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MINI-FOCUS ISSUE ON VALVULAR HEART DISEASE

CASE REPORT: MULTIDISCIPLINARY TEAM DISCUSSIONS: ESC 2024

Brain vs Heart

Prioritizing Treatment in Left-Side Infective Endocarditis With Neurologic Complications

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ABSTRACT

A paradigmatic case is presented of subarachnoid hemorrhage as the initial sign of bacterial endocarditis on a mechanical cardiac prosthesis, in the absence of symptoms and echocardiographic evidence of infective endocarditis and vegetation. The presentation emphasizes the need to pursue a diagnostic workup for bacterial endocarditis whenever a patient with a mechanical prosthesis presents to the emergency department with focal neurologic signs. In addition, it highlights the potential use of second-level diagnostic tools to assess the extent of abscess presence and lesion extension to other cardiac structures for proper surgical planning. Finally, the presented case confirms that cardiopulmonary bypass surgery is not contraindicated and should not be delayed, even in the presence of extensive endocardial lesions with concurrent subarachnoid hemorrhage. (JACC Case Rep. 2024;29:102697) © 2024 Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

CASE PRESENTATION

A 64-year-old man with a history of cardiovascular disease presented to the emergency department (ED) owing to a persistent headache that was unresponsive to paracetamol. He reported having had a fever in the past few days. His medical history included 2 cardiac surgeries for aortic valve disease: a bicuspid aortic valve repair at the age of 33 years and a Bentall procedure with a mechanical valve and a coronary artery bypass graft 10 years later.

On admission to the ED, the patient's vital signs were temperature 37 °C, heart rate 90 beats/min, and

TAKE-HOME MESSAGES

- This case highlights the importance of considering infective endocarditis in patients with mechanical valves who present with neurologic signs, even if initial tests are negative.
- According to international guidelines, the use of cardiopulmonary bypass should be considered to be a feasible option in patients requiring urgent cardiac surgery, even in the presence of subarachnoid hemorrhage and a mechanical valve.

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ABBREVIATIONS AND ACRONYMS

ACH = aortic cryopreserved homograft

aPTT = activated prothrombin time

CAH = cryopreserved aortic homograft

CT = computed tomography

ED = emergency department

EHT = endocarditis heart team

IE = infective endocarditis

MRI = magnetic resonance imaging

PT = prothrombin time

INR = international normalized ratio

SAH = subarachnoid hemorrhage

TEE = transesophageal echocardiogram

TTE = transthoracic echocardiogram

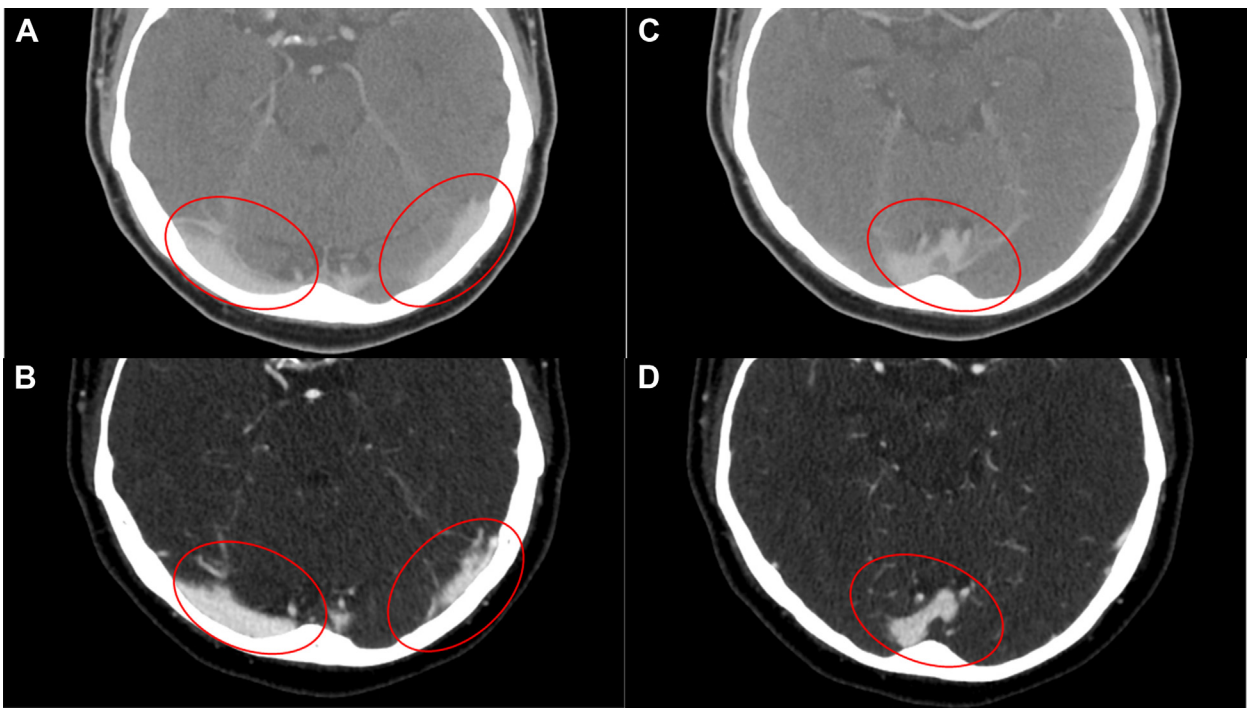
blood pressure 130/80 mm Hg. He was on anticoagulation therapy with warfarin. A brain computed tomographic (CT) scan revealed a subarachnoid hemorrhage (SAH) (Figure 1). Subsequent selective arteriography of the epiaortic vessels evaluated both intracranial and extracranial circulation, showing no signs of arteriovenous malformations, aneurysmal dilation, or active bleeding. A total body CT scan revealed multiple splenic infarction focal areas. Initial laboratory workup, including coagulation panel and inflammatory markers, particularly prothrombin time (PT), activated prothrombin time (aPTT), and international normalized ratio (INR), showed results within normal ranges. The patient was then transferred to the stroke unit for further care.

During his recovery in the stroke unit, he developed a fever with a peak temperature of 39 °C. Laboratory workup revealed elevated inflammatory markers and positive blood cultures for *Staphylococcus aureus*, raising suspicion for infective endocarditis. Transthoracic echocardiography (TTE) showed an increased pressure gradient across the mechanical prosthesis (maximum 24 mm Hg, mean 14 mm Hg) but no signs of endocardial vegetation. He was treated with paracetamol and switched from warfarin to 6,000 IU enoxaparin twice daily for anticoagulation.

QUESTION 1: WHAT IS THE DIAGNOSTIC PATH THAT CONFIRMS IE IN PROSTHETIC VALVES?

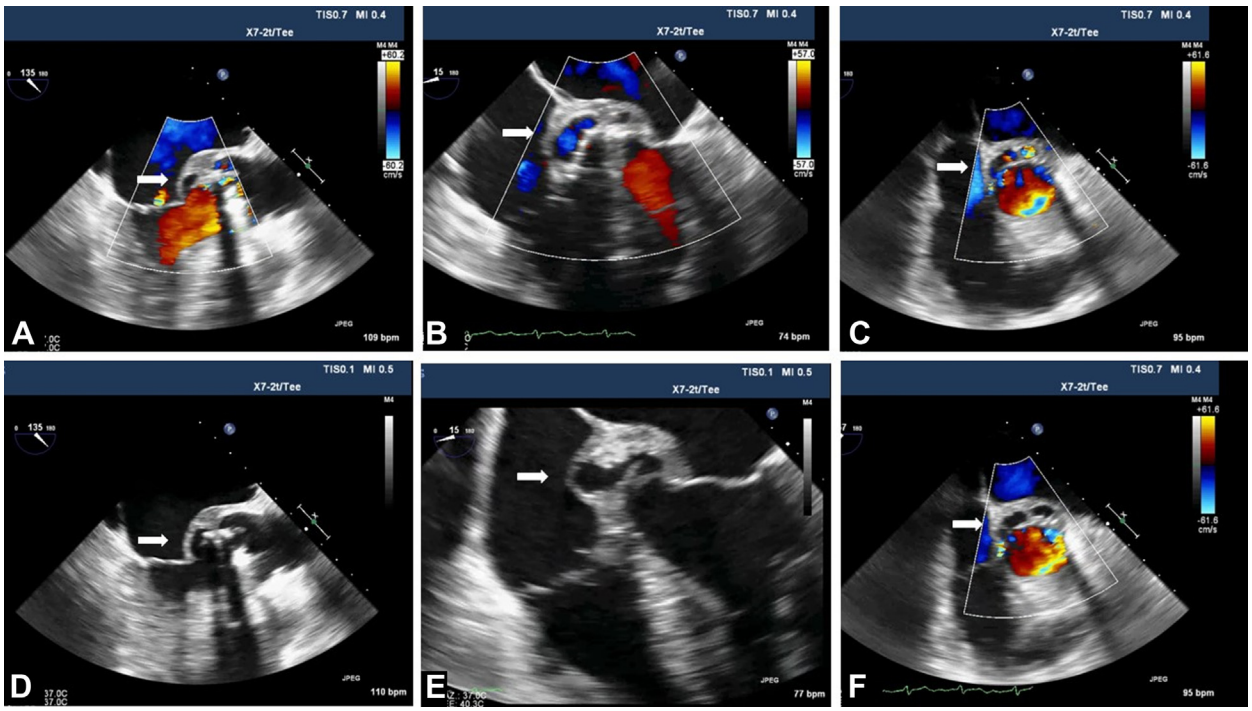
The patient met at least 1 major Duke criterion, a positive blood culture, and 2 minor criteria, fever and brain embolization. Fever in a patient with a cardiac device or prosthetic valve should always be thoroughly investigated, especially when accompanied by general malaise. According to the guidelines set forth by the American College of Cardiology/American Heart Association (ACC/AHA), and in alignment with the European Society of Cardiology 2023 guidelines,[1,2] the diagnosis of infective endocarditis (IE) is confirmed by positive blood cultures and echocardiogram, and in patients with a prosthetic valve it is mandatory to perform transesophageal echocardiography (TEE).

FIGURE 1 Preoperative Brain-CT Scan



Brain computed tomography revealed subarachnoid hemorrhage (SAH) depicted as a hyperdense area in the prepontine paramedian subarachnoid spaces, highlighted by the red circles.

FIGURE 2 **Preoperative Transesophageal Echocardiogram**



The transesophageal echocardiogram displays the paravalvular aortic abscess, indicated by the white arrows.

Initially, the patient was evaluated for a critical neurologic condition, because there were no evident signs of cardiac involvement at admission. A TEE was eventually performed and confirmed the diagnosis of IE, complicated by a paravalvular aortic abscess extending to the mitral-aortic junction (**Figure 2**, Video 1).

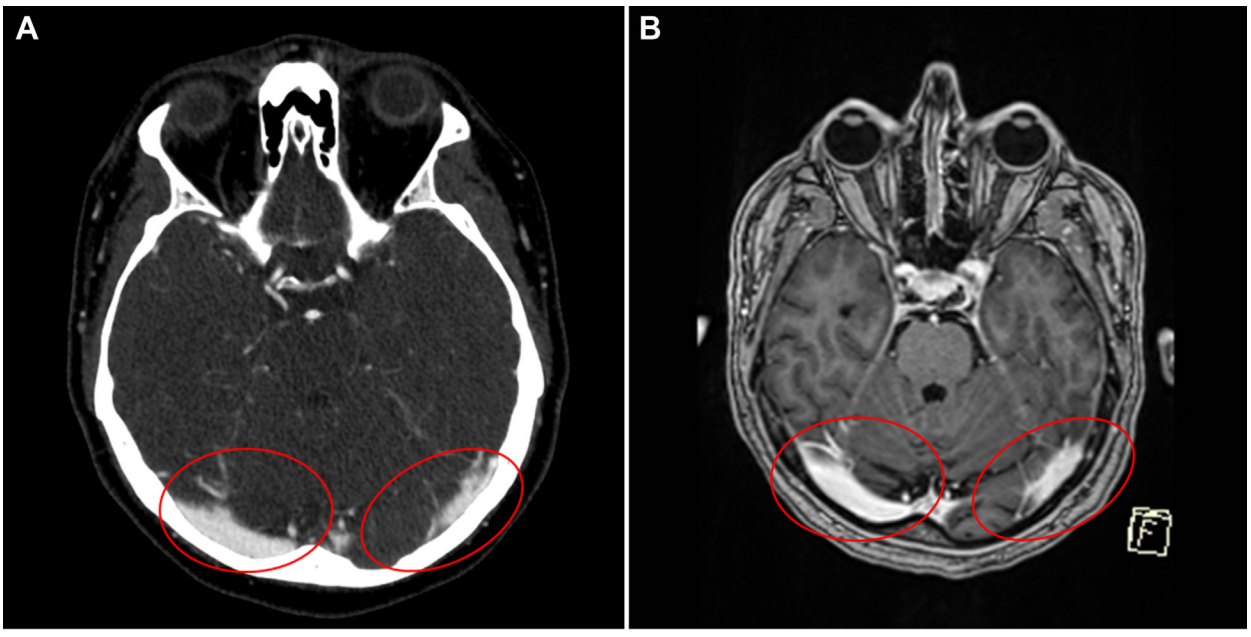
When a patient with a mechanical prosthesis presents to the emergency department with focal neurologic signs, a diagnostic workup for bacterial endocarditis is recommended. If initial findings suggest complex involvement, second-line diagnostic tools such as angio-CT or positron emission tomography-CT scans may be indicated. These advanced imaging techniques can help to identify pseudoaneurysms, circumferential abscesses, and involvement of the interventricular septum, mitral annulus, or left atrial roof, facilitating more accurate surgical planning.

QUESTION 2: IS THERE A CORRELATION BETWEEN SAH AND IE?

Cerebrovascular complications in IE such as ischemic stroke, intracerebral hemorrhage, and intracranial rupture of a mycotic aneurysm, occur in approximately 30% of patients.[2] SAH can emerge as an early neurologic manifestation of IE, particularly in patients at high risk of bleeding owing to anticoagulant therapy. *Staphylococcus aureus*, among other pathogens, is notably aggressive and is associated with an increased risk of early embolism.[2,3] The pathophysiologic mechanism leading to cerebral complications involves inflammatory changes in the vessel wall due to the septic condition, resulting in erosion caused by micro-embolization during the acute phase of IE, either before or shortly after initiating antibiotic therapy.[4-6] This can occur even in the absence of a clearly defined mycotic aneurysm detectable on brain magnetic resonance imaging (MRI) and CT scans.[6] This aligns with the presence of septic infections involving the spleen and renal parenchyma due to systemic embolism, which may also be found in patients with SAH and IE.

The presence of SAH should prompt further investigations, especially when there is no identifiable source of bleeding. This is particularly important in patients exhibiting general malaise and with risk factors such as prosthetic heart valves, cardiac devices, and anticoagulant therapy

FIGURE 3 Subarachnoid Hemorrhage Preoperative and Postoperative Evaluation



(A) Preoperative brain computed tomography. (B) Postoperative brain magnetic resonance imaging reveals no change in the dimension of the subarachnoid hemorrhage, depicted by the red circle.

QUESTION 3: WHAT IS THE BEST MEDICAL THERAPY FOR A PATIENT WITH IE ON A MECHANICAL AORTIC VALVE COMPLICATED BY A SAH?

Medical therapy for active IE involves the prompt initiation of empiric antibiotic treatment, which is later adjusted based on antibiogram results. Our patient was given 2 g oxacillin intravenously every 4 hours, 80 mg gentamicin every 8 hours, and 600 mg rifampicin daily. The management of anticoagulation therapy in this context is more controversial and was thoroughly discussed by the multidisciplinary endocarditis heart team (EHT). Given that our patient had a mechanical valve prosthesis complicated by SAH, the treatment approach needed to balance thrombotic and hemorrhagic risks. This evaluation included a comprehensive laboratory workup, including blood count, PT, INR, aPTT, creatinine, and liver function tests.

Warfarin was suspended on admission, and the patient was administered 6,000 IU enoxaparin twice daily. The team assessed the hemorrhagic risk associated with anticoagulation against the thromboembolic risk posed by active IE and the mechanical prosthesis.[6]

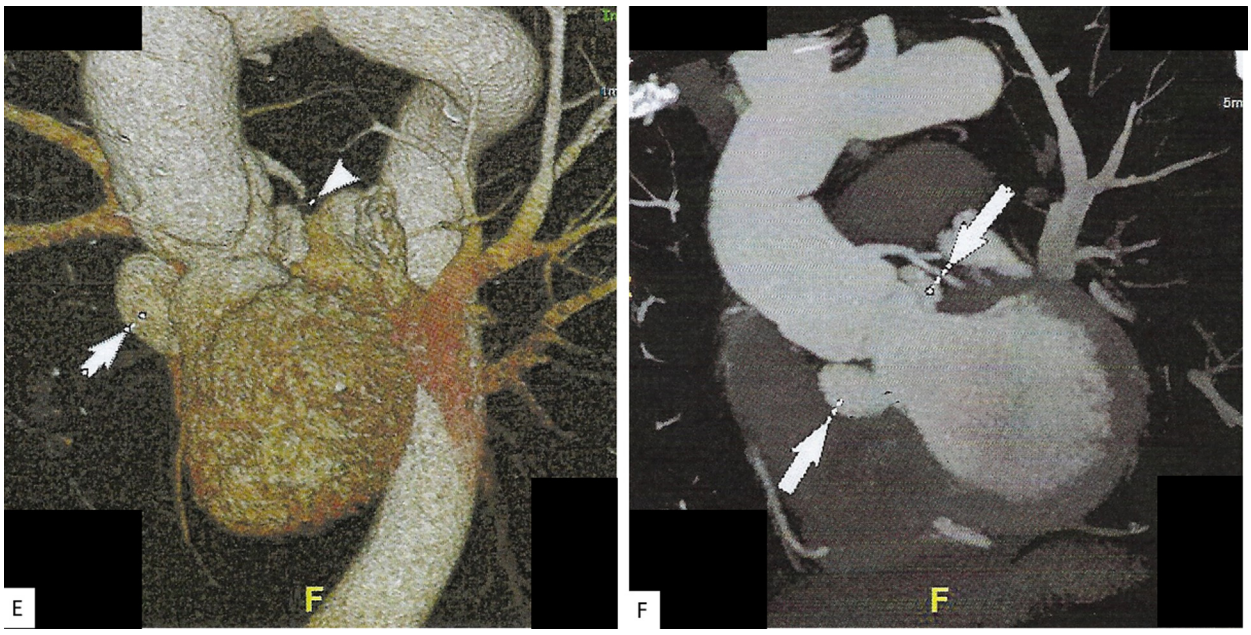
Some studies support continuing anticoagulation in patients with IE who are at high thrombotic risk, even with a high risk of intracranial bleeding, whereas others recommend suspending anticoagulation for at least 2 weeks.

In our case, the neurosurgeon did not recommend surgical intervention for the SAH, because it did not cause midline shift or significant intracranial compression. The cardiologist advised maintaining the INR within the therapeutic range of 2.5 to 3.5. Furthermore, surgery could not be postponed, as recommended by the ACC/AHA guidelines,[1] owing to the extension of the paravalvular abscess to the mitral-aortic junction, necessitating urgent cardiac surgery. The EHT decided to maintain enoxaparin therapy.

QUESTION 4: HOW CAN SAH INFLUENCE THE SURGICAL TIMING FOR AN IE?

Neurologic complications occur in 20% to 40% of patients with IE presenting a significant challenge when urgent cardiac surgery is needed.[7,8] Systemic heparinization and hypotension due to cardiopulmonary bypass can exacerbate neurologic conditions.[8] The EHT meets to discuss and determine the

FIGURE 4 Postoperative Angio-CT Scan



Angio-CT performed 6 months after surgery demonstrates the presence of 2 pseudoaneurysms with no paravalvular leakage and the homograft in position.

optimal timing for surgery on a case-by-case basis, balancing the risks of complications associated with IE.

In this patient's case, the aortic root abscess involving the mitral-annular junction was considered to be an acute condition with a potential risk of fatal rupture, posing a serious threat to the patient's life.

The patient underwent surgery 5 days after admission. Postoperative brain MRI revealed no change in the dimension of the subarachnoid hemorrhage (**Figure 3**), and there were no neurologic complications after surgery. The patient made a full recovery, and angio-CT performed 6 months after surgery showed the homograft in position with no paravalvular leakage (**Figure 4**).

QUESTION 5: WHAT ARE THE SURGICAL OPTIONS IN CASE OF IE WITH AN AORTIC ROOT ABSCESS IN A PATIENT UNDERGOING REOPERATION?

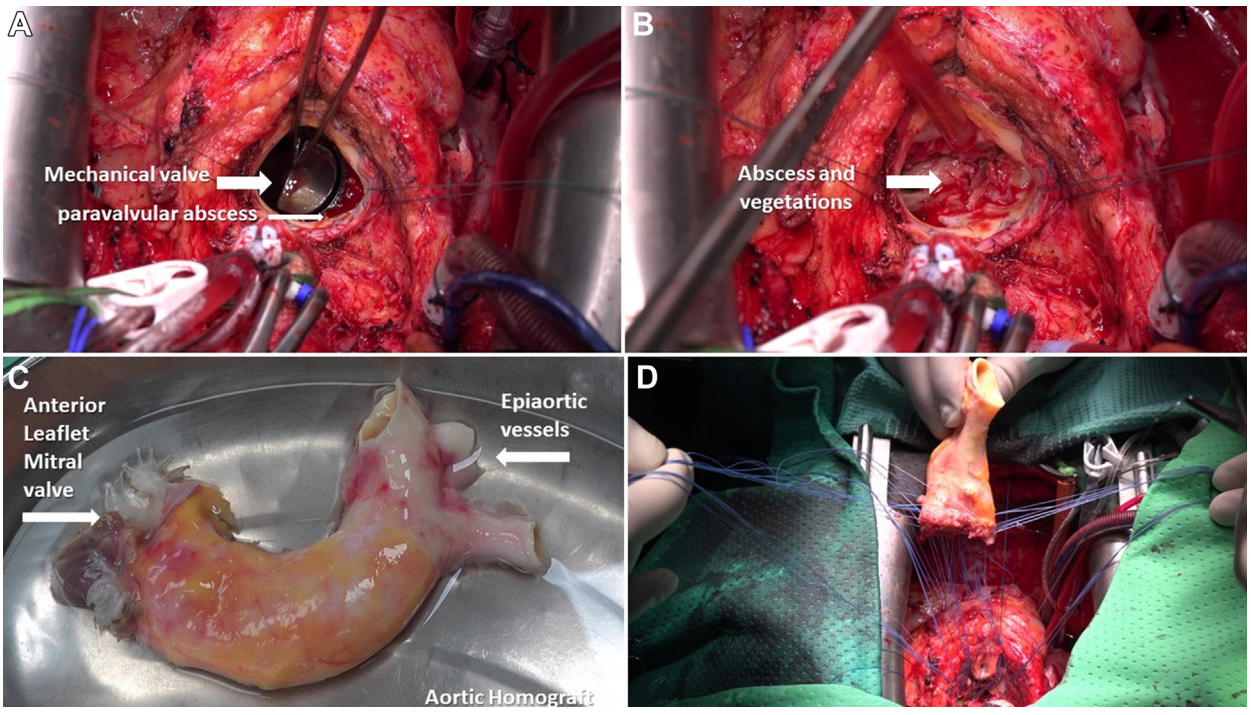
An aortic root abscess is a life-threatening condition that requires urgent surgical intervention. The 30-day mortality rate is reported to be as high as 19% to 25%. Surgical treatment often involves total aortic root replacement with the use of the Bentall operation with a biological conduit, patch reconstruction of the abscess cavity, a commando operation if the abscess is extensively spread, and the use of an aortic cryopreserved homograft (ACH).[8,9] Using biological material is crucial to minimize the risk of reinfection. In this case, we opted for an ACH. ACH provides several advantages, including the graft's adaptability to the patient's anatomy and the preservation of the anterior leaflet of the mitral valve, which allows for the reconstruction of the mitral-annular junction and enables more aggressive debridement.[10]

In addition, ACH has a low transvalvular gradient, reducing the risk of thromboembolic events and eliminating the need for systemic anticoagulation. It also offers a lower risk of reinfection. In **Figure 5**, the various steps of the surgical procedure are depicted.

CONCLUSIONS

Neurologic complications are rare but often represent the initial symptom of bacterial endocarditis. They frequently appear before IE vegetations are visible on an echocardiogram. This, combined with artifacts caused by cardiac prostheses, can delay diagnosis and significantly worsen surgical outcomes. Therefore, whenever a patient with a cardiac prosthesis presents to the ED with focal neurologic signs, bacterial endocarditis should be suspected, even in the

FIGURE 5 Intraoperative Images



(A) The mechanical valve appears detached from the mitral-aortic fibrosa owing to the presence of a paravalvular abscess, as indicated by the arrows. (B) After removal of the mechanical valve, vegetations and tissue erosion due to infection are exposed. (C) Cryopreserved aortic homograft with preservation of the anterior leaflet of the mitral valve for the repair of the mitral-aortic fibrosa abscess. (D) Positioning of the homograft.

absence of other symptoms and echocardiographic signs. It is advisable to repeat a negative echocardiogram or proceed to a second-level diagnostic modality.

This case demonstrates no progression of neurologic damage after surgery, aligning with current literature, which does not discourage surgery with cardiopulmonary bypass in these patients.

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KEY WORDS **aortic abscess, endocarditis, endocarditis heart team, prosthetic valve endocarditis, subarachnoid hemorrhage, systemic embolism**

APPENDIX **For a supplemental video and video summary, please see the online version of this paper.**