The Egyptian Journal of Hospital Medicine (July 2019) Vol. 76 (2), Page 3523-3529

Metabolic Profile as A Predictor of Coronary Artery Disease Detected by Multislice Computed Tomography in Asymptomatic Type II Diabetic Patients

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ABTRACT

Background: previous studies have demonstrated that coronary artery calcium score (CACS) assessment combined with risk factors among asymptomatic adults provides prognostic information superior to either method alone, and the combined approach can more accurately guide primary preventive strategies for patients with coronary artery disease (CAD) risk factors.

Objective: the purpose of this study was to assess the presence and extent of coronary calcium in symptomatic type 2 diabetic patients with metabolic syndrome by MSCT.

Patients and Methods: this was a prospective observational study that was done between January 2018 and December 2018. The study included 150 patients referred to the MSCT Coronary Angiography unite in Mustafa Kamel Military hospital (Alexandria, Egypt) with metabolic syndrome according to IDF.

Results: in our study 51 cases (86.4%) of those with serum parathyroid hormone level less than 65 pg/dl had a coronary calcium score (CCS) less than 10 compared to 8 cases (18. 6%) among those with more than 65 pg/dl (p value 0.001), while 0% out of those with normal serum parathyroid hormone less than 65 pg/dl had a CCS more than 200 (p value= 0.001) while 100% cases with CCS more than 200 had serum parathyroid level more than 65 pg/dl. So, the trend toward a high CCS is linked to increasing serum parathyroid hormone level.

Conclusion: CAC screening is accurate and valuable modality as a completely non-invasive and relatively time-efficient screening way when avoiding high radiation burden to patients with metabolic syndrome criteria even when asymptomatic.

Keywords: CACS, MetS, CVD, HDL, DMT2, CCS.

INTRODUCTION

Metabolic syndrome (MetS) is a complex disorder that is considered a worldwide epidemic. MetS is defined by a cluster of interconnected factors that directly increase the risk of coronary artery diseases (CHD), other forms of cardiovascular atherosclerotic diseases (CVD), and diabetic mellitus type 2 (DMT2), is main component s are dyslipidaemia (elevated triglycerides and apolipoprotein B (apo)-containing lipoprotein, and low high-denisty lipoproteins (HDL), elevated arterial blood pressure (BP) and dysregulated glucose hemostasis, while abdominal obesity and/or insulin resistance (IR) have gained increasing attention as the core manifestation of the syndrome [1-3].

The three components of atherogenic lipidemia (increase low density lipoprotein (LDL), decrease high density lipoprotein (HDL) and high blood triglyceride concentration) are individually associated with a cardiovascular risk can contribute to the buildup of plaques in arteries[4].

Metabolic syndrome has been associated with atherosclerosis in some epidemiological studies. It is important to investigate the prevalence of metabolic syndrome and its components, and study the association of metabolic syndrome with subclinical atherosclerosis. The presence and extent of coronary artery calcium (CAC) are strongly correlated with the magnitude of coronary atherosclerosis plaque burden and subsequent coronary events[4]. Coronary artery disease is one of the leading causes of death. Quantification the amount of coronary artery calcium with unenhanced CT calcium score has been shown to be a reliable non invasive technique for screening risk of future cardiac events [5, 6] and can be quantified by using the Agatston score [7] or scores such as the volume score [8] or calcium mass[9].

AIM OF THE WORK

The purpose of this study is to assess the presence and extent of coronary calcium in symptomatic type 2 diabetic patients with metabolic syndrome by MSCT.

PATIENTS AND METHODS

This was a prospective observational study that was done between January 2018 and December 2018. The study included 150 patients referred to the MSCT coronary angiography unite in Mustafa Kamel Military hospital (Alexandria, Egypt) with metabolic syndrome according to IDF. **The study was approved by the Ethics Board of Al-Azhar University.**

Inclusion Criteria:

Central obesity based on waist circumference ≥94cm for males and ≥ 80 cm for females and/or BMI >30.

Plus two of the followings:

a- Raised fasting triglycerides ≥150 mg/dl (1.7mmol/l).
b- Reduced high density lipoprotein cholesterol < 40mg/dl (1.03mmol/l) for males or <50 mg/dl (1.29 mmol/l) for females.

Received:13/4/2019
Accepted:12/5/2019

c- Raised blood pressure ≥130mmhg systolic or ≥85mmhg diastolic or on treatment of previously diagnosed hypertension.
d- Raised fasting plasma glucose ≥100mg/dl (5.6mmol/l), or previously diagnosed type 2 DM.

Exclusion Criteria:
1. No central obesity.
2. Patients known to have coronary artery disease.
3. Presence of irregular heartbeats (AF, extra systole).
4. Inability to hold breath (respiratory impairment).
5. Renal impairment (serum creatinine >2 mg/ dl).

All patients were subjected to full clinical examination, ECGs, lipid profile, renal function serum parathyroid hormone, HbAIC, serum phosphorous level and coronary calcium score. Follow up was done on outpatient basis for all cardiovascular events within six months.

Coronary calcium score grades:
- Grade I calcium score less than 10.
- Grade II calcium score between 10 and 100.
- Grade III calcium score between 101 and 200.
- Grade IV calcium score more than 200.

Multi-slice coronary CT:

1- Imaging Technique:

○ **All CT scans were performed on The SEMIENS Somatom Definition Flash which is a second generation dual source 128-slice CT scanner.**

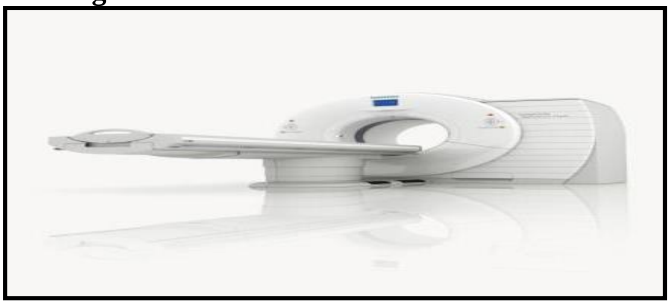

Figure (1): SEMIENS SOMATM, Definition Flash second generation dual source 128-slice CT scanner (Source: Kobry Elkobba Medical Military complex).

The steps of the scan:
Topogram:
- To define region of interest for imaging.
- Taken from the chin of the mandible till the upper abdomen.
- The region of interest was planned along the acquired topogram from tracheal bifurcation to the diaphragm.

Helical image acquisition:

All images were acquired in craniocaudal direction under full ECG gating. Prospective acquisition was done in all patients. The acquisitions were done in diastole over a single end-inspiratory breath hold period (few seconds were required for whole breath hold).

Image reconstruction:

Acquired images were reconstructed using a B35f Kernel, reconstruction increment was 3 mm resulting in a 50% overlap. Electrocardiographically triggered images were acquired at 80% of the R-R interval during one end-inspiratory breath-hold period.

2- Measurement of calcium score:

All images were electronically transferred to one dedicated workstation for CS evaluation (Leonardo; Siemens; Forchheim; Germany). CAC was defined as a hyper-attenuating lesion >130 Hounsfield units with an area >3 pixels. Baseline CAC was quantified by Agatston score. Agatston score was calculated by multiplying the lesion area (mm^2) by a density factor (between 1 and 4). A total calcium score was determined by summing individual lesion scores from each of four anatomic sites; left main (LM), left anterior descending (LAD), left circumflex (LCX), and right coronary artery (RCA).

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:
- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square (x^2) test of significance was used in order to compare proportions between two qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. The p-value was considered significant as the following:
- Probability (P-value)
  - P-value <0.05 was considered significant.
  - P-value <0.001 was considered as highly significant.
  - P-value >0.05 was considered insignificant.

RESULTS

The demographic criteria of the study population are presented in Table (1). The study included 150 consecutive patients into two groups. Group I (Diabetic group) included 130 patients; 74 (56.9%) males. Group II (non diabetic group) consisted of 20 control; 11 (55%) males no significant statistical differences between the two groups in the context of gender distribution.

The prevalence of hypertension in groups I and IIwas 44% and 95% respectively (p value 0.001). The prevalence of smoking in group I and II was 33.8% and 0% respectively (p value 0.002) while positive family history of CAD was 66.9% and 0% in groups I and II respectively (p value 0.001). There were significant statistical differences between the two groups as regards to HTN, smoking and positive family history for CAD.

Table (1): Comparison between the two studied groups according to demographic data

Demographic data	DM (n = 130)		Non DM (n = 20)		Test of sig.	P
	No.	%	No.	%		
Sex: Male	74	56.9	11	55.0	χ^2=	
Female	56	43.1	9	45.0	0.026	0.872
HTN	57	43.8	19	95.0	18.146	<0.001*
Smoking	44	33.8	0	0.0	9.579*	0.002*
Positive familyhistory for CAD	87	66.9	0	0.0	31.868	<0.001*

Coronary calcium score distribution in both groups was as follows:

Group I:

- 59 cases (45.4%) had coronary calcium score less than 10.
- 34 cases (26.2%) had coronary calcium score (11-100).
- 34 cases (26.2% had coronary calcium score (101-200).
- 3 cases (2.3%) had coronary calcium score more than 200.

Group II:

Showed coronary calcium score of zero in all cases.

Table (2): Comparison between the two studied groups according to Ca score.

Ca score	DM (n = 130)		Non DM (n = 20)		Test of sig.	P
	No.	%	No.	%		
Min. – Max. Mean ± SD. Median	0.00 – 299.0 59.28 ± 68.60 26.0		0.0 – 0.0 0.0 ± 0.0 0.0		t= 9.853*	<0.001*
Grade I (0 - 10)	59	45.4	20	100.0	χ^2= 21.710*	^{MC}p <0.001*
Grade II (11- 100)	34	26.2	0	0.0		
Grade II (101 - 200)	34	26.2	0	0.0		
Grade IV (>200)	3	2.3	0	0.0		
Min. – Max. Mean ± SD. Median	0.0 – 299.0 59.28 ± 68.60 26.0		0.0 – 0.0 0.0 ± 0.0 0.0		t= 9.853*	<0.001*

Correlation between lipogram and CCS in both groups:

Serum total cholesterol level:

This study showed that 27 cases (45.8%)of those with total serum cholesterol level less than 200mg/dl had a coronary calcium score (CCS)less than10 compared to 32 cases (54%) among those with total cholesterol more than 200mg/dl (p value 0.001) while 0% out of those with normal total cholesterol less than 200mg/dl had a CCSmore than 200(p value 0.001) while 100% cases with CCS more than 200 hada total cholesterol level more than 200. So .the trend toward a high CCS is linked to increasing serum total cholesterol, table (3).

Serum triglyceride level:

In this study 26 cases (44,1%) of those with serum triglyceride levelless than 200mg/dl had a CCSless than 10 compared to 33 cases (55,9%) among those with serum triglyceridemore than 200mg/dl (p value0.212) while 33.3 % outof those with normal triglyceride level less than 200mg/dl hada CCS more than 200.66.7% cases with CCS more than 200 had a serum triglyceride level more than 200 (p value 0.212). So, CCS not associated with elevated serum triglyceride, table (3).

Serum LDL level:

This study showed 33 cases (55,9%) of those with serum LDL levelless than 200mg/dl had a CCS less than 10 compared to 26 cases (44,1%) among those with serum LDLmore than 200mg/dl (p value0.945)while 66.7 % outof those with normal LDL level less than 200mg/dl hada CCS more than 200.33,3% with CCS more than 200 had a serum LDLlevel more than 200 (p value 0.945) .so, elevated serum LDL not associated with CCS and this may bedue to this cases on medical treatment (statin), table (3).

Serum HDL level:

In this study 36 cases (61%) of those with serum HDL levelless than 40mg/dl in male and less than 50mg/dl in femalehad a CCSless than 10 compared to 23 cases (39%) among those with serum LDLmore than 40mg/dl in male and 50mg/dl in female (p value0.015) while 100 % out of those with normal LDL levelhada CCS more than 200.0% with CCS more than 200 had a serum HDLlevel more than 40mg/dl in male and less50mg/dl in female(p value 0.015). So, high HDL level seems to be protective against high CCS values, table (3).

Table (3): Relation between Ca score and for DM cases (n = 130)

Lipid profile	**Ca score**								**χ^2**	**^{MC}p**
	Grade I (0 - 10) (n=59)		**Grade II (11- 100) (n=34)**		**Grade II (101 - 200) (n=34)**		**Grade IV (>200) (n=3)**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
S. cholestrole										
Normal (≤200)	27	45.8	12	35.3	2	5.9	0	0.0	18.874	<0.001*
Abnormal (>200)	32	54.2	22	64.7	32	94.1	3	100.0		
S. triglyceride									4.537	0.212
Normal (≤150)	26	44.1	17	50.0	9	26.5	1	33.3		
Abnormal (>150)	33	55.9	17	50.0	25	73.5	2	66.7		
LDL										
Normal (≤150)	33	55.9	21	61.8	20	58.8	2	66.7	0.517	0.945
Abnormal (>150)	26	44.1	13	38.2	14	41.2	1	33.3		
HDL										
Normal less 40 M Less 50 Female	36	61.0	11	32.4	17	50.0	3	100	9.560*	0.015*
Abnormal	23	39.0	23	67.6	17	50.0	0	0.0		

χ^2: **Chi square test** MC: **Monte Carlo**

p: p value for comparing between the different categories, *: Statistically significant at p ≤ 0.05

#: Abnormal values for HDL: Males (<40), Females (<50)

Body mass index (BMI) level:

Our study showed that 58 cases (98.3%) of those with BMI less than 30m2/kg had a coronary calcium score (CCS) less than10compared to 1 cases (1.7%) among those with BMI more than 30m2/kg (p value 0.001) while 33% out of those with normal BMI less than 30m2/kg had a CCS more than 200(p value 0.001) while 66.7% cases with CCS more than 200 had BMI more than 30m2/kg. So, the trend toward a high CCS is linked to increasing BMI, table (4).

Waist circumference level: In this study 27 cases (45.8%) of those with waist circumference less than (94-102cm)for male and (80-88cm)for female had a coronary calcium score (CCS) less than10 compared to 32 cases (54.2%) among those with waist circumference more than (94-102cm) for male (80-88cm) for female (p value 0.075) while 33.3% out of those with normal waist circumference had a CCS more than 200 (p value 0.075) while 66.7% cases with CCS more than 200 had BMI more than (94-104) for male (80-88) for female. So, the trend toward a high CCS is linked to increasing waist circumference as table (4).

Table (4): Relation between Ca score and BMI and waist circumference for DM cases (n = 130

	Ca score								**χ^2**	**^{MC}p**
	Grade I (0 - 10) (n=59)		**Grade II (11- 100) (n=34)**		**Grade II (101 - 200) (n=34)**		**Grade IV (>200) (n=3)**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
BMI (m^2/kg)										
Normal (≤ 30	58	98.3	27	79.4	20	58.8	1	33.3	28.893*	<0.001*
Abnormal (>30)	1	1.7	7	20.6	14	41.2	2	66.7		
Waist circumference									6.653	0.075
Normal	27	45.8	10	29.4	7	20.6	1	33.3		
Abnormal	32	54.2	24	70.6	27	79.4	2	66.,7		

χ^2: **Chi square test** MC: **Monte Carlo**

p: p value for comparing between the different categories

*: Statistically significant at p ≤ 0.005

#: Abnormal values for waist circumference: Males (>94), Females (>80)

Serum phosphorus level:

This study showed 43 cases(72.9 %)ofthose with serum phosphoruslevelless than 4.5 mg/dl had a CCSless than 10 compared to 16 cases (27.1%) among those with serum phosphorusmore than 200mg/dl (p value0.212) while 33.3 % outof those with normal triglyceride level less than 4.5 mg/dl hada CCS more than 200.66.7% cases with CCS more than 200 had a serum phosphorus level more than 4.5 (p value 0942) .so, there was no statistically association between serum level of phosphorus and extent of CCS.

Table (5): Relation between Ca score and Phosphorus for DM cases (n = 130)

Phosphorus	Ca score								χ^2	^{MC}p
	Grade I (0 - 10) (n=59)		Grade II (11- 100) (n=34)		Grade II (101 - 200) (n=34)		Grade IV (>200) (n=3)			
	No.	%	No.	%	No.	%	No.	%		
Normal (≤4.5)	43	72.9	26	76.5	26	76.5	2	66.7	0.652	0.942
Abnormal (>4.5)	16	27.1	8	23.5	8	23.5	1	33.3		

χ^2: **Chi square test** MC: **Monte Carlo,** p: p value for comparing between the different categories

Serum HbAIC level:

Our study showed that 0% of those with serum HbAIC level less than 6.5 mg/dl had a coronary calcium score (CCS) less than10compared to 59 cases (100%) among those with more than 6.5 mg/dl (p value 0.028) while 33.3% out of those with normal serum HbAIC less than 6.5 mg/dl had a CCS more than 200(p value 0.028) while 66.7% cases with CCS more than 200 had serum HbAIC level more than 6.5 mg/dl. So .there was statistically association between CCS and serum HbAIC.

Table (6): Relation between Ca score and HbA1C for DM cases (n = 130)

HbA1C	Ca score								χ^2	^{MC}p
	Grade I (0 - 10) (n=59)		Grade II (11- 100) (n=34)		Grade II (101 - 200) (n=34)		Grade IV (>200) (n=3)			
	No.	%	No.	%	No.	%	No.	%		
Normal (≤6.5)	0	0.0	1	2.9	0	0.0	1	33.3	8.513*	0.028*
Abnormal (>6.5)	59	100.0	33	97.1	34	100.0	2	66.7		

χ^2: **Chi square test** MC: **Monte Carlo**

p: p value for comparing between the different categories, *: Statistically significant at p ≤ 0.05

Serum parathyroidlevel:

In our study 51 cases (86.4%) of those withserum parathyroid hormone level less than 65 pg/dl had a coronary calcium score (CCS) less than10compared to 8 cases (18. 6%) among those with more than 65 pg/dl (p value 0.001) while 0% out of those with normal serum parathyroid hormone less than 65 pg/dl had a CCS more than 200 (p value 0.001) while 100% cases with CCS more than 200 hadserum parathyroidlevel more than 65 pg/dl. So .the trend toward a high CCS is linked to increasing serum parathyroid hormone level.

Table (7): Relation between Ca score and parathyroid for DM cases (n = 130).

Parathyroid	Ca score								χ^2	^{MC}p
	Grade I (0 - 10) (n=59)		Grade II (11- 100) (n=34)		Grade II (101 - 200) (n=34)		Grade IV (>200) (n=3)			
	No.	%	No.	%	No.	%	No.	%		
Normal (≤65)	51	86.4	18	52.9	16	47.1	0	0.0	24.974*	<0.001*
Abnormal (>65)	8	13.6	16	47.1	18	52.9	3	100.0		

χ^2: **Chi square test** MC: **Monte Carlo**

p: p value for comparing between the different categories, *: Statistically significant at p ≤ 0.05

Table **(8)** show that the univariate parameters affecting calcium score show that one parameter increase in parathyroid result (1.6) increase in calcium score .one parameter increase in BMI result (16.7) increase in calcium score. One parameter increase in waist circumference result (1.3) increase in calcium score. One parameter decrease in HDL result (1.6) increase in calcium score and one parameter increase in age result (3.6) increase in calcium score. But, no association between serum phosphorus and coronary Ca score (p value = 0.282).

Table (8): Univariate analysis for the parameters affecting Ca.score (n =130) for diabetic group

Ca. score	Correlation		Univariate	
	r	P	B(95%C.I)	P
Phosphorus	-0.095	0.282	-5.630(-15.944–4.685)	0.282
Para thyroid	0.553*	<0.001*	1.630(1.200–2.059)	<0.001*
BMI	0.598*	<0.001*	16.706(12.795–20.617)	<0.001*
Waist circumference	0.193*	0.028*	1.366(0.149–2.583)	0.028*
HbA1C	0.060	0.498	8.458(-16.158–33.074)	0.498
S. Cholesterol	0.079	0.372	0.118(-0.143–0.380)	0.372
S. triglyceride	-0.037	0.679	-0.044(-0.253–0.165)	0.679
HDL	-0.203*	0.021*	-1.689(-3.115–-0.263)	0.021*
LDL	0.010	0.909	0.017(-0.278–0.312)	0.909
Age	0.482*	<0.001*	3.674(2.506–4.842)	<0.001*
Sex (1=M, 2=F)	-0.117	0.184	-16.184(-40.154–7.786)	0.184

Table (**9**) shows the prevalence of CAC in coronary arteries. LAD was the most vessel affected by CAC in 74 cases (49.3%), then LCX was affected in 60 cases (40%), then RCA was affected in 43 cases (28.6%). At last LMC was the least vessel affected by CAC in 3 cases (2%). Regarding the affected vessels the highest percentage of CAC was recorded in three vessels diseased followed (22%) by two vessels disease (20%).

Table (9): Distribution of the studied cases according to Coronary arteries (n = 150.

Coronary arteries	No.	%
LM	3	2
LAD	74	49.3
LCX	60	40
RCA	43	28.6
No of affected vessels		
No vessel	66	44.
One vessel	21	14
Two vessels	30	20
Three vessels	33	22
Four vessels	0	0

DISCUSSION

In our study, we evaluated the relationship between metabolic syndrome components defined by IDF in asymptomatic individuals rather than parathyroid hormone, phosphorus level and presence and extent of coronary calcification. This study showed the prevalence of coronary artery calcification increased in metabolic syndrome patients. Numerous studies have reported an association between metabolic syndrome (Mets) and CAC.

Mahoney *et al.*[3] found that markers of metabolic syndrome such as increased waist circumference, decreased HDL, and increased blood pressure in childhood, predict increased coronary calcification in young adults.

St Francis Heart Study, in which abdominal adiposity measured by Waist circumference was positively correlated with presence of CAC in 50–70-y-old US men and women[10].

Several cross-sectional studies examined the association between obesity and CAC scores [11]. The Coronary Artery Risk Development in Young Adults study showed that higher waist circumference and waist to hip ratio were associated with CAC in 2951 African-American and white young adults [4].

They reported that WC had stronger associations with atherosclerosis than the waist: hip ratio and better predicted myocardial events. He also found that BMI was not correlated with as many of the known risk factors for CHD, whereas WC was correlated [5].

In our study, we found that central obesity identified by increased body mass index was significantly associated with presence and extent of coronary calcium p=0.001, whereas waist circumference wasp=0.075. The precise mechanisms of the interrelationships between coronary atherosclerosis, calcification, and hypertension are complex. Hypertension may participate in the atherogenic process through the arterial wall trauma induced by the rise in arterial pressure and/or particular coexistent shearing conditions. In our study, we found significant correlation between HTN and presence and extent of coronary calcium p=0.001. Another interesting observation of the present study was the strong, independent association between coronary calcium score and DM.

Hoff *et al.*[6] had already pointed to higher values of Calcium score in diabetics compared to non-diabetic. **Schurgin *et al.***[7] also demonstrated an increased prevalence (26%) of CAC scores >400 (indicating extensive disease) comparing patients with diabetes to matched control subjects (14%, P = 0.004).

Wagenknecht *et al.*[8] recently reported a high prevalence (27%) of extensive CAC in patients with diagnosed type 2 diabetes compared with non-diabetics (8%, P = 0.003) [11]. Our study similarly to **Hoff *et al.***[6] strongly associated between coronary artery calcification and diabetic group rather than control group. The present study found that serum HDL.

Cholesterol strongly correlated with the presence and extent of CAC p=0.015 in HDL and p=0.001in cholesterol. Also, in the prospective Muscatine study, low HDL cholesterol was consistently one of the most strongly associated risk factors for the presence of coronary artery calcification in young adults[12].

It is noteworthy that total cholesterol and LDL .Cholesterol were significantly associated with increased coronary calcium score as p=0.000, p=0.006 respectively.

Hecht *et al.*[9] conducted a similar analysis on 930 asymptomatic patient underwent coronary electron beam computed tomography at the Arizona Heart Institute. They found that patients who demonstrated the presence of calcified coronary plaque had higher total and LDL cholesterols, while having lower HDL cholesterol levels.In comparison to our study we found coronary calcium calcification highly associated with total cholesterol p=0.001, serum parathyroid hormonep=0.001.on the other side we found not association between phosphorus level, serum LDL and coronary calcification, serum phosphorus p = 0.282 in LDL p=0.945 and this result need more researches.

The difference in result between our study and other studies may be due to difference in the age of cases where in our study there is variable in ages but, other study done in old ages. The mechanisms of the association between triglycerides and coronary atherosclerosis remain to be clarified by further investigations, in particular those concerning the genetic susceptibility of dyslipidemic subjects[12].

In a previous study of 374 patients, it was observed a significant correlation of elevated TG with elevated CAC[13]. In contrast to this study there is no association between triglyceride and coronary calcium calcification p=0.212. As, this study was done in variable age but the previous study done only old age.

Age and sex are strongly associated with the amount of coronary calcification. Because CAC increases with age, so CAD known to be the disease of agebeit has been argued that calcification is merely a sign of aging. The same direct correlation was observed in a Brazilian study that showed a positive correlation between age male sex and coronary calcium score (r = 0.4, p <0.01)[14]. Similarly to our study we found that CAC had an ascending trend with increasing age p=0.000, and was significantly higher in males p=0.001.

CONCLUSION

Metabolic syndrome is significantly associated with presence and extent of coronary calcification even in asymptomatic patients. When there is an increase in the number of metabolic syndrome components, there is significant increase in the prevalence of coronary calcification. CAC screening is accurate and valuable modality as a completely non-invasive and relatively time-efficient screening way when avoiding high radiation burden to patients with metabolic syndrome criteria even when asymptomatic.

RECOMMENDATION

Screening of coronary calcium in asymptomatic persons with metabolic syndrome or diabetes mellitus may more promptly and reliably identify those at highest risk who could benefit from intensified therapeutic options. We have to be aware of the radiation dose in the coronary calcium scan, although the radiation dose is low, based on the ALARA ("as low as reasonably achievable") principle, every effort should be made to reduce the radiation dose without reducing the ability to accurately assess CAC burden.

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