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From Persistent Bacteremia to Pulmonary Valvectomy: A Multidisciplinary Approach to Isolated Pulmonary Valve Endocarditis

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Abstract

Background: Isolated pulmonary valve endocarditis (PVE) is an uncommon form of infective endocarditis, accounting for less than 2% of cases. It most commonly occurs in patients with intravenous drug use, congenital heart disease, indwelling catheters, or prosthetic material. Its infrequency, coupled with nonspecific clinical features and the absence of dedicated management guidelines, renders diagnosis and treatment particularly challenging.

Case Presentation: We describe a 63-year-old male without traditional risk factors who presented with malaise and persistent Enterococcus faecalis bacteremia following a complicated urinary tract infection associated with nephrolithiasis and ureteral stenting. Despite appropriate antimicrobial therapy, blood cultures remained positive. Transesophageal echocardiography revealed a large, mobile mass on the pulmonary valve with moderate-to-severe pulmonary regurgitation, raising concern for endocarditis versus a cardiac tumor.

Diagnosis and Management: The patient was diagnosed with isolated PVE complicated by refractory bacteremia. Given failure of medical therapy and evidence of valvular destruction, he underwent surgical pulmonary valvectomy with concomitant coronary artery bypass grafting. Definitive pulmonary valve replacement was deferred until bloodstream sterilization was achieved, necessitating a staged surgical approach with temporary mechanical circulatory support for multifactorial shock.

Outcomes: Histopathology confirmed infective endocarditis with extensive valve destruction and E. faecalis infiltration. Following stabilization and delayed bioprosthetic pulmonary valve replacement, the patient recovered and was discharged to rehabilitation where he completed a 6-week postoperative course of ampicillin and ceftriaxone.

Conclusions: This case highlights the diagnostic complexity and multidisciplinary management required for isolated PVE and emphasizes the importance of considering endocarditis in patients with persistent bacteremia, even in the absence of classic risk factors.

Keywords: Pulmonary valve endocarditis; Valve replacement; Shock; VA-ECMO; CABG

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Introduction

Infective endocarditis (IE) remains a life-threatening disease with substantial morbidity and mortality despite advances in antimicrobial therapy, imaging, and surgical management [1]. Its incidence has risen over recent decades, driven by an aging population, increased exposure to invasive medical procedures, and a growing burden of comorbid conditions [1,2]. While left-sided valves are predominantly affected, right-sided IE accounts for a minority of cases and is most often associated with intravenous drug use, congenital heart disease, indwelling catheters, or intracardiac devices [1,3].

Isolated pulmonary valve endocarditis (PVE) is rare, representing less than 2% of all IE cases [4,5]. The pulmonary valve is thought to be relatively protected from infection due to lower intracardiac pressures, reduced shear stress, and less turbulent flow compared with left-sided valves [5]. As a result, isolated PVE typically occurs in the presence of predisposing factors such as congenital heart disease, prosthetic material, or prolonged intravascular access [6]. Clinical presentation is often nonspecific, frequently lacking classic peripheral stigmata of IE or overt signs of right-sided involvement, which can delay diagnosis [7,8]. Enterococcus faecalis is an increasingly recognized pathogen in IE, particularly among older adults and in healthcare-associated infections, yet it most commonly involves left-sided valves [7,8]. Only sporadic cases of Isolated PVE caused by E. faecalis have been reported in the literature [4]. Current international guidelines provide limited valve-specific recommendations for PVE, and management decisions are largely extrapolated from left-sided or general right-sided IE data [7,9,10].

We report a case of isolated pulmonary valve infective endocarditis caused by E. faecalis in a structurally normal heart, presenting with persistent bacteremia despite appropriate antimicrobial therapy. To our knowledge, this is among the first reported cases describing a staged pulmonary valvectomy (initial source-control excision without prosthetic implantation) with postoperative VA-ECMO support followed by staged surgical pulmonary valve replacement after documented bloodstream sterilization. This case underscores the diagnostic challenges of isolated PVE, highlights the importance of maintaining suspicion for endocarditis in refractory bacteremia even when an extracardiac source appears evident, and illustrates the complex multidisciplinary decision-making required for optimal management of this rare clinical entity.

Case Presentation

Clinical Findings: A 63-year-old, caucasian, male presented with several days of malaise, chills, and polyuria. He had undergone left ureteral stent placement for nephrolithiasis two months prior, complicated by a UTI with E. faecalis. He denied chest pain, dyspnea, orthopnea, or peripheral edema. Two weeks before admission, an exercise stress echocardiogram—performed for preoperative cardiovascular assessment before elective prostate surgery—was positive for inducible ischemia in the LAD territory. On admission, vital signs were: temperature 99.1°F, blood pressure 133/79 mmHg, heart rate 90 bpm, respiratory rate 23/min, SpO_2 96% on room air. Physical examination was unremarkable, with normal cardiac and pulmonary auscultation and no peripheral stigmata of IE.

Past Medical History: Comorbidities included hypertension, hyperlipidemia, poorly controlled type 2 diabetes mellitus, stable CAD, benign prostatic hyperplasia, and recent left-sided nephrolithiasis managed with percutaneous nephrostomy and subsequent ureteral stenting. His previous UTI with E. faecalis had been treated with a three-week course of oral ampicillin without evidence of bacteremia.

Diagnostic Evaluation: Initial laboratory evaluation revealed diabetic ketoacidosis, acute kidney injury, and E. faecalis bacteremia. Empiric therapy with intravenous vancomycin was initiated, later de-escalated to ampicillin and ceftriaxone upon confirmation of sensitivities.

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Despite appropriate therapy, blood cultures remained positive for ten days. A transthoracic echocardiogram (TTE) was performed early in the hospitalization, but the pulmonary valve was not well visualized; therefore a transesophageal echocardiogram (TEE) was performed to evaluate for an endovascular source in the setting of persistent bacteremia and non-diagnostic TTE, consistent with guideline-based imaging escalation in suspected IE. TEE identified a large, mobile mass on the pulmonary valve moderate-to-severe pulmonary regurgitation, preserved biventricular function, and a PFO with bidirectional shunt (Figure 1).

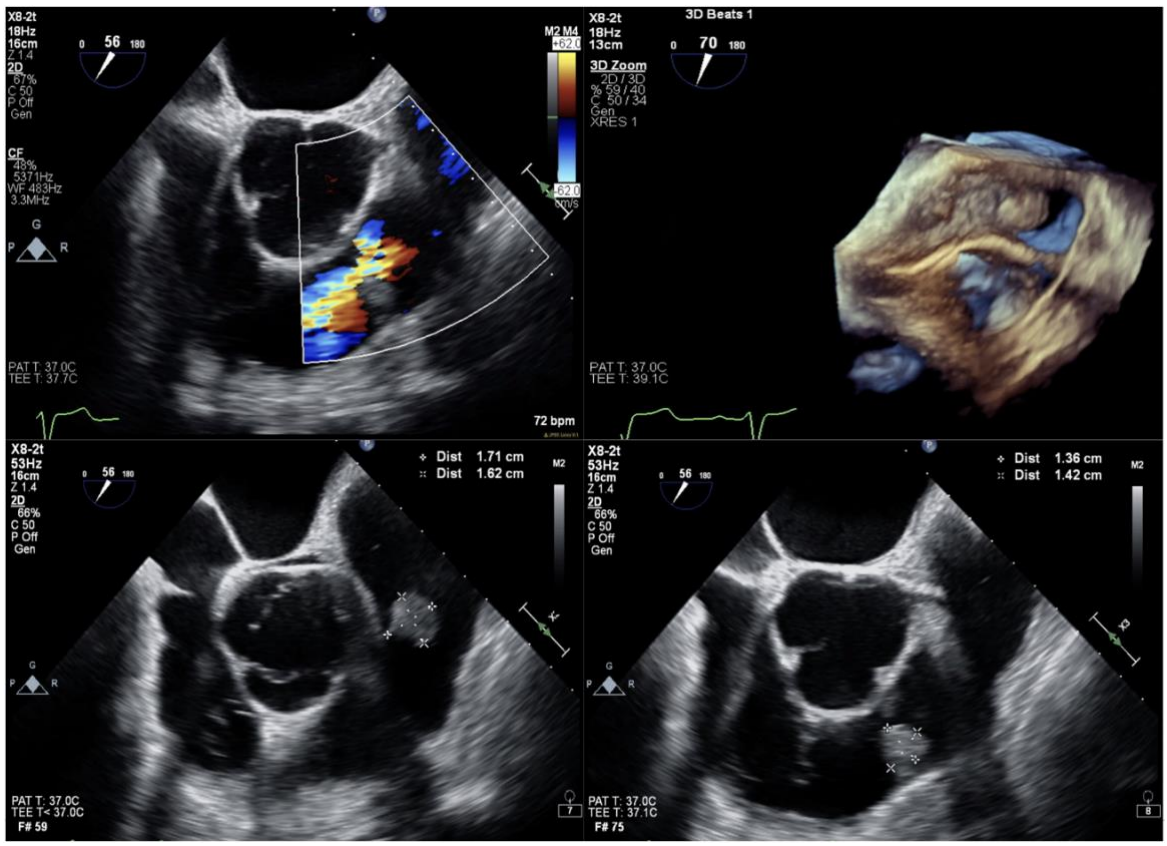

Figure 1: Transesophageal Echocardiography Showing Pulmonary Valve Vegetation.
Transesophageal 2D and 3D echocardiographic images demonstrating a large, mobile vegetation attached to the pulmonary valve. Color Doppler reveals moderate to severe pulmonary regurgitation. The vegetation measures up to 1.71 × 1.62 cm in size.

Differential Diagnosis: The differential included isolated pulmonary valve IE, papillary fibroelastoma, Lambl's excrescences, cardiac myxoma with superimposed infection, or an organized thrombus with secondary endocarditis.

Treatment Plan: Given the persistent bacteremia, surgical source control was indicated. Preoperative coronary angiography revealed multivessel CAD. The patient underwent median sternotomy with CABG using the left internal mammary artery to LAD and saphenous vein graft to the ramus intermedius. Intraoperatively, the pulmonary valve was found to have a large mass on the right cusp, vegetations on the left cusp, and friable vegetations with perforation of the anterior cusp. Complete excision of the pulmonary valve and vegetations was performed, and the specimen was sent for pathologic examination (Figure 2). A bioprosthetic pulmonary valve replacement was deferred at this stage due to ongoing bloodstream infection and concern for early prosthetic infection. Post-valvectomy TEE demonstrated severe pulmonary insufficiency with right ventricular volume overload and preserved RV systolic function.

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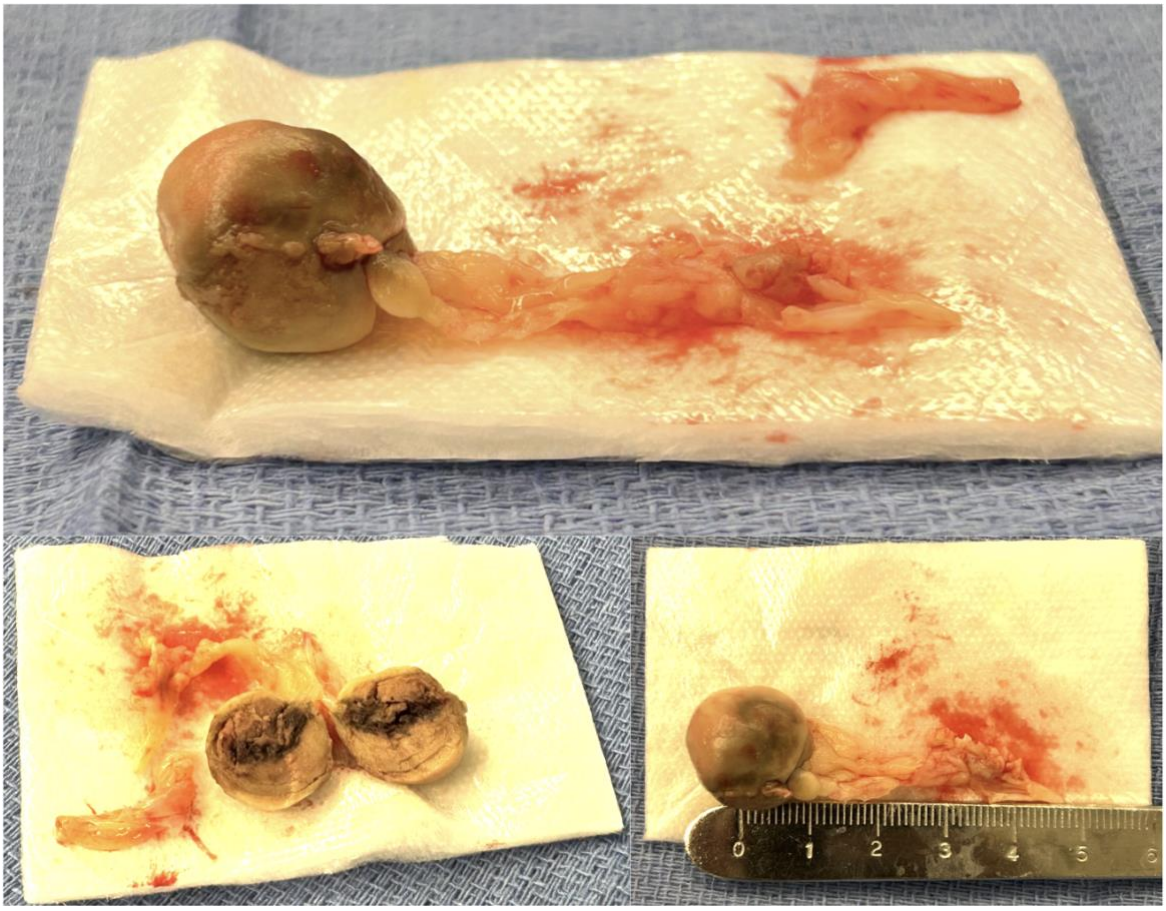

Figure 2: Gross Pathology of Excised Pulmonary Valve Vegetation.

Surgical specimen showing the excised pulmonary valve with an attached large vegetation. The vegetation is seen intact and bisected, revealing necrotic material within. A ruler is included for scale, confirming the mass size corresponds to echocardiographic measurements.

Shortly after weaning from cardiopulmonary bypass, the patient developed acute hypotension and hypoxemia following methylene blue administration, necessitating emergent surgical re-exploration, which did not reveal a mechanical cause of hemodynamic collapse. VA-ECMO was instituted reactively (not anticipated preoperatively) via femoral cannulation to stabilize hemodynamics. Postoperatively, the patient developed significant hemorrhagic chest tube output and worsening vasoplegia despite aggressive resuscitation. Emergent mediastinal exploration revealed diffuse oozing controlled by ligating a bleeding branch of the saphenous vein graft. Despite these interventions, the patient exhibited persistent vasoplegic shock, likely multifactorial in etiology—including intraoperative blood loss, septic shock, systemic inflammatory response from endocarditis, and vasoplegia associated with prolonged cardiopulmonary bypass (194 minutes) and aortic cross-clamp times (138 minutes). Infectious workup, including repeat blood cultures, was negative. He was managed with high-dose vasopressor support, stress-dose steroids, and serial surgical washouts. Severe volume overload and oliguric kidney injury were treated with continuous loop diuretics. Pathology of the excised pulmonary valve revealed fibromyxoid degenerative changes, with vegetations demonstrating organized fibrin and extensive infiltration of gram-positive cocci identified as E. faecalis via tissue culture. Histology showed acute on chronic inflammation, necrosis, and destruction of elastic fibers without evidence of underlying neoplasm or congenital dysplasia. Once the patient stabilized with sterile blood cultures and improving hemodynamics, a second surgery was performed five days later. He underwent VA-ECMO explantation and placement of a 29-mm Inspiris bioprosthetic pulmonary valve, along with right ventricular outflow tract augmentation using a pericardial patch. Intraoperative TEE confirmed satisfactory prosthetic function without paravalvular leak.

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Follow-up & Outcomes: The patient was discharged to a subacute rehabilitation facility and has remained clinically stable without evidence of recurrence through one year of outpatient follow-up. He completed a total 6-week postoperative antibiotic course with ampicillin and ceftriaxone. Antibiotic prophylaxis for future dental and invasive procedures, particularly for upcoming urological interventions, was recommended.

Table 1: Timeline of Key Clinical Events: This table provides a clear timeline of the patient's presentation, diagnostic evaluation, surgical interventions, and discharge with follow-up.

Hospital Day	Event
2 Months prior to hospitalization	Nephrolithiasis and left ureteral stent placement complicated by E. Faecalis UTI.
HD 0	Presentation with DKA/AKI; blood cultures positive for E. faecalis; empiric vancomycin started then narrowed to ampicillin + ceftriaxone.
HD 0-7	Repeat blood cultures persistently positive despite targeted therapy.
HD 3	TTE performed; pulmonary valve not well visualized (non-diagnostic for endocarditis).
HD 10	TEE obtained for persistent bacteremia; large mobile pulmonary valve mass with moderate-to-severe pulmonic regurgitation identified (Figure 1).
HD 11	Coronary angiography: multivessel CAD.
HD 12	CABG + pulmonary valvectomy/vegetectomy for refractory infection; valve replacement deferred due to ongoing bacteremia (Figure 2).
HD 12 (post-operative course)	Unanticipated hemodynamic collapse; VA-ECMO instituted reactively; subsequent re-exploration for bleeding/vasoplegia.
POD 5	After blood-culture sterilization and hemodynamic stabilization: VA-ECMO explant + 29-mm Inspiris pulmonary valve replacement + RVOT augmentation.
Discharge	Discharged to rehabilitation; completed 6 weeks of postoperative IV ampicillin + ceftriaxone. Patient is clinically well at 1 year follow up.

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Discussion

IE remains a clinical challenge due to its variable presentations and significant morbidity and mortality. The estimated incidence of right-sided IE accounts for 5-10% of all IE cases, with a rising trend attributed to factors such as invasive medical procedures, prosthetic valve use, and an aging population [6,10]. Isolated PVE is an uncommon phenomenon, accounting for less than 2% of all IE cases [4,5]. The pulmonary valve is relatively protected from endothelial injury and infection due to lower hemodynamic pressures and shear stress compared to left-sided valves [5]. The absence of common risk factors for right-sided IE—such as intravenous drug use, congenital heart disease, indwelling catheters, or prosthetic material—renders this case particularly unique.

E. faecalis is an uncommon cause of IE with left-sided involvement being predominant [7]. In this case, the presumed source of bacteremia was a UTI following ureteral stent placement, yet the patient exhibited no predisposing structural heart disease. This led to an initial anchoring bias toward a urinary source of sepsis without suspicion of endocarditis, a diagnostic delay that is not uncommon in cases of right-sided IE with atypical presentations [7,8]. The patient presented with nonspecific constitutional symptoms (malaise, chills) without classical stigmata of IE such as peripheral emboli, immunologic phenomena, or new cardiac murmurs. Furthermore, clinical signs suggestive of right-sided endocarditis (e.g., septic pulmonary emboli, cavitary lung lesions, or empyema) were absent, contributing to initial diagnostic uncertainty.

However, the persistence of E. faecalis bacteremia despite appropriate antimicrobial therapy warranted a thorough evaluation for an endovascular source, ultimately prompting a TEE, which revealed a large mass on the pulmonary valve with moderate-to-severe regurgitation. While TTE is an appropriate initial screening modality, TEE offers markedly greater sensitivity for the detection of vegetations—especially within right-sided cardiac structures—and is particularly valuable when TTE findings are inconclusive, as demonstrated in our case [7,9].

The TEE findings of a large mass with associated pulmonary regurgitation raised concerns for IE but also necessitated consideration of differential diagnoses such as papillary fibroelastoma, Lambl's excrescence, or cardiac myxoma with superimposed infection. The spherical morphology and atypical location of the mass complicated the diagnostic process. The 2023 Duke-International Society for Cardiovascular Infectious Diseases Infective Endocarditis Criteria supported the diagnosis of definite endocarditis [11]. The persistence of bacteremia for over ten days despite targeted antimicrobial therapy met the criteria for complicated IE, warranting surgical intervention for source control. Indications for surgery in IE include refractory infection, heart failure due to valvular dysfunction, recurrent embolization, abscess formation, and prosthetic valve involvement [7,9]. Although the patient lacked heart failure symptoms preoperatively, the echocardiographic evidence of severe pulmonary insufficiency and the risk of septic embolization justified surgical excision. Intraoperatively, extensive destruction of the pulmonary valve leaflets with friable vegetations and cusp perforation was identified.

Histopathological examination confirmed IE, demonstrating organized fibrin deposition, inflammatory infiltrate, necrosis, and gram-positive cocci consistent with E. faecalis. Notably, no underlying neoplasm or congenital anomaly was identified, supporting the diagnosis of isolated PVE. Given the persistence of bacteremia and the risk of prosthetic infection, pulmonary valve replacement was deferred during the initial surgery, with the patient supported postoperatively on VA-ECMO due to hemodynamic instability.

During the postoperative period, the patient was supported via VA-ECMO after an unexpected hemodynamic collapse. Temporary mechanical circulatory support provided a bridge through the postoperative course that was further complicated by vasoplegic shock, coagulopathy, and hemorrhage, which necessitated multiple mediastinal washouts and aggressive medical management before definitive pulmonary valve replacement.

Multifactorial contributors to vasoplegia likely included systemic inflammatory response from endocarditis, prolonged cardiopulmonary bypass, intraoperative blood loss, and relative adrenal insufficiency [12]. These complications highlight the complexity of surgical decision-making in IE cases with persistent bacteremia and underline the importance of multidisciplinary coordination among cardiology, cardiac surgery, infectious disease, and critical care teams.

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Once the bloodstream was sterilized and hemodynamics stabilized, pulmonary valve replacement with a 29-mm Inspiris bioprosthesis was performed along with right ventricular outflow tract augmentation. Post-replacement echocardiography confirmed excellent prosthetic function without regurgitation or paravalvular leak. This case illustrates several critical learning points. First, persistent bacteremia, even with a clear extra-cardiac source, should prompt consideration of endocarditis, especially when cultures remain positive despite appropriate therapy. Second, isolated PVE should be included in the differential of right-sided cardiac masses, even in the absence of classic risk factors. Third, surgical timing in complicated IE cases requires balancing infection control with hemodynamic stability, necessitating a consideration for staged procedural approach.

While uncommon, isolated PVE caused by E. faecalis is a diagnostic and therapeutic challenge that underscores the importance of maintaining a high index of suspicion and adopting a multidisciplinary strategy for optimal outcomes.

Conclusions

Isolated pulmonary valve endocarditis is a rare clinical entity that mandates a high index of suspicion, particularly in patients with persistent bacteremia of unclear source. This case underscores the importance of early consideration of IE in patients with bacteremia, even in the absence of classical risk factors, and highlights the complex decision-making involved in timing surgical intervention.

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