Increased depression risk in patients with abdominal aortic aneurysm: a nationwide cohort study

Mi-hyeong Kim¹, Ju-hwan Yoo², Hyung-jin Cho¹, Kyung-Jai Ko³, Kang-woong Jun⁴, Kyung-do Han⁵, Jeong-kye Hwang⁴

¹Division of Vascular and Transplant Surgery, Department of Surgery, Eunpyeong St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
²Department of Biomedicine and Health Science, The Catholic University of Korea, Seoul, Korea
³Department of Surgery, Kangdong Sacred Heart Hospital, Seoul, Korea
⁴Division of Vascular and Transplant Surgery, Department of Surgery, Bucheon St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Bucheon, Korea
⁵Department of Statistics and Actuarial Science, Soongsil University, Seoul, Korea

**INTRODUCTION**

Abdominal aortic aneurysm (AAA) is a very serious disease that is frequently associated with severe disability or death. Even after successful treatment, various sequelae or impairment can occur. Most studies of AAA have considered 30-day...
mortality, reoperation rate, reintervention rate, complications, and mortality as their end-points. Additionally, clinicians in practice generally concentrate on a patient’s physical problems, not psychiatric problems. Furthermore, Asian cultures generally associate depression with negative sentiments, such as considering it a “weakness of will,” so patients hesitate to express their feelings or difficulties. In these contexts, previous studies that consider AAA and depression are rare.

In contrast, the relationship between heart disease and depression has been widely investigated. The incidence of depression is reportedly 14%–47% after coronary bypass surgery and 19%–66% after myocardial infarction, which is 3 times higher than the general population [1-5]. Patients diagnosed with depression have double the risk of developing coronary artery disease [6,7]. Depression and heart disease each affect the development of the other and have a bidirectional interaction in their prognosis. Patients who have both depression and heart disease have more complications, lower life expectancy, and higher mortality, which are related to poor compliance to treatment or lifestyle corrections [1,8,9]. These effects are also associated with pathophysiologic interactions between depression and heart disease, with one of the most well-known mechanisms being neuroendocrine theory. In pathologic conditions, the hypothalamic-pituitary-adrenal axis is stimulated, which increases cortisol excretion, affects neurons, and contributes to depression development. In another pathway, increased cortisol induces atherosclerosis and sustains low-activity chronic inflammation, which eventually leads to heart disease [1,10,11]. Other mechanisms under investigation involve proinflammatory cytokines, depletion of folate or homocysteine, and continuous stimulation of the autonomic nervous system [1,8,12-15].

Both AAA and coronary artery disease are caused by atherosclerosis and inflammatory reactions, and both share risk factors such as smoking, male sex, hypertension, or dyslipidemia. Because of these similarities, we hypothesized that AAA and depression may interact [16,17]. In addition, depression can be caused in AAA patients after surgery by posttraumatic stress disorder (PTSD) caused by fear of aneurysm rupture, time spent in an intensive care unit (ICU), or social and functional impairment [18-20]. In this study, we investigated the incidence and risk ratios of depression in patients with AAA using nationwide cohort data.

**METHODS**

**Data source and study population**

The National Health Insurance Service (NHIS) is a single-payer universal coverage health insurance system for the entire Korean population managed by Korean government. The system has 2 health care programs: national health insurance and medical aid. About 97% of the population is under national health insurance and the remaining 3% is under medical aid [21]. NHIS contains all information claimed by medical service providers in Korea about diagnosis, prescription, and consultation. Statements in the NHIS database are defined by the Korean Classification of Disease, 6th edition, and a modified version of the International Classification of Diseases, 10th edition. All NHIS subscribers are requested to have a general health checkup biannually. General health checkups include questionnaires (e.g., smoking, alcohol consumption, regular exercise, sleeping), physical examination (height, weight, waist circumference, blood pressure, eye test, and hearing tests), laboratory tests (blood, urine, and tumor biomarkers), imaging tests (simple chest or mammogram), and esophagogastroduodenoscopy.

![Flowchart of the study population](image-url)  
**Fig. 1.** Flowchart of the study population. AAA, abdominal aortic aneurysm.
Table 1. Definitions for data collection

| Definition |
|-----------------------------|
| AAA | At least 2 claims per year under ICD-10 codes I71, I713-716, I718, or I719, or at least one claim for hospitalization under the same ICD-10 codes, or at least one claim for surgery under the same ICD-10 codes |
| OSAR | Open surgical aneurysm repair, codes O0223, O0224, or O0234 |
| EVAR | Endovascular aneurysm repair, codes M6603, M6611, or M6612 |
| Depression | At least 1 claim under ICD-10 codes F32 or F33 |
| Diabetes | At least 1 claim for the prescription of antidiabetic medication or insulin under ICD-10 codes E09-14 |
| Hypertension | At least 1 claim for the prescription of antihypertension medication under ICD-10 codes I10-11 |
| Dyslipidemia | At least 1 claim for the prescription of antidyshlipidemic medication under ICD-10 code E78 |
| Stroke | At least 1 claim under ICD-10 codes I60-64 or stated history of stroke by patient |
| Coronary disease | At least 1 claim under ICD-10 codes I20-25 or stated history of myocardiac infarction or angina by patient |

AAA, abdominal aortic aneurysm; ICD-10, a modified version of the International Classification of Diseases, 10th edition; OSAR, open surgical aneurysm repair; EVAR, endovascular aneurysm repair.

We selected subjects from the NHIS database who were diagnosed with AAA between 2009 and 2015 (n = 45,767). We excluded subjects who did not get a general health checkup in the previous 2 years (n = 26,091), who were diagnosed with depression before their AAA diagnosis (n = 6,462), who were less than 20 years old (n = 2), or who had missing data (n = 162). We included subjects who survived more than 1 year after AAA diagnosis or AAA surgery (n = 10,373). We set the control group using propensity score matching by age and sex and included 3 times as many subjects as the AAA cohort (n = 31,119) (Fig. 1).

Data collection

We collected data from the NHIS database, including baseline data (age, sex, and medical aid), lifestyle data (smoking, alcohol consumption, and regular exercise), physical examination data (body mass index [BMI], waist circumference, and blood pressure), laboratory test data (fasting glucose and cholesterol), and comorbidities (diabetes, hypertension, dyslipidemia, stroke, and coronary disease). Among lifestyle data, alcohol consumption was classified into 3 grades according to the amount of daily use: none, mild to moderate (1–30 g/day), and heavy (over 30 g/day). Regular exercise was exercising more than 5 times per week with slight sweating (mild intensity) or more than 3 times per week with heavy sweating or increased heartbeat (high intensity). We determined AAA, depression, and comorbidities from claim data in the NHIS database (Table 1).

The present study was approved by the Institutional Review Board of the Catholic University of Korea (No. PC2021SI0145). This study was performed in accordance with the Declaration of Helsinki and written informed consent was exempted.

Statistical analysis

Continuous variables are presented as means ± standard deviation and categorical variables are presented as number and percentages. To compare cohort characteristics, we used analysis of variance for continuous variables and chi-square test for binary or categorical variables. We calculated the incidence rate of depression by dividing the event number by 1,000 person-years. To evaluate the hazard ratio (HR) for depression development, we used the Cox proportional hazards model. Model 1 analyzed HR without adjustment. Model 2 was adjusted for age, sex, smoking, alcohol, regular exercise, BMI, medical aid, diabetes, hypertension, and dyslipidemia. Model 3 was based on model 2, and we also adjusted for stroke and coronary disease. We analyzed HRs according to the absence or presence of AAA and performed subgroup analysis after dividing the AAA group into non-surgery and surgery groups (subgroup 1) or into non-surgery, open surgical aneurysm repair (OSAR), and endovascular aneurysm repair (EVAR) groups (subgroup 2). We used a Kaplan-Meier plot to analyze the incidence of depression according to the absence or presence of AAA and treatment modalities (subgroups 1 and 2). We performed subgroup analysis for HRs of depression according to each variable after adjustment for model 3. All statistical analyses were performed using SAS ver. 9.4 (SAS Institute Inc., Cary, NC, USA) and the R Project for Statistical Computing ver. 3.3 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Demographic characteristics of abdominal aortic aneurysm patients

We compared demographic characteristics of AAA and control groups (Table 2, Supplementary Table 1). Patients with a history of smoking, especially current smokers, were more common in the AAA group (P < 0.001). Patients in the AAA group exercised less and drank less alcohol (P < 0.001 and P < 0.001, respectively). Diabetes (P = 0.017), hypertension (P < 0.001), dyslipidemia (P < 0.001), stroke (P < 0.001), and coronary artery disease (P < 0.001) were more common in the AAA group.
Table 2. Demographic characteristics of AAA cohort (n = 10,373)

| Characteristic                  | AAA | P-value |
|---------------------------------|-----|---------|
| No. of patients                 | 31,119 | 10,373 |
| Male sex                        | 21,966 (70.6) | 7,322 (70.6) | >0.999 |
| Age (yr)                        | 64.74 ± 11.80 | 64.74 ± 11.80 | >0.999 |
| Smoking                         |       | <0.001 |
| Non                             | 16,979 (54.6) | 4,823 (46.5) |       |
| Ex-smoker                       | 7,922 (25.5) | 2,615 (25.2) |       |
| Current smoker                  | 6,218 (20.0) | 2,935 (28.3) |       |
| Alcohol consumption (g/day)     |       | <0.001 |
| None                            | 18,159 (58.4) | 6,553 (63.2) |       |
| Mild (<30)                      | 10,678 (34.3) | 3,080 (29.7) |       |
| Heavy (>30)                     | 2,282 (7.3) | 740 (7.1) |       |
| Regular exercise<sup>a</sup>    | 7,177 (23.1) | 2,191 (21.1) | <0.001 |
| Diabetes                        | 5,960 (19.2) | 2,097 (20.2) | 0.017 |
| Hypertension                    | 16,006 (51.4) | 8,055 (77.7) | <0.001 |
| Dyslipidemia                    | 9,389 (30.2) | 5,726 (55.2) | <0.001 |
| Stroke                          | 1,359 (4.4) | 1,406 (13.6) | <0.001 |
| Coronary disease                | 3,397 (10.9) | 4,985 (48.1) | <0.001 |
| Medical aid<sup>b</sup>         | 5,901 (19.0) | 1,874 (18.1) | 0.042 |
| Body mass index (kg/m<sup>2</sup>) | 23.91 ± 3.06 | 24.06 ± 3.20 | <0.001 |
| Waist circumference (cm)        | 83.21 ± 8.47 | 84.31 ± 8.83 | <0.001 |
| SBP (mmHg)                      | 127.41 ± 15.37 | 128.71 ± 16.86 | <0.001 |
| DBP (mmHg)                      | 77.52 ± 9.80 | 78.63 ± 11.03 | <0.001 |
| Fasting glucose (mg/dL)         | 104.01 ± 27.66 | 102.1 ± 25.05 | <0.001 |
| Cholesterol (mg/dL)             | 192.54 ± 38.56 | 193.13 ± 44.59 | 0.194 |

Values are presented as number only, number (%), or mean ± standard deviation.
AAA, abdominal aortic aneurysm; SBP, systolic blood pressure; DBP, diastolic blood pressure.
<sup>a</sup>More than 5 times per week with mild intensity or more than 3 times per week with high intensity (sweating, increased heartbeat);
<sup>b</sup>Socioeconomic state in the lowest 20% and whose medical costs were supported by the government.

Table 3. Incidence of depression and hazard ratio according to AAA diagnosis and type of management

| Variable       | No. of patients | Depression | Incidence per 1,000 person-years |
|----------------|-----------------|------------|---------------------------------|
| AAA            |                 |            |                                 |
| No             | 31,119          | 4,906      | 35.8193                         |
| Yes            | 10,373          | 2,003      | 50.1666                         |
| AAA_subgroup1  |                 |            |                                 |
| No             | 31,119          | 4,906      | 35.8193                         |
| Non-surgery    | 7,403           | 1,482      | 50.2589                         |
| Surgery        | 2,970           | 521        | 49.906                          |
| AAA_subgroup2  |                 |            |                                 |
| No             | 31,119          | 4,906      | 35.8193                         |
| Non-surgery    | 7,403           | 1,482      | 50.2589                         |
| OSAR           | 903             | 163        | 47.4453                         |
| EVAR           | 2,067           | 358        | 51.1131                         |

Values are presented as number or hazard ratio (95% confidence interval).
AAA, abdominal aortic aneurysm; OSAR, open surgical aneurysm repair; EVAR, endovascular aneurysm repair.
Model 1: unadjusted; model 2: adjusted for age, sex, smoking, alcohol, regular exercise, body mass index (BMI), medical aid, diabetes, hypertension, and dyslipidemia; model 3: adjusted for age, sex, smoking, alcohol, regular exercise, BMI, medical aid, diabetes, hypertension, dyslipidemia, stroke, and coronary disease.
and waist circumference were higher in the AAA group (P < 0.001 and P < 0.001, respectively) and systolic and diastolic blood pressure were also higher (P < 0.001 and P < 0.001, respectively).

**Risk of depression development in abdominal aortic aneurysm patients**

The AAA group had a higher incidence of depression (Table 3). In the adjusted model, we found that patients with AAA had 1.28–1.40 times higher risk of developing depression than patients in the control group. We analyzed the incidence of depression in the AAA group according to treatment modalities (non-surgery vs. surgery or non-surgery vs. OSAR vs. EVAR) but did not find significant differences in depression incidence among them.

We performed subgroup analysis to evaluate how individual variables related to risk of developing depression (Table 4). The incidence of depression was higher in patients aged <65 years (HR, 1.539). Risk of depression was higher in patients with no previous diagnosis of dyslipidemia or coronary artery disease. We found that sex or other comorbidities, such as diabetes, hypertension, or stroke, had no effect on depression development.

Results from the Kaplan-Meier curve and log-rank tests were similar. The incidence of depression was significantly higher in the AAA group (P < 0.001), but there were no significant differences among types of treatment for AAA (Fig. 2).

| Variable                  | AAA     | Incidence per 1,000 person-years | Modela | P for interaction |
|---------------------------|---------|----------------------------------|--------|-------------------|
| Age (yr)                  |         |                                  |        |                   |
| <65                       | No      | 23.5632                          | 1 (Reference) | <0.001           |
|                           | Yes     | 37.3741                          | 1.539 (1.383–1.712) |           |
| ≥65                       | No      | 48.6449                          | 1 (Reference) |                   |
|                           | Yes     | 63.2319                          | 1.27 (1.171–1.378) |           |
| Dyslipidemia              |         |                                  |        |                   |
| No                        | No      | 33.7532                          | 1 (Reference) | 0.045            |
|                           | Yes     | 47.5365                          | 1.316 (1.213–1.429) |           |
|                           | No      | 40.8705                          | 1 (Reference) |                   |
|                           | Yes     | 52.4987                          | 1.253 (1.150–1.364) |           |
| Coronary disease          |         |                                  |        |                   |
| No                        | No      | 33.9773                          | 1 (Reference) | 0.035            |
|                           | Yes     | 46.1553                          | 1.342 (1.247–1.445) |           |
|                           | No      | 51.9582                          | 1 (Reference) |                   |
|                           | Yes     | 54.5002                          | 1.171 (1.061–1.293) |           |

Values are presented as number or hazard ratio (95% confidence interval).

AAA, abdominal aortic aneurysm.
aAdjusted for age, sex, smoking, alcohol, regular exercise, body mass index, medical aid, diabetes, hypertension, dyslipidemia, stroke, and coronary disease.

**Fig. 2.** Kaplan-Meier plot of the incidence of depression. (A) The incidence of depression is increased in the abdominal aortic aneurysm (AAA) cohort with statistical significance. (B, C) There is no definite difference between non-surgery and surgery groups and among non-surgery, open surgical aneurysm repair (OSAR), and endovascular aneurysm repair (EVAR) groups.
DISCUSSION

This study analyzed the incidence of depression in a nationwide cohort of patients with AAA. Depression has been rarely studied in this cohort, and we found that the incidence of depression in patients with AAA was 50.1 per 1,000 person-years, which was 1.4 times higher than in the control group. There were no differences between non-surgery and surgery groups.

There are some significant differences between previous studies and our study. Liberzon et al. [18,19] performed prospective studies of the incidence of PTSD and depression in patients who underwent aorta surgery due to aneurysm or aortic occlusive disease. They found a very high incidence of psychiatric disease (10.5%, or 16 events among 152 patients). In that study, the risk of developing psychiatric disease was higher in the surgery group than in the conservative care group (32% vs. 9%), and the risk was especially high in the open surgery group. We posit that these differences are due to differences in the study models. Liberzon et al. [18,19] prospectively evaluated the psychiatric status of patients using various psychosocial measurement tools and recorded patient data immediately postoperative, 3 months after, and 9 months after surgery. They concluded that increased incidence of psychiatric disease was associated with intubation at the end of surgery, time spent in the ICU, and postoperative pain. In contrast, we enrolled patients who survived for more than 1 year after surgery or diagnosis, and we defined depression as when a patient was diagnosed with depression, rather than evaluating emotional status using psychosocial measurement tools. For these reasons, our study found a lower depression incidence and was less influenced by immediate postoperative effects.

Interestingly, we found that the incidence of depression was greatly increased in younger patients with AAA. For further analysis, we divided age into 3 groups and sex into 2 groups (Table 5). In both male and female groups, the youngest group had the highest risk of depression (male 2.029 and female 3.142, respectively) and the risk gradually decreased as patient age increased. Previous studies of heart disease and depression suggest that younger patients with severe illness have a higher risk of depression due to functional or physical impairment, longer treatment duration, and increased stress to support their families [22,23].

We suggest that AAA in younger patients has different pathophysiology than that of aneurysm development in older patients. Typical AAA is an advanced atherosclerotic disease that is common in adults more than 65 years old and is induced by thinning of the media and adventitia in the vasculature due to smooth muscle cell loss [16,17]. However, AAA in younger patients is thought to be caused by proinflammatory cytokines, dysregulation of the immune system, genetics, or rheumatic disease, rather than degenerative changes from aging [16,17,24,25]. We hypothesized that differences in underlying disease could affect vulnerability to depression in younger patients with AAA.

The low incidence of depression in older people may be related to low detection rates. According to Liberzon et al. [18,19], the incidence of psychiatric disease increased by 15%–32% among older people.

![Table 5. Hazard ratio of depression development according to age and sex](image)

| Sex   | Age (yr) | AAA | Incidence per 1,000 person-years | Model* |
|-------|----------|-----|----------------------------------|--------|
| Male  | 20–39    | No  | 9.4795                           | 1 (Reference) |
|       |          | Yes | 16.3482                          | 2.029 (1.027–4.008) |
|       | 40–59    | No  | 15.1876                          | 1 (Reference) |
|       |          | Yes | 27.0242                          | 1.496 (1.214–1.842) |
|       | 60–79    | No  | 38.1988                          | 1 (Reference) |
|       |          | Yes | 53.6296                          | 1.277 (1.173–1.391) |
|       | ≥80      | No  | 58.9667                          | 1 (Reference) |
|       |          | Yes | 74.3938                          | 1.163 (0.908–1.491) |
| Female| 20–39    | No  | 9.5879                           | 1 (Reference) |
|       |          | Yes | 27.7708                          | 3.142 (1.227–8.047) |
|       | 40–59    | No  | 27.7446                          | 1 (Reference) |
|       |          | Yes | 42.1114                          | 1.346 (1.071–1.691) |
|       | 60–79    | No  | 51.1931                          | 1 (Reference) |
|       |          | Yes | 68.3820                          | 1.211 (1.073–1.367) |
|       | ≥80      | No  | 67.9555                          | 1 (Reference) |
|       |          | Yes | 97.1522                          | 1.352 (1.021–1.79) |

Values are presented as number or hazard ratio (95% confidence interval).
AAA, abdominal aortic aneurysm.
*Adjusted for age, sex, smoking, alcohol, regular exercise, body mass index, medical aid, diabetes, hypertension, dyslipidemia, stroke, and coronary disease.
in a group of patients who had aorta surgery. They evaluated patient emotional status before patients expressed difficulties on their own, using various measurement tools [18,19]. Our study did not include any screening and diagnosed depression when patients got worse and needed treatment. Moreover, depression in the elderly can present in various forms, such as cognition impairment, dementia, lack of vigor, or loss of interest in normal activities [26]. Diagnosing depression in older people requires circumspect vigilance and a willingness to take precautions when abnormal behaviors arise.

We found a higher risk for depression in AAA patients, with an especially high risk for depression in younger patients. Clinicians should closely monitor the emotional and psychiatric state of AAA patients and intervene appropriately.

SUPPLEMENTARY MATERIALS

Supplementary Table 1 can be found via https://doi.org/10.4174/astr.2021.101.5.291.

ACKNOWLEDGEMENTS

Fund/Grant Support
This work was supported by The Catholic University of Korea.

REFERENCES

1. Raič M. Depression and heart diseases: leading health problems. Psychiatr Danub 2017;29 Suppl 4(Suppl 4):770-7.
2. Zhang Y, Chen Y, Ma L. Depression and cardiovascular disease in elderly; current understanding. J Clin Neurosci 2018;47:1-5.
3. Lichtman JH, Froelicher ES, Blumenthal JA, Carney RM, Doering LV, Frasure-Smith N, et al. Depression as a risk factor for poor prognosis among patients with acute coronary syndrome: systematic review and recommendations: a scientific statement from the American Heart Association. Circulation 2014;129:1350-9.
4. Peters A, McEwen BS. Stress habituation, body shape and cardiovascular mortality. Neurosci Biobehav Rev 2015;56:139-50.
5. Thombs BD, Bass EB, Ford DE, Stewart KJ, Tsilidis KK, Patel U, et al. Prevalence of depression in survivors of acute myocardial infarction. J Gen Intern Med 2006;21:30-8.
6. Lett HS, Blumenthal JA, Babyak MA, Sherwood A, Strauman T, Robins C, et al. Depression as a risk factor for coronary artery disease: evidence, mechanisms, and treatment. Psychosom Med 2004;66:305-15.
7. Pratt LA, Ford DE, Crum RM, Armenian HK, Gallo JJ, Eaton WW. Depression, psychotropic medication, and risk of myocardial infarction: prospective data from the Baltimore ECA follow-up. Circulation 1996;94:3123-9.
8. Lang UE, Borgwardt S. Molecular mechanisms of depression: perspectives on new treatment strategies. Cell Physiol Biochem 2013;31:701-77.
9. Correll CU, Solmi M, Veronese N, Bortolato B, Rosson S, Santonastaso P, et al. Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: a large-scale meta-analysis of 3,211,768 patients and 113,383,368 controls. World Psychiatry 2017;16:163-80.
10. Feng HP, Chien WC, Cheng WT, Chung CH, Cheng SM, Tseng WC. Risk of anxiety and depressive disorders in patients with myocardial infarction: a nationwide population-based cohort study. Medicine (Baltimore) 2016;95:e4464.
11. Chan JN, Lee JC, Lee SS, Hui KK, Chan AH, Fung TK, et al. Interaction effect of social isolation and high dose corticosteroid on neurogenesis and emotional behavior. Front Behav Neurosci 2017;11:18.
12. Shah SU, White A, White S, Littler WA. Heart and mind: (1) relationship between cardiovascular and psychiatric conditions. Postgrad Med J 2004;80:683-9.
13. Stover PJ. Physiology of folate and vitamin
14. Trebatická J, Dukát A, Ďuračková Z, Muchová J. Cardiovascular diseases, depression disorders and potential effects of omega-3 fatty acids. Physiol Res 2017;66:363-82.
15. Young SN. Folate and depression: a neglected problem. J Psychiatry Neurosci 2007;32:80-2.
16. Golledge J. Abdominal aortic aneurysm: update on pathogenesis and medical treatments. Nat Rev Cardiol 2019;16:225-42.
17. Sakalihasan N, Michel JB, Katsargyris A, Kuivaniemi H, Defraigne JO, Nchimi A, et al. Abdominal aortic aneurysms. Nat Rev Dis Primers 2018;4:34.
18. Liberzon I, Abelson JL, Amdur RL, King AP, Cardneau JD, Henke P, et al. Increased psychiatric morbidity after abdominal aortic surgery: risk factors for stress-related disorders. J Vasc Surg 2006;43:929-34.
19. King AP, Abelson JL, Gholami B, Upchurch GR Jr, Henke P, Graham L, et al. Presurgical psychological and neuroendocrine predictors of psychiatric morbidity after major vascular surgery: a prospective longitudinal study. Psychosom Med 2015;77:993-1005.
20. Nyrønning LÅ, Stenman M, Hultgren R, Albrectsen G, Videm V, Mattsson E. Symptoms of depression and risk of abdominal aortic aneurysm: a HUNT study. J Am Heart Assoc 2019;8:e012535.
21. Lee YH, Han K, Ko SH, Ko KS, Lee KU; Taskforce Team of Diabetes Fact Sheet of the Korean Diabetes Association. Data analytic process of a nationwide population-based study using National Health Information Database established by National Health Insurance Service. Diabetes Metab J 2016;40:79-82.
22. Kozela M, Bobak M, Besala A, Micek A, Kubinova R, Malyutina S, et al. The association of depressive symptoms with cardiovascular and all-cause mortality in Central and Eastern Europe: prospective results of the HAPIIE study. Eur J Prev Cardiol 2016;23:1839-47.
23. Adamis D, Ball C. Physical morbidity in elderly psychiatric inpatients: prevalence and possible relations between the major mental disorders and physical illness. Int J Geriatr Psychiatry 2000;15:248-53.
24. Silvestri V, Simonte G. Aortic pathology in systemic lupus erythematosus: a case report and review of literature. Ann Vasc Surg 2017;43:312.
25. Jost CJ, Gloviczki P, Edwards WD, Stanson AW, Joyce JW, Pairolero PC. Aortic aneurysms in children and young adults with tuberous sclerosis: report of two cases and review of the literature. J Vasc Surg 2001;33:639-42.
26. Alexopoulos GS. Depression in the elderly. Lancet 2005;365:1961-70.