Iran J Public Health, Vol. 51, No.6, Jun 2022, pp.1245-1250

Original Article

The Association between Suicidal Ideation and Albuminuria in Korean Adults

Soo Jung Choi [1], ***Taehyun Nam*** [2], ****In Cheol Hwang*** [1]

1. *Department of Family Medicine, Gil Medical Center, Gachon University College of Medicine, Incheon, South Korea*
2. *Division of Pulmonology and Allergy, Department of Internal Medicine, Gil Medical Center, Gachon University College of Medicine, Incheon, South Korea*

***Corresponding Author:** Email: spfe0211@gmail.com

(Received 09 Feb 2021; accepted 09 May 2021)

Abstract

Background: Data on the association between suicide and kidney function in the general population are scarce. This study evaluated albuminuria across suicidal ideation in Korean adults.

Methods: We performed a cross-sectional study using data from the 2011 to 2013 Korean National Health and Nutrition Examination Survey. Overall, 14,101 adults were included in an examination of the amount of albuminuria associated with suicidal ideation. Suicidal ideation was measured using a self-reported questionnaire and albuminuria was assessed using the urinary albumin-to-creatinine ratio (ACR).

Results: Various factors, including suicidal ideation, were associated with ACR. Multivariate regression analyses were stratified by age group and type 2 diabetes due to their strong relation to ACR. In the non-diabetic young group, individuals with suicidal ideation presented ACR 11.4 mg/g higher than those without suicidal ideation (P=0.038).

Conclusion: In healthy young people, suicidal ideation is associated with increased albuminuria.

Keywords: Albuminuria; Kidney function test; Suicidal ideation; Young adults

Introduction

Suicide is a critical public concern of global dimensions. Approximately 800,000 people worldwide die by suicide every year, and suicide accounts for ~1.5% of all deaths (1). In South Korea, the suicide attributable death rate has been constantly in excess of the global rate estimated by WHO (2). In addition to emotional suffering of the remaining people, suicide contributes a substantial socioeconomic cost amounting to an estimated $51 billion (e.g., medical and work loss costs) (3). Suicide is highly complex with numerous underlying genetic, neurological, psychological, and environmental etiologies (4).

Poor mental health in patients with chronic kidney disease (CKD) is evident and in turn substantially affects the outcome of CKD (5, 6). Despite this, the association between subclinical renal dysfunction and mental health has seldom been investigated in the general population. One study of nationwide Korean data indicated that the odds of depressive mood significantly increased in subjects with an estimated glomerular filtration

rate (eGFR) < 45mL/min/1.73m^2 (7). Another Chinese population-based cohort study reported that an eGFR < 60mL/min/1.73m^2 is independently associated with depressive symptoms in the general elderly (8).

Albuminuria is another key kidney measure, and microalbuminuria is considered a surrogate marker of endothelial dysfunction and subclinical cardiovascular disease (9). One study of primary care clinics in the USA found that albuminuria was not significantly associated with depression in diabetic patients, regardless of prior cardiovascular disease (10). Another study in the Netherlands showed that albuminuria, not eGFR, was associated with depressive symptoms and depressive episodes in the general population (11).

To our knowledge, only one study has investigated the relationship between renal dysfunction and suicidal ideation in the general population. Jhee et al. analyzed the data of 44,938 participants from the 2007 to 2014 Korean National Health and Nutrition Examination Survey (KNHANES) and found that eGFR is associated with suicidal ideation in a dose-dependent manner, unlike depressive mood (7). Notably, suicide is not a specific and/or narrow symptom of depression (12).

In this study, we aimed to evaluate albuminuria according to suicidal ideation using a nationally representative sample of Korean adults.

Methods

This is a nationwide cross-sectional study using data from the 2011 to 2013 KNHANES, which has a multistage stratified complex sampling. The KNHANES has been conducted biennially by the Korea Centers for Disease Control and Prevention to assess the health and nutritional status of the Korean civilian noninstitutionalized population. Trained interviewers and laboratory technicians performed surveys in households that included administering questionnaires, conducting health examinations, and collecting blood samples. Detailed information is described elsewhere (13).

Written informed consent was obtained from all participants in the KNHANES. The Institutional Review Board (IRB) of the Korea Centers for Disease Control and Prevention approved the KNHANES, and the IRB of Gachon University Gil Medical Center approved our study protocol (IRB no., GFIRB2020-271).

We identified 15,344 subjects who were ≥ 18 yr old and had available data on suicidal ideation and urinary albumin. Of these, 1243 subjects were excluded because they had critical mediators, such as history of any cancer and major cardiovascular diseases (i.e., myocardial infarction or any stroke), and current depression. Thus, 14,101 Korean adults were included in the final analysis.

The primary outcome of our study was the amount of albuminuria. A random urine sample was obtained from the first morning void, and urinary albumin concentration (μg) was measured using a turbidimetric immunoassay (Hitachi Automatic Analyzer 7600). Urinary creatinine concentration (mg) was also checked using a colorimetric method (Hitachi Automatic Analyzer 7600), and the albumin-to-creatinine ratio (mg/g; ACR) was calculated by dividing the urinary albumin concentration by the urinary creatinine concentration.

The main exposure was suicidal ideation, assessed by a self-reported yes/no question "in the last 12 months, did you think about committing suicide?" This item is a well-documented predictor for suicide risk that has been previously used in other surveys (14). Assessments of other aspects of mental health were similar. *Stressful* was assessed based on response to the question "how much stress do you have in your daily life" as 'moderate' or 'severe'. This grouping followed the KNHANES guidelines and has been used in other KNHANES studies (13, 15). *Depressed* was defined as an affirmative response to "have you ever felt sadness or despair continuously for more than 2 weeks during the past year?" The question for depression is included in the WHO Composite International Diagnostic Interview-Short Form, validated to be a cost-effective method for a public survey (16).

The following were included as covariates: age, sex, body mass index, monthly household income, smoking status, drinking behavior, physical activity, physician-diagnosed hypertension and type 2 diabetes, perceived stress, and depressive mood. Household income was divided into quartiles. Problem drinking was defined as alcohol intake >7 drinks/time, at least twice per week for men and > 5 drinks/time at least twice per week for women. Physical activity was measured using the International Physical Activity Questionnaire, and regular exercise was defined as three or more times per week and 20 min or more per trial.

Statistical analyses were performed using STATA ver. 9.2 (STATA Corp., College Station, TX), considering sample weights and complex sample design effects. Characteristics of participants by suicidal ideation were presented as mean±standard error or number (percentage), and the differences between groups were tested by the t-test or chi-squared test. Linear regression models were used to investigate the association between suicidal ideation and ACR. We first identified factors associated with ACR in simple regression analyses. Given the strong effect of age and diabetes on ACR, multivariate regression analyses were stratified by these factors, with adjustment for other identified factors. $P < 0.05$ were considered statistically significant.

Results

The characteristics of participants by suicidal ideation are summarized in Table 1. Approximately 10.7% of participants had experienced suicidal ideation. People with this experience were more likely to be older, female, poorer, or to have a comorbidity (e.g., hypertension or type 2 diabetes) or poor mental health (i.e., stressful or depressive), or to present high level of ACR.

Table 1: Characteristics of participants by suicidal ideation

Variable	*Suicidal ideation*		*P*-values
	Absent (n=12,591)	Present (n=1,510)	
Demographics			
Age, years	49.5±0.1	53.6±0.5	<0.001
Women	6,387 (54.3)	1,034 (68.5)	<0.001
Lowest quartile of income	2,057 (16.5)	451 (30.3)	<0.001
Health-related habits			
Current smoking	2,589 (20.6)	342 (22.7)	0.060
Frequent drinking	2,726 (24.8)	304 (24.0)	0.523
Regular exercise	2,260 (18.0)	255 (17.0)	0.333
Comorbidites			
Obesity[a]	4,071 (32.4)	473 (31.4)	0.433
Hypertension	3,486 (27.7)	162 (10.8)	<0.001
Type 2 diabetes	1,151 (9.5)	175 (12.4)	0.001
Mental health			
Stressful	2,626 (20.9)	846 (56.1)	<0.001
Depressive	984 (7.8)	768 (50.9)	<0.001
Urinary ACR ratio, mg/g	19.3±1.2	28.2±6.0	0.029

ACR, albumin-to-creatinine.
Data are presented as mean±standard error or number (%).
[a]Body mass index ≥ 25kg/m^2

Table 2 identifies factors associated with suicidal ideation from the univariate regression models. Various factors were associated with ACR, including suicidal ideation: individuals with suicidal ideation presented ACRs 8.8 mg/g higher than those without suicidal ideation (*P*=0.029). In a multivariate regression model with adjustment for all covariates, beta value of suicidal ideation did not reach the statistical significance.

Table 3 estimates amounts of albuminuria by suicidal ideation from the age group- and diabetes-stratified multivariate regression analyses. Non-diabetic young adults with suicidal ideation presented ACRs 11.4 mg/g higher than those without suicidal ideation (*P*=0.038).

Table 2: Factors associated with albuminuria (assessed by the urinary albumin-to-creatinine ratio)

	A urinary albumin-to-creatinine ratio (mg/g)		
Variable	β[a]	95% CI	*P*-value
Suicidal ideation	8.8	0.9–16.7	0.029
Age (per 1 year)	0.7	0.5–0.8	< 0.001
Women	−1.6	−6.5–3.3	0.517
Hypertension	8.7	3.2–14.3	0.002
Type 2 diabetes	53.2	46.3–60.1	<0.001
Body mass index (per 1 kg/m²)	1.6	0.9–2.3	<0.001
Lowest quartile of income	17.3	10.9–23.7	<0.001
Current smoking	2.4	−3.6–8.4	0.433
Problem drinking	−0.6	−6.5–5.4	0.857
Regular physical activity	−3.7	−10.1–2.7	0.252
Stressful	−0.7	−6.4–4.9	0.800
Depressed	2.2	−5.2–9.6	0.560

CI, confidence interval.

[a]From univariate regression models

Table 3: Amounts of albuminuria[a] by suicidal ideation in subgroups

		No diabetes			***Diabetes***	
Age, years	*No.*	β (95% CI)	*P*	No.	β (95% CI)	*P*
19–40	4,275	11.4 (0.6–22.2)	0.038	84	36.8 (−63.5–137.2)	0.467
41–60	4,810	−3.7 (−9.5–2.1)	0.215	473	−15.2 (-109.3–79.0)	0.752
> 60	2,983	−7.0 (−17.6–3.6)	0.198	749	−17.6 (-76.0–40.9)	0.555

CI, confidence interval.

All analyses were adjusted for body mass index, hypertension, and economic status, identified (*P*<0.05) with univariate regression models.

[a]Assessed using a urinary albumin-to-creatinine ratio (mg/g)

Discussion

Most prior reports have investigated the associations between mental health problems and renal function in patients with specific diseases (e.g., type 2 diabetes or chronic kidney diseases), and those in the general population are not well known. In this nationally representative study, we found that healthy young adults with suicidal ideation have more albuminuria than those without suicidal ideation. Our findings suggest that evaluation of renal function is needed in individuals with suicidal behaviors, particularly in specific subpopulation.

People with poor mental health are more likely to have low quality of life, functional impairment,

poor adherence to medical treatment, and impair nutritional status (17). There is a solid evidence that depression significantly increases the risk of adverse outcomes in patients with chronic kidney disease (5), and this may be true for suicidal ideation. In our study, the distinguished significance in non-diabetic young population could be explained by the relatively strong contribution of suicidal ideation on renal dysfunction (e.g., old age or type 2 diabetes critically impact on renal function).

One comparable study (7) with data from the KNHANES reported that suicidal ideation is closely related to renal dysfunction assessed by eGFR. However, the study differs from ours in terms of analytic direction and implication. Their findings conclusively support the need for evaluation regarding suicidal ideation in people with renal dysfunction. Additionally, in contrast to ours, they found a statistical significance in the fully adjusted models including age and type 2 diabetes. This means that albuminuria may be less specific than eGFR for addressing the relationship between suicide and subclinical renal dysfunction.

The most critical limitation of our study is its cross-sectional design, which limits causal inference. Mental problems in patients with CKD are generally explained by chronic comorbid conditions and the direct effect of uremic toxins (5). However, non-diabetic young adults have very few comorbidities, and uremic symptoms begin to manifest in severe renal dysfunction. Thus, we posit that mental distress leads to renal dysfunction via endothelial damage or systemic inflammation (18). Indeed, depressive symptoms trigger the progression of renal disease (19). Further basic investigation of the possible link between renal dysfunction and suicide is needed.

Other limitations should also be borne in mind. There might have been recall bias or misclassification error for suicidal ideation due to self-reported single-question format and errors in the spot-urine sampling to measure albuminuria. However, these methods are easy, rapid, and reasonable in surveys involving large samples (20, 21). Next, our findings may not be applicable to other communities, given that suicide is largely dependent on ethnicity and socioeconomic environment (22). Finally, we did not consider residual confounders (e.g., drug history, infection status, or muscle mass) that could affect albuminuria.

Despite these limitations, this is the first study to examine the relationship between suicidal behavior and renal function using data from a nationwide community-based cohort. The extensive data and large number of participants also enables stratified analysis and adjustments for multiple confounders.

Conclusion

Suicidal ideation in healthy young people is associated with albuminuria. Future longitudinal studies should examine the direction of the association and the sequential change of renal function across mental distress.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

This work was supported by the Gachon University Gil Medical Center (Grant no. FRD2021-14). The funder had no role in study design, data collection, and analysis, decision to publish, or preparation of the manuscript. Soo Jung Choi and Taehyun Nam contributed equally to this work as a first author.

Conflict of interest

The authors declare that there is no conflict of interests.

References

1. Naghavi M, Global Burden of Disease Self-Harm C (2019). Global, regional, and national burden of suicide mortality 1990 to 2016: systematic analysis for the Global Burden of Disease Study 2016. *BMJ,* 364:l94.
2. WHO (2019). The global burden of disease-estimates for 2000-2016. Geneva; World Health Organization.
3. CDC (2015). Suicide facts at a glance 2015. National Center for Injury Prevention and Control.
4. Fazel S, Runeson B (2020). Suicide. *N Engl J Med,* 382:266-274.
5. Bautovich A, Katz I, Smith M, Loo CK, Harvey SB (2014). Depression and chronic kidney disease: A review for clinicians. *Aust N Z J Psychiatry,* 48:530-41.
6. Liu CH, Yeh MK, Weng SC, Bai MY, Chang JC (2017). Suicide and chronic kidney disease: a case-control study. *Nephrol Dial Transplant,* 32:1524-1529.
7. Jhee JH, Lee E, Cha MU, et al (2017). Prevalence of depression and suicidal ideation increases proportionally with renal function decline, beginning from early stages of chronic kidney disease. *Medicine (Baltimore),* 96:e8476.
8. Liu Q, Li YX, Hu ZH, Jiang XY, Li SJ, Wang XF (2018). Reduced estimated glomerular filtration rate is associated with depressive symptoms in elder Chinese: A population-based cross-sectional study. *Neurosci Lett,* 666:127-132.
9. Chronic Kidney Disease Prognosis C, Matsushita K, van der Velde M, et al (2010). Association of estimated glomerular filtration rate and albuminuria with all-cause and cardiovascular mortality in general population cohorts: a collaborative meta-analysis. *Lancet,* 375:2073-81.
10. Katon WJ, Lin EH, Russo J, et al (2004). Cardiac risk factors in patients with diabetes mellitus and major depression. *J Gen Intern Med,* 19:1192-9.
11. Martens RJH, Kooman JP, Stehouwer CDA, et al (2018). Albuminuria is associated with a higher prevalence of depression in a population-based cohort study: the Maastricht Study. *Nephrol Dial Transplant,* 33:128-138.
12. Miret M, Ayuso-Mateos JL, Sanchez-Moreno J, Vieta E (2013). Depressive disorders and suicide: Epidemiology, risk factors, and burden. *Neurosci Biobehav Rev,* 37:2372-4.
13. Kweon S, Kim Y, Jang MJ, et al (2014). Data resource profile: the Korea National Health and Nutrition Examination Survey (KNHANES). *Int J Epidemiol,* 43:69-77.
14. Gaynes BN, West SL, Ford CA, et al (2004). Screening for suicide risk in adults: a summary of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med,* 140:822-35.
15. Kim Y, Cho WK (2014). Factors Associated with Successful Smoking Cessation in Korean Adult Males: Findings from a National Survey. *Iran J Public Health,* 43:1486-96.
16. Gigantesco A, Morosini P (2008). Development, reliability and factor analysis of a self-administered questionnaire which originates from the World Health Organization's Composite International Diagnostic Interview - Short Form (CIDI-SF) for assessing mental disorders. *Clin Pract Epidemiol Ment Health,* 4:8.
17. Alegria M, NeMoyer A, Falgas Bague I, Wang Y, Alvarez K (2018). Social Determinants of Mental Health: Where We Are and Where We Need to Go. *Curr Psychiatry Rep,* 20:95.
18. Chrysohoou C, Kollia N, Tousoulis D (2018). The link between depression and atherosclerosis through the pathways of inflammation and endothelium dysfunction. *Maturitas,* 109:1-5.
19. Tsai YC, Chiu YW, Hung CC, et al (2012). Association of symptoms of depression with progression of CKD. *Am J Kidney Dis,* 60:54-61.
20. Lambers Heerspink HJ, Brantsma AH, de Zeeuw D, et al (2008). Albuminuria assessed from first-morning-void urine samples versus 24-hour urine collections as a predictor of cardiovascular morbidity and mortality. *Am J Epidemiol,* 168:897-905.
21. Nock MK, Borges G, Bromet EJ, et al (2008). Suicide and suicidal behavior. *Epidemiol Rev,* 30:133-54.
22. Turecki G, Brent DA, Gunnell D, et al (2019). Suicide and suicide risk. *Nat Rev Dis Primers,* 5:74.