CASE REPORT

Fever of unknown origin, with a twist

Ronstan Lobo,¹ Brendan Meany,¹ Rory O'Hanlon,² Thomas John Kiernan¹¹Department of Cardiology, University Hospital Limerick, Dooradoyle, Limerick, Ireland²Centre of Cardiovascular Magnetic Resonance, Blackrock Clinic, Dublin, IrelandCorrespondence to
Dr Ronstan Lobo,
doctorrlobo@gmail.com

SUMMARY

The authors present a case of an 81-year-old man with fever of unknown origin. The case report is illustrated with the images which clarified the diagnosis in this challenging case. The cardiac MR images were of critical importance in arriving at a diagnosis of aortic root mycotic pseudoaneurysm with rupture into the right ventricle.

BACKGROUND

This case highlights the importance of multimodality imaging in the investigation of patients with fever of unknown origin. We provide detailed images, videos and explain the investigative steps that were taken before the final diagnosis of a mycotic pseudoaneurysm was obtained.

CASE PRESENTATION

An 81-year-old man presents with a 1 week history of fever, chills and rigors. The patient's history included emphysema, hypertension, benign prostatic hypertrophy and previous lumbar discectomy.

Three months previously the patient had been admitted with pneumonia. Blood cultures at that time grew methicillin-sensitive *Staphylococcus aureus* (MSSA). Appropriate intravenous antibiotics were administered and the patient made an uneventful recovery.

Upon presentation, physical examination was unremarkable. Notably, no murmur was noted on auscultation nor were there stigmata of infective endocarditis. The lungs were clear to auscultation. On admission, blood cultures grew MSSA once again.

INVESTIGATIONS

On admission white cell count was elevated at $19.4 \times 10^9/l$ with predominant neutrophilia ($17.11 \times 10^9/l$). Inflammatory markers were raised with erythrocyte sedimentation rate of 91 mm/h and C reactive protein of 169 mg/l. Serology for Q-fever, mycoplasma pneumoniae, chlamydia and brucella were all negative. Chest x-ray was normal.

Transthoracic echocardiography (TTE) revealed right atrial enlargement with a broad-based mass attached to the right side of the atrial septum with an overlying mobile mass. There was also moderate-to-severe tricuspid regurgitation. A transoesophageal echocardiogram (TOE) to further define the mass was not significantly helpful.

In order to determine the aetiology and nature of the lesion, the patient proceeded to have a cardiac MRI. This revealed a mass-like effect anterior to the aortic root possibly overlying the right ventricular (RV) free wall. A communication was evident, with a suggestion of a possible ruptured

aortic abscess with evidence of pseudoaneurysm formation and evidence of thrombus (figure 1 and figure 2; videos 1 and 2). Tissue characterisation of the mass with T1, T2, Short tau inversion recovery sequence STIR and gadolinium was performed. The 'mass' was iso-intense on T2 and STIR imaging, indicating that it did not represent oedema/fluid. Late gadolinium images showed no evidence of enhancement of the mass-like structure, which rules out myocardial fibrosis, infiltration or infarction (figure 3).

A precontrast and postcontrast (CT) of the thorax was done, which revealed an enhancing irregular-shaped mass that was iso-dense to the aortic root, suspicious for a mycotic pseudoaneurysm of the aortic root with low-attenuation fluid infiltrating the surrounding mediastinal fat. It also revealed calcification of the aortic arch and descending aorta.

Aortography revealed a large pseudoaneurysm of the aorta which starts above the right coronary artery and has partially ruptured into the RV (figure 4 and videos 3).

DIFFERENTIAL DIAGNOSIS

While infective endocarditis may have been a differential diagnosis in this case, there was no evidence of same on echocardiography, nor did the patient have any risk factors for infective endocarditis such as intravenous drug use or history of rheumatic fever.

Figure 1 Still image capture of cardiac MRI on coronal orientation showing the mycotic aneurysm (MA) which arises from the aorta (Ao) with a fistula (*) draining into the right ventricle (RV) (see accompanying videos 1).

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Figure 2 Still image capture of steady-state free-precession SSFP cine in tranaxial (A) and sagittal views (B). The connection between the aorta (Ao) (just above the aortic valve) and mycotic aneurysm (MA) is clearly seen with evidence of a fistula (*). The relationship to the right ventricle is also noted (RV) (see accompanying videos 2). Ant, anterior chest wall; Post, posterior.

Cardiac malignancy was certainly a differential in this case. Certainly, primary cardiac tumour (eg, sarcoma), with invasion into the aorta would be a consideration in this case, albeit very rare. In addition, metastatic disease, with invasion into the aorta, could also be a consideration but the clinical presentation, the results of the extensive investigations, together with the significant clinical improvement after antibiotic treatment makes this diagnosis unlikely.

Finally, thrombus could also be a consideration, especially if considering a malignancy as the hypercoagulable state can predispose to thrombus formation.

TREATMENT

The patient was treated with 6 weeks of intravenous antibiotics, in liaison with the clinical microbiology service. The patient was initially treated with IV flucloxacillin, but subsequently developed renal impairment. The patient was switched to IV daptomycin and finished the 6 week course of treatment. The patient had improved significantly after treatment.

OUTCOME AND FOLLOW-UP

The patient was referred to the cardiothoracic surgical team for assessment. Evidence of a persistent fistula was obvious but there was no evidence of significant ventricular failure. As the patient was clinically well, the decision was made to observe the patient as surgical management would involve an aortic root replacement with re-implantation of the coronary arteries. This would be a high risk surgery given the patient's age and comorbidities, and would not be justified given his clinical state.

DISCUSSION

This case illustrates this uncommon but important disease that is potentially life threatening. It was very unusual because the extension of the pseudoaneurysm with rupture into the right ventricle essentially forming a left-to-right shunt, yet the patient was haemodynamically stable.

The name mycotic aneurysm was coined by Osler to describe aneurysms associated with bacterial endocarditis.¹ The term mycotic was used to describe the appearance of 'fresh fungus vegetations', although the majority of cases of mycotic pseudoaneurysms are due to Gram-positive cocci, with *S aureus* being the most common.^{2 3}

Video 1 Cardiac MRI in coronal orientation showing the mycotic aneurysm which arises from the aorta with a fistula draining into the right ventricle.

Video 2 Cardiac MRI in axial orientation showing the mycotic aneurysm with its relationship to the aortic root.

Figure 3 Tissue characterisation using cardiac MRI (A–D). T1- weighted image (A) demonstrate a complex mass arising from the anterior aspect of the aorta and overlying the RV with evidence of a fistula (*). The 'mass' has no evidence of fat. Short tau inversion recovery sequence (STIR) (B), a sequence designed to image fluid filled/oedematous regions, shows no evidence of a cystic structure. Blood passing through the 'mass' continues to give a dark signal despite representing fluid/non solid structure since it is not stagnant fluid (such as a cyst which would be bright on this sequence). Late gadolinium- enhanced images (C+D) demonstrate non enhancing regions within the structure consistent with thrombus. The combination of findings is consistent with an aneurysm with thrombus.

The risk factors for development of mycotic pseudoaneurysms include arterial injury, antecedent infection, impaired immunity (eg, in diabetics, alcoholism, immunosuppressant use and malignancy) and atherosclerosis.⁴ Our patient had two risk factors. The first being the antecedent infection, where the patient was diagnosed with a pneumonia and MSSA septicaemia 3 months prior to presentation, with the same bacterial pathogen grown on this admission. The second risk factor is atherosclerosis, which

was evident on the patient's coronary angiogram and CT thorax which showed significant calcification of the aorta. The aorta is the most common location affected primarily since it is the most frequent site of atherosclerosis.⁴ The intima is normally highly resistant to infection, but when diseased, bacteria would be able to pass into the deeper layers of the arterial wall, resulting in

Figure 4 Still image capture of aortogram on right anterior oblique orientation. Fistula (*) between mycotic aneurysm (MA) that arises from the aorta (Ao) and right ventricle (RV) is clearly seen. (see accompanying videos 3).

Video 3 Aortogram in right anterior oblique orientation. Injection of contrast delineates the mycotic pseudoaneurysm and drainage into the right ventricle can be seen.

infection, suppuration, localised perforation and pseudoaneurysm.⁴ The elderly are at particular risk of bacteraemic seeding of atheromatous plaques.⁴

There are four aetiologies for the development of mycotic pseudoaneurysms, which are direct bacterial inoculation (trauma or self-inflicted, eg, injection drug abuse), bacteraemic seeding (as in this case), contiguous infection (a foci of infection elsewhere extending to the arterial wall, eg, after hip replacement surgery) and septic emboli (direct embolisation of bacteria into the vasa vasorum of the vessel leading to vascular wall infection and mycotic aneurysm formation).⁴

Infected aneurysm of the thoracic aorta is rare.⁵ A literature search using PubMed revealed less than 30 previously reported cases of mycotic aneurysms of the aortic root. The largest cohort was reported by Feigl *et al*⁶ in their pathologic study of 20 cases. They reported one case of perforation of the pseudoaneurysm into the right atrium, which was similar to the patient in this case.

Learning points

- ▶ Mycotic pseudoaneurysm is an uncommon but important differential in a patient with fever of unknown origin.
- ▶ Look for mycotic pseudoaneurysm, especially in patients with risk factors—recent surgical intervention or intravenous drug use are not the only risk factors.
- ▶ Consider vessel wall infections especially in elderly patients who have significant atherosclerosis and present with fever of unknown origin.

Competing interests None.

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