almost half that reported in Lopes *et al*'s³ systematic review.

The role of the anaesthetist as an intraoperative echocardiographer was critical in making a diagnosis in this case. Anaesthetists who specialise in cardiac anaesthesia obtain additional examination-based accreditation in TOE and are required to perform and report over 100 supervised perioperative studies. The application of TOE by anaesthetists in cardiac and non-cardiac surgery continues to increase, and while the cardiac surgical casemix that echo-anaesthetists are exposed to may limit their 'optical mileage', the unique diagnostic window offered by the use of intraoperative TOE reinforces the need to maintain a high index of suspicion for rare diseases such as in this case. Application of a comprehensive TOE examination, the use of 'panning' manoeuvres and the use of standard and non-standard views to further elucidate unusual features were of utmost importance in obtaining the diagnosis in this case. 'Panning' refers to gentle TOE probe movements at right angles to the sector scan rotation, allowing the sonographer to 'pan through' perpendicular sections of a feature of interest. This technique is otherwise known as 'dynamic echo imaging'. When features are of uncertain significance, the involvement of medical colleagues who may have alternative TOE casemix exposure is crucial in avoiding a missed diagnosis. Our approach to the timing of surgery in relation to general patient condition and the rate of aneurysm enlargement demonstrates that a period of expectant management may be ideal for patient outcome.

Learning points

- ▶ A high index of suspicion should be maintained for the diagnosis of mycotic aortitis in patients with risk factors who present with non-specific symptoms and fever of unknown cause.
- ▶ Early use of serial transoesophageal echocardiography (TOE) or MRI/high-resolution contrast CT scanning should be considered to facilitate early diagnosis of the disease and to track its progression.
- ▶ A judicious approach to the timing of surgery for mycotic aortitis with pseudoaneurysm formation should be undertaken, taking into account patient stability, rate of aneurysm enlargement and response to targeted antibiotic therapy.
- ▶ When performed, intraoperative TOE examinations should be fully comprehensive, including non-standard views with the use of 'panning' manoeuvres, despite a seemingly narrow clinical indication.
- ▶ An echocardiologist should review the TOE findings whenever a comprehensive TOE examination suggests suspicious features that may be consistent with disease requiring early change in management.

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