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STUDY TO KNOW THE ARTERIAL PHASE 128-SLICE MULTIDETECTOR CT ANGIOGRAPHY DIAGNOSTIC ACCURACY FOR DETECTING THROMBUS IN LEFT ATRIAL APPENDAGES IN PATIENTS PREPARED FOR ATRIAL FIBRILLATION ABLATION

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Abstract:

Objective: *The aim of this study is to determine the Arterial Phase 128-Slice Multidetector CT Angiography diagnostic accuracy for detecting thrombus in Left Atrial Appendage in patients prepared for Atrial Fibrillation Ablation.*

Place and duration: *In the Radiology department ofChaudhry Pervaiz Elahi Institute of Cardiology (CPEIC), Multan in collaboration with Cardiology department for one year duration from October 2017 to October 2018.*

Methods: *The accuracy of MDCT variability in the left atrial thrombus evaluation before AFA and its investigation was done. Before the procedure, 50 MDCT and transesophageal echocardiography examinations were performed. All MDCT images were reviewed by 3 experienced observers to detect the thrombus presence in the left atrial appendage, and transesophageal echocardiograms (TEE) were reviewed by two different readers, which were taken as reference standards. For clinical data; all observers were blinded to and each other.*

Results: *Inter-observer variability was low between the 3 readers of MDCT (P = 0.001, highest kappa statistic, 0.43). Diagnostic accuracy was much different with sensitivities from 100% to 50% and with specificities from 86% to 45%. The ETE reader contract was 97%.*

Conclusion: *MDCT has only a modest diagnostic accuracy and high interobserver variability for detecting left atrial appendage thrombus in subjects done with AFA procedure. The accuracy of MDCT affected by potential factors includes the image quality and the problem in differentiating the clot from the pectinate muscle. It is supposed that MDCT is not the most appropriate procedure for the left atrial thrombus detection by using interpretation standards and existing techniques.*

Key Words:*MDCT, Arterial Phase, diagnostic accuracy, Radiology.*

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INTRODUCTION:

MDCTA; Cardiac multidetector computed tomography angiography was launched in 1999 and has since grown in the clinical cardiovascular environment [1]. MDCTA was first regarded as a new invention to furnish a coronary angiogram, and has been shown to have a best accuracy as diagnostic tool compared to invasive coronary angiography for the obstructive atherosclerotic disease detection [2]. However, for cardiac MDCTA, other applications such as analysis of left ventricular function, myocardial perfusion of effort, and fibrosisdetection and myocardial viability have been proposed and tested [3]. In addition, to improve visualization and diagnostic accuracy of the small coronary artery, MDCT new generation scanners (ie128 detectors) have very good spatial resolution to an extreme of 0.35 mm in an isotropic voxel size (0.35 mm on each side) [4].For (AFA)atrial fibrillation ablation, the electroanatomicintegration of imaging with high-resolution MDCTA in three-dimensional (3D) allows to detect the accurate anatomically oriented ablation lesions and help in complex strategies of ablation [5]. Typically, (TEE) transesophageal echocardiogram is done before the AFA method to detect the thrombus in the left atrial appendage (LAAT), which may result in ischemia helps in the restoration of normal rhythm of sinus. We are trying to determine the accuracy of MDCTA and interobserver variability in the LAAT diagnosis [6-7]. The MDCTA with his good performance helps in determining LAAT can prevent the TEE studyneeds to save cost,time and anxiety and discomfort in patients [8].

MATERIALS AND METHODS:

This prospective study was held in the Radiology department of CPE Institute of Cardiology Multan in collaboration with Cardiology department for one year duration from October 2017 to October 2018. 128 MDCTA and TEE detectors were done in a total of 200 patients before the AFA was included. Because the LAAT prevalence in patients prepared for AFA methods was minimum due to vigorous anticoagulation, we do cohort by taking 5 consecutive subjects who had canceled their AFAs due to LAAT. 10 subjects with higher risk of LAAT (defined below) and were selected randomly had decreased LAAT risk. Previous cerebrovascular accident history, low left atrial ejaculation rate or spontaneous echo contrast in the L.A were evaluated by TEE. As shown in transthoracic echocardiography, a large (> 6 cm) depression with left ventricular ejection fraction (LV) (<40%). All TEE and MDCTA were done one day before or on the day of AFA procedure. All cases underwent chronic anticoagulation with enoxaparine and warfarin (1 mg / kg every 12 hours) before the method. The MDCTA performance was evaluated by the in-house variability analysis and the consensus discussed below was compared with the TEE interpretations.

MDCTA scans were performed with a MDCT scanner 128 detector (Toshiba Medical Systems, Aquilion,CXL Japan), which was commercially available before the introduction of AFA procedure. By two responsible physicians the research technique was explained in order to achieve optimal image quality while decreasing exposure to radiation, and was also dependent on gender and age of the subject. The segmented collimation varies from 65 x 0.6 to 33 x 2 mm, the 120 kV was the tube voltage. Multi-part restructuring was performed as required to make transitional decisions of 70-200 ms. A non-ionic iodonic contrast bolus (ULTRAVIST 300 MG) was applied at 4-5 ml / min flow rate in the antecubital vein, followed by a Saline bolus using a double power injector head (IMaxion Dual barrel (syringe). We used the automatic recovery detection of the 180 Houns field unit (HU) in the descending aorta (Toshiba Medical Systems, SureStart, Japan) to trigger the screening. Studies were done with a cut-length of 0.5 mm, an increase of 0.3 mm (images were obtained with a cut-up of 128 x 0.5, helps in an better spatial qualityof 0.35 mm on both side of the pixel or 1 mm). An increase of 0.79 with an incision thickness (images obtained with 32 x 1 collimations resulted in a spatial resolution of about 1 x 0.35 × 0.35 mm) and in the normal heart cycle phases, ie at in the atrial rhythm 50% of the RR interval. At 10% intervals of phases which were reconstructed for analysis of function (the cut thickness was 2 mm with 2 mm increase). All studies of MDCTA were blinded by organizers with ten years experience or above in cardiac images (two have experience of more than 25 years). There are 3 MDCTA clinical observers readers and each has given information on MDCTA in international conferences. Using a workstation with cardiac imaging software package (Vital Images, Vitrea5.12265.3045) Scans were done. To determine whether the presence of slow LAA-induced spontaneous contrast was evacuated to the iodinated contrast filling with TEE, be careful not to add a 100 mm2 circular (ROI) region of interest to the center of LAA of the MDCTA images. By mean HU contrast attenuation was determined.

Acquisition and analysis of TEE images:

Using broadband multichannel transducer of 7 MHz TEE was performed connected to an IE 33 ultrasound machine or HP Sonos 5500 (VIVIDE 95 CI SPR11). The LAA Long axis images were taken in the middle

esophagus in 10-15 of increments. For all TEEs; the clinical indication was to exclude LAAT better than to discard AFA. The 2 blind observers and independent observers with experience commented on TEE in the absence or presence of LAAT and 3rd observer solved disputes. For this reason, MDCTA and TEE comparison was done and the TEE interpretations of first two were used to measure the interobserver concurrence between TEE. Using precision and kappa statistics and the MDCTA specificity was calculated the agreement between readers was determined to give an idea of the test accuracy. To compare Student's test and compare rates; Fisher's exact test was used. A p value of <0.05 was accepted to state strong significance. We used commercially used(SPSS 18.0 for Windows) for data analysis.

RESULTS:

50 total patients were examined, women were 10 (20%) and 40 men; The 63.1 ± 11.0 was the mean age as given in Table 1.

Table No 01: Summary of Patient Characteristics

Age in years, mean (SD)	**63.10 (11.0)**
Males, n (%)	40 (80%)
AFib during MDCTA, n (%)	27 (54%)
Heart rate during MDCTA, median (IQR)	68.50 (54.8-81.3)

TEE = transesophageal echocardiography
MDCTA = Multidetector Computed Tomography Angiography
AFib = Atrial Fibrillation Rhythm
IQR = Interquartile Range

Beta-blockers are not used on daily basis; 68.5 (interquartile range [IQR] 54.8-81.3) pulse (bpm); Twenty-seven patients (54%) had atrial fibrillation rhythm screening and sinus rhythm in 23 (46%) (mean HR 80.93 ± 22.06 and 58.5 ± 11.4lpm, P>0.06). Although; positive with TEE by consensus (4% prevalence)two patients were considered, the AFA procedure was canceled due to the reading of LAAT clinical TEE in 5.

Table No 02: Sensitivity and Specificity Results as Compared to TEE For the Individual MDCTA Interpretations

	Sensitivity	Specificity	PPV	NPV
All Patients				
CT reader 1	50%	73%	07%	97%
CT reader 2	50%	85%	13%	98%
CT reader 3	100%	44%	07%	100%
Slice collimation 64 × 0.5 mm				
CT reader 1	0%	73%	0%	95%
CT reader 2	0%	88%	0%	96%
CT reader 3	100%	46%	7%	100%
Slice collimation 32 × 1 mm				
CT reader 1	100%	73%	14%	100%
CT reader 2	100%	82%	20%	100%
CT reader 3	100%	41%	07%	100%
Heart rate ≤ 65 bpm				
CT reader 1	0%	71%	0%	94%
CT reader 2	0%	86%	0%	95%
CT reader 3	100%	52%	9%	100%
Heart rate > 65 bpm				
CT reader 1	100%	74%	13%	100%
CT reader 2	100%	85%	80%	100%
CT reader 3	100%	37%	06%	100%

Although TEE and MDCTA also examined the thrombus of the L.Abody,they could not find anything at the same time. The specificity and sensitivity of each MDCTA reader was compared to TEE is shown in Table 2 and the MDCTAinterobserver agreement is shown in Table 3.

Table No 03: Agreement Between MDCTA Readers as Calculated by kappa Statistics

	Kappa	P-value
All Patients		
CT reader 1 vs 2	0.43	0.001
CT reader 2 vs 3	0.24	0.009
CT reader 3 vs 1	0.37	0.002
Slice collimation 64 × 0.5 mm		
CT reader 1 vs 2	0.29	0.09
CT reader 2 vs 3	0.18	1
CT reader 3 vs 1	0.30	0.062
Slice collimation 32 × 1 mm		
CT reader 1 vs 2	0.55	0.006
CT reader 2 vs 3	0.30	0.011
CT reader 3 vs 1	0.44	0.011
Heart rate ≤ 65 bpm		
CT reader 1 vs 2	0.32	0.099
CT reader 2 vs 3	0.27	0.062
CT reader 3 vs 1	0.36	0.056
Heart rate > 65 bpm		
CT reader 1 vs 2	0.51	0.005
CT reader 2 vs 3	0.22	0.066
CT reader 3 vs 1	0.36	0.013

Figure 1 gives graphical visualization of the MDCTA readers agreement between them. In 26 (52%) cases, 20 were negative for LAAT(all negative for ETE)and positive cases were 6 (for ETE one was positive) and 3 observers coincided.Taking all MDCTA readerspossible combinations, the minimum 20% was the disagreement, which combined A and B readers.

The 10 control patients' analysis showed a similar disagreement between MDCTA readers of this patient group. comparison with the whole cohort (at least 20% and a dispute greater than 40%). The readers of TEE 1 and 2 agreed on all studies except one, which resolved by TEE 3rd observer.

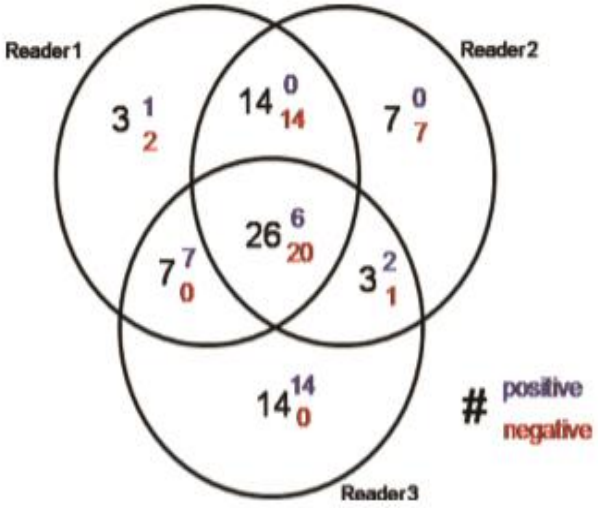

Figure 1. *Diagram showing the reading agreements between the three MDCTA readers. The total number of reads is shown in black, the positive reads are shown in blue in upper case, and the negative reads are shown in red in lower case.*

DISCUSSION:

The MDCTA of the 128 cardiac detector provides a series of high-quality image data of the heart, and nearby organs coupled with low-resolution electroanatomical maps can increase AFA procedures in three dimensions; the speed, accuracy and safety of applications of radio frequency [9-10].With this cardiac MDCTA scan, other parts of the heartinformation, like LAA, is obtained as "free" with iodized contrast filled in lumen, which means, "LAAT, the potential of avoiding the need for a TEE before AFA [11]. Our analysis shows that even strong interpreters, LAAT cannot be detected by MDCT because our performance resultsvariability is greater as given in Table 3 and Figure 1. The accuracy of a specific MDCTA reader was 100% but% this configuration may be clinically useful, and may be safe to send MDCTA negative patients.On a positive MDCTA,AFA procedures and to perform TEE alone however, between readersgive the high variability, As a result, predictive values in high negative in general, at the very low predictive positive values expense; however, the first may be wrong leading in view of the low LAATprevalence observed in AFA procedurespatients in general, and to a large number of patientsthis combination will erroneously canceled procedures and vigorous anticoagulation [12]. Two other analysis attempted to determine the ability of MDCT'to detect LAAT only with a different browser invention. One of them showed excellent MDCT sensitivity (sensitivity and 100% specificity) in the LAATdiagnosis using a former MDCTgeneration scanner with 4 detector sequences and a 500 ms portal rotation time which provides greater temporal and spatial resolution[13]. The MDCTA different imaging protocols may have rendered our diagnostic accuracy: higher flows and finer shear thickness give good signal-to-noise ratio to spatial resolution, but at risk of increased exposure to radiation, especially if patients were given more radiation during the procedure of ablation. For visualizing the function and morphology of LAA;TEE is considered as a preferred method, including LAAT [14].From other imaging modalities;TEE has many advantages in terms of high imaging resolution because of its close proximity to the heart in the evaluation of LAAT and transient (less than two to ten times the spatial resolution and temporal resolution of MDCT4-6 times and no exposure to ionizing radiation [15]. On the other side, the data supporting the TEEuse prior to AFA is based on reality that if the TEE not detects the thrombuspresence, early cardioversion can be done safely without the need for long-term oral anticoagulation before the method. Therefore, TEE was not approved against a gold color or pathology to obtain images, but instead confirmed clinical results.

CONCLUSION:

If the MDCTA could diagnose thrombus, it would have two benefits, and in some patients it could eliminate the need for pre-ATI TEE. Additional research targeting different imaging techniques, reduction of heart rate by beta-blockers, rapid

technological developments and clinical follow-up in the MDCTA environment should continue to be evaluated and use of MDCTA for larger LAAT detection.

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