#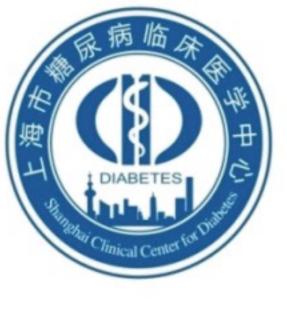 Association between serum ANGPTL3 levels and Triglyceridein patients with metabolic syndrome and type 2 diabetes mellitus

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[Abstract] Angiopoietin like protein 3(ANGPTL3) is a glycoprotein which is secreted from the liver. Previous research have found that the ANGPTL3 could inhibit the activity of lipoprotein lipase (LPL) and decrease the clearance rate of triglyceride in animal experiments. However there is rarely and controversial reports about the exactly correlation between serum lipids, blood glucose, insulin resistance and serum ANGPTL3 in patients with diabetes mellitus and metabolic syndrome.

Objective To evaluate the level and relevant factors of serum ANGPTL3 in patients with metabolic syndrome (MS) and type 2 diabetes (T2DM).

Methods A total of 150 subjects aged 40 to 65 were selected in Shanghai area from May,2015 to April,2016.Using diagnostic criteria for the metabolic syndrome (MS) in the 2013 edition of the Chinese Medical Association Diabetes Society (CDS), All of the 150 subjects were divided into 83 subjects with non-metabolic syndrome group (NMS) and 67 patients with metabolic syndrome (MS), and according to the 1999 WHO diagnostic criteria for diabetes, the objects of study were divided into 49 cases of normal glucose regulation as control (control) group and 101 cases of diabetes mellitus (T2DM) group. The fasting serum concentration of ANGPTL3 was detected by liquid phase factor concentration quantitative analysis(Luminex). Waist circumference, hip circumference, blood Pressure were measured, blood biochemistry and glycometabolism indicators were also detected. Calculating the body mass index (BMI), waist to hip ratio (WHR) and insulin resistance index (HOMA-IR).The data using SPSS 21.0 software for statistical analysis.

Results Serum level of ANGPTL3 was significantly increased in MS group company with the NMS group (3.40±1.60ng/ml vs. 2.66±1.33ng/ml P=0.001) (Table 1). Serum ANGPTL3 levels of T2DM group was also higher than that of control group (3.17±1.46 ng/ml vs. 2.62±1.51 ng/ml P=0.026) (Table 2). Spearman correlation analysis indicated that serum ANGPTL3 was positively associated with waist circumference, WHR, BMI, HOMA-IR, fasting blood glucose, fasting insulin and triglycerides(P<0.05) (Table 3). Multiple linear stepwise regression analysis showed the Triglyceride was an independent risk factors for serum ANGPTL3 level, after adjusting for the effects of waist circumference, BMI, WHR,HOMA-IR, fasting glucose and fasting insulin (Table 4).

Discussion Precious study have found that high concentration of glucose could increase the expression of ANGPTL3 in the culture hepatocytes, especially in the case of insulin resistant. Animal studies also found that ANGPTL3 adenovirus vector or ANGPTL3 recombinant treated could significantly increase the TG and free fatty acid (FFA) levels in mice. Our study shows that theANGPTL3 levels is elevated in the metabolic syndrome individual, which is associated with hyperglycemia and insulin resistant, all of these may lead to the increase of ANGPTL3 expression, and the elevated levels of ANGPTL3 may further induce the risk of hyperlipidemia, resulting a vicious cycle.

Conclusions Serum level of ANGPTL3 was elevated in the patients with metabolic Syndrome and type 2 diabetes mellitus and triglyceride was independently correlated with ANGPTL3.

Table1 Comparison of clinical and biochemical data between MS group and NMS group [X±s, M (P25, P75)]

variable	NMS	MS	P value
N（M/F）	83(41/42)	67(34/33)	
Age(year)	54.74±5.53	56.83±5.96	0.059
BMI	24.33±2.96	27.35±3.08	0.000
Waist(cm)	81.63±8.38	91.48±8.27	0.000
WHR	0.88±0.05	0.93±0.06	0.000
HOMA -IR△	0.70±0.81	1.33±0.74	0.000
SBP(mmHg)	132.90±16.38	147.14±20.75	0.000
DBP(mmHg)	80.53±10.81	85.28±10.82	0.009
FPG(mmol/L)	5.80(5.41-7.35) a	7.02(5.87-8.70) a	0.002
FINS(mmol/L)	6.86(4.89-9.75) a	11.66(6.98-16.95) a	0.051
HbA1c(%)	6.00(5.70-6.70) a	6.80(6.00-7.90) a	0.001
TC(mmol/L)	4.83±0.75	4.98±0.90	0.287
TG (mmol/L)	1.04(0.83-1.33) a	1.93(1.30-2.89) a	0.000
HDL-C(mmol/L)	1.31±0.23	1.13±0.33	0.000
LDL-C(mmol/L)	3.36±0.62	3.48±0.74	0.263
Angptl3(ng/ml)	2.66±1.33	3.40±1.60	0.001

Note : a, Non normal distribution , △，Data are converted by natural logarithms; P value, MS VS NMS

Table2 Comparison of clinical and biochemical data between Control group and T2DM group [X±s, M (P25, P75)]

variable	Control	T2DM	Pvalue
N （M/F）	49(24/25)	101(51/50)	
Age(year)	54.53±6.41	56.21±5.42	0.097
BMI	24.69±3.02	26.14±3.43	0.013
Waist(cm)	83.61±9.75	87.11±9.43	0.037
WHR	0.88±0.06	0.91±0.06	0.011
HOMA-IR△	0.47±0.62	1.23±0.82	0.000
SBP(mmHg)	136.25±15.32	140.60±21.44	0.207
DBP(mmHg)	83.39±10.66	82.23±11.25	0.551
FPG(mmol/L)	5.41(5.04-5.67) a	7.38(6.48-8.80) a	0.000
FINS(mmol/L)	6.90(4.95-9.53) a	10.00(6.23-15.51) a	0.023
HbA1c(%)	5.70(5.50-5.90) a	6.90(6.40-8.00) a	0.000
TC(mmol/L)	4.82±0.79	4.93±0.84	0.467
TG(mmol/L)	1.07(0.85-1.48) a	1.39(1.00-2.05) a	0.004
HDL-C(mmol/L)	1.31±0.25	1.20±0.31	0.026
LDL-C(mmol/L)	3.40 ±0.64	3.42±0.70	0.857
Angptl3(ng/ml)	2.62±1.51	3.17±1.46	0.026

Note : a, Non normal distribution , △，Data are converted by natural logarithms; P value, MS VS NMS

Table 3 Correlation analysis of serum ANGPTL3 and observation index

	BMI	Waist	WHR	TG	FPG	FINS	HOMA-IR
r	0.183	0.197	0.167	0.284	0.179	0.173	0.207
p	0.028	0.018	0.045	0.001	0.032	0.037	0.012

Note：r is the Spearman correlation coefficient；

Table4 Multiple stepwise regression analysis of serum ANGPTL3 and observation index

	ß	ß'	SD	t	p	95% CI
TG*	0.845	0.298	0.224	3.779	0.000	2.475-3.014