OP-0023 The impacts of low testosterone and metabolic syndrome on cardiovascular risk factors and renal outcomes in diabetic men

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Background:

Both low total testosterone (TT) levels and metabolic syndrome(MetS) are frequently associated with type 2 diabetes (T2DM).¹ Some cohort study revealed that there was high prevalence of cardiovascular disease and MetS in Chinese diabetic men with low TT. ²

Aim:

Our aim is to assess the impacts of low TT or MetS or both on cardiovascular risk factors, arterial stiffness and clinical renal outcomes in T2DM male patients .

Methods:

This cross-sectional study enrolled 240 male subjects with T2DM from September 2014 to February 2015. Serum testosterone, waist circumference, body mass index (BMI), brachial-ankle pulse wave velocity (ba-PWV), ankle-brachial index (ABI) were measured along with fasting and postprandial blood sugar levels, glycated hemoglobin (HbA1c), total cholesterol, triglyceride (TG), and low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C), serum creatinine, estimated glomerular filtration rate (eGFR) and ACR (albumin creatinine ratio). We divided our subjects to four groups; namely, Group 1 (low TT with MetS), Group 2 (low TT without MetS), Group 3 (high TT with MetS) and Group 4 (high TT without MetS). Correlations of PWV and renal outcomes with multiple variables included low TT or MetS were assessed using the Pearson correlation coefficient. Multivariate logistic regression or multivariate stepwise linear analyses were then performed to obtain the predictive factors of the clinical outcomes to analyze the relationship.

Table 1. Baseline Characteristics of the Analysis Population

	Group 1 (n=60)		Group 2 (n=18)		Group 3 (n=69)		Group 4 (n=39)		P
	Low TT with MetS		low TT without Met		high TT with MetS		high TT without Mets		
Age	60.88 ± 10.62		55.15 ± 8.08		56.97 ± 11.82		55.15 ± 8.08		0.089
height	166.84 ± 5.54		164.64 ± 4.55		167.60 ± 6.14		166.67 ± 4.74		0.542
weight	82.14 ± 14.56		71.86 ± 10.75		78.69 ± 10.59		68.26 ± 10.87		<0.001 ^{CF}
BMI	29.32 ± 4.66		26.47 ± 3.60		27.79 ± 3.05		24.59 ± 3.85		<0.001 ^{CF}
waist	102.00 ± 12.50		92.00 ± 17.00		97.000 ± 9.500		86.000 ± 11.00		<0.001 ^{ABDF}
FPG	131.000 ± 41.50		117.000 ± 56.500		130.00 ± 44.75		120.00 ± 33.500		0.412
PPG	194.14 ± 67.75		216.29 ± 97.38		177.48 ± 55.11		168.83 ± 58.76		0.135
HbA1c	7.000 ± 1.50		6.900 ± 3.150		7.100 ± 1.28		7.00 ± 1.150		0.918
TC	148.71 ± 36.45		157.25 ± 33.70		156.75 ± 32.00		159.38 ± 39.89		0.532
TG	179.42 ± 96.59		109.38 ± 31.81		140.85 ± 62.88		111.63 ± 61.90		<0.001 ^{bc}
LDL	83.18 ± 28.65		89.50 ± 25.30		85.91 ± 26.16		86.66 ± 33.67		0.914
HDL	37.00 ± 13.00		50.00 ± 9.75		38.00 ± 9.000		45.00 ± 14.00		<0.001 ^{AcDF}
GPT	24.00 ± 15.00		25.00 ± 11.00		27.00 ± 18.000		25.00 ± 14.50		0.486
Cr	1.00 ± 0.40		0.900 ± 0.250		1.000 ± 0.40		0.90 ± 0.300		0.053 ^f
eGFR	74.00 ± 36.50		88.45 ± 32.25		77.500 ± 38.250		85.000 ± 30.70		0.045 ^{df}
ACR	17.50 ± 70.20		6.300 ± 39.100		28.300 ± 60.40		6.95 ± 15.550		0.009 ^{ad}
ABI	1.11 ± 0.12		1.13 ± 0.08		1.09 ± 0.14		1.11 ± 0.11		0.865
ba-PWV	1860.00 ± 405.00		1462.00 ± 175.50		1680.00 ± 357.000		1460.00 ± 230.50		<0.001 ^{ABcDF}

Data are presented as the mean value or median ± standard deviation or median (IQR)
BMI=body mass index; FPG= fasting plasma glucose; PPG=post-meal plasma glucose; HbA1c=glycosylated hemoglobin; TC=total cholesterol; TG=triglyceride; LDL=low-density lipoprotein cholesterol; HDL-C= high-density lipoprotein cholesterol; GPT=glutamic-pyruvic transaminase; Cr=creatinine; eGFR=estimated glomerular filtration rate; UACR=urine albumin-creatinine ratio.
a Group1 vs Group 2 p< 0.05 ; A group1 vs group 2 p<0.001;b Group1 vs Group 3 p< 0.05 ; B group1 vs group 3 p<0.001; c group1 vs Group 4 P< 0.05 ; C group1 vs group 4 P<0.001;d Group 2 vs group 3 P<0.05 ; D group2 vs group 3 p<0.001; e Group 2 vs group 4 p< 0.05 ;E group 2 vs group 4 p<0.001; f Group 3 vs group 4 p<0.05 ; F group 3 vs group 4 P<0.001.

Figure 1. This figure indicated the relationships between number of criteria of metabolic syndrome and total testosterone level. All subjects with T2DM was correspond with at least one of the criteria.

Results:

The prevalence of MetS was 70% (131/186) and low TT was 43% (78/186) in this study. Group 1 comprised 32% (60/186) of total subjects; these individuals had significantly higher TG, ACR and PWV but lower eGFR and HDL than the other 3 groups. (Table 1)
PWV was both significantly correlated with MetS and low TT in multiple regression. After adjusting for confounding factors with low TT, PWV showed significant positive correlation with MetS and Age in diabetic men (Table 2).
As shown in Table 3, the multivariable logistic regression analysis demonstrated a significant association between MetS with composite renal outcomes or CKD. In albuminuria, the logistic regression analysis didn't indicate any significant correlations after adjusting for confounding factors.

Discussion:

Both low TT or MetS are associated with macro- and microvascular dysfunction due to endothelial dysfuction.^{3,4} The association of inceasing PWV for arterial stiffness is attributed to both low TT and MetS. However, CKD was just only significantly correlated with MetS. Albuminuria was not correlated with either MetS or low TT.

Conclusion:

In our study, comparsion with low TT, MetS was more significantly correlated with PWV and renal outcomes in male patients with T2DM.

Table 2. simpe and multivariate linear regression of variables with associated with PWV after adjustment for covariables in male patients with type 2 diabetes mellitus.

Variables	Simple Linear regression			Multiple Linear regression			Multiple Linear regression		
	Beta	95% CI	p	Beta	95% CI	p	Beta	95% CI	p
Age	0.60 ^b	14.04 ~ 23.37	<0.001				0.51 ^b	0.61 ~ 0.49	<0.001
eGFR	-0.12	-3.82 ~ 1.04	0.259						
HbA1c	0.01	-51.26 ~ 58.52	0.896						
ACR	0.19	-0.02 ~ 0.44	0.073						
Low TT	0.26 ^a	308.09 ~ 37.99	0.013	-0.21 ^a	-0.28 ~ -0.21	0.027	-0.13	-0.28 ~ -0.13	0.101
MetS	0.43 ^b	182.43 ~ 423.95	<0.001	0.39 ^b	0.43 ~ 0.39	<0.001	0.28 ^b	0.43 ~ 0.26	<0.001

eGFR=estimated glomerular filtration rate; HbA1c=glycosylated hemoglobin;; ACR=urine albumin-creatinine ratio; TT=total testosterone; MetS=metabolic syndrome.
^a Correlation is significant at the 0.05 level (two-tailed).
^b Correlation is significant at the 0.01 level (two-tailed).

Table 3. Multivariate logistic regression of variables with associated with CKD or/and albuminuria after adjustment for covariables in Chinese men with type 2 diabetes mellitus.

Variables	CKD or albuminuria			CKD			albuminuria		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Age	1.03	0.97 ~ 1.10	0.305	1.10 ^a	1.02 ~ 1.19	0.012	0.98	0.92 ~ 1.04	0.464
Low TT	1.00	1.00 ~ 1.01	0.272	1.00	1.00 ~ 1.01	0.560	1.00	1.00 ~ 1.01	0.312
HbA1c	1.17	0.70 ~ 1.94	0.549	0.78	0.42 ~ 1.44	0.421	1.40	0.84 ~ 2.34	0.202
TG	1.00	1.00 ~ 1.01	0.463	1.01	1.00 ~ 1.02	0.167	1.00	0.99 ~ 1.01	0.989
ba-PWV	1.00	1.00 ~ 1.00	0.857	1.00	1.00 ~ 1.00	0.173	1.00	1.00 ~ 1.00	0.313
MetS	3.66 ^a	1.05 ~ 12.80	0.042	10.32 ^a	1.15 ~ 92.61	0.037	2.81	0.77 ~ 10.28	0.118

TT=total testosterone;HbA1c=glycosylated hemoglobin; TG=triglyceride; ba-PWV=brachial-ankle pulse wave velocity; MetS=metabolic syndrome..
^a Correlation is significant at the 0.05 level (two-tailed).
^b Correlation is significant at the 0.01 level (two-tailed).

Reference

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