

# Cost Effectiveness of CT Coronary Angiography in Patients with Suspected Coronary Artery Disease

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## ABSTRACT

### BACKGROUND

Coronary artery disease is one of the leading causes of death in India. Evaluation of the coronary artery can be done by CT, MRI or conventional angiography and conventional angiography is the gold standard. Conventional angiography is invasive, expensive, has fewer complications and not easily available. CT coronary angiography is accurate, non-invasive, easily available and has fewer complications. In this study usefulness of performing CT coronary angiography prior to conventional angiography is assessed. The purpose of study was to determine the cost effectiveness of performing CT coronary angiography prior to conventional angiography in patients with suspected coronary artery disease.

### METHODS

Patients with chest pain suspected to have coronary artery disease underwent CT coronary angiography. Patients were referred to conventional angiography only if significant stenosis was identified on CT coronary angiography. Cost effectiveness of performing CT coronary angiography before conventional angiography was compared with patients directly going for conventional angiography.

### RESULTS

19 patients (63.3%) had normal coronary arteries and 5 patients (16.6%) had non-significant stenosis (<50%). 6 patients (20%) had significant stenosis (>50%) and were referred for conventional angiography. Assessment of cost incurred showed performing CT coronary angiography before conventional angiography could reduce the cost up to 50%.

### CONCLUSIONS

In patients with suspected to have coronary artery disease, performing CT coronary angiography prior to invasive angiography can reduce the cost by up to 50%.

### KEYWORDS

Coronary Angiography, Cost Effectiveness, Coronary Artery Disease

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**BACKGROUND**

Coronary Heart Disease (CHD) is the leading cause of death in India with a death rate of 1.46 million. Prevalence of coronary heart disease in India is 3% with unadjusted CHD rate of 1.6% to 7.4% in rural populations and 1% to 13.2% in urban populations.<sup>1,2</sup> Imaging modalities available for evaluation of suspected coronary artery disease (CAD) are convention angiography, computed tomography coronary angiography (CTA), magnetic resonance angiography, single photon emission computed tomography (SPECT), positron emission tomography (PET) and cardiac MRI.<sup>3</sup>

CT coronary angiography has very high accuracy for detecting coronary artery stenosis of more than 50% with sensitivity of 93 to 100%, specificity of 91 to 96% and negative predictive value of 96 to 100%. Currently CT coronary angiography is used as a diagnostic tool for ruling out coronary artery disease or for determining diagnosis in suspected cases of coronary artery disease.<sup>4-12</sup> SPECT has sensitivity and specificity of 86% and 74% for detecting significant coronary stenosis (>50%). Positron emission tomography PET has sensitivity of 92% and a specificity of 85% for diagnosing significant CAD (>50%). Cardiac MRI has sensitivity of 89% and specificity of 80% for the diagnosis of significant CAD.<sup>3</sup>

Sensitivity and specificity of CT coronary angiography in detecting or ruling out significant stenosis is well established. Study comparing the cost effectiveness of CT coronary angiography and conventional angiography are very limited.

**METHODS**

All patients with chest pain suspected to have coronary artery disease referred for CT coronary angiography between January 2012 to December 2014 were included in the study. All scans were done on Philips Brilliance 64 slice CT scan machine. Patients heart rate was kept below 60 beats per minute by administrating beta blockers. Contrast enhanced coronary angiography was done with retrospective ECG gating by bolus tracking method with locator and tracker at the level of arch of aorta. About 100 ml of non-iodinated contrast agent was injected at the rate of 5ml/sec using dual head power injector (OptiVantage DH, Mallinckrodt), followed by saline bolus of 30 ml at rate of 5 ml/sec. CT parameters were, Collimation 64 × 0.625, Pitch 0.2, Rotation time 0.4 sec, FOV 150 mm, Thickness 0.8 mm, Increment 0.4 mm, kV 120, mAs/slice 1050. Reconstruction were done in 35%, 45%, 70%, 80% and 90% phases. Image reconstruction was done on Philips extended brilliance Workspace. Axial, Multiplanar, curved multiplanar reformation and volume rendered images were used for evaluation of coronary arteries. Left main, left anterior descending, left circumflex, right coronary artery, diagonal, acute and obtuse marginal arteries were assessed for calcified plaque, soft plaque and amount of stenosis.

Patients were categorized as normal, non-significant stenosis (<50% luminal stenosis) and significant stenosis

(>50% luminal stenosis). Patients only with significant stenosis were referred for conventional angiography for further management. Cost effectiveness of performing CT coronary angiography before conventional angiography was compared with patients directly going for conventional angiography. Average cost of CT coronary angiography and conventional coronary angiography are summarized in table 1.

Modality	Average Cost in INR
<b>CT Coronary Angiography</b>	
Procedure Charges	10000
Hospitalization Charges	Nil
<b>Conventional Angiography</b>	
Procedure Charges	15000
Hospital Charges	5000

**Table 1. Average Cost of CT Angiography and Conventional Angiography**

**RESULTS**

Patient demographic and CT angiography results are summarized in table 2.

Total Number of Patients	30
Mean Age	55.5 (35-79)
M:F	23:7
CT Angiography Normal	19
Non-significant stenosis (<50% stenosis)	5
Significant stenosis (>50% stenosis)	6

**Table 2. Patient Demographic and CT Angiography**

Total of 30 patients were included in the study with mean age of 55.5 years (range 35 to 79 years), 23 patients were male and 7 were female. 19 patients (63%) had normal coronary arteries and 5 patients (16.6%) had non-significant stenosis (<50%). 6 patients (20%) had significant stenosis (> 50%). No further evaluation was done in patients with normal CTA and non-significant stenosis. Patients with significant stenosis were referred for conventional angiography for further management. Performing CT coronary angiography prior to invasive angiography would reduce the cost upto 50% compared to patients directly going for invasive angiography.

**DISCUSSION**

In our study, 19 patients (63%) had normal coronary arteries and 5 patients (16.6%) had non-significant stenosis and no further evaluation was done in both groups. 6 patients (20%) had significant stenosis who underwent conventional angiography for further management. Assessment of cost incurred showed performing CT coronary angiography before conventional angiography could reduce the cost up to 50%. Findings in the current study are in concordance with other studies. Study done by Goehler et al comparing the clinical and economical outcome between standard of care treatment and coronary CTA-based triage in patients with chest pain showed decrease in number of patients undergoing for conventional angiography and

decreased cost in patients who underwent CTA based triage.<sup>13</sup>

Study done by Halpern et al in patients with positive stress test with no symptoms showed performing coronary CTA before convention angiography is a cost-effective and can reduce unwanted catheter angiography.<sup>14</sup> In patients with chest pain without coronary artery disease performing only coronary CT angiography is the most cost-effective diagnostic strategy.<sup>15</sup> Another study done by Min JK et al comparing the cost and clinical outcome between CTA and SPECT in patients with no coronary artery disease showed reduced cost in patients who underwent CTA and similar adverse cardiac events and hospitalization in both groups.<sup>16</sup>

#### Limitations

Study is limited by small sample size, study with large sample size is required to validate the findings. Long term outcome were not assessed in the study.

### CONCLUSIONS

In patients with suspected to have coronary artery disease, performing CT coronary angiography prior to invasive angiography can reduce the cost by up to 50%.

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