

Review Article,

Right Sided Infective Endocarditis and Mycotic Pulmonary Artery Aneurysm- A Brief Review of Important Literature

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Abstract:

Right-sided infective endocarditis (IE) involves the infection of the endocardial surface of either the tricuspid or pulmonary valve. The tricuspid valve is involved in almost 90% of cases. Isolated right-sided infective endocarditis can present with multiple complications; the most common of which include valvular insufficiency, abscess formation, and septic pulmonary embolism. Other complications include pulmonary infarcts, pleural effusion, empyema, and pneumothorax. Mycotic pulmonary artery aneurysm is a rare complication of right-sided infective endocarditis. Staphylococcus and Streptococcus species are the most common culprits for mycotic pulmonary artery aneurysms. IV drug use and bacterial endocarditis are the two major known risk factors for mycotic aneurysm. Computerized tomography angiography is the mainstay of imaging modalities to diagnose mycotic pulmonary artery aneurysms. MRI angiography can also be used to diagnose mycotic pulmonary artery aneurysms, but this imaging modality is not available widely. The mycotic pulmonary artery aneurysm is treated both surgically and conservatively depending on the symptoms and clinical status of the patient. The surgical approach includes emergent arterial embolization, lobectomy, resection, banding, and aneurysmectomy.

Keywords: Right-sided infective endocarditis, septic pulmonary embolism, mycotic aneurysm of the pulmonary artery, IV drug use

Introduction:

Data is limited on the clinical features of right-sided infective endocarditis (RSIE) compared to left-sided infective endocarditis [1]. Mycotic aneurysm of the pulmonary artery is one of the rare complications of RSIE. It is associated with a high mortality rate due to its risk of growth and rupture, leading to hemoptysis [2]. It usually results from septic emboli from the infected valve occluding the vessel lumen. This article aims to present an updated overview of right-sided infective endocarditis and its complications, with a main focus on mycotic

pulmonary artery aneurysm secondary to infective endocarditis.

Discussion:

Infective endocarditis refers to the infection of endocardial surfaces of the heart. It can affect a single or multiple valves. According to literature, right-sided IE accounts for 5-10% of all cases of IE [3]. 90% of right-sided IE (RSIE) cases occur in the Tricuspid Valve [4]. The majority of cases of RSIE occur in intravenous drug users (IDUs). The incidence of RSIE in IDUs is believed to be 1.5–20 per 1000 addicts per year [5]. Other etiologies include intra-cardiac devices, congenital heart

diseases, and central venous catheters. Compared to left-sided IE, RSIE has a good prognosis with in-hospital mortality of 5–10% [6]. It is important to diagnose IE as soon as possible to initiate appropriate empiric antibiotic therapy and to identify patients at high risk for complications who may be best managed by early surgery.

Complications of Right Sided Infective Endocarditis:

If left untreated, RSIE can lead to multiple complications, the most common of which are valvular insufficiency, embolic events, and abscess formation [7]. Pulmonary involvement occurred in 80% of cases, leading from minor atelectasis to large infiltrates, pleural exudates, and cavitation. Our patient also had an uncommon complication in the pulmonary vessels known as Mycotic Aneurysms.

Diagnosis and Treatment of Right Sided Infective Endocarditis:

The diagnosis can be made easily based on echocardiogram. The first-line treatment for RSIE is medical with an intravenous antibiotic. However, surgery may be indicated in some cases. The surgery indication and patients with right-sided infective endocarditis include vegetation size greater than 2 cm, intractable right-sided heart failure despite being on appropriate medical therapy, perivalvular abscess, fungal infective endocarditis, concomitant left-sided infective endocarditis, positive blood culture despite being on appropriate antibiotic and recurrent septic pulmonary embolism [7].

Mycotic Aneurysm:

A mycotic aneurysm is a dilation of an arterial wall due to infection. The term "mycotic" was first used by William Osler in 1885 to describe a mushroom-shaped aneurysm in a patient with subacute bacterial endocarditis [8]. Although the term mycotic refers to fungus, mycotic aneurysms shouldn't be referred to aneurysms of fungal etiology: the majority of mycotic aneurysms are caused by bacterial pathogens. Mycotic aneurysms caused by IE occur mostly in the intracranial arteries, followed by visceral arteries and arteries of the upper and lower extremities [9].

Mycotic pulmonary artery aneurysm due to RSIE is rare. Data is limited on its epidemiology in the literature. In 1961, Charlton and DuPlessis reported a case of multiple mycotic aneurysms of the secondary and tertiary branches of the pulmonary arteries in a 25-year-old male. They also reviewed 30 cases of pulmonary artery aneurysm available in the literature. The majority of those were mycotic aneurysms [10]. In 1964, Calenoff added 2 more such cases to the literature [11]. In addition, 25 more cases were reported in the world literature by Benveniste et al. between 1961 and 1988 [12]. Most of the reported cases were patients with intravenous drug use or congenital heart disease. Little is known about the exact incidence of mycotic pulmonary artery aneurysms in IE. According to a study published in 1985, the incidence of mycotic pulmonary artery aneurysm as a complication of IE was estimated to be 10%–15% [13].

Pathophysiology of Mycotic Aneurysm:

A mycotic pulmonary artery aneurysm may form when an organism reaches the media of the artery by direct extension from a neighboring focus of infection, such as Rasmussen aneurysm in TB, from the bloodstream via the vasa-vasorum or by invasion of the intima from the lumen after the lodgment of a septic embolus. Once microorganisms infect the vessel wall, the deeper layers are rapidly degraded, resulting in the formation of an aneurysm [14]. Bacterial infection stimulates the release of pro-inflammatory cytokines, which attract neutrophils. Matrix metalloproteinases (MMP) are activated in response, leading to focal breakdown of the vessel wall. Some studies suggest that higher MMP activity leads to a higher chance of rupture, so they can be used as prognostic indicators for risk of rupture in patients with aneurysms [15]. Staphylococcus and Streptococcus species are the most common culprits for mycotic pulmonary artery aneurysms. Other organisms may include Mycobacterium tuberculosis or fungal organisms [16].

Less is written in the literature about the exclusive signs and symptoms of mycotic pulmonary artery aneurysms. Patients may present with dyspnea, chest pain, cough, right ventricular failure, pulmonary hypertension, and hemoptysis [17].

Mycotic pulmonary artery aneurysms should be diagnosed as soon as possible as they have the potential for growth and rupture, leading to hemoptysis as in our patient [18]. Hemoptysis is estimated to be present in less than 10% of cases of pulmonary aneurysm [19,20].

Diagnosis of Mycotic Pulmonary Artery Aneurysm:

CT Angiography (CTA) is the mainstay of the imaging modality in the detection of mycotic pulmonary artery aneurysms [21]. CTA allows for better assessment of the presence, size, and location of the aneurysm. It may also help in understanding the etiology of the aneurysm as the surrounding structures, including the heart, lung, and mediastinum, can be seen in the CTA. MRI and CT Angiography were previously considered the gold standards, but they have recently been replaced. Apart from being more invasive, the major limitation of pulmonary angiography is that it doesn't allow a view of the extraluminal structures, which can provide further hints in terms of the etiology of the aneurysm. MRI is a viable alternative to CTA when CTA cannot be performed, such as in patients with iodinated contrast allergy or renal insufficiency [21]. The roles of CTA and MRI are expanding with further evolving technology [23].

Treatment of Mycotic Pulmonary Artery Aneurysm:

According to the literature, mycotic pulmonary artery aneurysms have been treated both surgically and conservatively, as in our case. Conservative management includes intravenous antibiotics. In general, a conservative approach should be adopted in patients with no emergency symptoms or acute hemoptysis [18]. Our patient was not a surgical candidate, so a conservative option was chosen despite the episode of hemoptysis. McLean et al. reported the first case where bilateral pulmonary artery aneurysm in a patient with intravenous drug use was resolved conservatively [24]. Originally, surgery was the only option available for patients with mycotic pulmonary artery aneurysm presenting with acute hemoptysis. Surgical options included resection, aneurysmectomy, lobectomy, aneurysmorrhaphy, and banding [25]. However, endovascular techniques have been the gold

standard procedure for treating these complex vascular lesions over recent years [18]. Emergent arterial embolization has become the standard first-line treatment for the management of acute bleeding from all sources [26]. The first reported coil embolization for mycotic pulmonary artery aneurysm was done in 1997 [27]. The first use of detachable coils for this disease was published by Wells et al. with a successful outcome. Both authors mentioned urgent embolization as the preferred procedure due to its safety, efficacy, and lack of morbidity associated with surgical approaches. Other endovascular techniques have also been mentioned in the literature, including the use of gel foam, detachable balloons, and pushable coils. These techniques were successful for treatment in the late 1970s. However, such techniques had a high rate of recanalization and were more difficult to deploy to the target site [18].

Conclusion:

An uncommon complication that can happen in patients with right-sided infective endocarditis is mycotic pulmonary artery aneurysm. Suspicion should be high if a patient with right-sided infective endocarditis presents with hemoptysis. CTA is the imaging modality of choice. MRI can be done in patients who are not candidates for CTA. Surgical techniques were more common in the past. However, in recent years, the endovascular approach has become more common. Emergent Arterial Embolization is the standard first-line procedure. Conservative is an option for patients who are not surgical candidates and who don't have emergent symptoms or acute hemoptysis.

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