RIGHT-SIDED NATIVE ENDOCARDITIS WITH SEPTICPULMONARY EMBOLISM : CASE REPORT AND IMAGING FINDINGS

ENDOCARDITE INFECTIEUSE DROITE AVEC EMBOLIE PULMONAIRE SEPTIQUE : CAS CLINIQUE EN IMAGERIE

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Abstract

The diagnosis of right-sided infective endocarditis (RSIE) is often challenging. A positive outcome depends on rapid diagnosis, accurate risk stratification, and thorough follow-up. Imaging plays a key role in achieving these steps.

We report the case of a 50-year-old male with diabetes insipidus, hypertension and renal failure. He had history of intravenous drug misuse. Transesophageal echocardiography (TEE) was performed and revealed an oscillating mass over the leaflets of the tricuspid valve and moderate tricuspid regurgitation. The chest computed tomography (CT) scan revealed septic pulmonary embolism with pulmonary infarctions. Retrospectively, ECG-gated multidetector-row CT revealed thickening of the tricuspid valve leaflets, dilated right atrium, and pericardial effusion. The patient was diagnosed with right-sided endocarditis and septic pulmonary embolism. He was medically treated without surgical intervention.

This report aims to demonstrate the pivotal role of radiologic findings in infectious endocarditis (IE), both in the diagnostic phase and in the evaluation of the dispersion of the infection.

Key - words: Right-sided infective endocarditis; Septic pulmonary embolism; Pulmonary infarction

Résumé

Le diagnostic de l'endocardite infectieuse droite est souvent difficile. Une bonne prise en charge dépend d'un diagnostic rapide, d'une stratification précise des risques et d'un suivi approfondi. L'imagerie joue un rôle clé dans la réalisation de ces étapes.

Nous rapportons le cas d'un homme de 50 ans hypertendu, diabétique et insuffisant rénal. Le patient rapporte l'usage abusif de drogues par voie intraveineuse. L'échographie trans-oesophagienne a été réalisée et a révélé une végétation oscillante sur les feuillets de la valve tricuspide avec une régurgitation tricuspide modérée. La tomodensitométrie thoracique a révélé une embolie pulmonaire septique avec infarctus pulmonaire. Le coroscanner a révélé un épaississement des feuillets de la valve tricuspide, une dilatation de l'oreillette droite et un épanchement péricardique. Le diagnostic d'endocardite infectieuse droite avec embolie pulmonaire septique a été retenu. Le patient a été traité médicalement sans intervention chirurgicale. Ce rapport vise à démontrer le rôle primordial des résultats d'imagerie dans l'endocardite infectieuse (EI), à la fois dans la phase de diagnostic et dans l'évaluation des localisations secondaires de l'infection.

Mots - clés : Endocardite infectieuse droite ; Embolie pulmonaire septique ; Infarctus pulmonaire

ملخص

غالبًا ما يكون تشخيص تعفن الشغاف القلبي أمرًا صعبًا. تعتمد الإدارة الجيدة على التشخيص السريع والتقسيم الطبقي الدقيق للمخاطر والرصد الدقيق. يلعب التصوير الطبي دورًا رئيسيًا في تحقيق هذه الخطوات، فقد أبلغنا عن حالة رجل يبلغ من العمر 50 عامًا مصابًا بارتفاع ضغط الدم والسكري والفشل الكلوي. يروي المريض عن تعاطي المخدرات عن طريق الوريد. تم إجراء الموجات فوق الصوتية عبر المريء وكشف الغطاء النباتي المتأرجح على وريقات الصمام ثلاثي الشرفات مع قلس ثلاثي الشرفات معتدلة. كشف فحص الصدر بالأشعة المقطعية عن انسداد رئوي إنتاني مع جلطة رئوية. كشف التصوير المقطعي للشرايين التاجية للقلب عن سماكة وريقات الصمام ثلاثي الشرفات، واتساع الأذين الأيمن وانصباب التامور. تم الإبقاء على تشخيص التهاب الشغاف القلبي الأيمن مع الانسداد الرئوي الإنتاني. ثم تم علاج المريض طبيا بدون جراحة. يهدف هذا التقرير إلى توضيح الدور الأساسي لنتائج التصوير في تعفن الشغاف القلبي (IE)، سواء في مرحلة التشخيص أو في تقييم المواقع الثانوية للعدوى.

الكلمات المفاتيح : تعفن الشغاف القلبي الأيمن ;الانسداد الرئوي الإنتاني ; جلطة رئوية.

INTRODUCTION

Right-sided infective endocarditis (RSIE) is less common than left-sided infective endocarditis (IE), encompassing only 5–10% of cases of IE. 90% of RSIE involves the tricuspid valve (TV)[1].Due to the increase in the number of intravenous drug users and the increased use of implantable cardiac devices and central vascular catheters, epidemiological data reveals a rising incidence. The diagnosis of RSIE is often challenging, resulting in a delay in initiating appropriate antimicrobial therapy, thus adversely affecting morbidity, mortality, and treatment-related costs [2].The diagnosis of right infectious endocarditis (IE) relies on a coherent evaluation based on the synthesis of clinical, microbiological, echocardiographic findings, and supplementary imaging techniques. The modified Duke criteria [3] are the standard criteria used to guide the diagnosis of IE. Positive blood cultures and imaging positive for IE are the two major criteria for a definite diagnosis of IE. Imaging plays a major role in diagnosing, pre-operative evaluation, during heart valve operations, and in the diagnosis of complications. Moreover, imaging is used at the end of treatment and during follow-up to reveal any long-term repercussions either on the heart or on other organs.

Here, we report a case of isolated tricuspid valve infectious endocarditis (IE) with septic pulmonary right embolism and multiple peripheral infarctions.

The purpose of the present review is to give an overview of the CT scan features of right infectious endocarditis and septic pulmonary embolism.

CASE PRESENTATION

A 50-year-old male with no past medical history presented with dyspnea and chest pain.

He had diabetes insipidus, hypertension and chronic renal failure on dialysis. He had no history of recent surgery, but he reported intravenous drug misuse. The patient denied any smoking history and had no other notable medical record. He also had no recent invasive procedures or surgeries.

On presentation, the patient was febrile and had a pulse rate of 130 beats/min, a blood pressure of 117/ 87 mm Hg, and a respiratory rate of 22 breaths/min.

Chest auscultation showed right crackles. The rest of his clinical examination showed no abnormalities. The patient's laboratory data revealed a biological inflammatory syndrome with elevated white blood cell count and C-reactive protein and high creatine level(388 µmol/L). Arterial blood gas measured in the ED revealed metabolic acidosis.

An initial chest radiograph revealed airspace opacity and central opacity, with the lesion in the right lower zone. (Figure 1). The electrocardiogram showed sinus tachycardia.

A Trans-thoracic and trans-esophageal echocardiogram were performed showing an oscillating mass adjacent to the anterior and septal leaflets of the tricuspid valve measuring 20 mm, a dilated atrium with moderate tricuspid regurgitation. PAPS:45 mmhg.

Because the patient's hemodynamic status and oxygen saturation rapidly deteriorated during observation in the cardiology department (CD), computed tomography pulmonary angiography with retrospectively ECG-gated multidetector-row was arranged to detect pulmonary complications as well as cardiac lesions (figure 2 and figure 3).

This patient was diagnosed with tricuspid valve infectious endocarditis complicated by septic pulmonary embolism and pulmonary infarctions.

Initial management included intravenous empiric antibiotics; Vancomycin(1gx2 per week), Imipenem/Cilastatin(250 mgx2 per day), Rifampicin (2capsulesx2 per day) .Once the organism had been specified asEnterococcus Faecalis, the antibiotic regimen changed to vancomycin(1gx2 per week) and Totapen(2gx2 per day).

A surgical opinion was obtained, but a trial of medical management was advised. The patient felt better, and his inflammatory markers normalized.

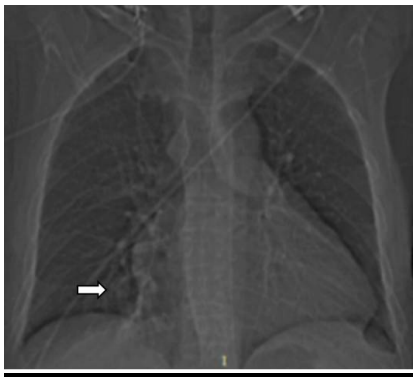

Figure 1: 50-year-old-male with septic pulmonary emboli secondary to pulmonary valve endocarditis.
FINDINGS: Anterior-posterior portable chest radiograph demonstrates airspace opacity and central clarity within the lesion in the right lower zone.
TECHNIQUE: Antero-posterior portable chest radiograph.

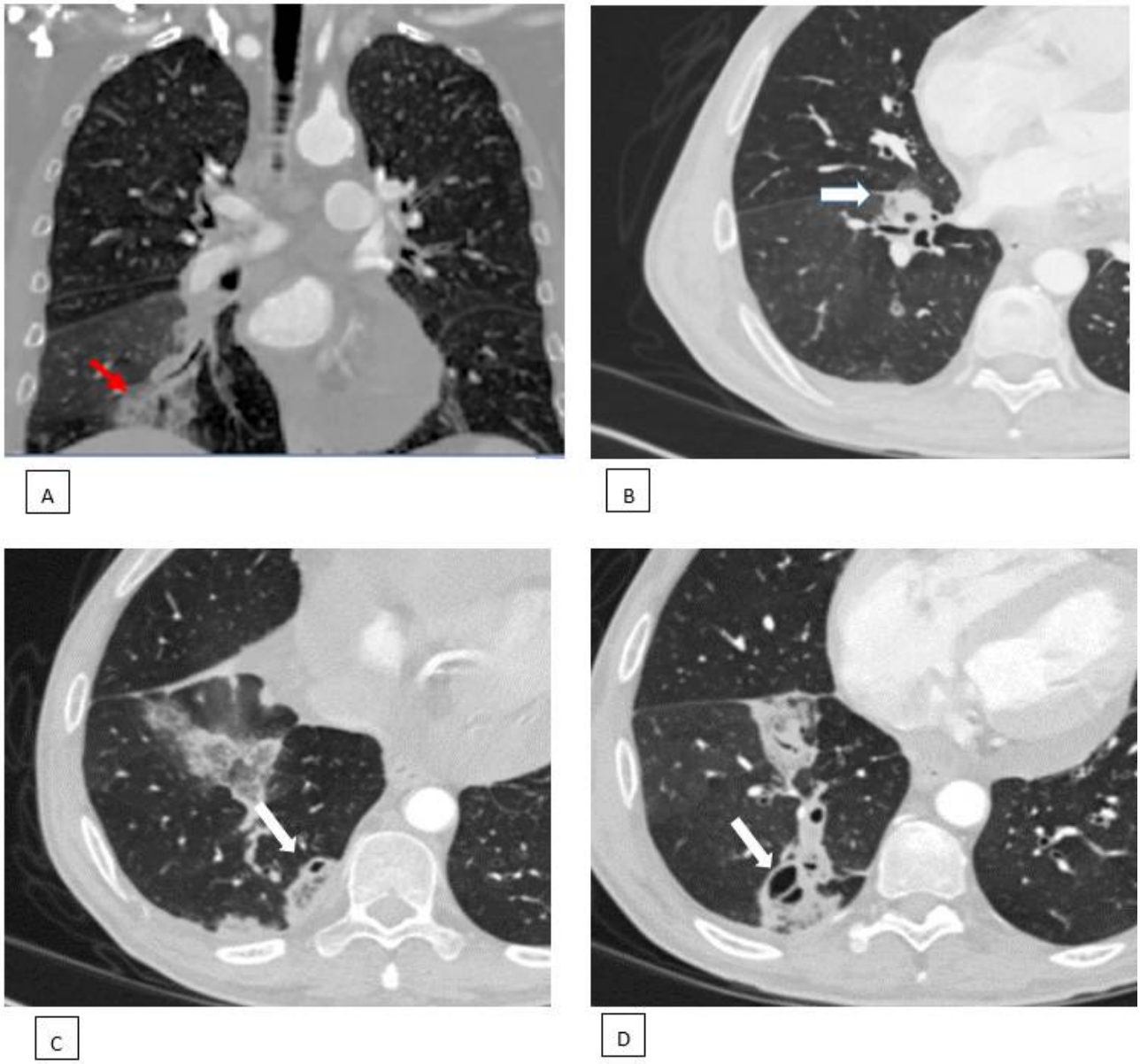

Figure 2: A 50-year-old-male with septic pulmonary emboli secondary to pulmonary valve endocarditis.
FINDINGS: Coronal reformatted (A), Axial (B, C, D) views of CT pulmonary angiography (CTPA) on lung window demonstrate multiple wedge-shaped peripherally located consolidation of the lower right lobe (Hampton hump) without air bronchograms, convex borders with a halo sign secondary to adjacent hemorrhage (B), areas of low attenuation within the lesion; racket sign (C), Cavitary pulmonary infarction (D).
TECHNIQUE: Axial CTPA with lung windows (center: 400 HU, width: 2000 HU), 653 mAs, 120 kV, 1.5 mm slice thickness, 100 ml Omnipaque 350.

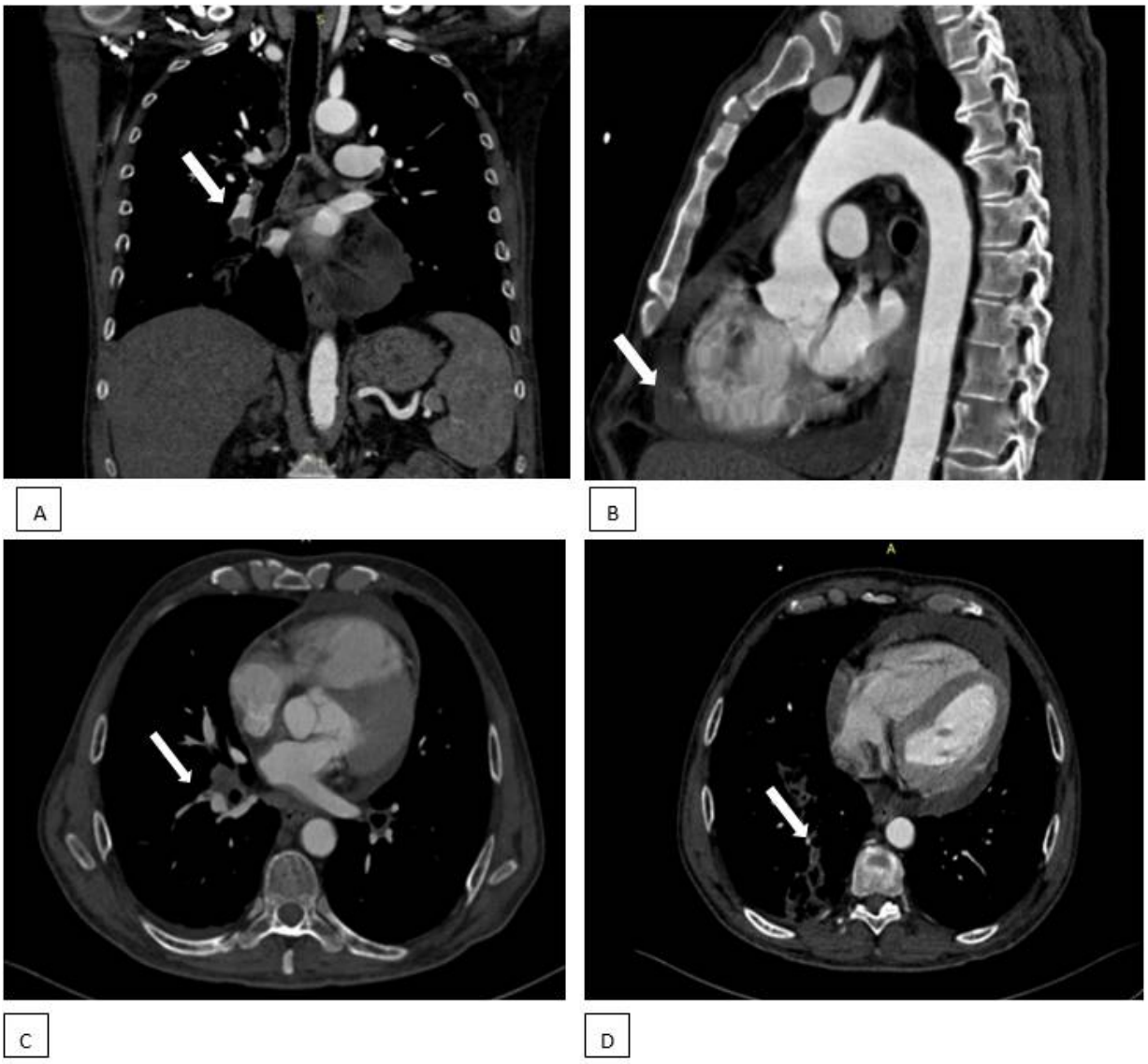

Figure 3: A 50-year-old-male with septic pulmonary emboli secondary to tricuspid valve endocarditis.
FINDINGS: coronal reformatted (A), sagittal (B), and Axial (B, C) views of CTPA on soft-tissue window demonstrate an arterial filling defect in the lower lobe of the right pulmonary artery(A), medial basal segment (C) and posterior basal segment (right lower lobe) and feeding vessel sign (D), pericardial effusion (B).
TECHNIQUE: (A, B) Axial and coronal CTPA with soft tissue window (center: 50 HU, width 400 HU), 653 mAs, 100 kV, 2 mm axial slice thickness, 3 mm coronal reconstruction, 150 ml Omnipaque 300.

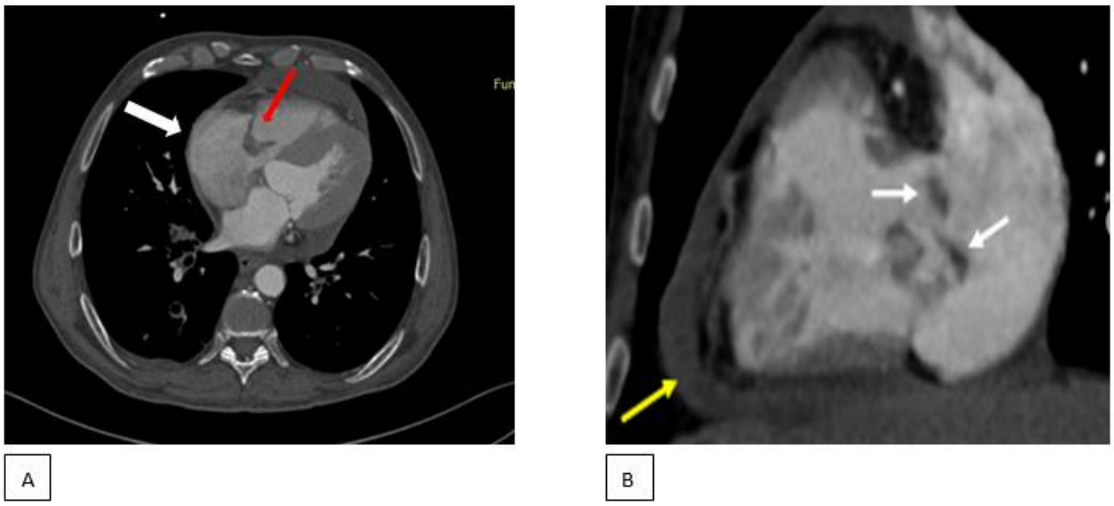

Figure 4: 50-year-old-male withseptic pulmonary emboli secondary to tricuspid valve endocarditis.
FINDINGS: Axial (A)and sagittal oblique (B)views of retrospectively ECG-gated multidetector-row CT on soft-tissue window demonstrate thickening of the tricuspid valve leaflets (white arrow B and red arrow A), dilated right atrium (white arrow A), and pericardial effusion (yellow arrow B).
TECHNIQUE: (A, B) Axial and sagittal CTPA with soft tissue window (center: 50 HU, width 400 HU), 653 mAs, 100 kV.

DISCUSSION

Etiology and demographics

Infective endocarditis (IE) is an important clinical and medical problem. It has a high mortality of up to 40%[4-5].
Less than 10% of infective endocarditis (IE) cases are declared to be right-sided IE with more than 90% of these cases involving the tricuspid valve [1].
Due to the increase in the number of intravenous drug users and the increased use of implantable cardiac devices and central vascular catheters, epidemiological data reveals a rising incidence.
Important risk factors for tricuspid valve infective endocarditis (TVIE) include:
Intravenous drug users (IVDU): Infections resulting from IVDU involve 30% to 40% of all TVIE cases [7].
Cardiac implantable electronic device (CIED) Infection: TVIE is considered device-related if there is evidence of valvular vegetation and tricuspid regurgitation in the presence of positive blood cultures.
Indwelling catheter: hemodialysis, parenteral nutrition, and chemotherapy requiring long-term central venous access.

Right-sided infective endocarditis is cited as the most common cause of septic pulmonary embolism (SPE). Other sources of SPE distinct from endocarditis include infected central lines or devices (pacemakers), deep soft tissue infections (osteomyelitis, fasciitis, and cellulitis), peripheral septic thrombophlebitis (Lemierre's syndrome, septic pelvic vein thrombophlebitis), and deep abscesses [8].
The majority of cases of SPE occur in patients with congenital heart disease, intravenous drug use, as seen in our patient, alcoholism, central intravenous lines, and prosthetic valves [9-7]. Various immunodeficiency states, including solid and hematological cancers, human immunodeficiency virus infection, diabetes mellitus, and organ transplantation are also important risk factors [8-5]. There is no age or gender predilection for SPE. Our patient was an intravenous drug addict.The most common pathogen responsible for SPE is Staphylococcus aureus [10] with methicillin-resistant Staphylococcus aureus comprising 40% of S. aureus cases [8]. Other common agents include Candida sp., Fusobacterium sp., Klebsiella pneumoniae, and Streptococcus viridans [10], but the relative frequency of each agent varies according to the underlying etiology leading to SPE[8].

In this patient, the primary origin of his bacteremia was probably venous sepsis.

Clinical and imaging finding

The modified Duke criteria [3] are the standard criteria used to guide the diagnosis of IE. The two major criteria for a definite diagnosis of IE are positive blood cultures and imaging positive for IE.

1. Echocardiogram positive for IE:(I) Vegetation, (II) Abscess, pseudoaneurysm, intracardiac fistula (III) Valvular perforation, or aneurysm (IV) New partial dehiscence of a prosthetic valve.
2. Abnormal activity around the site of prosthetic valve implantation. detected by 18F-FDG PET/CT (only if the prosthesis was implanted for >3 months) or radiolabelled leukocytes SPECT/CT.
3. Definite paravalvular lesions by cardiac CT. On CT, may be detected cardiac manifestations that include:

✓ Valvular vegetation; small, round, hypoattenuating masses or simply thickening of valvular leaflets as seen in our patient.

✓ Dehiscence; appears as a gap between the aortic annulus and the opposing margin of the artificial valve that allows visualization of a continuous column of contrast material from the left ventricular cavity into the aortic root

✓ Pseudoaneurysm: focal dilatation involving all three layers of a blood vessel which appears as a saccular or fusiform dilatation of the aorta.

✓ Abcess: periprosthetic or perivalvular collection.

Not surprisingly, given the systemic process, the presentation of SPE is nonspecific. A systematic review of observational studies from 1978 to 2012, which included 168 cases of SPE, found that the most common clinical features were fever, dyspnea, chest pain, and cough [10], which were all features in our patient. The diagnosis of SPE is a clinical-radiological one, which is commonly based on criteria proposed by Cook et al. [3] and includes: 1) focal or multifocal lung infiltrates compatible with septic embolism in the lung, 2) presence of an active extra-pulmonary source of infection as a potential embolic source, 3) exclusion of other potential explanations for lung infiltrates, and 4) resolution of lung infiltrates with appropriate antibiotic therapy.Imaging may provide more specific findings of SPE. On chest radiograph, nonspecific lower lobe infiltrates are the most common abnormality [11]. Peripheral opacities with cavitation, although highly suggestive of SPE [11] are unusual, only found on approximately 20% of chest radiographs [10-11] pulmonary infarcts as seen in the current case.

On chest CT imaging, the most common finding is multiple peripheral lung nodules, occurring in 66% to 93% of affected patients in two different case series [8, 10]. Nodules are soft tissue density, well- or ill-defined, and range from 0.5 cm to 3.5 cm in diameter [11]. Cavitation is reported to occur in approximately 55% to 67% of cases [8, 10], and is associated with gram-positive organisms as the etiologic agent [11]. The lesions are bilateral and multiple in approximately 90% of patients [8- 10].

A pulmonary artery branch traversing the nodule, termed the "feeding vessel sign", is a nonspecific finding but suggests a hematogenous spread of the pulmonary nodule [11], as seen in our case. Furthermore, an area of central consolidation with peripheral ground-glass opacity, termed the "CT halo sign", is a characteristic but nonspecific imaging finding that is reflective of surrounding hemorrhagic infarction in the context of SPE [11]as seen in our case. The halo is also a feature of other diseases, including hemorrhage from metastases and fungal angioinvasion seen in aspergillus, zygomycetes, and candida [11]. Both the CT halo sign and the feeding vessel sign are reported to occur in approximately 30% of cases and are more frequent with gram-negative organisms [10- 11]. Most emboli in SPE occlude segmental or subsegmental pulmonary arteries [11], with one study reporting involvement of the segmental pulmonary arteries in approximately 50% of cases, as seen in the current case [4]. The presence of a large septic central pulmonary embolus in the main pulmonary artery is rare.With the development of retrospectively ECG-gated multidetector-row CT (CT heart function and morphology with contrast), the recognition of paravalvular and myocardial abscesses, as well as infective pseudoaneurysms, can be possible [11-12]. In depicting aortic valve pseudoaneurysms, one study [13] showed a sensitivity, specificity, positive predictive value, and negative predictive value of 100%, 87.5%, 91.7%, and 100%, respectively. CT may play a major role in the assessment of prosthetic valve leaflets to evaluate leaflet pannus, thrombus, or other reasons for prosthesis failure [14].

In our case, a retrospectively ECG-gated multidetector-row CT showed thickened tricuspid leaflets, a dilated right atrium, and pericardial effusion.

Treatment and prognosis

Patients with TVIE should be started on an empiric antibiotic regimen once it is suspected. Initial empiric antibiotics should include coverage against the most common pathogens. It is considered that staphylococcus and streptococcus are the major agents of IE. Then, intravenous antibiotics should be tailored based upon blood culture results. The antibiotic regimen should typically be continued for six weeks from the date of the first negative blood culture[1]. These candidates include those with isolated tricuspid valve infectious endocarditis TVIE, those without any complications secondary to IE, and those with IE from HACCEK organisms [15]. For patients with methicillin-sensitive Staph aureus (MSSA) IE, it is vital to change vancomycin to an antibiotic more specific against MSSA. Such antibiotics include oxacillin or cefazolin. Patients with MRSA IE should be treated with vancomycin for six weeks. The three indications of surgical procedure recommended in the 2015 ESC Guidelines for IE were as followed (I) TV vegetations > 20 mm and recurrent septic pulmonary emboli with or without concomitant right heart failure; (II) IE caused by microorganisms that are difficult to eradicate or bacteremia for at least 7 days despite adequate antimicrobial therapy; and (III) Right heart failure secondary to severe tricuspid regurgitation TR with poor response to diuretic therapy.
Management of SPE involves treating the underlying infection with intravenous antibiotics [8]. In certain settings, procedural intervention is required to eliminate the infectious focus [10]. Anticoagulation for SPE, especially in the setting of right-sided endocarditis, is controversial, mainly due to the risk of hemorrhage from the potential central nervous system (CNS) embolization [8]. Anticoagulation may diminish the risk of embolization [11] and thus its use should be individualized according to the competing risks of embolism and hemorrhage [11].
Mortality from SPE is high despite treatment, ranging from 10 to 20%, most commonly from septic shock and multi-organ failure [8-10].

TEACHING POINTS

- Tricuspid valve endocarditis with a resultant septic embolus of the pulmonary artery is a rare finding, often requiring a high index of suspicion to secure the proper radiological diagnosis for an underlying infectious pathoetiology.
- The presence of coexisting peripheral, lower lobe-predominant, randomly distributed cavitary nodules, consolidations, and pulmonary infarct should prompt the radiologist to strongly consider a source of hematogenous source of infection, including right-sided endocarditis.
- The clinical context is important in image interpretation and differential considerations. Most patients will be clinically septic and have positive blood.
- Imaging may provide specific findings of SPE:

✓ Arterial filling defect in segmental or subsegmental pulmonary arteries
✓ Multiple wedge-shaped peripherally located consolidation of the lower left lobe (Hampton hump) without air bronchograms.
✓ Sub pleural nodular lesions or wedge-shaped densities with or without necrosis caused by septic infarcts (these can manifest as cavitary pulmonary infarcts).
✓ Convex borders with a halo sign secondary to adjacent hemorrhage.
✓ feeding vessel sign: peripheral nodules with clearly identifiable feeding vessels associated with pulmonary

- With retrospectively ECG-gated multidetector-row CT (CT heart function and morphology with contrast), the identification of paravalvular and myocardial abscesses and infective pseudoaneurysms can be possible, as well as thickening or vegetations of Valvular leaflets.

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