

How to Cite:

Pandurangan, N., Veeraraghavan, S., Ananya, K., & Vinoth, T. (2022). Coronary CT angiography to guide percutaneous coronary intervention. *International Journal of Health Sciences*, 6(S4), 11208–11213. <https://doi.org/10.53730/ijhs.v6nS4.11394>

Coronary CT angiography to guide percutaneous coronary intervention

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Abstract---Background: The present study was conducted for assessing efficacy of Coronary CT angiography to guide percutaneous coronary intervention. Materials & methods:A total of 100 patients of chronic total occlusion (CTO) were enrolled in the present study. The CT-guided PCI procedure involved placing CT and fluoroscopic images side-by-side on the screen. Images were analysed for location, segment, plaque characteristics, calcification, and proximal lumen diameter of the CTO before PCI. The guidewire was advanced and manipulated under CT guidance. The PCI was carried out and the results were compared. Results:Mean age of the patients with success (n=88) and failure (n=12) was 62.3 years and 61.8 years respectively. There were 56 males and 32 females among the successful PCI group while there were 8 males and 4 females in the failure PCI group respectively. Location of CTO and length of occlusion were significantly different among patients divided on the basis of prognosis. Conclusion:From the above results, the authors conclude that CT Guidance can delineate the routes of CTOs and clearly characterize plaques and hence improve the outcome.

Keywords---coronary, angiography, computed tomography.

Introduction

Coronary computed tomography angiography (CTA) has come a long way. With hardware and software having gone through tremendous developments, coronary CTA can now be considered robust and accurate. Multiple registries and randomized trials have demonstrated the potential of coronary CTA to guide clinical decision making and potentially even to reduce hard cardiovascular events compared with current standards. Recently, the National Institute for Health and Care Excellence (NICE) stable chest pain guideline (CG95) recommended coronary CTA to be preferred over functional testing as the first-line test for evaluation of chest pain in patients without known coronary artery disease (CAD). Importantly, the NICE guidelines suggest first-line coronary CTA testing at all levels of pre-test risk probability of CAD. This is a radical departure from existing U.S. and European societal guidelines, which currently recommend limiting the use of coronary CTA to patients with low to intermediate pre-test risk.¹⁻³ In fact, a more widespread clinical use of coronary CTA and its application in high-risk individuals may be somewhat problematic given the modest diagnostic specificity of coronary CTA and its tendency to overestimate stenosis, particularly in patients with severe coronary calcium. Moreover, when the results of coronary CTA are considered as the basis of clinical decision making, it is important to keep in mind that stenosis severity alone is a poor discriminator upon which to base revascularization decisions. Anatomic characteristics beyond stenosis severity and the hemodynamic relevance of coronary lesions need to be taken into account. The anatomic SYNTAX score (SS) is based on the invasive angiogram; it takes into account the amount of myocardium subtended by the artery distal to each lesion, and findings associated with the interventional risk (e.g., occlusions, long lesions, severe calcification). It has emerged as an important tool in decision making between percutaneous coronary intervention and coronary artery bypass grafting in complex CAD. Adding information on lesion-specific ischemia to the SS (functional SYNTAX score [FSS]) is associated with higher reproducibility measures, classification of fewer patients as high-risk, and improved clinical outcomes.⁴⁻⁶ Hence; the present study was conducted for assessing efficacy of Coronary CT angiography to guide percutaneous coronary intervention.

Materials & Methods

The present study was conducted for assessing efficacy of Coronary CT angiography to guide percutaneous coronary intervention. A total of 100 patients of chronic total occlusion (CTO) were enrolled in the present study. A CTO was defined as an obstruction of a native coronary artery with no luminal continuity. The CT-guided PCI procedure involved placing CT and fluoroscopic images side-by-side on the screen. Images were analysed for location, segment, plaque characteristics, calcification, and proximal lumen diameter of the CTO before PCI. The guidewire was advanced and manipulated under CT guidance. The PCI was carried out and the results were compared. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Chi-square test and student t test were used for evaluation of level of significance.

Results

Out of 100 patients, who underwent CT guided PCI, success was seen in 88 percent of the patients while failure was seen in 12 percent of the patients. Mean age of the patients with success and failure was 62.3 years and 61.8 years respectively. There were 56 males and 32 females among the successful PCI group while there were 8 males and 4 females in the failure PCI group respectively. Location of CTO and length of occlusion were significantly different among patients divided on the basis of prognosis.

Table 1: Baseline data

Variable	Successful PCI (n=88)	Failure PCI (n=12)	p- value
Age (years)	62.3	61.8	0.12
Males (n)	56	8	0.36
Females (n)	32	4	0.63
Diabetic (n)	32	5	0.96
Hypertensive (n)	28	4	0.84

Table 2:CT angiography variables

CT angiography variables		Successful PCI (n=88)	Failure PCI (n=12)	p- value
Location of CTO	LAD	41	5	0.885
	LCX	23	3	
	RCA	24	4	
Plaque	Soft	51	3	0.000 (Significant)
	Fibrous	18	5	
	Calcified	19	4	
Length of occlusion (mm)		18.9	35.1	0.001 (Significant)

Discussion

Coronary artery anomalies are rare, accounting for about 0.3–1.3% of patients undergoing diagnostic coronary angiography. Most coronary artery anomalies are clinically silent and do not affect quality of life. However, specific forms of anomaly may be associated with symptoms such as myocardial ischemia, congestive heart failure, and sudden death. The exact incidences of these events are not known. CT angiography provides a non-invasive means of assessment of coronary artery disease and also shows the anatomy of the coronary tree. Multislice computed tomography (MSCT), in the presence of an expert interpreter, may achieve a high level of reliability and accuracy in the visualization of the coronary tree.^{6- 10}Hence; the present study was conducted for assessing efficacy of Coronary CT angiography to guide percutaneous coronary intervention.

Out of 100 patients, who underwent CT guided PCI, success was seen in 88 percent of the patients while failure was seen in 12 percent of the patients. Mean age of the patients with success and failure was 62.3 years and 61.8 years

respectively. Fang HY et al compared the differences between ostial LAD and all other CTOs and to identify the predictors of successful ostial LAD CTO PCI. Ostial LAD CTO was defined as CTO at the position whose distance between lesion and left main bifurcation was less than 1 mm. Baseline demographics, lesion characteristics, interventional procedure details, and devices were compared between the ostial LAD group and the all other CTOs group. The predictors of successful ostial LAD CTO PCI were also evaluated. 621 patients who underwent CTO PCI were enrolled retrospectively to this study. A total of 70 patients of ostial LAD CTO were compared with 551 patients of all other CTOs group in this study. Ostial LAD CTO was found to have more bridging and better collaterals than all other CTOs. Procedure time, fluoroscopic time, contrast volumes, the use of contralateral injection, and the use of the retrograde approach were significantly greater in the ostial LAD CTO group. The ostial LAD CTO group also had significantly higher J-CTO scores (2.7 ± 0.8 vs. 2.2 ± 1.1 , $P = 0.011$) and higher Syntax Scores (28.3 ± 6.5 vs. 20.9 ± 9.7 , $P < 0.001$). A slightly lower final success rate, but statistically non-significant, was observed in the ostial LAD CTO group (80.0% vs. 81.9% , $P = 0.706$). Univariate and multivariate logistic regression revealed that without antegrade failure and with retrograde success were predictors of the success of ostial LAD CTO PCI. Syntax Score was also capable of predicting the ostial LAD CTO PCI outcome. J-CTO score was not found to be associated with final success for ostial LAD CTO patients. Ostial LAD CTO resulted in higher lesion complexity in J-CTO scores and Syntax Scores.¹⁰

There were 56 males and 32 females among the successful PCI group while there were 8 males and 4 females in the failure PCI group respectively. Location of CTO and length of occlusion were significantly different among patients divided on the basis of prognosis. Hong SJ et al tested whether the success rate of percutaneous coronary intervention (PCI) for chronic total occlusion (CTO) increased with pre-procedural coronary computed tomography angiography (CTA). A total of 400 patients with CTO were randomized to receive PCI with pre-procedural coronary CTA (coronary CTA-guided group; $n = 200$) or without coronary CTA (angiography-guided group; $n = 200$) between January 2014 and September 2019. The primary endpoint was the successful recanalization rate, a final TIMI (Thrombolysis In Myocardial Infarction) grade ≥ 2 , and $\leq 30\%$ residual stenosis on the final angiogram. A total of 10 operators performed PCI. Successful recanalization was achieved in 187 patients (93.5%) in the coronary CTA-guided group and in 168 patients (84.0%) in the angiography-guided group (absolute difference, 9.5% [95% confidence interval: 3.4% to 15.6%]; $p = 0.003$). When comparing the success rates according to the Multicenter CTO Registry of Japan score (J-CTO), the coronary CTA guidance was favored over the angiography-guidance in the subset of J-CTO ≥ 2 versus in the subset of J-CTO < 2 (p interaction = 0.035). Coronary perforations occurred in 2 (1%) and 8 patients (4%) in the coronary CTA- and angiography-guided groups, respectively ($p = 0.055$). Periprocedural myocardial infarction was not observed in the coronary CTA-guided group, whereas it occurred in 4 patients (2%) in the angiography-guided group ($p = 0.123$). Total procedure and fluoroscopic times were not different. There were no differences between the groups in the occurrences of cardiac death, target vessel-related myocardial infarction, or target-vessel revascularization at 1 year. Pre-procedural coronary CTA-guidance for CTO resulted in higher success rates with numerically

fewer immediate periprocedural complications such as coronary perforations or periprocedural myocardial infarction than angiography guidance.¹¹

Conclusion

From the above results, the authors conclude that CT Guidance can delineate the routes of CTOs and clearly characterize plaques and hence improve the outcome.

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