ELEVATED TSH WAS POSITIVELY CORRELATED TO THE PREVALENCE OF CKD AMONG ELDER TAIWAN CHINESE

S.-L.Hu[1,2,5], C.-S.Liu[2,3], C.-H..Lin[1,2], C.-I.Li[3], C.-C.Lin[1,3,4], T.-C.Li[3,4], W.-Y.Lin[2,3]

胡松林、劉秋松、林志學、李佳霙、林正介、李采娟、林文元

[1]中國醫藥大學暨附設醫院老年醫學科、[2]家庭醫學科、[3]醫學研究部；[4]中國醫藥大學生物統計所、[5]醫學院老化醫學博士學位學程[4]

CMUH

Background

Chronic kidney disease was demonstrated to increase all cause and cardiovascular disease mortality. Prior report revealed the negative correlation between thyroid stimulating hormone(TSH) and estimated glomerular filtration ratio(eGFR). Our aim was to demonstrate the relationship between elevated TSH levels and the prevalence of CKD among elder Taiwan Chinese.

Materials and methods

We recruited 200 elder people who consecutively attended the hospital for regular health exam. Basic data and laboratory report were collected. Besides, thyroid function as thyroid stimulating hormone and free thyroxine(FT4) were recorded. Chronic kidney disease were defined as urine protein more than 30 md/dL and/or eGFR less than 60 ml/min/1.73m2. eGFR was calculated by the Modification of Diet in Renal Disease equation. FT4 between 0.54-1.40 ng/dL were selected. TSH was divided into higher TSH and lower TSH group according to equal number. WC was divided into two group with cutoff value of 90 cm in men, and 80 cm in women. Student t was used for continuous values. Logistic linear regression was used for predicting the odds ratio of CKD between higher and lower TSH groups.

Results

A total of 195 people were selected into analysis. Subjects with higher TSH were 3.05±1.75 nIU/ml and those with lower TSH were 0.96±0.37 nIU/ml. There were 52 people corresponding to CKD definition. LnTSH was negatively associated to eGFR after adjusting possible confounders. The odds ratios of CKD among higher TSH group was 2.31(1.05-5.11) after adjustment with age, gender, BMI, WC, social habits, chronic disease, compared to lower TSH group. And this effect was more prominent among high WC subgroup.

Conclusions

Higher TSH levels were related to the prevalence of CKD. Adequately controlling the insult of CKD was necessary.

Keyword: thyroid stimulating hormone, chronic kidney disease, elder Taiwan Chinese

Table 1 Baseline demographic characteristics according to TSH level[#]

	Lower TSH Group (N=97)	Higher TSH Group (N=98)	P[§]
Male (n,%)	44(45.4%)	48(49%)	0.613
Age (years)	76.3±6.1	76.9±6.6	0.518
Height (cm)	159.8±8.4	158.8±7.9	0.432
Body weight (kg)	59.6±11.0	61.9±13.0	0.197
WC(cm)	85.9±10.3	88.3±11.2	0.113
BMI (kg/m^2)	23.27±3.33	24.39±3.85	**0.032**
SBP (mmHg)	135.5±18.9	138.2±15.7	0.277
DBP (mmHg)	76.7±11.6	77.3±10.8	0.711
MAP (mmHg)	96.3±13.6	97.6±11.6	0.473
ALT(U/L)	24.7±18.1	25.7±18.4	0.708
AST(U/L)	26.9±16.5	27.0±12.4	0.984
FPG (mg/dL)	108.4±25.1	106.2±20.8	0.491
TCHOL (mg/dL)	198.6±52.7	185.6±43.5	0.062
Triglycerides (mg/dL)	101.8±53.8	128.6±88.7	**0.012**
HDL-C(mg/dL)	55.0±14.3	49.8±11.2	**0.005**
Creatinine (mg/dL)	0.92±0.51	1.01±0.61	0.254
eGFR(ml/min)	78.9±22.3	72.5±21.3	**0.042**
Urine protein(mg)	8.8±30.5	17.1±64.9	0.251
TSH(nIU/mL)	0.96±0.37	3.05±1.75	**0.000**
Free T4(ng/dL)	0.97±0.15	0.89±0.14	**0.000**
Smoking (n,%)			0.643
Current	4(4.1%)	2(2%)	
Former	2(2.1%)	3(3.1%)	
Never	91(93.8%)	93(94.9%)	
Alcohol consumption (n, %)			0.509
Current	1(1.0%)	2(2.0%)	
Former	1(1.9%)	3(3.1%)	
Never	95(97.9%)	93(94.9%)	
Exercise (n, %)			0.801
Current	78(80.4%)	75(76.5%)	
Former	8(8.2%)	10(10.2%)	
Never	11(11.3%)	13(13.3%)	
HTN (n, %)	72 (74.2%)	75(76.5%)	0.709
T2DM (n, %)	91 (93.8%)	93(94.9%)	0.743
Dyslipidemia(n, %)	90 (92.8%)	95(96.9%)	0.188

Data are presented as mean ± SD or n (%)

Abbreviation: BMI, body mass index ; MAP, mean arterial pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure; ALT, Alanine Aminotransferase; AST, Aspartate Aminotransferase; FPG, fasting plasma glucose, TCHOL, total cholesterol; HDL-C, high-density lipoprotein cholesterol; Cr, creatinine; eGFR, estimated glomerular filtration rate; TSH: thyroid stimulating hormone

＃TSH level was divided into two groups according to population numbers.

§Student's test was used for comparing mean values of continuous variables between groups and Pearson χ† test was used for categorical data.

Table 2 Baseline demographic characteristics according to chronic kidney disease[#]

	Normal (n=145)	CKD (n=52)	P[§]
Male (n,%)	44(45.4%)	48(49%)	0.613
Age (years)	75.6±6.1	79.1±6.2	**0.000**
Height (cm)	158.6±8.1	161.5±7.9	**0.024**
Body weight (kg)	58.8±11.8	66.2±11.4	**0.000**
BMI (kg/m^2)	23.29±3.46	25.33±3.67	**0.000**
WC(cm)	85.6±10.0	91.4±11.8	**0.001**
SBP (mmHg)	135.1±16.3	141.5±19.3	**0.021**
DBP (mmHg)	76.1±10.4	79.1±13.0	0.100
MAP (mmHg)	95.8±11.8	99.9±14.1	**0.042**
ALT(U/L)	23.5±13.8	29.9±26.4	0.102
AST(U/L)	25.3±9.5	31.3±22.9	0.071
FPG (mg/dL)	104.9±19.7	113.3±29.7	0.064
TCHOL (mg/dL)	194.5±36.0	193.3±63.6	0.869
Triglycerides (mg/dL)	105.8±55.1	139.3±108.7	**0.037**
HDL-C(mg/dL)	54.3±12.4	48.2±12.4	**0.003**
Creatinine (mg/dL)	0.79±0.18	1.47±0.88	**0.000**
eGFR (ml/min)	83.6±16.3	53.4±21.0	**0.000**
Urine protein(mg)	3.0±6.4	42.4±93.3	**0.004**
TSH(nIU/mL)	1.99±2.39	3.05±4.34	**0.032**
Free T4(ng/dL)	0.93±0.14	0.91±0.17	0.444
Smoking (n,%)			0.643
Current	4(4.1%)	2(2.0%)	
Former	2(2.1%)	3(3.1%)	
Never	91(93.8%)	93(94.9%)	
Alcohol consumption (n,%)			0.509
Current	1(1.0%)	2(2.0%)	
Former	1(1.0%)	3(3.1%)	
Never	95(97.9%)	93 (94.9%)	
Exercise (n, %)			0.801
Current	78(80.4%)	75(76.5%)	
Former	8(8.2%)	10(10.2%)	
Never	11(11.3%)	13(13.3%)	
HTN (n, %)	111(76.6%)	37(71.2%)	0.440
T2DM (n, %)	140(96.6%)	46(88.5%)	**0.029**
Dyslipidemia(n, %)	135(93.1%)	51(98.1%)	0.180

Data are presented as mean ± SD or n (%)

Abbreviation: WC, waist circumference; BMI, body mass index ; MAP, mean arterial pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure; ALT, Alanine Aminotransferase; AST, Aspartate Aminotransferase; FPG, fasting plasma glucose, TCHOL, total cholesterol; HDL-C, High-density lipoprotein cholesterol; eGFR, estimated glomerular filtration rate; CKD, chronic kidney disease; TSH: thyroid stimulating hormone

＃CKD was defined as eGFR below 60 mL/min and/or urine protein equal to or more than 30mg/dL. eGFR was calculated from Modification of Diet in Renal Disease equation.

§Student's test was used for comparing mean values of continuous variables between groups and Pearson χ test was used for categorical data

Table 3 Multiple linear regression models showing regression coefficient (β±S.E.) with eGFR as dependent variable, and the other listed variables as independent variables.

Variables	Model 1 (R^2=0.129)	Model 2[δ] (R^2=0.217)	Model 3[δ,#] (R^2=0.319)	Model 4[δ,#] (R^2=0.239)
Ln TSH	-2.584±1.672	-3.274±1.851	1.023±3.220	**-5.136±2.382***
Age	**-0.770±0.244†**	**-0.735±0.254†**	-0.489±0.407	**-0.872±0.368***
Gender	**9.465±3.081†**	**9.700±3.642†**	**14.252±6.550***	10.868±5.540
BMI	-	-1.034±0.622	-1.531±1.004	-0.530±0.898
WC	-	0.218±0.214	0.565±0.445	0.042±0.371
MAP	-	-0.144±0.124	-0.261±0.195	-0.101±0.177
Ln FPG	-	-4.733±9.040	-30.197±20.433	-1.395±10.800
Total cholesterol	-	0.026±0.040	0.122±0.082	-0.014±0.049
Ln triglycerides	-	**-8.914±3.894***	**-15.681±6.457***	-4.633±5.500
HDL-C	-	-.0.35±0.156	-0.055±0.236	-0.076±0.223
Free T4	-	**-25.594±11.332***	-6.402±17.126	**-38.007±15.776***

*: p <0.05; †: p <0.01; ‡: p <0.001

Abbreviation: BMI, body mass index ; WC: waist circumference; MAP, mean arterial pressure; FPG, Fasting plasma glucose; TCHOL, total cholesterol; HDL-C, High-density lipoprotein cholesterol; eGFR, estimated glomerular filtration rate; TSH: thyroid stimulating hormone; Free T4: free thyroxine

[δ]Model 2, 3 & 4 were additionally adjusted with social habit of cigarette smoking, alcohol consumption and exercise.

[#]Model 3 & 4: divided into low WC group and high WC group with cutoff value of 90 cm in men, and 80 cm in women.

Table 4. Odds ratio (95% confidence interval) for chronic kidney disease in different models derived from a stepwise multiple logistic regression analysis using TSH group as independent variables, adjusted for potential confounders.

Total	Model 1	Model 2	Model 3
Lower TSH	1.00(Reference)	1.00(Reference)	1.00(Reference)
Higher TSH	**2.78(1.37-5.64)†**	**2.30(1.10-4.83)***	**2.31(1.05-5.11)***
Low WC[ε]			
Lower TSH	1.00(Reference)	1.00(Reference)	1.00(Reference)
Higher TSH	1.50(0.50-4.56)	1.42(0.41-4.90)	1.25(0.34-4.54)
High WC[ε]			
Lower TSH	1.00(Reference)	1.00(Reference)	1.00(Reference)
Higher TSH	**5.12(1.84-14.20)†**	**5.38(1.76-16.41)†**	**6.96(1.95-24.81)†**

*: p <0.05; †: p <0.01

Model 1: adjusted for age and gender

Model 2: model 1 + adjusted for social history (smoking, alcohol consumption, and exercise habit) body mass index, and waist circumference

Model 3: model 2 + adjusted for chronic disease (hypertension, diabetes, dyslipidemia)

[ε]WC was divided into two group with cutoff value of 90 cm in men, and 80 cm in women.