

관상동맥경화증 환자에서 보이는 내장지방축적

조홍근¹ · 신길자¹ · 이종호²

Visceral Fat Accumulation in Coronary Artery Disease

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ABSTRACT

Background : The visceral fat accumulation, an important factor to increase the insulin resistance is known to be associated with coronary artery disease. We investigated the relation between visceral fat accumulation and the coronary artery disease. **Methods :** The coronary artery disease (CAD) group included 14 patients (9 men and 5 women) with angina pectoris. All patients had typical chest pain, diagnosed as coronary artery disease with coronary angiogram or treadmill test. The patients with hypertension, hyperlipidemia, non-insulin dependent diabetes mellitus (NIDDM), impaired glucose tolerance (IGT) and taking any medication known to affect the insulin sensitivity were excluded. The control group included 24 healthy volunteers (11 men and 13 women) who were not taking any medication. We measured the visceral fat area, abdominal subcutaneous fat area, thigh muscle area and the thigh fat area with computed tomography (CT) in both groups. We measured the plasma lipid profile, plasma insulin and glucose level during the oral glucose tolerance test in both groups. **Results :** There were no differences in the age, sex ratio, body mass index (BMI) and the waist to hip ratio (WHR) between both groups. The total cholesterol and LDL cholesterol were significantly higher in CAD group ($p < 0.001$). The HDL cholesterol was significantly lower in CAD group ($p < 0.05$). The fasting insulin, fasting glucose, area under curve (AUC) of the insulin and glucose, and the insulin to glucose (IG) ratio were significantly higher in CAD group ($p < 0.001$). There were significant differences between CAD group and the control group in the visceral fat area ($94.2 \pm 19.1 \text{ cm}^2$ vs. $76.5 \pm 34.3 \text{ cm}^2$, $p < 0.05$), thigh fat area ($60.2 \pm 24.8 \text{ cm}^2$ vs. $92.6 \pm 41.0 \text{ cm}^2$, $p < 0.01$) and the visceral fat to thigh fat area ratio (VSFTF ratio : 1.74 ± 0.61 vs. 1.07 ± 0.80 , $p < 0.01$). The visceral fat area was independently associated with fasting insulin ($r = 0.661$, $p < 0.01$), fasting glucose ($r = 0.490$, $p < 0.05$), the AUC of glucose ($r = 0.605$, $p < 0.01$), HDL cholesterol ($r = -0.528$, $p < 0.01$) and triglyceride ($r = 0.483$, $p < 0.05$) in control group. After adjustment for visceral fat area, there were still significant differences in the fasting insulin, fasting glucose, AUC of insulin, AUC of glucose and the IG ratio between both groups. **Conclusion :** We observed significant increase in the visceral fat area and VSFTF ratio and decrease in thigh fat area in CAD group compared with age, BMI, WHR matched control group. The insulin resistance was observed in the CAD group. The visceral fat area and VSFTF ratio was associated with cardiovascular risk factors such as low HDL cholesterol and the insulin resistance in control group. (Korean Circulation J 1998;28(5):740-748)

KEY WORDS : Coronary artery disease · Visceral fat area · Visceral fat to thigh fat area ratio · Insulin resistance.

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hexokinase (International Reagent Co., Kobe, Japan), (Eiken Chemical Co., Tokyo, Japan) (area under curve : AUC) $0.25 \times \{ \dots + 2(30 \dots + 60 \dots + 90 \dots) + 120 \dots \}$ (insulin - glucose ratio : IG ratio) AUC of insulin \div UC of glucose (Daiichi Co., Tokyo, Japan) lipase glycerol kinase(Daiichi Co.,Tokyo, Japan) HDL (International Reagent Co., Kobe, Japan) . LDL Friedwald - /5 + HDL)

IBM PC SPSSWIN 7.0 Student's t - test Chi - square test Pearson's correlation multiple stepwise regression 가 ANCO - P VA(Analysis of Covariance) 0.05 가

결 과

대상의 임상적 특성 51.4 \pm 7.9 48.8 \pm 6.4 가 , 229.7 \pm 62.0 mg/dl, 175.0 \pm 29.9 mg 가 LDL 160.9 \pm

55.6 mg/dl 104.7 \pm 27.3 mg/dl (p<0.001). HDL 32.0 \pm 11.0 mg/dl 42.8 \pm 16.6 mg/dl (p<0.05, Table 1). 대상의 인슐린과 혈당에 관계된 지표 16.8 \pm 5.6 μ U/ml 5.9 \pm 2.8 μ U/ml (p<0.001). 75 percentile 13.9 μ U/ml 100%가 75 percentile 92.4 \pm 14.2 mg/dl 77.5 \pm 9.2 mg/dl (Fig. 1). (p<0.001). 75 percentile 95 mg/dl odds ratio가 15.4 (2.2 - 109.3, p<0.001, Fig. 2). 165.9 \pm 74.8 μ U/ml.hr, 284.9 \pm 51.6 mg/dl.hr,

Table 1. Clinical features of the CAD and the normal control group

	CAD (n = 14)	Control (n = 24)
Age(years)	51.4 \pm 7.9	48.8 \pm 6.4
Systolic BP(mmHg)	126.7 \pm 23.0	119.4 \pm 9.1
Diastolic BP(mmHg)	80.0 \pm 15.3	79.7 \pm 7.2
BMI(kg/m ²)	25.9 \pm 1.8	24.5 \pm 2.2
Waist to hip ratio(WHR)	0.90 \pm 0.60	0.89 \pm 0.59
Total cholesterol(mg/dl)	229.7 \pm 62.0	175.0 \pm 29.9**
LDL cholesterol(mg/dl)	160.9 \pm 55.6	104.7 \pm 27.3**
HDL cholesterol(mg/dl)	32.6 \pm 11.0	42.8 \pm 16.6*
Triglyceride(mg/dl)	180.9 \pm 68.7	137.9 \pm 62.4

CAD : coronary artery disease BMI : body mass index *p<0.05 **p<0.001

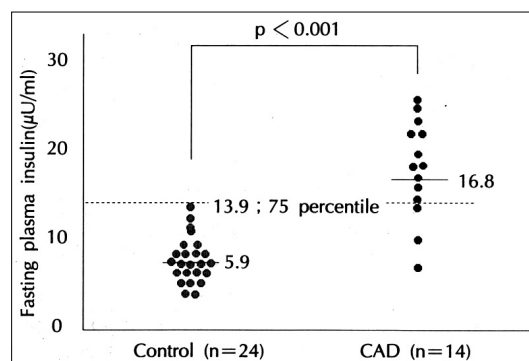


Fig. 1. Fasting plasma insulin of control and CAD.

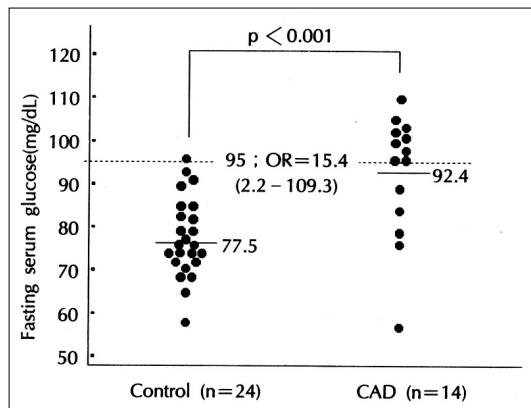


Fig. 2. Fasting serum glucose of control and CAD.

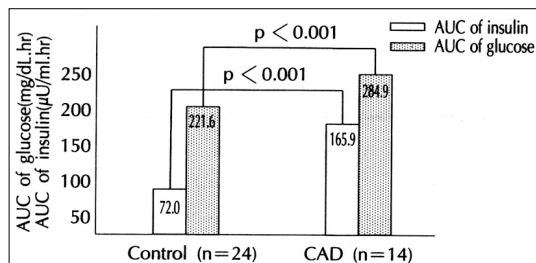


Fig. 3. The AUC (Area Under Curve) of insulin and glucose of control and CAD.

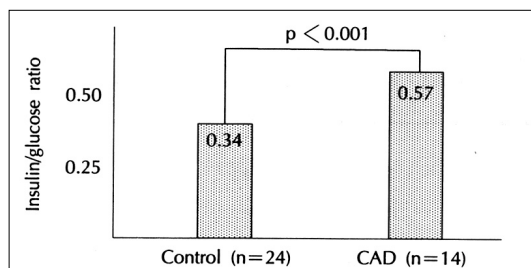


Fig. 4. The insulin / glucose ratio of control and CAD.

0.57 ± 0.24 $72.0 \pm 30.2 \mu\text{U/ml.hr}$, $221.6 \pm 32.4 \text{ mg/dl.hr}$, 0.34 ± 0.11 ($p < 0.001$, Figs. 3 and 4).

대상의 신체지표

$94.2 \pm 19.1 \text{ cm}^2$
 $76.5 \pm 34.3 \text{ cm}^2$ ($p < 0.05$, Fig. 5).
 0.48 ± 0.12 , 0.47 ± 0.26
가
 $\pm 24.8 \text{ cm}^2$, $92.6 \pm 41.0 \text{ cm}^2$

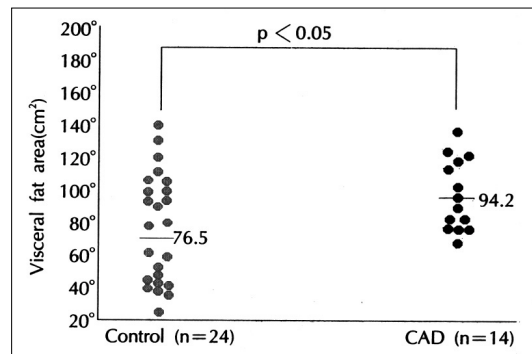


Fig. 5. Visceral fat area of control and CAD.

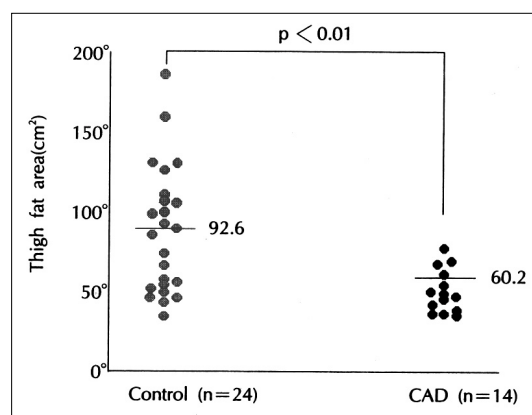


Fig. 6. Thigh fat area of control and CAD.

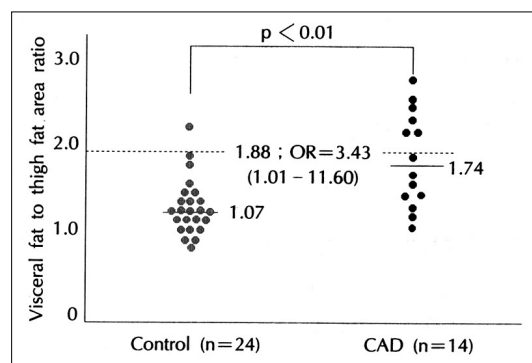


Fig. 7. Visceral fat to thigh fat are (VSFTF) ratio of control and CAD.

($p < 0.01$, Fig. 6).
 1.74 ± 0.61 ,
 1.07 ± 0.80 가 ($p < 0.01$, Fig. 7),
75 percentile 1.88
Odds ratio가 3.43
(1.01 - 11.60, $p < 0.05$, Fig. 7)

신체지표와 관상동맥경화증의 위험인자와의 상관관계, HDL, LDL, CT, HDL, LDL (Table 2, 3). (Table 4, 5).

Table 2. Pearson correlation coefficients of the visceral fat area, VS ratio and VSFTF ratio with fasting insulin, fasting glucose, AUC of insulin and AUC of glucose in control group (n = 24) AUC of

	Fasting insulin (μ U/ml)	Fasting glucose (mg/dl)	AUC of insulin (μ U/ml.hr)	AUC of glucose (mg/dl.hr)
Visceral fat area (cm ²)	0.661**	0.490**	0.314	0.605**
VS ratio	0.350	0.462	0.217	0.575**
VSFTF ratio	0.239	0.366	0.068	0.508*

AUC : area under curve

VSFTF ratio : visceral fat to thigh fat area ratio VS ratio : visceral fat to subcutaneous fat area ratio,

*p<0.05 **p<0.01

Table 3. Pearson correlation coefficients of the visceral fat area, VS ratio and VSFTF ratio with total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride in control group (n = 24)

	Total cholesterol (mg/dl)	HDL-cholesterol (mg/dl)	LDL-cholesterol (mg/dl)	Triglyceride (mg/dl)
Visceral fat area (cm ²)	0.061	- 0.457**	0.166	0.483**
VS ratio	- 0.214	- 0.504*	- 0.099	0.351
VSFTF ratio	- 0.197	- 0.457**	0.350	0.352

VSFTF ratio : visceral fat to thigh fat area ratio VS ratio : visceral fat to subcutaneous fat area ratio

*p<0.05 **p<0.01

Table 4. Multiple stepwise regression analysis of fasting insulin, fasting glucose, AUC of insulin and AUC of glucose with visceral fat area, VS ratio and VSFTF ratio in control group (n = 24)

	Visceral fat area (cm ²)	VS ratio	VSFTF ratio	Adjusted R square	Significance of F
Fasting insulin (μ U/ml)	0.661**	-	-	0.407	0.001
Fasting glucose (mg/dl)	0.490*	-	-	0.206	0.015
AUC of insulin (μ U/ml.hr)	-	-	-	-	NS
AUC of glucose (mg/dl.hr)	0.605**	-	-	0.366	0.002

VSFTF ratio : visceral fat to thigh fat area ratio VS ratio : visceral fat to subcutaneous fat area ratio

AUC : area under curve *p<0.05 **p<0.01

Table 5. Multiple stepwise regression analysis of total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride with visceral fat area, VS ratio and VSFTF ratio in control group (n = 24)

	VSFTF ratio	Adjusted R square	Significance of F	Visceral fat area (cm ²)	VS ratio
Total cholesterol (mg/dl)	-	-	-	-	NS
HDL cholesterol (mg/dl)	- 0.528**	-	-	0.246	0.008
LDL cholesterol (mg/dl)	-	-	-	-	NS
Triglyceride (mg/dl)	0.483*	-	-	0.233	0.017

VSFTF ratio : visceral fat to thigh fat area ratio VS ratio : visceral fat to subcutaneous fat area ratio

NS : not significant *p<0.05 **p<0.01

Table 6. Adjusted means of biochemical characteristics in both groups after adjusted with visceral fat area

	CAD (n = 14)	Control (n = 24)	Significance of F
Fasting insulin (μ U/ml)	16.4	5.5	0.0001
Fasting glucose (mg/dl)	91.0	78.4	0.002
AUC of insulin (μ U/ml.hr)	163.7	64.4	0.0001
AUC of glucose (mg/dl.hr)	279.8	224.6	0.0001
IG ratio	0.57	0.34	0.0001
Total cholesterol (mg/dl)	227.4	176.4	0.0019
HDL cholesterol (mg/dl)	34.8	41.5	NS
LDL cholesterol (mg/dl)	158.8	106.0	0.008

CAD : coronary artery disease IG ratio : insulin to glucose ratio NS : not significant

($r = 0.483$, adjusted R square = 0.233, $p < 0.05$, significance of F = 0.017),

내장지방면적을 보정한 후 양군의 생화학적 지표 (abdominal obesity) (tru - ncal obesity) , , HDL (14)(15) 1980 CT (ANCO - CT , VA). , HDL (visceral fat obesity syndrome) (16) (Table 6).

고 안 Yamashita CT (V/S ratio) 가 0.4 (4) Williams 110 cm^2 23 kg/m^2 28 kg/m^2 가 110 cm^2 110 cm^2 40 cm^2 (10) Finnish study (11) (borderline) , 40 cm^2 (17) (12) 가 1996 Cho Kissebach (18) Cha 가 0.4 (3) Lapidus 가 가 (19)

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중심 단어 :

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