

Sensitivity of 16-Row CT Angiography as Compared with Conventional Invasive Angiography

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Abstract: Sensitivity is one of the important indicatives for evaluating the reliability of a medical procedure. Herein, we have evaluated the sensitivity of CT angiography (CTA) in comparison with conventional invasive angiography (CIA) in the diagnosis of significant stenosis. For this purpose we used a 16-multidetector-row scanning machine. In this regard, 8 patients suspected to stenosis were investigated. They patients were undertaken both procedures. The obtained results show, the sensitivity of 87.5 % for patient-base analysis. The findings of this study reveal that CT angiography with 16-slice scanner might be considered as an acceptable technique for rapid triage of patients. The moderate value of sensitivity depicts moderate score for CTA protocol for replacement. It should be noted that the low number of patients results in obtaining results which cannot be used for final decision. and more patients is required to examine the procedure.

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1. Introduction

For several centuries, the coronary artery disease is one of the main causes of disability and death. The conventional invasive angiography (CIA) was considered as conventional method for making the diagnosis of coronary artery disease [1-2]. CIA is highly reliable compared to other indirect evaluation methods such as stress testing.

However, CIA is not a good choice in some cases due to its invasive nature and the risks of complications i.e. arrhythmia, myocardial infarction, stroke, access site problems, etc. Therefore, an accurate non-invasive alternative evaluation method for diagnosing coronary artery disease is highly desirable. In order to overcome the complications of CIA, multi-slice computed tomography angiography (CTA) has been proposed in recent years as an alternative procedure for determining the presence of coronary obstructions. With the recent development in hardware with multiple detectors, the spatial resolution of the images has been significantly improved and consequently CTA has become the center of interest for clinicians. The imaging machines facilitated the rapid identification and assessment of atherosclerosis within the moving coronary arteries and potentially reduced the necessity of CIA.

To conquer the problem of complications of CIA, multi-slice computed tomography angiography (CTA) has been proposed in recent years as an alternative procedure for determining the presence of coronary obstructions. With the recent development in hardware with multiple detectors, the spatial resolution of the images has been significantly

improved and consequently CTA has become the center of interest for clinicians. The 4-slice, 16-slice and 64-slice imaging machines have been utilized in 1998, 2001 and 2004, respectively [2]. These machines facilitated the rapid identification and assessment of atherosclerosis within the moving coronary arteries and potentially reduced the necessity of CIA.

As the literature review, in Ref. [3,4] one can find another comprehensive systematic review and meta-analysis of the clinical effectiveness and cost-effectiveness of 64-slice or higher CTA as an alternative to CIA for detecting coronary artery disease. Other systematic reviews on evaluation 64-Slice CTA in the diagnosis and assessment of coronary artery disease has been conducted in refs. [2, 5,6]. Stein et al. [7] performed a systematic review on 64-slice CTA for diagnosis of coronary artery disease. They concluded that negative CTA reliably excluded significant coronary artery disease. However, the data suggest that stenosis shown on CTA need confirmation. Combining the results of 64-slice CTA with a pretest clinical probability assessment would strengthen the diagnosis [7]. Further useful findings can be found in other works that examined the accuracy of 64-row CTA in comparison with CIA for detecting coronary artery diseases [8-15].

As known, the sensitivity is one of the most important indicatives for evaluation of procedures. Hence, this investigation is conducted to evaluate the sensitivity of CTA in identifying significant stenosis. The accuracy of 16-row CTA is compared with that of

CIA method. This is conducted using a 16-row-detector CT scanner.

2. Methods

2.1. Patients

The study population was chosen from patients referred to hospitals with suspected coronary artery disease. In this study 8 patients asked to participate. According to cardiologist diagnoses, all these patients underwent CIA after CTA performed. Exclusion criteria for CTA were based on technical factors that made the patient unsuitable for the procedure. These included known allergic reaction to iodinated contrast agents, high baseline heart rate (>70 beats/min) with contraindication to beta-blockade, atrial fibrillation, inability to perform a 15-s breath hold, inability to lie flat, abnormal renal function (serum creatinine level >1.5 mg/dL).

2.2. Scanning Protocol

All patients were scanned with a 16-slice CT scanner. A dose of 15 ml contrast material was used during the bolus timing scan calculated (by the apparatus software) at the level of the descending aorta. All data sets acquired were reconstructed from the axial images using retrospective electrocardiogram gating.

The reconstructed images were visually evaluated for estimation of coronary artery narrowing. The judgment about the absence/presence of desises was made after viewing the various images and checking stenosis of main coronary vessels.

2.3. CIA procedure and analysis

Routine CIA was performed via the femoral or radial artery. All evaluated vessels were classified as normal as having non-significant disease, or as having significant stenosis. Accordingly, patients were classified as positive for the presence of significant coronary artery disease if there was a significant stenosis in any artery.

2.4. Statistical Analysis

The CTA accuracy for detecting vessel stenosis was evaluated via an indicative statistical parameter. These parameters were calculated for patient and presented as percentage.

3. Results

The characteristics of the 8 patients were analyzed and the result is presented in Table 1. The obtained result reveals that patients were diagnose as normal by both CIA and CTA.

Table 1: Diagnostic performance of CTA for the detection of significant stenosis.

Analysis	Sensitivity %
Patient based	87.5

Many progresses have been accomplished to provide the time-saving accurate diagnostic protocols

for suspected patients. The advent of 16-slice CT scanners accelerated this evolution. CTA is recommended useful especially for patients due to the higher complications of CIA. However, a crucial issue is to understand how much the CTA findings are close to those of CIA. According to the patient-based data presented in Table 1, CTA have a sensitivity value of 87.5% when compared to CIA procedure.

Comparison between the obtained result and those presented in other review papers [5, 6], show that the patient-based sensitivity of presented study are less than the values reported by previous researchers for 64-slice CTA. Comparing the present study with other investigations reveals that the computed sensitivity is less than those reported in literature [5,6]. This reveals a moderate performance of CTA.

3.1 Problems with respect to technology

It is expected that new generation of scanning machines with higher number of slice per rotation (rows) and higher temporal resolution can diminish some inaccuracy of the present 16-slice CT scanners. Previous research on different generation of multi-detector CT machines (4-slice, 16-slice and 64-slice scanners) revealed that increasing in number of slice per rotation result in more accurate results [21]. This trend is expected to be continued for the forthcoming multi section scanners with further number of detectors. For example new generated 320-row scanners improved image acquisition as well as reduced radiation dose compared with retrospectively gated 64-row CTA [15]. Moreover, in recent years, several modified techniques i.e. dose modulation [22], eliminating helical oversampling [23], prospectively gated approach with electrocardiogram triggering [24], etc. have been developed to decrease CTA radiation dose. These technological advances reveal that the reliability of CTA can approach to CIA in future.

3.2. Future directions

For increasing the diagnostic performance of the CTA, one might evaluate the myocardial perfusion. This can be performed via combine the anatomic data with physiologic significance of the atherosclerotic lesions. Further investigation is required for developing appropriate acquisition protocols for optimal image acquisition and decreased radiation dose. With the ongoing developments in CTA technology, future attempts should be conducted on further reducing radiation exposure, while maintaining high image quality.

4. Conclusions

Sensitivity is an important indicative for making decision on the reliability of CTA and CIA procedures. The obtained results demonstrated moderate diagnostic accuracy for the assessment of obstructive disease using 16-row CTA. CTA had the

sensitivity of 87.5%. The value of sensitivity shows that CT angiography with 16-slice scanner might be considered as a suitable technique for rapid triage of patients presenting to emergency hospitals. However, due to the low number of patients, further investigations is required to determine whether 16-row scanning technology has sufficient resolution to delineate coronary artery diseases.

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