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Original research

THE CHARACTERISTICS OF CORONARY ARTERY LESION IN PATIENTS WITH METABOLIC SYNDROME AT NINH THUAN GENERAL HOSPITAL

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ABSTRACT

Background: *Patients with metabolic syndrome are at high risk of morbidity and mortality from coronary artery disease. Understanding the characteristics of coronary artery lesions and the relationship with components of metabolic syndrome has important implications for treatment and prognosis. This study aims to survey the clinical and paraclinical characteristics and coronary artery lesions in metabolic syndrome patients with coronary artery disease at Ninh Thuan General Hospital; and evaluate the relationship and correlation between the characteristics and extent of coronary artery lesions and the components of metabolic syndrome.*

Methods: *Cross-sectional descriptive study on 89 metabolic syndrome patients with coronary artery disease treated as inpatients at the Department of Interventional Cardiology - Ninh Thuan General Hospital.*

Results: *The average age of the study subjects was 66.7 ± 12.8 years old. Patients with severe stenosis accounted for 89.9%, mainly type B and C lesions accounted for 93.3%; Multivessel lesions accounted for 78.7%. Low SYNTAX scores accounted for 61.8%, medium and high scores were 24.7% and 13.5%, respectively. Patients with increased waist circumference were 4.87 times more likely to have multivessel lesions than patients without increased waist circumference [OR = 4.87, 95%CI: (1.65 - 14.40), p = 0.006]; The risk of having severe coronary artery lesions was 3.96 times higher [OR = 3.96, 95%CI (1.21 - 12.91), p = 0.017]. Patients with >3 components of metabolic syndrome had a 3.75 times higher risk of multivessel lesions than patients with 3 components [OR = 3.75, 95%CI: (1.30 - 10.82), p = 0.011]; had 12.39 times the risk of severe lesions [OR = 12.39, 95%CI: (2.70 - 56.90), p = 0.0001]. There was a moderately statistically significant positive correlation between SYNTAX score and waist circumference (r = 0.345) and HDL-C (r = 0.320).*

Conclusion: *There was an association between the components and number of components of metabolic syndrome and coronary artery disease. There was a moderate positive correlation between SYNTAX score and waist circumference and HDL-C.*

Keywords: *Metabolic syndrome, coronary artery disease, risk factor.*

I. INTRODUCTION

Coronary artery disease is a pathological process characterized by atherosclerotic plaque accumulation in the epicardial arteries, whether obstructive or non-obstructive [1]. Coronary artery disease is not only a very common disease but also a leading cause of death and tends to increase rapidly in countries around the world. According to the Global Report in 2022, there were more than 315 million cases, more than 9.2 million deaths and an age-standardized prevalence of coronary artery disease of 3605 per 100.000 people [2]. In Vietnam, coronary artery disease is also on the rise. According to the announcement of the Vietnam National Heart Institute, the prevalence of coronary artery disease in 1991 was 3%; in 1996 it was 6.03% and in 1999

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it was 9.5% [3]. The rate of ischemic heart diseases tended to increase clearly (11.2% in 2003 increased to 24% in 2007) [4].

Patients with metabolic syndrome are at high risk of morbidity and mortality from coronary artery disease. Each component of the metabolic syndrome is a risk factor for coronary artery disease. There have been many studies around the world showing the relationship between metabolic syndrome and coronary artery lesions. The study by McNeil et al. showed that the risk of coronary artery disease in men with metabolic syndrome is 1.5 times higher and in women with metabolic syndrome is 2.0 times higher than in people without metabolic syndrome [5].

Understanding the characteristics of coronary artery lesions and the relationship with components of the metabolic syndrome is important in therapeutic intervention, helping to better prognosis, as well as supplementing data on the relationship in Vietnamese people. Therefore, we conducted this study in Ninh Thuan General Hospital, with unique ethnic, cultural and lifestyle characteristics to survey clinical and paraclinical characteristics and coronary artery lesions in metabolic syndrome patients with coronary artery disease at Ninh Thuan General Hospital; and evaluate the relationship and correlation between the characteristics and extent of coronary artery lesions and the components of metabolic syndrome.

II. MATERIALS AND METHODS

2.1. Study participants

The study participants were 89 patients with metabolic syndrome (MetS) and coronary artery disease (CAD) being treated as inpatients at the Department of Interventional Cardiology - Ninh Thuan General Hospital.

Inclusion criteria: Patients with MetS diagnosed according to the 2009 consensus criteria of IDF, AHA/NHLBI, WHF, IAS and IASO, with at least 3 of the following 5 criteria: (1) Increased waist circumference: Waist circumference ≥ 90cm for men, ≥ 80cm for women. (2) Hypertriglyceridemia ≥ 150 mg/dl (≥ 1.7mmol/L), or specific treatment for this lipid disorder. Low HDL-Cholesterol < 40 mg/dl (< 1.03 mmol/L) in men or < 50 mg/dl (< 1.29 mmol/L) in women or specific treatment for this lipid disorder. (4) Elevated blood pressure with systolic blood pressure ≥ 130 mmHg and/or diastolic blood pressure ≥ 85 mmHg or previously treated for hypertension. (5) Increased fasting blood glucose: ≥ 100 mg/dl (≥ 5.6 mmol/L), or previously diagnosed type 2 diabetes [6]. These patients have coronary artery disease confirmed by coronary angiography results (with at least 1 vessel stenosis ≥ 50% of the diameter of the vessel lumen) [7].

Exclusion criteria: Patients with coronary artery disease who have been treated with coronary stent placement or previous coronary-aortic bypass graft. Patients with severe infections or severe acute illnesses cannot stand safely to measure waist circumference.

2.2. Study methods

Study design: cross-sectional descriptive study.

Sample size and sampling method: Convenient sampling, selecting all subjects that meet the inclusion criteria during the study period (from April 2022 to April 2023). We selected 89 MetS patients with coronary artery disease.

Study variables: Age, gender, risk factors for CAD, blood pressure (mmHg), waist circumference (cm). Paraclinical variables: fasting blood glucose, Triglyceride, HDL-Cholesterol (HDL-C). Coronary angiography evaluates: position, type of lesions, number of vessels and extent of lesions, calculation of SYNTAX score [8].

2.3. Data analysis

All data were collected through data collection forms, then entered and statistically analyzed using SPSS 26.0 software.

III. RESULTS

After studying on 89 MetS patients with CAD receiving inpatient treatment at the Department of Interventional Cardiology - Ninh Thuan General Hospital during the period from April 2022 to April 2023, we obtained the results as follows.

3.1. Clinical and paraclinical characteristics and coronary artery lesions in metabolic syndrome patients with coronary artery disease

The ≥ 60 years old age group accounted for the highest proportion at 69.7%. The most common risk factors for coronary artery disease were dyslipidemia and hypertension at 100% and 94.4%, respectively. The most common component of MetS was elevated blood pressure, 94.4% and the majority of patients had 4 components of MetS (Table 1).

Table 1: General characteristics of study participants

Characteristic		Total (n = 89)	
		n	%
Average age (years) (X ± SD)		66.7 ± 12.8	
Age group	< 60 years old	27	30.3
	≥ 60 years old	62	69.7
Gender	Male	59	66.3
	Female	30	33.7
CAD risk factor	Dyslipidemia	89	100.0
	Hypertension	84	94.4
	Smoking	50	56.2
	Diabetes	41	46.1
	Family history of CAD	6	6.7
MetS component	Increased waist circumference	66	74.2
	Hypertriglyceridemia	80	89.9
	Low HDL-Cholesterol	83	93.3
	Elevated blood pressure	84	94.4
	Increased fasting glucose	41	46.1
Number of MetS components	3 components	26	29.2
	4 components	39	43.8
	5 components	24	27.0

The average waist circumference of the study participants was 90.42 ± 8.0 cm. Average systolic blood pressure was 138.3 ± 24.2 mmHg. Average blood glucose 8.1 ± 5.1 mmol/L and average blood triglyceride 2.2 ± 1.6 mmol/L were both higher than normal levels (Table 2). The majority of MetS patients with coronary artery disease had severe lesions (89.9%) and lesions in all 3 vessels accounted for a high rate of 45.0%. The vessel having most lesions was LAD with 87.6% and the most common lesion was type C (Table 3).

Table 2: Average value of components of MetS

MetS component	Average value
Waist circumference (cm)	90.4 ± 8.0
Triglyceride (mmol/L)	2.2 ± 1.6
HDL-C (mmol/L)	1.0 ± 0.2
Systolic blood pressure (mmHg)	138.3 ± 24.2
Diastolic blood pressure (mmHg)	82.7 ± 13.5
Blood glucose (mmol/L)	8.1 ± 5.1

Table 3: Characteristics of coronary artery lesions in patients with MetS

Characteristic		n	%
Extent of coronary artery lesion	Moderate	9	10.1
	Severe	80	89.9
Number of vessels	1 vessel	19	21.3
	2 vessels	30	33.7
	3 vessels	40	45.0
Location of vessels	Left main (LM)	6	6.7
	Left anterior descending (LAD)	78	87.6
	Left circumflex (LCx)	52	58.4
	Right coronary artery (RCA)	70	78.7
Type of lesions	Type A lesion	3	3.4
	Type B1 lesion	3	3.4
	Type B2 lesion	34	38.2
	Type C lesion	49	55.1
	Diffuse lesion	14	15.7
	Calcified lesion	22	24.7
SYNTAX score distribution	Low (≤ 22)	55	61.8
	Intermediate (23 - 32)	22	24.7
	High (≥ 33)	12	13.5

3.2. Relationship and correlation between characteristics and extent of coronary artery lesions with components of metabolic syndrome

Patients with increased waist circumference had a 4.87 times higher risk of multivessel coronary artery lesions than patients without increased waist circumference. Patients with > 3 components of MetS had a 3.75 times higher risk of multivessel coronary artery lesions than patients with only 3 components. The difference was statistically significant ($p < 0.05$) (Table 4).

Table 4: The relationship between the number of vessels and the components of MetS

Component		Number of vessels		OR	95%CI	p
		1 vessel	≥ 2 vessels			
Increased waist circumference	Yes (n = 66)	9 (13.6%)	57 (86.4%)	4.87	1.65 - 14.40	0.006
	No (n = 23)	10 (43.5%)	13 (56.5%)			
Hypertriglyceridemia	Yes (n = 80)	15 (18.8%)	65 (81.2%)	0.093		
	No (n = 9)	4 (44.4%)	5 (55.6%)			
Low HDL-C	Yes (n = 83)	19 (22.9%)	0 (0%)	0.334		
	No (n = 6)	64 (77.1%)	6 (100%)			

Component		Number of vessels		OR	95%CI	p
		1 vessel	≥ 2 vessels			
Elevated blood pressure	Yes (n = 84)	17 (20.2%)	2 (40.0%)	0.289		
	No (n = 5)	67 (79.8%)	3 (60.0%)			
Increased fasting glucose	Yes (n = 41)	8 (19.5%)	11 (22.9%)	0.696		
	No (n = 48)	33 (80.5%)	37 (77.1%)			
Number of MetS components	> 3 components (n = 63)	10 (38.5%)	16 (61.5%)	3.75	1.30 - 10.82	0.011
	3 components (n = 26)	9 (14.3%)	54 (85.7%)			

Patients with increased waist circumference had a 3.96 times higher risk of severe coronary artery lesions than patients without increased waist circumference. Similarly, increased fasting glucose had a 2.83 times higher risk of severe coronary artery lesions than patients without so. Patients with > 03 components of MetS had a 12.39 times higher risk of severe coronary lesions than patients with only 03 components. The difference was statistically significant ($p < 0.05$) (Table 5). Patients with increased waist circumference had a 4.57 times higher risk of coronary artery calcified lesions than patients with no increase, and patients with more than 3 components of MetS had a 5.58 times higher risk of coronary artery calcified lesions than patients with only 3 components. The difference was statistically significant ($p < 0.05$) (Table 6). There was a moderate positive correlation between SYNTAX score and waist circumference and was statistically significant ($p < 0.05$) (Table 7).

Table 5: The relationship between the extent of coronary artery lesions and the components of MetS

Component		Extent of coronary artery lesions		OR	95%CI	p
		SYNTAX intermediate - high (> 22 points)	SYNTAX low (≤ 22 points)			
Increased waist circumference	Yes (n = 66)	30 (45.5%)	36 (54.5%)	3.96	1.21 - 12.91	0.017
	No (n = 23)	4 (17.4%)	19 (82.6%)			
Hypertriglyceridemia	Yes (n = 80)	34 (42.5%)	46 (57.5%)	0.012		
	No (n = 9)	0 (0%)	9 (100%)			
Low HDL-C	Yes (n = 83)	31 (37.3%)	52 (62.7%)	0.671		
	No (n = 6)	3 (50.0%)	3 (50.0%)			
Elevated blood pressure	Yes (n = 84)	33 (39.3%)	51 (60.7%)	0.645		
	No (n = 5)	1 (20.0%)	4 (80.0%)			

Component		Extent of coronary artery lesions		OR	95%CI	p
		SYNTAX intermediate - high (> 22 points)	SYNTAX low (≤ 22 points)			
Increased fasting glucose	Yes (n = 41)	21 (51.2%)	20 (48.8%)	2.83	1.17 - 6.84	0.019
	No (n = 48)	13 (27.1%)	35 (72.9%)			
Number of MetS components	>3 components (n = 63)	32 (50.8%)	31 (49.2%)	12.39	2.70 - 56.90	0.0001
	3 components (n = 26)	2 (7.7%)	24 (92.3%)			

Table 6: The relationship between coronary artery calcified lesions and MetS components

Component		Coronary artery calcified lesions		OR	95%CI	p
		Yes	No			
Increased waist circumference	Yes (n = 66)	20 (30.3%)	46 (69.7%)	4.57	1.98 - 21.35	0.039
	No (n = 23)	2 (8.7%)	21 (91.3%)			
Hypertriglyceridemia	Yes (n = 80)	21 (26.3%)	59 (73.8%)	0.442		
	No (n = 9)	1 (11.1%)	8 (88.9%)			
Low HDL-C	Yes (n = 83)	21 (25.3%)	62 (74.7%)	0.636		
	No (n = 6)	1 (16.7%)	5 (83.3%)			
Elevated blood pressure	Yes (n = 84)	21 (25.0%)	63 (75.0%)	0.801		
	No (n = 5)	1 (20.0%)	4 (80.0%)			
Increased fasting glucose	Yes (n = 41)	21 (51.2%)	20 (48.8%)	0.670		
	No (n = 48)	13 (27.1%)	35 (72.9%)			
Number of MetS components	>3 components (n = 63)	20 (31.7%)	43 (68.3%)	5.58	1.20 - 25.96	0.017
	3 components (n = 26)	2 (7.7%)	24 (92.3%)			

Table 7: Correlation between SYNTAX score and components of MetS

Component	r	R2	Equation	p
Waist circumference (cm)	0.345	0.119	y = - 21.13 + 0.45*x	0.001
HDL-C (mmol/L)	0.320	0.102	y = 14.24 + 5.55*x	0.002
Systolic blood pressure (mmHg)	0.081	0.007	y = 29.04 - 0.11*x	0.452
Diastolic blood pressure (mmHg)	0.147	0.022	y = 29.04 - 0.11*x	0.169
Triglyceride (mmol/L)	0.100	0.010	y = 21.03 - 0.66*x	0.349
Blood glucose (mmol/L)	0.024	0.001	y = 19.96 - 0.05*x	0.824

IV. DISCUSSION

4.1. Clinical and paraclinical characteristics and coronary artery lesions in metabolic syndrome patients with coronary artery disease

Our study showed that the average age was 66.7 ± 12.8 and the majority of MetS patients with coronary artery disease were 60 years old or older. This was consistent with the characteristics of age, which has been shown to be an unchangeable risk factor for coronary artery disease [9].

Our study also showed that the highest rate of risk factors for patients with coronary artery disease with MetS was dyslipidemia with 100%, followed by hypertension with 94.4% and the least common was a history of 6.7% of families having coronary artery disease. Our study was not similar to Ho Van Phuoc's study on 95 coronary artery disease patients and noted two common risk factors: hypertension with 76.8% and smoking with 61.2% [10]. This difference might be due to the fact that our study subject was coronary artery disease in patients with MetS, which inherently had components including dyslipidemia and hypertension.

The majority of MetS patients with coronary artery disease in our study had severe stenosis, accounting for 89.9%, moderate stenosis 10.1%; Most lesions were types B2 and C, accounting for 93.3%. This result was similar to Do Thi Thu Ha's study conducted on the group of coronary artery disease with MetS, in which severe coronary stenosis accounted for the majority with 86.9%, moderate stenosis accounted for 13.1% and this rate was statistically significantly higher than in CAD group without MetS [11]. Besides, assessing the extent of coronary artery lesions according to the SYNTAX score, the results of patients with low, intermediate and high SYNTAX scores were 61.8%, 24.7% and 13.5%, respectively. Our study also noted that in patients with MetS, coronary artery lesions were mainly multivessel, of which the highest proportion was 3 vessels with 45.0% and the most common artery was left anterior descending artery with 87.6%.

4.2. Relationship and correlation between characteristics and extent of coronary artery lesions with components of metabolic syndrome

Through the study, we found that: patients with increased waist circumference had a 4.87 times higher risk of multivessel coronary artery lesions than patients without increased waist circumference. In addition, we also determined that patients with more than 3 components of MetS had a 3.75 times higher risk of multivessel coronary artery lesions than patients with only 3 components. Our study was consistent with a number of domestic studies showing differences in the number of coronary lesions and the number of MetS components [3], [11]. In terms of pathophysiology, all components of MetS are risk factors for coronary artery disease. Previous studies had also shown that all components of MetS and an increase in components of MetS were associated with increased risk of coronary artery disease [12].

Similarly, we noted a statistically significant association between increased waist circumference and increased blood glucose with the degree of coronary lesions calculated by the SYNTAX score. Among them, patients with increased waist circumference had a 3.96 times higher risk of severe coronary artery lesions than patients without

increased waist circumference. Patients with increased blood glucose had a 2.83 times higher risk of severe coronary artery lesions than patients without so. On the other hand, patients with more than 3 components of MetS had a 12.39 times higher risk of severe coronary artery lesions than patients with only 3 components. Our study results were consistent with study showing the relationship between MetS and the severity of coronary artery disease using the Gensini score. [13]. There were differences in the scoring scale used in the 2 studies, but the SYNTAX score used in our study had been shown to assess the extent of lesions and was significantly superior to the Gensini score in predicting the decision to revascularize [14].

Our study also noted the relationship between calcified lesions and components of MetS. Patients with MetS with increased waist circumference had a 4.57 times higher risk of coronary artery calcification than patients without increased waist circumference. In addition, patients with more than 3 components of MetS had a 5.58 times higher risk of coronary artery calcification than patients with only 3 components.

Our study recorded a statistically significant positive correlation between SYNTAX score and waist circumference of the study participants, according to the equation $y = 21.13 + 0.45*x$, with the correlation coefficient $r = 0.345$; where x was the waist circumference and y was the SYNTAX score. In addition, there was a statistically significant moderate positive correlation between SYNTAX score and HDL-C component, according to the equation $y = 14.24*x + 5.55$, with correlation coefficient $r = 0.320$; where x was the HDL-C and y was the SYNTAX score. Thus, through this study, we noted that the components of MetS had a certain relationship with the extent of coronary artery lesions through assessment by SYNTAX score.

V. CONCLUSION

Coronary artery disease in patients with metabolic syndrome was characterized by a high rate of severe stenosis and multivessel lesions. Not only each component but the number of components of metabolic syndrome was related to the extent of coronary artery lesions. The more components of the metabolic syndrome there were, the more multivessel lesions, severe stenosis, and more complex the lesion morphology was.

Disclosure

The authors report no other conflicts of interest in this work.

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