

## A Prospective Study of 477 Subjects through Risk Stratification and Corroboration by a Non-Invasive CT Coronary Angiogram in a Tertiary Hospital Setting in India

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### Abstract

**Background:** Coronary artery disease (CAD) is a very common cause of morbidity and is the leading cause of death in adults, accounting for ~one-third of all deaths in subjects over age 35. Catheter coronary angiography (CCA) has been the gold standard in the diagnosis and management of CAD. Over the last some years, Coronary CT angiography (CCTA), a non-invasive test is being adopted by positive evidence and usability for low-medium pre-test probability for CAD.

**Aim:** The objective of our study was to decode the Cardiac risks using weighted average tool and thereby stratify to utilize the CT Coronary Angiogram cost-effectively, in a resource-limited country.

**Methods:** 1320 subjects were screened, and a Cardiac risk profiling were done to assess the traditional risk factors for CAD. A weighted average risk stratification tool was devised to ramify suspected CAD groups and to thereby clinically corroborate using CT Angiogram. 477(36%) underwent 320 slice Coronary CT Angiogram including the asymptomatic subjects, severity and extent of CAD were thereby studied.

**Results:** 199 (42%) cases were found to have normal coronary arteries on CCTA, 278(58%) of the subjects had an abnormal CT angiogram finding. 2 risk factors (hypertension, diabetes or dyslipidemia) resulted in 87(31.3%) cases of 278 abnormal CT Angio findings arm versus 62(31.1%) of 199 normal CT Angio findings. 3 risk factors (hypertension, diabetes & dyslipidemia) present in 39(95%) cases of the total 41 cases had an abnormal CT Angiogram ( $p < 0.05$ ). Of the total 278 abnormal CT Angio, mild CAD was noted in 121(44%), thick plaque (<50% stenosis) noted in 59(21%), obstructive CAD (>50% stenosis) were noted in 98(35%) cases. Double vessel disease was seen in 156(56%) cases and single vessel disease was seen in 108 (39%). Significantly obstructive triple vessel disease was noted in 14 (5%) of total cases.

**Conclusion:** Risk profiling and stratification may correlate with CT angio findings, which can be a valuable tool to assess CAD non-invasively. The coexisting risk triads-Hypertension, Dyslipidemia and Diabetes pose a significant extent of CVD burden. One third having abnormal CT Coronary Angiogram findings in age groups of <40 years suggestive of Coronary artery disease from this study, a decade/few decades early shift of cardiac events in population, is quite alarming.

**Keywords:** Cardiac risk factors; CT angiogram and CAD; Cardiac risk scoring; Coronary artery disease and risk factors

### Introduction

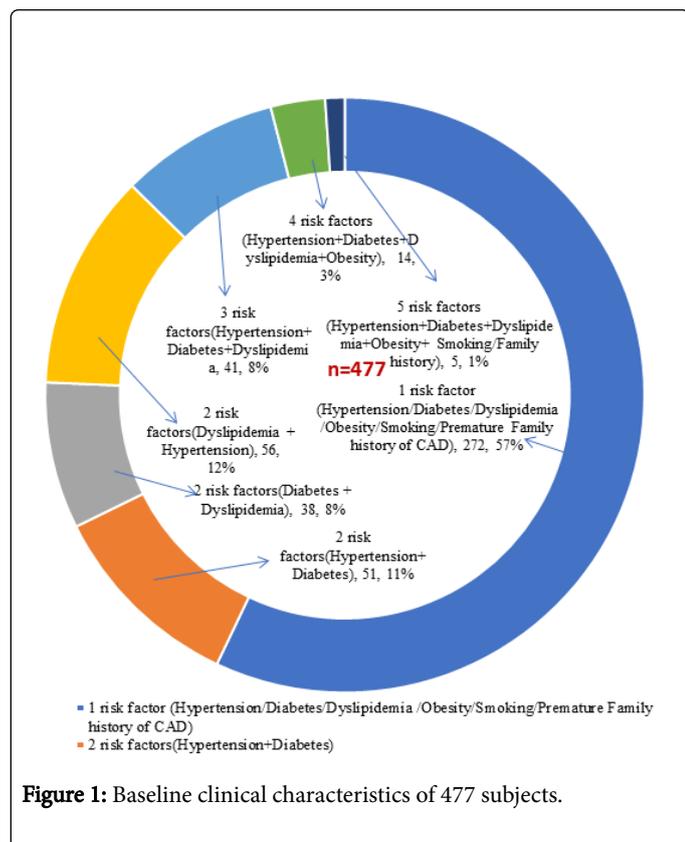
Timely recognition of population at high risk of cardiovascular events is the cornerstone of cardiovascular disease prevention and a challenge for healthcare worldwide. The Framingham risk score, QRISK and Systemic Coronary Risk Evaluation (SCORE) have been some of the most validated risk algorithms in predicting cardiovascular events to determine how risk might change with modification of risk factors such as weight loss, smoking cessation, use of statins and better blood pressure control. The risk estimates are also well documented

and correlated with carotid intima-media thickness (CIMT) and coronary calcium score (CCS)- the two well established measures of subclinical atherosclerosis and reliable predictors of future risk of CV events.

In the light of the above, the objective of our study was targeted to collect, analyse and decipher the Cardiac risk scores using our devised weighted average tool and thereby ramify to utilize the CT Coronary Angiogram cost-effectively, in a resource-limited country setting. The rationale and effectiveness of CCTA is in direct visualisation of the coronary artery lumen and wall in the assessment of Coronary artery disease.

## Case Study

1320 subjects were screened, and a Cardiac risk profiling were done in a 6 months study period in 2016. Traditional risk factors for CAD like hypertension, dyslipidaemia, diabetes, obesity, smoking, family history of CAD etc. were mapped out. A weighted average risk stratification tool was devised to stratify suspected CAD groups and to thereby clinically corroborate using CT Angiogram. 477 (36%) underwent 320 slice Coronary CT Angiogram including the asymptomatic subjects. Patients were classified as (a) normal (no calcific or soft plaque), (b) thick plaque and moderate CAD (<50% stenosis), (c) obstructive coronary disease (>50% stenosis) (Figure 1 and Table 1).



**Figure 1:** Baseline clinical characteristics of 477 subjects.

## Results

316 (66%) were males and 161 (34%) were females. Mean age was 55.6 ± 8.3 years. 199 (42%) cases were found to have normal coronary arteries on CCTA, 278 (58%) of the subjects had an abnormal CT angiogram finding of which 78 (16.3%) were status post Percutaneous Interventions/Coronary Artery bypass surgeries reviewed for graft patency. Out of these 78 cases, 28 (35.9%) had graft or the native vessel occlusion after a median follow up of 8.2 years after the CABG/PTCA by this CCTA (Figure 2).

3 risk factors (hypertension, diabetes and dyslipidaemia) present in 39 (95%) cases had abnormal CT Angiogram of the total 41 cases. 2 risk factors (hypertension, diabetes or dyslipidaemia) resulted in 87 (31.3%) cases of 278 abnormal CT Angio findings arm versus 62 (31.1%) of 199 normal CT Angio findings. This is statistically significant (p<0.01) and clinically significant to infer that 3 risk factors

pose a great threat to cardiovascular risk and predictors of risk are long duration and uncontrolled comorbid conditions.

Smoking is a risk factor for mortality and coronary heart disease in hypertension and in diabetes and the absolute risk of smoking is usually greater in diabetic subjects than in nondiabetic subjects [1-3]. Smoking was found in 14 (3%) of the cases which is grossly under-reported by subject's declaration for risk scoring.

Risk stratification tool - Baseline data		
Traditional risk factors for cardiac events (Non-discrete multiple co-morbid data in 477 subjects)	N	% of 477
Chest Pain/Angina	77	16
Atypical Chest Pain	54	11
Asymptomatic	85	18
SOB/Dyspnoea	95	20
Status Post CABG/PTCA	78	16
TMT (Treadmill) Positive/Borderline	55	12
Palpitation	24	5
ECHO (EF<40)	9	2

**Table 1:** Baseline clinical characteristics of 477 subjects: Non-discrete multiple comorbid risk factors.

Coronary calcium score zero was found in 236 (59%) out of the 399 cases (n=78 post CABG and post PTCA cases excluded). Coronary calcium score (>100) in 73 (18%) in the abnormal CT angio arm versus 3 (0.7%) in normal CT Angio arm (Table 2).

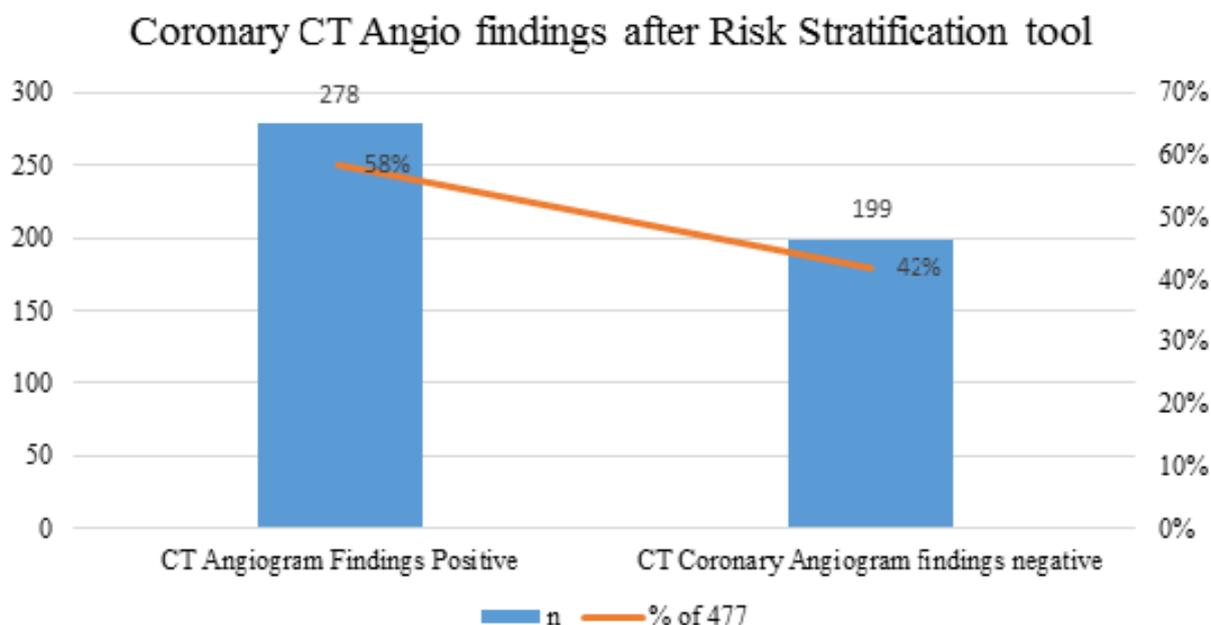
Of the total 278 abnormal CT Angio, mild CAD was noted in 121 (44%), thick plaque (<50% stenosis) noted in 59 (21%), obstructive CAD (>50% stenosis) were noted in 98 (35%) cases. Double vessel disease was seen in 156 (56%) cases and single vessel disease was seen in 108 (39%). Significantly obstructive triple vessel disease was noted in 14 (5%) of total cases (Figure 3).

58 (12%) of the subjects who had a CCTA, were less than 40 years old of which 18 (31%) had a CAD, 12 (66%) were soft and thick plaque whereas 6 (33%) had obstructive coronary artery disease (>50% stenosis). Right coronary artery dominant was found in 383 (80%), left dominant in 79 (17%) and co-dominant in 14 (3%) of the total cases.

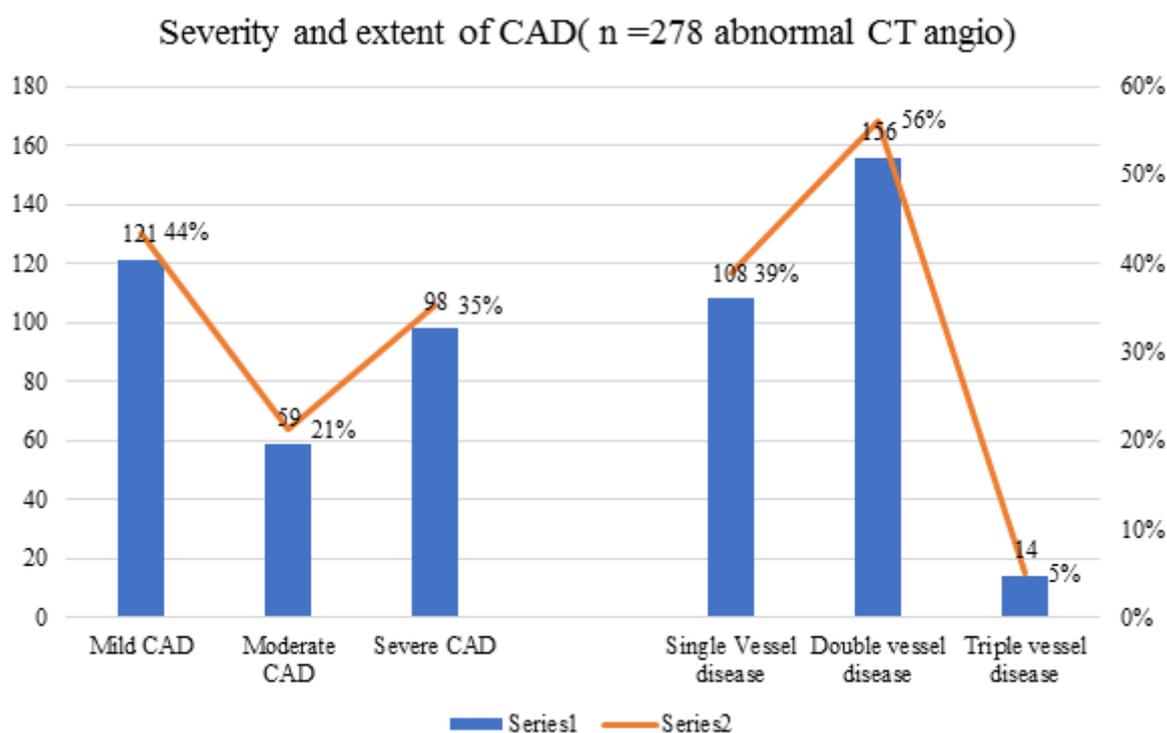
Congenital Heart Disease (ASD/VSD) were found in 7(1%) of the cases. Left Ventricular Hypertrophy in 31 (6%) of the cases as other CCTA findings. The non-ionic contrast usage was 65ml in 386 (81%) and 70 ml in 83 (17.3%) of the total 477 cases.

## Discussion

Health economics and cost-effective disruptive screening programs are in vogue and risk stratification tools may add a lot of impact in enhancing the pick-up of disease burden rates precisely and accurately and thereby better patient deliverables. QRISK3 is a prediction algorithm for cardiovascular disease (CVD) that uses traditional risk factors and to also estimate individualised lifetime risk of cardiovascular disease [4].



**Figure 2:** Graph representing the CT Coronary Angiogram (CCTA) findings.



**Figure 3:** Graph representing the severity and extend of CAD in positive CT Coronary Angiogram (CCTA) findings.

Primary prevention of Coronary artery disease is extremely crucial and deciphering the population at large with risk categorization and

management will potentially prevent or reduce the severity of dreadful cardiac events and complications.

CAC score to predict CAD in our Indian study had 96% sensitivity, 65% specificity with a positive predictive value of 39% and a negative predictive value of 98.5%. Considering ASCVD risk estimates and

CAC Score together, can provide valuable insights to decide the management plan to initiate Statins or not [5].

Total - 399 subjects	0	0-10	10-100	<100	100-399	>400
CAC Score in Normal CT Angio findings subjects	178	16	16	210	2	1
CAC Score in Abnormal CT Angio findings subjects (primary prevention arm)	58	20	34	113	34	38

**Table 2:** Coronary calcium score in Indian subjects, n= 399, 78 cases of post CABG and post PTCA cases excluded.

## Conclusion

Risk profiling and stratification may be a valuable tool which may correlate with CT angio findings. Hypertension, Dyslipidaemia and Diabetes as 3 co-existing risk factors contribute to a large extent of CVD burden. One third having abnormal CT Coronary Angiogram findings in age groups of <40 years suggestive of Coronary artery disease from this study, a decade/few decades early shift of cardiac events in population, is quite alarming.

## Conflicts of Interest

There are no conflicts of interest for the present study.

## References

1. Sanchis-Gomar F, Perez-Quilis C, Leischik R, Lucia A (2016) Epidemiology of coronary heart disease and acute coronary syndrome. *Ann Transl Med* 4: 256.
2. Maurya VK, Ravikumar R, Sharma P, Agrawal N, Bhatia M (2016) Coronary CT angiography: A retrospective study of 220 cases. *Med J Armed Forces India* 72: 377-383.
3. Fagard RH (2009) Smoking amplifies cardiovascular risk in patients with hypertension and diabetes. *Diabetes care* 32: 429-431.
4. Hippisley-Cox J, Coupland C (2016) QRISK2. *Annual Update Information* 2016: 5.
5. Greenland P, Blaha MJ, Budoff MJ, Erbel R, Watson KE (2018) Coronary calcium score and cardiovascular risk. *J Am Coll Cardiol* 72: 434-447.