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***The Incidence of Coronary Calcification on Non-gated thoracic
Computed Tomography (CT scan)***

Research Presented By

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Abbreviation

CT	Computed tomography
PCE	Pooled cohort equation
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCTA	CT coronary angiography
DM	Diabetic mellitus

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Abstract

Background: Coronary artery calcification as assessed by computed tomography (CT) is a validated predictor of cardiovascular risk, whether identified on a dedicated cardiac study or on a routine non-gated chest CT. The prevalence of incidentally detected coronary artery calcification on non-gated chest CT imaging and consistency of reporting have not been well characterized.

Hypothesis: Coronary calcification is present on chest CT in some patients not taking statin therapy and may be under-reported.

Methods: Non-gated chest CT images dated 1/9/2022 to 10/2/2023 were retrospectively reviewed. Demographics and medical history were obtained from charts. Patients with known history of coronary revascularization and/or pacemaker/defibrillator were excluded. Two independent readers with cardiac CT expertise evaluated images for the presence and anatomical distribution of any coronary calcification, blinded to all clinical information including CT reports.

Original clinical CT reports were subsequently reviewed.

Results: Coronary calcification was identified in 27/50 (54%) chest CTs. Patients with calcification were older and had more hyperlipidemia, smoking history, and DM

Conclusions: A high prevalence of coronary calcification was found in non-gated chest CT scans performed for non-cardiac indications. In one-third, coronary calcification was not mentioned in the clinical report when actually present. In this population of patients with cardiac risk factors, standard reporting of the presence of coronary calcification may provide an opportunity for risk factor modification.

Introduction

Cardiovascular disease is one of the leading causes of death in the western world, with coronary artery disease accounting for >10% of all deaths in the UK in 2017.⁽¹⁾ so is an ongoing epidemic.

Most first cardiac events occur in asymptomatic individuals, and therefore waiting for symptoms to develop is not a feasible strategy because at that time the damage have already been done and the persons will experience some limitations to their daily activity.

Risk scores have been developed from the Framingham Risk Score to the Pooled Cohort Equation (PCE) to estimate the likelihood of a person developing ASCVD over a defined period⁽²⁾. However, they have shown significant limitations, including over or underperforming in ethnic minorities, the lack of acknowledgment of dynamic changes in risk factors, and the overreliance age.

The development of coronary artery calcium scoring (CAC) and later CT coronary angiography (CCTA) surged as potential complementary tools to visualize coronary plaque and provide the basis for individualized management directly.

In this study, we sought to estimate the prevalence of coronary calcification in non-gated chest CTs performed for noncardiac indications, in hope that this method will enable as to prevent the occurrence of coronary heart disease by identified the persons who have the risk to develop it and give them Statin.

In this research we will only focus on the prevalence of coronary calcification in non-gated CT of the chest performed for non cardiac indication and we hope that we can follow the patient with positive result in this research after 10 Years to identify patients who develop coronary artery disease and we can later estimate the risk for coronary calcification to develop into CAD so as to reduce the incidence of CAD by giving these people prophylactic therapy and also increase the use of CT scan as a

screening tool to identify high-risk patients but this will require improvement in our health care system.

Method

Data collection

non-contrast, non-ECG gated chest CT scan performed for patients referred for non-cardiac indications to Baquba teaching hospital from 2022 / 9 / 1 to 2023 / 2 / 10 period.

-criteria for selection of the patient include:

1- Age above 40.

2-no previous history of Coronary artery disease.

-A questionnaire designed for collecting the patient's data include:

(Age - sex - Hypertension - DM - body mass index - smoking - Hyperlipidaemia - Drugs - medication history - CT finding)

Imaging

CT images were acquired using standard clinical protocols at our institution. To meet inclusion criteria, all studies were non-contrast, non-ECG-gated chest CT scans.

Two readers with expertise in cardiac CT imaging reviewed CT images for the presence or absence of coronary calcium, as well as distribution in the coronary arterial tree. Readers were blinded to all clinical data, including the clinical CT report. Neither reader was the original clinical reader of the chest CT for any case. All images were reviewed for the presence or absence of calcium in each of the following

3 coronary vessels: (1) left main or left anterior descending (LAD) coronary artery and its branches, (2) left circumflex coronary artery and branches, and (3) right coronary artery (RCA).

Statistical analysis

The Statistical Analysis System- SAS program was used to detect the effect of different factors on study parameters. Kruskal Wallis test was used to significantly compare between means. compared between patients with calcium on chest CT and without calcium on chest CT.

Parameter	Number	With calcification	Without calcification
Number of patients	50	27(54%)	23(46%)
Age	40-80	Mean=62.7	Mean=54.2
male	25(50%)	16(64%)	9(36%)
Female	25(50%)	9(36%)	16(64%)
Hypertension	20	13(65%)	7(35%)
Diabetes	15	11(73%)	4(27%)
Obesity	9	6(66%)	3(34%)
Smoking	12	9(75%)	3(25%)
Dyslipidemia	14	11(78%)	3(22%)

Table 1: Comparison of characteristics between patients with and without calcification on chest CT

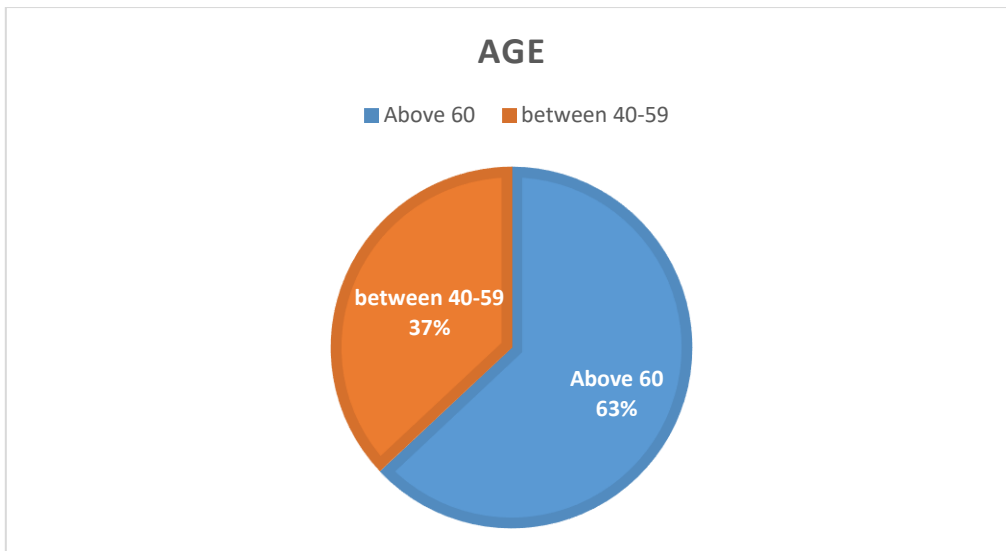


Results

A total of 72 CT scans from consecutive patients referred for non-cardiac indications were assessed for inclusions.

Among these 50 subjects who met the criteria were included in the analysis.

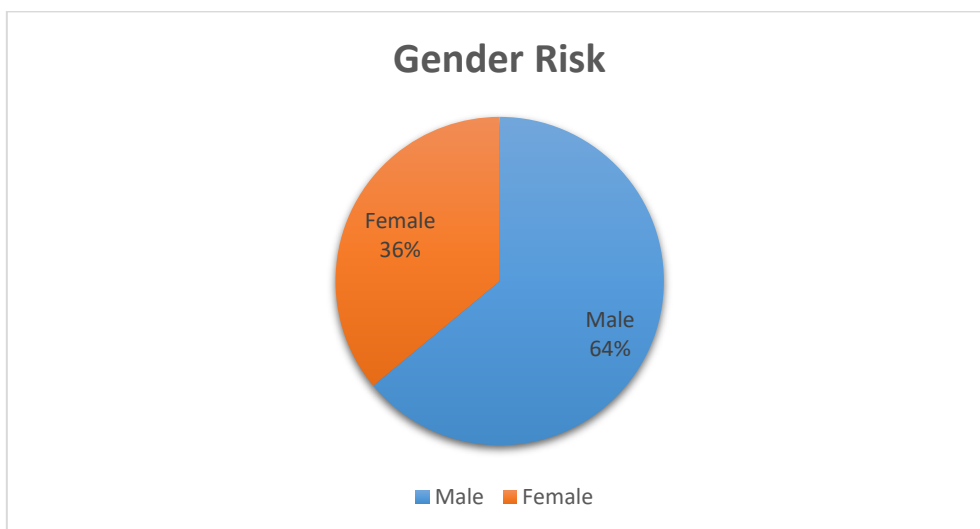
-The mean age for patients in the study was 60.1 years and the mean age for those with calcifications was 62.7 years and for those without calcifications was 54:2 years. And the risk increase as age increase as figer1 show :



Figer1: show the age-related risk

-the number of patients who were affected was 27 and those who were not affected was 23.

-The number of females in the study was equal to males but males were affected More than females as shown in figer2.



Figer2: show gender related risk

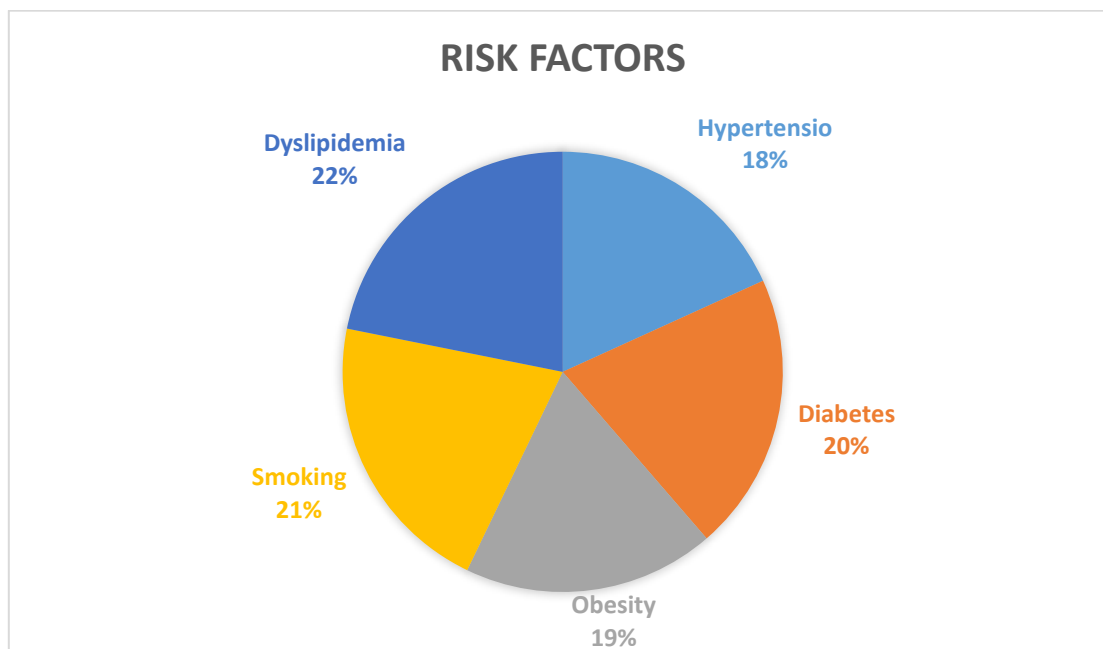
-In the entire study only 20 patients had a history of hypertension and from these only 13 effected.

-Number of patients with DM was 15 but only 11 who have calcifications also number of obese patients were 9 and sex of them were effected.

-Smoker patients were 12 and from them only 9 have calcifications.

-Number of patients with dyslipidemia was 14 and those effected were 11.

-older patients especially those with hypertension, smoking, and dyslipidemia are more likely to have coronary calcifications as shown in this figer3:



Figer3:show risk of the parameters included in the study

DISCUSSION

Approximately 54% of CT scans performed for noncardiac, routine indications were found to have coronary calcification in this study. Given that the mean age of this group was over 62, over half were smokers, and half had dyslipidemia, the prevalence of coronary calcification is not unexpected. Therefore, identification and awareness of the presence of coronary calcium on a routine chest CT could provide an opportunity for cardiovascular risk reduction.

Coronary artery calcium measurement on ECG-gated or triggered cardiac CT is a powerful cardiovascular risk assessment technique using a well-validated score (typically Agatston units)⁽³⁾. Both the presence and the amount of calcium are associated with increased risk of cardiovascular events⁽⁹⁾. Although scoring coronary calcium on chest CT acquired without timing to the cardiac cycle is not currently standardized and may suffer

significant limitations (eg, motion artifact), a recent study showed an excellent correlation between scores derived from gated and non-gated scans in the same patients⁽⁴⁾. A meta-analysis of 6 studies involving coronary artery calcium scoring showed an increased overall relative risk for cardiovascular death or MI (relative risk = 4.3) for any measurable calcium compared to a low or 0 score⁽³⁾. Similarly, a coronary artery calcium score above 0 in women with low Framingham risk was associated with a hazard ratio of 5.2 for cardiovascular events in the Multi-ethnic Study of Atherosclerosis (MESA) study.⁽²⁾ Thus, assessment for any coronary calcification, regardless of the extent, may be useful in clinical decision-making for risk factor modification.

We believe that coronary calcium should be routinely reported because, as an incidental finding, it provides an opportunity for risk factor modification prior to clinically evident cardiovascular disease. Prior studies have shown that the presence of any coronary calcification confers elevated cardiovascular disease risk above the absence of any calcification. The MESA study showed that nearly half of the participants classified as having intermediate cardiovascular risk based on traditional risk factors were reclassified using coronary calcium scoring into lower and higher risk groups⁽¹¹⁾. Therefore, additional knowledge of the presence of coronary calcium is a valuable tool for preventive care.

We advocate for the standardization of reporting coronary calcium on routine chest CT scans. This is not specifically addressed in current CT guidelines⁽¹²⁾. Current American College of Cardiology/American Heart Association (ACC/AHA) prevention guidelines suggest that coronary artery calcium scoring can be used as an additive decision-making tool when cardiovascular risk is indeterminate⁽¹³⁾. This is in line with a recent study showing that standard clinical risk scores alone are limited for predicting the presence of coronary atherosclerosis⁽¹⁴⁾.

Thus, it behooves clinicians to review any available chest CTs to determine whether coronary calcification is present.

Another study performed in 2017 by Bohm M et al and Mahfoud f et al on more than 304 patients show a 68% risk of coronary calcifications with an increased risk of calcification with increased age and with smoking, hypertension, DM, and obesity.⁽¹⁵⁾

Also, a study performed in 2019 by Haller et al on more than 5,000 patients show a 63% risk of coronary calcifications.⁽¹⁶⁾

Limitations

There are several limitations to our study. We examined the presence or absence of calcium on CT but did not assess the extent of calcium in our cohort. Additionally, visual interpretation of coronary calcification on a non-cardiac chest CT can miss small calcific lesions, particularly with the 5-mm slice thickness used in these clinical scans.

Dedicated cardiac CT scans for coronary calcium typically use 3-mm slice thickness, and thus the prevalence of calcium may be underestimated in our study. At our tertiary referral center, the population studied may have a more complex medical disease than a community cohort and therefore a higher prevalence of the disease. We did not have access to future ordering practices of all referring physicians (if patients were sent for additional calcium scores or cardiac testing), and due to the high number of patients referred from outside our institution, medical history was not available for review in a nearly half the original patients identified.

CONCLUSION

In our study of non-gated chest CT scans done for noncardiac indications, we found a high prevalence of coronary calcification. Nearly all of the cases with coronary calcification did not include this information in the clinical report. From the history, we were able to identify that large proportions of these patients were not on preventive medications for cardiovascular risk reduction. Thus, the reporting of coronary calcification

has potential value to referring providers, and we advocate for the standardization of chest CT reporting in this regard.

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