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CASE REPORT

Pneumococcal pulmonary valve endocarditis

Apostolos Vrettos1, Paula Mota1, James Nash2, Iain Thorp3, Max Baghai4 and Adam Marzetti3

1Cardiology, East Kent Hospitals University NHS Foundation Trust, William Harvey Hospital, Ashford, UK
2Microbiology, East Kent Hospitals University NHS Foundation Trust, William Harvey Hospital, Ashford, UK
3Echocardiography, East Kent Hospitals University NHS Foundation Trust, William Harvey Hospital, Ashford, UK
4Cardiothoracic Surgery, King’s College London School of Medical Education, London, UK

Summary

Pulmonary valve endocarditis is a rare type of infective endocarditis (IE). Streptococcus pneumoniae is a pathogen that is uncommonly associated with IE. A 50 year-old male was referred to us after an incidental echocardiographic finding of a pulmonary valve vegetation. The patient had a recent admission for drainage of a scrotal abscess from which S. pneumoniae was isolated, complicated by hospital acquired pneumonia and pulmonary embolism. Analysis using polymerase chain reaction of the surgically resected mass revealed signs of 16S ribosomal DNA consistent with S. pneumoniae infection. This was an extremely rare case of pneumococcal pulmonary valve IE presenting entirely asymptotically in the absence of any known risk factors.

Learning points:

- Streptococcus pneumoniae endocarditis can present with very few symptoms or even entirely asymptotically, as in this case.
- Pulmonary valve endocarditis can affect healthy patients, even in the absence of any known predisposing risk factors or pre-existing heart conditions.
- An echocardiogram may be considered following severe infection with sepsis by pneumococci, to screen for vegetations that could evolve silently over the following weeks.

Background

This report describes a case of pulmonary valve endocarditis due to Streptococcus pneumoniae, presenting entirely asymptotically in a healthy individual. This case carries significant educational messages and promotes clinical knowledge and diagnostic reasoning by:

- Presenting a case that is unique.
- Clearly presenting our dilemmas and clinical questions in this rare case of infective endocarditis, for the management of which there is no clear guidance.

- Relating echocardiographic images with high-quality intra-operative images of the vegetation and the perforated pulmonary valve cusp causing significant regurgitation.

Case presentation

A 50 year-old male was referred to the Cardiology Department as a suspected case of endocarditis after the...
incidental finding of an echogenic mass on the pulmonary valve seen in an outpatient echocardiogram (Fig. 1). This patient had presented three months prior to this admission with pain and swelling in the left testicle for 4 days, which was confirmed to be an epididymo-orchitis on an ultrasound scan and was treated with oral ciprofloxacin for 10 days, anti-inflammatories and scrotal support. About two weeks later, the patient re-presented with fever and rigors, persistent testicular pain and swelling. Exploration revealed a left hemiscrotal abscess, which was drained and *S. pneumoniae* was isolated from the pus. Moreover, a urine antigen test was positive for *S. pneumoniae* antigen. The patient was treated as an inpatient with clindamycin IV for 8 days and ciprofloxacin orally for another 6 days. Repeated blood cultures came back as negative. This admission was further complicated by a left lower lobe pneumonia and bilateral pulmonary emboli (Fig. 2), which was treated with levofoxacin, tazocin and meropenem IV. The patient was also started on rivaroxaban 20mg daily in consultation with the respiratory team.

**Investigation**

An echocardiogram revealed mild pericardial effusion, with a maximum depth of 18 mm around the left ventricular posterior wall (Fig. 2). A repeat echocardiogram about one week later showed some improvement in the pericardial effusion, with a greatest maximum depth of 14 mm. Both scans did not show any vegetations. The patient recovered fully and was discharged home with an outpatient follow-up echocardiogram. Six weeks later, the follow-up echocardiogram revealed a suspicious echogenic mass, which was very mobile and appeared to be attached to the pulmonary valve causing turbulent flow and flow acceleration (Fig. 1). It was 21.4 × 18 mm in largest dimensions. This finding warranted admission for suspected pulmonary valve endocarditis (PVE). There was no history of congenital heart disease, valvulopathy or previous infective endocarditis, and no risk factors of immunosuppression. On examination, the patient was completely asymptomatic, with no fever, night sweats or any other constitutional symptoms. There were no stigmata of infective endocarditis. All observations were normal, and there was no evidence of sepsis. The patient’s latest blood tests showed a hemoglobin of 119 g/L, white cell count of 6.3 × 10⁹/L, neutrophils of 3.50 × 10⁹/L and a CRP of 21 mg/L. Urea, electrolytes and the liver function tests were within normal limits. Repeated blood cultures came back as negative. Additional tests for the HACEK micro-organisms as well as serology for Q-fever, Bartonella and Whipple’s disease were requested, which all came back as negative. The patient also tested negative for HIV infection. A repeat CT pulmonary angiogram did not reveal any new pulmonary emboli and showed partial resolution of the previously identified ones. In view of the typical appearance of the vegetation on the echocardiogram, as well as the presence of pulmonary arterial emboli, we decided that it was very likely that this was a case of infective endocarditis causing septic emboli. Therefore, the patient was started on amoxicillin and gentamicin IV as per local microbiology protocol. The patient was then transferred to a tertiary cardiothoracic center where the patient underwent a transoesophageal echocardiogram (TOE) and then surgical resection of the mass. The TOE showed a severely deformed pulmonary valve with a large vegetation attached on the valve and severe pulmonary regurgitation (Fig. 3). Intraoperatively, the pulmonary valve was destroyed with a large vegetation attached to it and a perforated left pulmonary valve cusp causing severe regurgitation was also revealed (Fig. 4).

**Treatment and outcome**

A 25 mm stentless bioprosthesis was implanted in the pulmonary position. The procedure was uneventful and a post-operative TOE did not show any regurgitation. Valve cultures came back as negative but polymerase chain reaction showed signs of 16S ribosomal DNA (rDNA) consistent with *S. pneumoniae* infection. The patient made a good recovery and was discharged home on IV antibiotics: cefuroxime 2g IV for 2 weeks post discharge.
Discussion

This is a rare case of PVE with a very uncommon clinical course and causative organism. There are many puzzling features that challenged our diagnostic reasoning, such as:

- What was the entry point of the organism? Potential entry sites could have been: the testicular abscess, the venous access used for IV antibiotics or a pneumonia causing chest sepsis.
- Whether pneumonia was primary or secondary to septic emboli.
- Whether there were any concomitant thrombotic emboli; the repeat CT pulmonary angiogram did not identify any further emboli, but the patient had already been started on rivaroxaban following the first episode of bilateral pulmonary embolism; however, the fact that there were still residual vascular occlusive images six weeks later might suggest vegetation material.
- Why the vegetation appears to have grown, while the patient was apyretic, having been treated with microbiology guided antibiotics?
- Whether the potential embolic risk of such large vegetation was important enough to warrant surgical intervention in the absence of signs of infection.
- Could we be certain of having achieved full sterilization of the vegetation? Should we restart antibiotics in an asymptomatic male with no evidence of infection?

In the first two admissions due to epididymo-orchitis, there was nothing to suggest the presence of infective endocarditis clinically, as well as in the two inpatient echocardiograms (done after the development of pulmonary emboli), which only showed some pericardial effusion. Cultures from the testicular abscess as well as a urine antigen test, revealed infection with *S. pneumoniae*, which is a rare causative organism of epididymo-orchitis (1). The patient’s course was complicated by chest sepsis, but no causative organism was identified in his blood and sputum cultures. Infective endocarditis was suspected following the incidental finding of a large vegetation on an outpatient echocardiogram six weeks later, which had been arranged in order to monitor for the resolution of the pericardial effusion and also based on the history of bilateral pulmonary emboli. Clinically, the patient was completely asymptomatic. According to the modified Duke’s criteria, at this point in time, the patient fulfilled 1 major (positive echocardiogram) and one minor (septic pulmonary infarcts) criteria. This classified as a possible case of infective endocarditis. We felt that the multiple and prolonged courses of IV and oral antibiotics received for the epididymo-orchitis and chest sepsis could have contributed to partial sterilization of the vegetation, the lack of systemic symptoms and the repeated negative blood cultures. We decided to commence treatment for infective endocarditis pending further discussion with the cardiothoracic surgeons with a view to obtaining a biopsy of the mass in order to establish a definite diagnosis.

![Figure 2](image1.png)
Pulmonary embolism on CTPA (left). Pericardial effusion around the left ventricular posterior wall (right).

![Figure 3](image2.png)
TOE echo showing disruption of the architecture of the pulmonary valve and a swinging vegetation attached to it (left). Pulmonary valve regurgitation was also demonstrated (right).
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Pulmonary valve endocarditis

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16S rDNA, which was the

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endocarditis has been reported once (4), and in the majority of
the cases, there is some underlying condition predisposing
to infective endocarditis; this was unlikely in our case, as
the patient had no known risk factors. Secondly, PVE is
also very rare and typically occurs in 1.5–2% of patients
hospitalized with IE (5). It is usually associated with
simultaneous involvement of other valves (6), commonly
in the context of an underlying structural heart disease.
A total of 70 cases of isolated PVE have been reported
between 1979 and 2013 (6). Clinical manifestations of
PVE commonly affect the respiratory system owing to
pulmonary septic embolization. Intravenous drug abuse,
alcoholism, sepsis, immunosuppression and catheter-
related infections or other unique aetiologies account for
the majority of predisposing factors, as well as infection
with Neisseria gonorrhoea which appears to have a particular
affinity for the pulmonary valve (7, 8, 9, 10).

Pulmonary valve endocarditis in structurally normal hearts, as in this
patient, is an extremely rare entity. Right-sided IE usually involves the tricuspid valve
rather than the pulmonary valve (11). This is possibly
due to the lower pressure gradient across the pulmonary
valve that leads to less shear stress (7), therefore causing
less valvular damage. The clinical course of PVE tends
to be less typical than that of left-sided IE and the final
diagnosis of PVE may be delayed. Typical signs of IE
may be absent as in this case, but in the majority of the
cases, the patients present with symptoms and sings of
sepsis. Four to six weeks of intravenous antibiotics are
the primary mode of treatment. Abscess formation, valve
obstruction or severe regurgitation, large vegetations at
risk of emboli formation and persistence of the infection
despite antibiotic treatment would warrant surgery
(12). Surgery for PVE is recommended in patients with
persisting vegetations >10mm after one or more clinical
or silent embolic events despite appropriate antibiotic
treatment, although it is generally not advisable in
the IVDU population (12). Surgery undertaken for the
prevention of embolism must be performed very early,
during the first few days following initiation of antibiotic
therapy, as the risk of embolism is highest at this time
(13). As with all right-sided IE, PVE has a better prognosis
than left-sided IE and most of the cases respond well to
appropriate antibiotic therapy (14).

In conclusion, this is the first confirmed case
of pneumococcal pulmonary valve endocarditis,
following pneumococcal orchitis, presenting entirely

Figure 4
Intraoperative photograph of gross surgical findings demonstrating the
large vegetation (arrow) attached to the pulmonary valve (left).
Intraoperative photograph showing a perforated left pulmonary valve
cusp (right).

view of the size of the vegetation, the embolic risk had to be
considered. The ESC guidelines for the management
of infective endocarditis do not clearly state the role of
surgery when the pulmonary valve is infected (2). After
discussion with our cardiothoracic surgical colleagues,
it was decided to proceed with urgent inpatient surgical
resection of the mass. The results from the histological
analysis of the sample confirmed the presence of infective
endocarditis. Interestingly, the PCR analysis of the valve
tissue revealed S. pneumoniae 16S rDNA, which was the
same causative organism as the one identified in the
scrotal pus and the one that was suggested from the
positive urine antigen test. With that evidence, the patient
now fulfilled the Duke’s criteria of infective endocarditis.

The entry point of the offending organism was another
puzzling feature in this case. Although the scrotal abscess
could potentially be the entry point of the infection,
there has never been a report of streptococcal endocarditis
secondary to testicular infection. Primary pneumococcal
orchitis is also extremely rare. In fact, during the course
of pneumococcal septicaemia due to endocarditis,
bacteria may reach many sites where they can multiply
and produce purulent lesions. Pneumococcal arthritis,
vertebral osteomyelitis, ophthalmitis and orchitis may
be produced this way (1). However, in our case, there was
no evidence of endocarditis at the time of the first illness
due to epididymo-orchitis (the patient had 2 inpatient
echocardiograms, which did not reveal any obvious
vegetations). Right-sided infective endocarditis presenting
with systemic illness and testicular swelling, orchitis and
pulmonary emboli due to Staphylococcus aureus tricuspid
endocarditis has been reported once (3), but there are

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asymptomatically in the absence of any known predisposing risk factors. An extensive literature review could not identify any similar case. It suggests that an echocardiogram may be recommended following severe infection with sepsis by pneumococci, to screen for vegetations that could evolve silently over the following weeks.

Declaration of interest
The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of this case report.

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Patient consent
Written informed consent has been obtained from the patient.

Author contribution statement
Dr Apostolos Vrettos performed a literature review and wrote up the case. Dr Paula Mota, Dr James Nash, Iain Thorp, Max Baghai and Adam Marzetti assisted with the literature review and provided expert input on their relevant fields (Cardiology, Microbiology, Echocardiography and Cardiac Surgery).

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