A Brief of Heart Valve Scan by CT Scan Medical Imaging

This article describes "how" to examine heart valves with computed tomography, normal, diseased, and prosthetic valves. A review of the current scientific literature is proposed. First, the technical basics, "how" to perform and optimize multi-slice CT, and "how" to interpret valves on CT images are described. Next, full-spectrum imaging of specific valve disease by CT, including prosthetic heart valves, is emphasized. The final section provides "how" guidance on using computed tomography to plan Trans Catheter Aortic Valve Implantation (TAVI), an emerging effective treatment option for patients with arterial stenosis. Heavy owner Particular emphasis is placed on the clinical applications of cardiac CT in the context of valvular disease. Multi-slice Computed Tomography (CT) is a new noninvasive evaluation modality of heart valves, with new clinical applications emerging in recent years. While multi slice computed tomography has been established to evaluate coronary arteries for a decade, the original heart valve has been overlooked. One of the reasons is that echocardiography is such an important modality in clinical practice. However, it has its own limitations, such as with regard to observer variability and high inter-individual variation in image quality depending on body habits or dependence from its throughput. In addition, echocardiography has limitations in assessing valve morphology. Therefore, multimodal imaging, including computed tomography, is essential for the diagnosis of valvular heart disease.

KEYWORDS: Heart • Medical Imaging • CT Scan • Coronary Arteries

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Introduction

The first part of this article describes the technical basis of the scanner, and how to recognize and optimize the multi-slot scanner. Next, the "how" to interpret the valve on CT and how to diagnose specific valve disease, including prosthetic valve dysfunction, is illustrated. Finally, a "how" guide to the use of CT in patients with severe aortic stenosis scheduled for Trans Catheter Aortic Valve Implantation (TAVI) is provided. TAVI is an emerging treatment option in these populations. Current and documented scientific evidence was reviewed. With particular emphasis on the latest and most useful clinical applications of "when and why" we effectively use cardiac computed tomography in the context of valvular heart disease in practice. From dream to reality While in the early 2000s the 4D cinema ("cinema image") of heart function by multi-slice Computed Tomography (CT) was just a "dream come true", the Continuous progress in resolution mainly in time, but also in space, has opened up new horizons. Since 2005, with 16, 64 or more slices and increased truss rotation speed, spatial and temporal resolution have been improved respectively. The highest temporal resolution of 75 ms is now achieved with second-generation dual-source computed tomography, allowing the best image quality for moving structures such as heart valves. In particular, left and right ventricular function can be quantified (ejection fraction, volume, etc.). This is no longer a dream, but reality [1, 2].

Discussion

To evaluate valvular function by multi-slice CT, it is necessary to collect one set of CT data over a number of complete cardiac cycles. There are two different ECG synchronization techniques. First, retrospective ECG, in spiral mode, is the technique of choice. For the 5-10 RR interval, the heart is imaged with a pitch range of 0.2-0.5. Second, two-stage potential ECG activation was introduced, a sequential scanning technique. This way the table moves "step by step" and covers the heart in 4-5 heartbeats. Two buffered ("pulsed") windows are placed: one at diastole with full tube current, to image the coronary arteries. The second buffer window (pulse) spans the entire RR interval at 20% mA of the reduction tube, allowing for assessment of valve function. Multiphase datasets are typically reconstructed at 5% or 10% intervals throughout the cardiac cycle. The advantage of prospective ECG activation is that the radiation dose is reduced by an average of 3.8 mSv, compared with retrospective spiral ECG activation. However, regular heart rate is necessary to avoid aberrations [3].

It is noteworthy that very new low-dose radiation CT techniques such as high-throughput coronary CTA with ECG synchronization record only the diastolic phase but allow for extremely low radiation exposure only 1 mSv. Therefore, it is feasible to evaluate valves in terms of morphology, not function. Cardiac arrhythmias such as atrial fibrillation or extra systoles are common in patients with valvular disease and may degrade image quality. Inconsistent RR intervals lead to "wrong registration" artifacts such as stair treads or "fuzzy and fuzzy" images. EKG correction is an effective technique to compensate for artifacts: "abnormal" heart rhythms (eg, extrasystoles) are "off" (= suppressed). On the other hand, if the interval between heartbeats is too long, data will be lost and a second reconstruction window must be added [4, 5].

It is generally not recommended to examine patients with atrial fibrillation with 16 or 64-slice CT scans, because diagnostic quality is often not achieved in these patients. In contrast, the superior temporal resolution of dual-source CT allows adequate image quality in most patients with atrial fibrillation and elevated heart rates. Beta-blockers should be used to lower and correct the heart rate (if there are no contraindications, eg. in patients with aortic stenosis). Inject iodinated contrast agent. To optimize the opacity of the chamber, the timing of contrast infusion is very important. If you inject a single-phase activator tablet during arterial phase, as is often done during coronary angiography (eg, at a high flow rate of 5 cc/s), the right chambers are usually "washed out" (without any contrast agent), and failed to assess the tricuspid cavity and pulmonary valve [6, 7].

Conclusion

In contrast, the biphasic contrast injection procedure is more favorable than the monophasic procedure in achieving enhancement of right ventricular function, allowing evaluation of all four valves and chambers, including the ability to regional and total analysis of left and right ventricular function. For this protocol, a rapid infusion at a high rate (5 cc/s) is administered first, followed by a second rapid infusion at a rate of approximately 3.5 cc/s. Total The volume of a rapid infusion is divided as follows: 80% high speed /20% low speed. After rapid infusion of contrast, approximately 30-40 cc of saline should be followed, to ensure rapid infusion of the rapid infusion and to optimize the conformation of the rapid infusion. It is recommended that the iodine concentration of the contrast agent be high (> 300 mg/dL). Another advantage of biphasic injection is the reduction of streaking caused by high contrast injection current [8-10].

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Conflict of Interest

None

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