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ORIGINAL ARTICLE

DIAGNOSTIC SENSITIVITY OF CORONARY CTA VERSUS CONVENTIONAL ANGIOGRAPHY IN PATIENTS WITH SUSPECTED CORONARY ARTERY DISEASE

Chyia Surchew Shareef, Aska Farooq Jamal

Radiology Department, Rizgary Teaching Hospital, Kurdistan Higher Council of Medical Specialties, Hawler, Kurdistan region, Iraq

ABSTRACT

Background: The coronary artery diseases are public health problem responsible for millions of deaths yearly all over the world. Earlier detection of these diseases is essential in treatment and prevention of high morbidity and mortality. The aim of this study was to find out the accuracy of detecting significant coronary stenosis by computerized tomography angiography versus conventional coronary angiography.

Materials & methods: Present study was retrospective cross-sectional study implemented in Cardiac center at Erbil city, Kurdistan region-Iraq in duration of six months from 1st of April to 31st of September, 2023 on sample of 100 patients with suspected coronary artery disease. Saved records of patients who were admitted in cardiac center hospital were reviewed regarding conventional angiogram with computerized tomography angiography in radiology department of this hospital.

Results: There were no significant differences between CTA findings and conventional angiography findings regarding coronary stenosis detection, severity of stenosis, LAD stenosis, CX stenosis, RCA stenosis, LM stenosis, diameter of stenosis and area of stenosis ($p>0.05$). There was a highly significant relationship between CTA stenosis detection and conventional angiography stenosis detection ($p<0.001$) with validity findings of CTA in diagnosis of stenosis were (75.9% sensitivity, 80.4% specificity and 78% accuracy).

Conclusions: The computed tomography angiography has an acceptable accuracy in diagnosis of coronary artery diseases as compared to conventional invasive angiography.

KEY WORDS: Angiography, Coronary artery disease, Coronary Stenosis.

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INTRODUCTION

Coronary artery diseases (CADs) are defined as atherosclerotic plaques occur in epicardial coronary arteries. The atherosclerosis resulted from genetic susceptibility and risk factors such as elderly age, female gender, dyslipidemia, hypertension, diabetes mellitus and smoking.[1] The CADs represented the fourth leading cause of mortality and disability in developed and developing countries. Globally, the Middle East countries had the higher CAD incidence. Increasing age threshold with modernization of lifestyle and urbanization leads to epidemiologic transition from infectious to non-communicable diseases specifically coronary artery diseases.[2] In Iraq, the coronary artery diseases are responsible of about one-fourth of total deaths at 2020.[3]

Although differences between different guidelines, the CAD diagnosis approaches are basically aiming to confirm the diagnosis, prognosis, timing and need for revascularization. To achieve these aims, different diagnostic techniques are designed to assess either the anatomy or functional testing.[1] Traditionally, the coronary angiography is the

Corresponding Author:

Dr. Chyia Surchew Shareef
Department of Radiology
Rizgary Teaching Hospital
Kurdistan Higher Council of Medical Specialties
Hawler, Kurdistan region, Iraq
E-mail: chiashareef@gmail.com

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most preferable invasive diagnostic technique of coronary artery diseases that is based on surgical catheter intervention which helps in detecting the plaque.[4] Despite rare post-procedure death rates, frequent rates of complications are reported following coronary angiography such as local vascular complications, vascular complications, arrhythmia, myocardial infarction, infection, stroke, etc. These complications are related to patients' demographics, clinical comorbidities, vascular anatomy and physicians' experience.[7]

The coronary computed tomography angiography visualizes directly the coronary arteries and provides better atherosclerotic detection and severity assessment.[5] Despite publicity of coronary angiography in CAD diagnosis, different authors revealed the close effectiveness of both coronary angiography and computed tomography angiography (CTA) in detecting obstructive CAD with high performance of CTA in non-obstructive CAD, in addition to low complications rate.[6-8] However, one trial found that earlier implement of CTA in diagnosis and management failed to improve clinical outcomes of intermediate risk acute coronary syndrome after one year follow up.[9] Many guidelines selected the CTA as the 1st line diagnostic approach of coronary artery diseases.[10] However, more information are needed regarding effect of patients demographics and angina pectoris types CTA performance.[11] It was shown that approximately two thirds of implemented coronary angiographies did not confirm obstructive CAD with high economic burden, for that improving imaging exclusion of obstructive CAD, improving the 5 years survival rate, and developing the diagnostic accuracy of coronary angiography.[11, 12] However, the use of CTA as first line imaging test for patients with suspicion of CAD is still controversial. The aim of this study was to find out the accuracy of detecting significant coronary stenosis by computerized tomography angiography versus conventional coronary angiography.

MATERIALS AND METHODS

A retrospective cross-sectional study implemented in Cardiac center at Erbil city, Kurdistan region-Iraq in duration of six months from 1st of April to 31st of September, 2023. All suspected patients with coronary artery diseases were study population. Patients taken during data collection are included in my study from both sexes aging from 25-80 years old, all are having both modalities performed for them correspondingly (i.e: CTA and conventional angiography) were the inclusion criteria. Exclusion criteria were patients with previous diagnosis of coronary artery disease less than 55 years age without any risk factors of hypertension, diabetes, obesity and smoking, chronic renal failure requiring hemodialysis and missing or incomplete saved records. Ethical issues were subjected to Ethical Committee of Kurdistan Board for Medical Specializations by approval of hospital authorities and confidentiality of data. A sample of 100 patients with suspected coronary artery disease was selected after eligibility to inclusion and exclusion criteria.

The saved records of patients were collected and reviewed retrospectively by researchers and filled in a prepared questionnaire that included basic characteristics (age, gender, body mass index, socioeconomic class, ethnicity and blood pressure), causes of admission (stable angina pectoris, unstable angina pectoris, non-cardiac chest pain, other chest deformities, retrosternal pain, pain aggravated by exertion, pain relieved by GTN, duration of chest pain and time interval between coronary CTA and conventional angiography), common risk factors of CAD, common co-morbidities of patients with CAD, computerized tomography angiography findings (stenosis, stenosis severity, LAD, CX, RCA, LM, diameter of stenosis ≥50% and area of stenosis ≥75%) and conventional invasive angiography findings (stenosis, stenosis severity, LAD, CX, RCA, LM, diameter of stenosis ≥50% and area of stenosis ≥75%). The files and computerized records of cardiac center were reviewed by researchers after taking official permission from their administration. Saved records of patients who were admitted in cardiac center hospital were reviewed regarding conventional angiogram with CTA in radiology department of this hospital. Patients were diagnosed with CAD or with suspected coronary artery disease by the cardiologists and cardiothoracic surgeons of the relevant center based on their own medical and surgical guidelines and they are referred to the radiology department for doing the radiological studies. The CTA was done by radiologists in the radiology department and invasive angiography was done by cardiologists. CTA equipment was ICT 256, multislice CT, and the invasive coronary angiogram device is Philips Azurion, release 1.2.1, 2018-09-06. The patient's data were entered and analyzed statistically by statistical package of social sciences program-26 with suitable tests like chi square and fishers' exact tests for statistical relationships, while independent sample t-test was used for continuous variables. Significance level was ≤0.05.

RESULTS

Our study included 100 patients with suspected coronary artery disease with mean age (58.7 years); 35% of them were in age of less than 50 years. Male patients with CAD were more than females (61% vs. 39%). Mean body mass index was (26.5 Kg/m^2); 23% of them were obese. The socioeconomic class of patients with CAD was categorized into low (24%), medium (58%) and high (18%). Most of patients were Kurdish and 25% of them had high blood pressure. As shown in Table 1; there

was a highly significant relationship between CTA stenosis detection and conventional angiography stenosis detection ($p<0.001$) with validity findings of CTA in diagnosis of stenosis were (75.9% sensitivity, 80.4% specificity and 78% accuracy).

Table 1: Validity of CTA in comparison to conventional angiography.

CTA	Conventional angiography				P
	Stenosis		No stenosis		
	No.	%	No.	%	
Stenosis	41	75.9	9	16.9	<0.001 S
No stenosis	13	24.1	37	80.4	
Sensitivity (75.9%), Specificity (80.4%), PPV (82%), NPV (74%), Accuracy (78%).					

S=Significant, PPV=Positive predictive value, NPV=Negative predictive value.

As shown in Table 2; CTA validity findings in LAD stenosis were (100% sensitivity, 75% specificity and 97.5% accuracy), in CX stenosis were (73.9% sensitivity, 72.2% specificity and 73.1% accuracy), in RCA stenosis were (83.9% sensitivity, 100% specificity and 87.8% accuracy), in LM stenosis were (70% sensitivity, 93.5% specificity and 87.8% accuracy), in stenosis diameter ≥50% were (90% sensitivity, 54.5% specificity and 80.5% accuracy) and in stenosis area≥75% were (77.8% sensitivity, 92.9% specificity and 82.9% accuracy).

Table 2: Validity findings of CTA in comparison to conventional angiography in different vessels and stenosis severity.

Variable	Sensitivity	Specificity	Accuracy
	%	%	%
LAD	100.0	75.0	97.5
CX	73.9	72.2	73.1
RCA	83.9	100.0	87.8
LM	70.0	93.5	87.8
Diameter≥50%	90.0	54.5	80.5
Area≥75%	77.8	92.9	82.9

DISCUSSION

In current study, the stenosis of coronary artery detected by computerized tomography angiography was significantly related to stenosis of coronary artery detected by conventional invasive angiography. This finding is consistent with results of different literatures.[10,13] Our study showed that validity findings of CTA in diagnosis of coronary artery stenosis were (75.9% sensitivity, 80.4% specificity and 78% accuracy) in comparison to invasive angiography. These findings are close to results of recent Chinese study which reported validity findings of CTA in diagnosis of coronary artery stenosis as compared to conventional invasive angiography as (81.8% sensitivity, 87.5% specificity and 78.5% accuracy).[14] The positive predictive value of CTA in diagnosis of coronary artery stenosis was (82%), while the negative predictive value was (74%). These findings are in agreement with results of retrospective study conducted in Singapore which reported higher positive predictive value of CTA in diagnosis coronary artery disease than negative predictive value.[15] Moreover, previous study revealed that highest sensitivity >90% (range 81–91%), while the negative predictive value was >98% (range 83–98%) in diagnosis of coronary artery stenosis.[16]

Present study showed that CTA validity findings in LAD stenosis were (100% sensitivity, 75% specificity and 97.5% accuracy), in CX stenosis were (73.9% sensitivity, 72.2% specificity and 73.1% accuracy), in RCA stenosis were (83.9% sensitivity, 100% specificity and 87.8% accuracy) and in LM stenosis were (70% sensitivity, 93.5% specificity and 87.8% accuracy). These findings are close to results of current observational Iraqi study which found higher validity findings of CTA for LAD stenosis and lower validity findings of CTA for LMS.[17] In our study, CTA validity findings for stenosis diameter ≥50% were (90% sensitivity, 54.5% specificity and 80.5% accuracy), while in stenosis area≥75% were (77.8% sensitivity, 92.9% specificity and 82.9% accuracy). These findings are in agreement with results of recent population study conducted in United States of America and European countries which documented higher sensitivity of CTA for stenosis diameter ≥50% and higher specificity of CTA for stenosis area≥75%.[18]

This study found that common risk factors of CAD reported for patients were diabetes mellitus (36%), hypercholesterolemia (36%), hypertension (33%), smoking (33%) and obesity (24%). These findings are close to results of systematic review study by Rzaij et al.[19] In our study, common co-morbidities of patients with CAD were chronic obstructive pulmonary disease (20%), peripheral vascular disease (6%), prior bypass graft surgery (6%), myocardial infarction (4%) and beta blocker need

(3%). These findings are similar to results of different literatures.[20]

CONCLUSION

This study concluded that computed tomography angiography has an acceptable accuracy in diagnosis of coronary artery diseases as compared to conventional invasive angiography. The computed tomography angiography is characterized by good specificity and positive predictive value in diagnosis of coronary artery diseases as compared to conventional invasive angiography. This study recommended the use of computed tomography angiography in earlier non-invasive diagnosis of coronary artery disease.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	CSS, AFJ
Acquisition, Analysis or Interpretation of Data:	CSS, AFJ
Manuscript Writing & Approval:	CSS, AFJ

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.