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Case Report
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Visualization of Heart Valve Affection in CRT-ICD Endocarditis Through Full Cardiac Cycle CT-Imaging

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Abstract

A tricuspid valve endocarditis was diagnosed in a 55-year-old female patient six months after CRT-ICD implantation. She presented with progressive symptoms of general weakness, loss of weight, loss of appetite and severe progressive dyspnea in the hospital which treated her initially. In laboratory test elevated CRP and leukocytosis was seen. The echocardiography showed some suspicious abnormal floating structure on the tricuspid valve. For further evaluation a transesophageal echocardiography was performed, which showed a 3.2 cm × 2 cm vegetation on the Right Ventricular (RV) lead. The patient was referred to our hospital for further diagnostics and treatment. We repeated the transesophageal echocardiography, which brought the same result so we decided to perform a CT-scan. A full cardiac cycle CT scan was performed on a photon-counting CT scanner, which showed besides vegetation on RV lead other multiple vegetations on the anterior leaflet of tricuspid valve in 4D imaging. The CT finding convinced us to opt for open surgical explanation of CRT-ICD System and surgical intervention of tricuspid valve. The CRT-ICD System was explanted safely, the vegetations were removed, and the anterior leaflet of tricuspid valve was partly resected and reconstructed using modified De Vega technique.

Keywords: CRT-ICD System; Tricuspid valve Endocarditis; Photon counting CT scan; Full cardiac cycle CT-imaging

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Introduction

Transthoracic and transesophageal echocardiography are the gold standard in the diagnostics of infective endocarditis. Along with Echocardiographic investigation, the role of CT scan in localization of vegetation is highly appreciable. With the advancement in the CT-technology was recently Photon Counting CT system (PCCT) introduced. It is a form of X-ray Computed Tomography (CT) in which X-rays are detected using a Photon-Counting Detector (PCD). These photon-counting detectors have the potential to overcome the limitations of current CT detectors, by providing CT data at very high spatial resolution, less noise, improved contrast-to-noise ratio, low radiation dose and with intrinsic spectral information. They are much more dose efficient than other detectors, have smaller pixels, which can significantly increase the spatial resolution. Here, we can expect qualitative images that visualize very fine tissue structures with low radiation and less use of contrast agent. Photon-counting CT offers several significant advantages over other existing CT imaging techniques, which opens potential to scan cardiovascular patients, overcoming compromises in lung and bone imaging and imaging of other organs and systems [1,2].

Here we present a case of CRT-ICD induced tricuspid valve endocarditis where photon counting full cardiac cycle CT-imaging played major role for the surgical intervention.

Case Presentation

A CRT-ICD was implanted in a 55-year-old female Patient with chronic heart failure due to dilated cardiomyopathy accompanying Left Bundle Branch block (LBB) in an external hospital. Six months later, the patient was admitted again in the same hospital with progressive dyspnea (NYHA III), general weakness and weight loss. The laboratory report presented with leukocytosis, thrombocytopenia, CRP elevation, raised transaminase and creatinine levels. The blood cultures were negative. The Transthoracic and Transesophageal Echocardiography (TTE, TEE) showed a high-grade tricuspid valve regurgitation and a 3.2 cm × 2 cm long vegetation on the RV lead. In

Figure 1: Shows vegetation visualization (star) in transesophageal echocardiography.

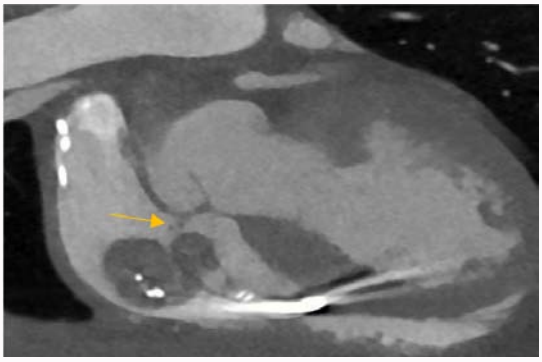

Figure 2: Shows the vegetation with a close contact to the tricuspid valve (arrow).

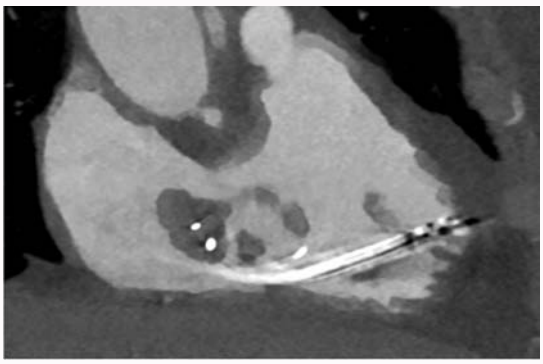

Figure 3: Shows the affection of the ICD lead.

history as well as in physical investigation there were no infective foci found.

For further assessment and therapy, the patient was referred to our hospital. Here we repeated transesophageal echocardiography, which showed similar findings, a vegetation on the RV lead and a high-grade tricuspid valve regurgitation. For further evaluation we decided to perform a CT-scan. A full cardiac cycle CT-scan with a photon counting CT scanner (NAEOTOM Alpha, Siemens Healthineers, Forchheim, Germany) was performed, which showed vegetation on the RV-lead and multiple minor vegetations on the anterior leaflet of tricuspid valve. So, we decided for sternotomy, surgical intervention on tricuspid valve and open CRT-ICD explanation. The vegetations were removed, the anterior leaflet of tricuspid valve was partly resected and reconstructed using modified De Vega technique. The Patient recovered fast and had a very uneventful stay in our hospital (Figures 1-3).

Discussion

In routine practice, the echocardiographic investigations are gold standards for the diagnosis of endocarditis. Its accuracy depends on factors like size and localization of vegetations, calcifications, concomitant valvular defects and the experience of echocardiographer [3].

The photon counting CT have certain advantages over other preexisting CT-scan techniques. The metal artifacts, beam hardening artifacts and noise streaks are better mitigated. High contrast and high-resolution structures are also better visualized [2]. The photon counting CT scan reduces radiation exposure, reconstructs images at a higher resolution, corrects beam hardening artifacts, optimizes the use of contrast agents and creates opportunities for quantitative imaging relative to other CT technology [4]. A full cardiac cycle CT investigation enables the assessment of morphological and functional structures of heart and can also be used to analyze in depth the ventricular function [5].

In our case, the vegetations on the tricuspid valve were in echocardiography not clearly visible, so we decided to perform CT-scan. A full cardiac cycle CT investigation with a photon counting CT scanner was done to explore the vegetations on tricuspid valve. The result was very convincing and helpful in making the decision for major surgical intervention.

There are also other alternative methods, such as 18F-Fluorodeoxyglucose Positron Emission Tomography with Computed Tomography-based attenuation Tomography correction (18F-FDG PET/CT), which has been increasingly used in the diagnosis of infective endocarditis. Its accuracy and sensitivity are reported to be better than echocardiographic investigations [6].

Conclusion

Despite all echocardiography remains first choice and a great diagnostic tool in evaluation of infective valvular disease, but CT scan performed especially on photon counting CT scanner can play an additional important role in representation of cardiac structures as a whole. It should be considered as standard in some selective cases of infective endocarditis, where echocardiography cannot provide sufficient information.

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