

# Techniques and Trends in Cardiovascular Imaging of Infective Endocarditis and Pericarditis: A Radiology Research Alliance Task-Force Report



<sup>1</sup> Bise, C . , <sup>2</sup> Rajiah, P.

1. LSU Health Sciences Center, School of Medicine, New Orleans, LA

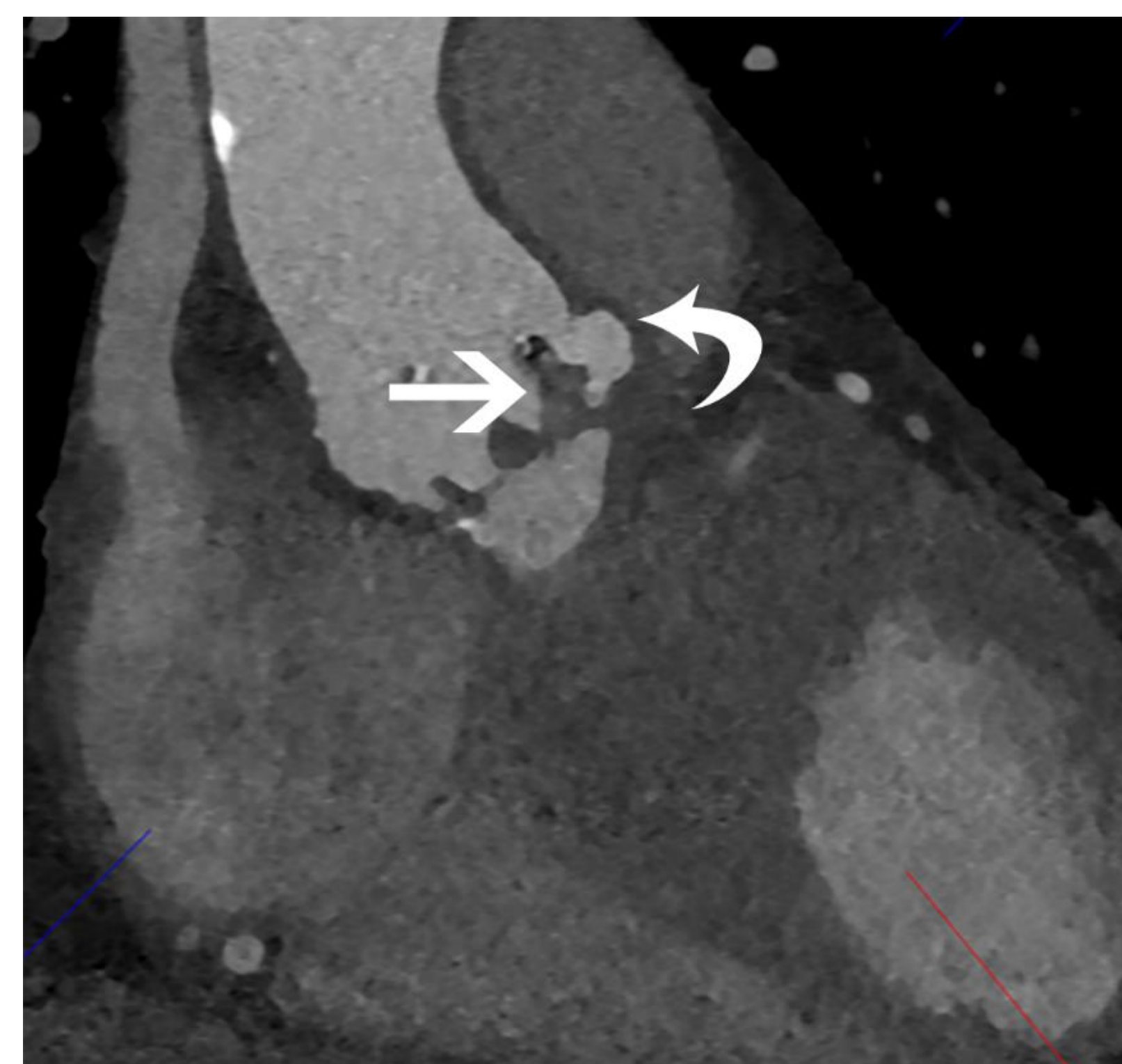
2. Mayo Clinic Hospital, Department of Radiology-Cardiovascular Imaging, Rochester, MN

## Introduction

- Infectious diseases caused by various organisms such as bacteria, virus, fungus and parasites remain an important contributor of morbidity and mortality. Lower respiratory infections (LRI) and diarrheal diseases are the 4th and 8th leading causes of death worldwide, claiming 2.6 million and 1.5 million lives in 2019 respectively (1).
- In low-income countries, there is a greater impact of infectious diseases with LRI the 2nd leading cause of death, and diarrheal diseases, malaria, tuberculosis and HIV/AIDS in 5th, 6th, 8th and 9th positions respectively (1). Infectious diseases can present in myriad ways. Infection can be confined to a specific organ with characteristic clinical presentation, which is easy to diagnose. However, the presentation is often non-specific and systemic, with no localizing features. In such circumstances, identifying the source and cause of infection becomes challenging.
- Imaging plays an important role in the evaluation of infection, including diagnosis, localization, prognostication, risk stratification and evaluation of treatment response. Several imaging techniques are now available for imaging infection, each with their own advantages and disadvantages.
- The choice of a specific imaging modality depends on the clinical presentation as well as the local availability of technology and expertise. In this article, we review the imaging techniques and trends, focusing on different body systems and also in special scenarios.

## Endocarditis

- Cardiac infections can involve the endocardium, myocardium or pericardium. Infective endocarditis (IE) is characterized by bacterial vegetations attached to the endocardium, cardiac valves or cardiovascular implanted electronic devices (CIEDs). IE can present as an acute, subacute or chronic illness, with non-specific, constitutional symptoms such as fever and malaise.
  - Diagnosis of IE relies on Duke diagnostic criteria, requiring either two major criteria, one major and 3 minor criteria, or 5 minor criteria (48). Major criteria include- two persistently positive blood cultures for endocarditis and evidence of endocardial involvement by echocardiography, including vegetation, perivalvular abscess, new partial dehiscence of prosthetic valve or new valvular regurgitation. Transthoracic echocardiography (TTE) is the most frequently used diagnostic test, but has limited sensitivity.
  - Transesophageal echocardiography (TEE) has higher resolution than TTE and is used as first-line tool in prosthetic valves (41).
  - CT scan is increasingly used for evaluation of paravalvular extension, particularly complications such as abscesses, pseudoaneurysm and fistula (Fig 9a)(49,50)



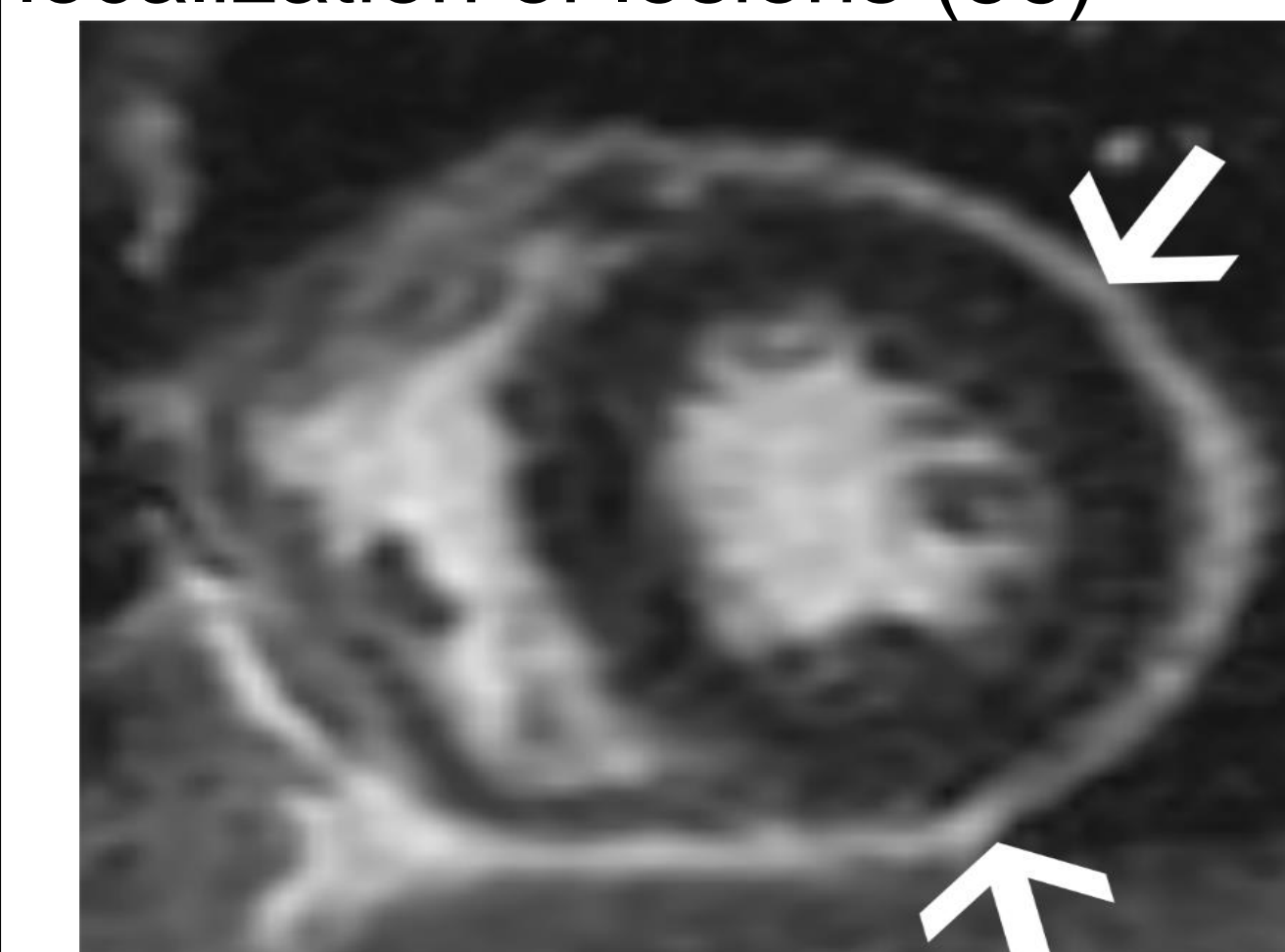
**Figure 9. A.** Coronal reconstructed CT image shows a vegetation attached to the aortic valve leaflet (straight arrow). There is also an infectious pseudoaneurysm adjacent to the valve (curved arrow)

## Pericarditis

Pericarditis, inflammation of the pericardial lining of the heart can be occasionally caused by infections. Clinical features include pericardial pain, pericardial friction rub, and abnormal ECG. Chest radiograph may show pericardial effusion. TTE is the first-line imaging modality, that can show effusion and evaluate functional complications such as constrictive pericarditis

. MRI is the mainstay in the diagnosis, providing both morphological and functional information (Fig 9c). Pericarditis is diagnosed when there is pericardial thickening, edema (seen in T2-w images) and contrast enhancement. Functional consequences such as constriction are also evaluated in MRI, particularly using free breathing cine images (55).

MRI can evaluate concomitant myocardial involvement. CT is used as an alternative to MRI, particularly providing information on calcifications, loculated effusions and localization of lesions (56)



**Figure 9C.** Short-axis post-contrast image shows diffuse circumferential late gadolinium enhancement of the pericardium (arrows), consistent with acute pericarditis.

## Conclusion

Imaging plays an important role in the evaluation of infectious diseases. The use of a specific imaging modality depends on the clinical presentation and availability. While radiograph and ultrasound are commonly used initial imaging techniques, CT is the most commonly used technique for evaluation of infections. MRI is also used for characterization, especially for nervous, musculoskeletal and cardiovascular systems. Molecular imaging techniques are valuable in infections without a specific source.