

Factors Related to Quality of Life among Patients with Brain Tumors*

Nguyen Thi Nghe¹, Wallada Chanruangvanich, RN, DNS¹, Orapan Thosingha, RN, DNS¹

Abstract

Purpose: To study the relationships between body mass index (BMI), symptom distress, anxiety, and quality of life (QOL) among patients with brain tumors.

Design: Descriptive correlational design.

Methods: The sample composed of 115 patients with brain tumors who were admitted to Bach Mai Hospital, Hanoi, Vietnam. Data were collected using 4 questionnaires: 1) Demographic data and illness information, 2) the MD Anderson Symptom Inventory-Brain Tumor (MDASI-BT) scale, 3) the Hamilton Anxiety Rating Scale (HAM-A), and 4) the Functional Assessment of Cancer Therapy-Brain (FACT-Br). Spearman's Rho was employed to test the relationship among studied variables.

Main findings: The findings revealed that symptom distress and anxiety were negatively related to QOL ($r_s = -.665$, $p < .05$; $r_s = -.702$, $p < .05$); while BMI was not related to the QOL ($p > .05$).

Conclusion and recommendations: Nurses should pay attention to the patients' anxiety and symptom distress by conducting routine assessment. Clinical practice guideline to reduce anxiety and manage symptom should be developed and implemented to improve QOL among patients with brain tumors.

Keywords: quality of life, brain tumors, BMI, anxiety, symptom distress

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Corresponding Author: Assistant Professor Wallada Chanruangvanich, Faculty of Nursing, Mahidol University, Bangkok 10700, Thailand, e-mail: wallada.cha@mahidol.ac.th

* Master thesis, Master of Nursing Science in Adult Nursing, Faculty of Nursing and Faculty of Graduate Studies, Mahidol University

¹ Faculty of Nursing, Mahidol University, Bangkok, Thailand

ปัจจัยที่มีความสัมพันธ์กับคุณภาพชีวิตของผู้ป่วยโรคเนื้องอกสมอง*

Nguyen Thi Nghe¹ วัลย์ลดา ฉันท์เรืองวณิชย์, พย.น.¹ อสพรรณ ไทสิงห์, พย.น.¹

บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาความสัมพันธ์ระหว่างดัชนีมวลกาย อาการรบกวน และความวิตกกังวล กับคุณภาพชีวิตของผู้ป่วยโรคเนื้องอกสมอง

รูปแบบการวิจัย: งานวิจัยเชิงสหสัมพันธ์

วิธีดำเนินการวิจัย: กลุ่มตัวอย่างเป็นผู้ป่วยโรคเนื้องอกสมอง จำนวน 115 คน ที่มารับการรักษาในโรงพยาบาลเป็คมาย ฮานอย ประเทศเวียดนาม เก็บข้อมูลโดยใช้แบบสอบถาม จำนวน 4 ชุด ได้แก่ 1) ข้อมูลประชากรและความเจ็บป่วย 2) แบบวัดคุณภาพชีวิต the MD Anderson Symptom Inventory-Brain Tumor (MDASI-BT) scale, 3) แบบวัดความวิตกกังวล the Hamilton Anxiety Rating Scale (HAM-A), และ 4) แบบสอบถามอาการรบกวน the Functional Assessment of Cancer Therapy-Brain (FACT-Br) วิเคราะห์หาความสัมพันธ์ด้วยสถิติ Spearman's Rho

ผลการวิจัย: อาการรบกวนและความวิตกกังวลมีความสัมพันธ์เชิงลบกับคุณภาพชีวิตอย่างมีนัยสำคัญทางสถิติ ($r_s = -.665, p < .05$; $r_s = -.702, p < .05$) แต่ดัชนีมวลกายไม่มีความสัมพันธ์กับคุณภาพชีวิต ($p > .05$)

สรุปและข้อเสนอแนะ: พยาบาลควรใส่ใจถึงความวิตกกังวล และอาการรบกวนในผู้ป่วยโรคเนื้องอกสมอง ด้วยการประเมินผู้ป่วยอย่างสม่ำเสมอ รวมทั้งควรพัฒนาแนวปฏิบัติทางคลินิกในการลดความวิตกกังวล และการจัดการกับอาการ เพื่อส่งเสริมคุณภาพชีวิตของผู้ป่วยโรคเนื้องอกสมอง

คำสำคัญ: คุณภาพชีวิต ความวิตกกังวล ดัชนีมวลกาย โรคเนื้องอกสมอง อาการรบกวน

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Corresponding Author: ผู้ช่วยศาสตราจารย์วัลย์ลดา ฉันท์เรืองวณิชย์, คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล บางกอกน้อย กรุงเทพฯ 10700, e-mail: wallada.cha.mahidol.ac.th

* วิทยานิพนธ์หลักสูตรพยาบาลศาสตรมหาบัณฑิต สาขาการพยาบาลผู้ใหญ่ คณะพยาบาลศาสตร์ และบัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล

¹ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล

Background and Significance

Brain tumors were known as serious disease with high mortality rate, with Glioblastomas and malignant gliomas were an annual incidence of 5.26/100,000 population or 17,000 new diagnosed cases per year¹. In the United States, prevalence of malignant primary brain tumor was 48.49/100,000 population in the group of 15-39 years old and 57.75/100,000 population in the group of older than 40 years old. Moreover, the incidence rate of all primary malignant and non-malignant brain and other CNS tumors was 22.36/100,000 accumulate to a total of 368,117 incident cases of tumors². According to Ostrom, et al. the ratios of brain tumors in developed countries (5.1/100,000 population) were significantly higher than underdeveloped countries (3.0/100,000 population)². In Vietnam, the prevalence of brain tumors was 1.3 cases per 100,000 population³.

Brain tumors' symptoms varied from benign or malignant, primary or metastatic, and intracerebral or extracerebral^{2,3}. Secondary brain tumors could be metastasis from breast, lung, colon or other organs². To select the proper treatment; some variables would be considered such as size, location, and type of tumor; related symptoms; and patient's overall condition⁴. Recently, treatment for brain tumor may involve chemotherapy, radiation therapy with or without Gamma knife, surgery, or combination of those therapy⁴. Complications or side effects of any type of therapy such as nausea, vomiting, pain, worse performance status, fatigue, loss of appetite, nutritional status, could bring several deteriorations which had negative effect to health and QOL⁵⁻⁷.

Nowadays, patient's quality of life became an important aspect in clinical care, especially health-related quality of life (HRQOL). According to Wilson and Cleary⁸, HRQOL was a multidimensional concept covering physical, psychological, and social domains, as well as symptoms induced by the disease and its treatment^{8,9}. Brain tumor patients who received treatments; the distress symptoms in physical,

mental, cognitive, and emotional would be fluctuated greatly and affected QOL^{10,11}. The common distress symptoms included stress, fatigue, and seizures. The results from previous research indicated that patients with primary and metastasis brain tumors had strong relationship between level of distress symptoms and anxiety¹⁰⁻¹³. Moreover, anxiety and depression were associated with diagnosis, tumor location, and medications; and finally effected QOL of brain tumor patients^{7,10,12,13}.

Obesity, assessed by Body Mass Index (BMI), was a risk factor for brain/central nervous system tumors, gliomas and meningiomas¹⁴. Since diagnosis or during treatment, distress symptoms such as appetite and weight loss, nausea, vomiting, dysphagia, headaches, and fatigue were found commonly among brain tumor patients^{5,15}. So, tumor itself and these symptoms could lead to malnutrition which was related to QOL⁵⁻⁷. Many studies reported the relationships among symptom distress, anxiety, BMI, and QOL^{5-7,12}. However, there were little, if any, studies in Vietnam. Therefore, it was essential to explore the factors related to HRQOL in patients with brain tumors. Better understanding in relationships among BMI, symptom distress, anxiety level, and QOL of patients with brain tumors would provide better comprehensive treatment and nursing care, resulted in better quality of life for patients with brain tumor in Vietnam.

Objective

To study the relationships between body mass index (BMI), symptom distress, anxiety, and quality of life (QOL) among patients with brain tumors.

Hypothesis

BMI, symptom distress, and anxiety were negatively related to quality of life among patients with brain tumors.

Methodology

This study was a descriptive correlational design.

Population and Sample

Population included patients both males and females who were diagnosed with primary or metastatic brain tumors, and were admitted at the Medical Nuclear and Oncology Centre in Bach Mai Hospital, Hanoi, Vietnam.

Sample was selected from the population with the inclusion criteria: 1) aged 18 years and older, 2) able to communicate in Vietnamese language. The exclusion criteria were: 1) unconscious, 2) bleeding after surgery, and 3) blood pressure > 160/90 mm.Hg or < 90/60 mm.Hg.

The sample size was calculated using G*Power Program¹⁶ to determine the minimum number of participants needed for correlational design with 3 independent variables. Based on the level of significance $\alpha = .05$; Power $1 - \beta = .9$; and medium effect size = $R = .3^{17}$; the sample size should be 109. Additional 5% was added to cover attrition or missing value, therefore the total sample was 115 patients with brain tumors.

Research Instruments

Data were collected using the following research instruments:

1. Demographic data and illness information were collected from the hospital records; including age, gender, education level, income, marital status, number of tumors, size of tumors, location, and BMI at admission.

2. The MD Anderson Symptom Inventory-Brain Tumor (MDASI-BT) Scale¹⁸. This scale had 28 items measured the symptom distress (22 items) and the interference of patient's life (6 items). Twenty two items used a rating scale from 0 (being not present) to 10 (as bad as you can imagine) to measure patients' health status throughout 24 hours prior to evaluation; and 6 items used a rating scale from 0 (being did not interfere) to 10 (being interfered completely) to measure symptoms interfered with patients' daily life. The total score ranged from 0-280; the higher score reflected the higher symptom distress¹⁸.

3. The Hamilton Anxiety Rating Scale (HAM-A)¹⁹. This scale was a psychological

questionnaire used by a clinician to rate the severity of patients' anxiety. The HAM-A was developed in 1959 by Max Hamilton¹⁹, with 14 items designed to assess the severity of patients' anxiety. Each item was scored on a scale of 0 (not present) to 4 (severe). The total scores ranged from 0-56; the severity of anxiety was categorized as < 17 = mild severity, 18-24 = mild to moderate severity, and ≥ 25 = moderate to severe anxiety.

4. The Functional Assessment of Cancer Therapy-Brain (FACT-Br) was developed by Weitzner, et al. in 1995 to measure quality of life (QOL)²⁰. The FACT-Br composed of 50 items in 5 dimensions: physical well-being, social/family well-being, emotional well-being, functional well-being, and disease-specific concerns. Score for each item used a 5-point Likert scale from 0 (not at all) to 4 (very much); higher score suggested higher QOL²⁰.

All instruments were either in the public domain or obtained permission to use and translate to Vietnamese language using back translation technique. Content validity was reviewed and approved by six experts in neurological area. Cronbach's alpha coefficient was employed to test reliability of each instrument: MDASI-BT = .89; HAM-A = .78; and FACT-Br = .89.

Protection of Human Subjects

The research proposal was approved by the Institutional Review Board of Faculty of Nursing, Mahidol University, Thailand (COA No.IRB-NS2016/339.0205), and the Vietnam National University, Vietnam. The researcher collected data according to the standard process suggested by the IRB to ensure protection of human right to all subjects. The issues of voluntary participation, safety, anonymity, and confidentiality were strictly concerned.

Data Collection

Data were collected as the following process:

1. After receiving permission to collect data from the director of Bach Mai hospital, the researcher met director of center and head nurse of Nuclear Medicine and Oncology Center, in order to explain the purpose and details of data collection. Then, the head nurse introduced the

researcher to target population.

2. The researcher selected the sample according to the inclusion criteria, self-introduced, explained objectives of the study, read the participation information sheet, described data collection procedure, and invited potential subjects to join the study. After the patients voluntarily agreed to join the study, they were asked to sign the consent form.

3. The researcher used the questionnaires and assessment form for data collection. Some demographic data were collected from the patients' hospital records. The subjects were interviewed with 3 questionnaires which lasted 30-40 minutes for each patient.

Data Analysis

Data were analyzed using computer statistical program with the significant level of .05 as follows:

1. Descriptive statistics included frequency, percentage, range, mean, and standard deviation were used to describe the demographic data, illness information, and studied variables.

2. After testing for normal distribution of all studied variables to meet assumption of the Pearson's Product Moment Correlation; and found that they were not normal distributed. Therefore, the Spearman's Rho correlation was used to examine relationships between variables including: symptom distress, anxiety, IBM, and quality of life in patient with brain tumors.

Findings

The findings showed that 60.87% of the subjects were males with the mean age of 51.88 years (SD = 13.5), 57.39 % were in middle age ranged from 41-60 years old, 86.96% were married, 40.87% finished college education, 37.39% were self-employer, and 95.65% had health insurance.

Regarding illness information: 46.96% were admitted with motor dysfunction/sensory deficits, followed by 44.35% with headache; 50.43% were diagnosed with brain tumor, followed by 34.78% with brain tumor and lung cancer; 50.43% were metastasis; 34.78% could

not identify location of tumor clearly, followed by 12.17% located at cerebral cortex, and 11.30% located at temporal lobe; 20.87% received radiation and chemotherapy, followed by 18.26% received Gamma knife, and 17.39% received radiation therapy and Gamma knife.

BMI, symptom distress, anxiety, and quality of life in patients with brain tumors

BMI of the subjects indicated that the mean BMI was 20.6 (SD = 2.5); 80.87% had normal weight, 13.91% had underweight, and 5.22% had overweight.

Symptom distress as measured by the MDASI-BT scale showed that most of the subjects scored symptom distress as moderate to severe; the highest percentage of each dimension was: in general symptoms, 10.43% had fatigue; in brain tumor symptoms, 9.57% had weakness; in symptoms interfered life, 11.30% were interfered with walking.

Anxiety as measured by the HAM-A scale revealed that the majority of patients had mild severity of anxiety (90.43%), followed with the level of mild to moderate severity of anxiety (6.96%), and moderate to severe anxiety (2.61%). The average score was at mild severity of anxiety (10.45, SD = 5.75).

Quality of life as measured by the FACT-Br indicated that the mean score of quality of life was at the moderate level (Mean = 129.47, SD = 18.85). For each dimension; the mean score of general well-being was 69.70 (SD = 8.70), which composed of physical well-being (Mean = 17.5, SD = 3.60), social well-being (Mean = 20.17, SD = 2.10), emotional well-being (Mean = 15.80, SD = 2.80), functional well-being (Mean = 16.11, SD = 4.10); and the mean score of disease-specific concern was 59.77 (SD = 11.60).

The relationships between BMI, symptom distress, anxiety, and QOL in patients with brain tumors

The findings indicated that symptom distress and anxiety were negatively related to QOL of patients with brain tumors ($r_s = -.665$, $p < .05$; $r_s = -.702$, $p < .05$); while BMI was not related to the QOL ($p > .05$).

Table 1: The relationships between BMI, symptom distress, anxiety, and QOL in patients with brain tumors (n = 115)

Variables	1	2	3	4
1. BMI	1			
2. Symptom distress	.014	1		
3. Anxiety	.068	.703*	1	
4. QOL	-.077	-.665*	-.702*	1

* $p < .05$

Discussion

The results indicated that quality of life of patients with brain tumors in this study was at the moderate level (Mean = 129.47, SD = 18.85), similar to the study of Piil, et al.²¹ Conversely, a literature review of 23 primary and metastatic brain tumors studies found that QOL in primary brain tumors was 111.27 as opposed to 92.83 in metastatic cases²² which lower than the result of this study. For general well-being, the mean score (69.70, SD = 8.70) was higher than the study of Binh, et al.²³ from Hanoi Medical University, Vietnam (Mean = 47.06, SD = 13.84). Therefore, considering that brain neoplasm was a progressive tumor with deteriorating patients' QOL, it was suggested from Korean study that health care workers have to pay more attention to emotional problems, and treatment strategies should be investigated in this regard to improve patients' QOL²⁴.

Hypothesis: BMI, symptom distress, and anxiety were negatively related to quality of life among patients with brain tumors.

The findings partially supported the proposed hypothesis that symptom distress and anxiety were negatively related to QOL of patients with brain tumors ($r_s = -.665$, $p < .05$; $r_s = -.702$, $p < .05$); while BMI was not related to the QOL ($p > .05$).

Symptom distress was negatively related to the QOL of patients with brain tumors; which meant that the more severe symptoms patients had, the less QOL they were. This finding was supported from many studies, which reported statistically worsen of symptoms in most patients, indicating lower QOL^{7,12,25,26}. However, the symptom distress in this study in

Vietnamese culture was different from the study in developed country due to the contrast in cultural and social support system⁷. The Vietnamese patients were trust and compliance with endurance to the treatment of physician and health care team while family closely took care of the patients. Therefore, these symptoms interfered the patients' life only at the mild level and caused moderate QOL of the patients in this study. Common symptom distress found in this study such as fatigue, pain, weakness, loss of appetite; were similar to the study of Cheng, et al.⁵ which strongly affected QOL.

The results found the negative relationship between anxiety and the QOL ($r = -.702$, $p < .05$), similar to the study concluded from literature reviews of Baker, et al.²⁷ revealed that current anxiety related to impaired QOL. They found the association of performance, and repair functional to mental health problems that connected to decline QOL²⁷. According to Teke, et al.²⁸ they reported that anxiety mood and insomnia were significant higher than other symptoms because patients felt fear when faced with brain neoplasm. These problems correlated to QOL and survival of metastasis brain tumor patients²⁸. However, the majority of patients in this study had mild severity of anxiety (90.43%), followed with the level of mild to moderate severity of anxiety (6.96%), and moderate to severe anxiety (2.61%). The average score was at mild severity of anxiety (10.45, SD = 5.75). This might be explained by coping and adaptation mechanism of the patients to their illness²²; Vietnamese endure culture combine with good family and social support. Therefore, patients' anxiety in this study was in mild

severity of anxiety level.

BMI was not related to QOL of patients with brain tumors in this study as proposed hypothesis. According to the study of Niedermairer, et al.²⁹ BMI was related to primary tumors in Germany; however BMI with overweight & obesity level were not associated with QOL in glioma patients²⁹. However, the systematic review of Lis, et al.⁶ confirmed that nutritional status was a strong predictor of QOL in cancer patients which contrasted with this study. The majority of those studies used weight loss or unintentional weight loss or percentage of weight loss or in combination with other method such as standard nutritional assessment tool in the studies. Those methods might be sensitive to the conditions of patients with brain tumors more than only BMI⁶, which might be the reason that the result of this study did not support the proposed hypothesis.

Conclusion and Implication for Practice and Further Study

The results of this study supported the importance of symptom distress and anxiety of patients with brain tumors that the more symptom distress and anxiety the patients had; the lower quality of life they experienced. Therefore, it was recommended for implication to nursing practice as follows:

1. Nurses and health care team should concern and improve their practice to assess symptoms including co-morbidities, anxiety, and nutritional status of patients with brain tumors.

2. Clinical practice guideline for health care team to manage symptom, reduce anxiety, and promote appropriate nutrition; should be developed and implemented to improve QOL among patients with brain tumors.

References

1. Omuro A, DeAngelis LM. Glioblastoma and other malignant gliomas: a clinical review. *JAMA*. 2013;310(17):1842-50.
2. Ostrom QT, Gittleman H, Xu J, Kromer C, Wolinsky Y, Kruchko C, et al. CBTRUS statistical report: primary brain and central nervous system tumors diagnosed in the United States in 2009-2013. *Neuro Oncol*. 2016;18 Suppl 5:v1-v75. doi: 10.1093/neuonc/nov207.
3. Ministry of Public Health. Cancer prevention project period 2008-2010. Ha Noi, Viet Nam: Ministry of Public Health; 2008.
4. Klein M. Neurocognitive functioning in adult WHO grade II gliomas: impact of old and new treatment modalities. *Neuro Oncol*. 2012;14 Suppl 4:iv17-24. doi: 10.1093/neuonc/nos161.
5. Cheng JX, Liu BL, Zhang X, Lin W, Zhang YQ, Liu WP, et al. Health-related quality of life in glioma patients in China. *BMC Cancer*. 2010;10:305. doi: 10.1186/1471-2407-10-305.
6. Lis CG, Gupta D, Lammersfeld CA, Markman M, Vashi PG. Role of nutritional status in predicting quality of life outcomes in cancer--a systematic review of the epidemiological literature. *Nutr J*. 2012;11:27. doi: 10.1186/1475-2891-11-27.
7. Jalali R, Dutta D. Factors influencing quality of life in adult patients with primary brain tumors. *Neuro Oncol*. 2012;14 Suppl 4:iv8-16. doi: 10.1093/neuonc/nos205.
8. Wilson IB, Cleary PD. Linking clinical variables with health-related quality of life: a conceptual model of patient outcomes. *JAMA*. 1995;273(1):59-65.
9. Dirven L, Aaronson NK, Heimans JJ, Taphoorn MJ. Health-related quality of life in high-grade glioma patients. *Chin J Cancer*. 2014;33(1):40-5.
10. Cordes MC, Scherwath A, Ahmad T, Cole AM, Ernst G, Oppitz K, et al. Distress, anxiety and depression in

- patients with brain metastases before and after radiotherapy. *BMC Cancer*. 2014;14:731.
doi: 10.1186/1471-2407-14-731.
11. Gazzotti MR, Malheiros SM, Batan Alith M, Nascimento O, Santoro IL, Jardim JR, et al. Quality of life and physical limitations in primary brain tumor patients. *Qual Life Res*. 2011;20(10):1639-43.
12. Wong E, Zhang L, Rowbottom L, Chiu N, Chiu L, McDonald R, et al. Symptoms and quality of life in patients with brain metastases receiving whole-brain radiation therapy. *Support Care Cancer*. 2016;24(11):4747-59.
13. Yucel B, Akkas EA, Okur Y, Eren AA, Eren MF, Karapinar H, et al. The impact of radiotherapy on quality of life for cancer patients: a longitudinal study. *Support Care Cancer*. 2014;22(9):2479-87.
14. Sergeantanis TN, Tsivgoulis G, Perlepe C, Ntanasis-Stathopoulos I, Tzanninis IG, Sergeantanis IN, et al. Obesity and risk for brain/CNS tumors, gliomas and meningiomas: a meta-analysis. *PLoS One*. 2015;10(9):e0136974.
doi: 10.1371/journal.pone.0136974.
15. McCall M, Leone A, Cusimano MD. Nutritional status and body composition of adult patients with brain tumours awaiting surgical resection. *Can J Diet Pract Res*. 2014;75(3):148-51.
16. Faul F, Erdfelder E, Buchner A, Lang A-G. Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behav Res Methods*. 2009;41(4):1149-60.
17. Cohen J. A power primer. *Psychol Bull*. 1992;112(1):155-9.
18. Cleeland CS, Mendoza TR, Wang XS, Chou C, Harle MT, Morrissey M, et al. Assessing symptom distress in cancer patients: the M.D. Anderson symptom inventory. *Cancer*. 2000;89(7):1634-46.
19. Maier W, Buller R, Philipp M, Heuser I. The Hamilton Anxiety Scale: reliability, validity and sensitivity to change in anxiety and depressive disorders. *J Affect Disord*. 1988;14(1):61-8.
20. Weitzner MA, Meyers CA, Gelke CK, Byrne KS, Cella DF, Levin VA. The Functional Assessment of Cancer Therapy (FACT) scale. Development of a brain subscale and revalidation of the general version (FACT-G) in patients with primary brain tumors. *Cancer*. 1995;75(5):1151-61.
21. Piil K, Jakobsen J, Christensen KB, Juhler M, Jarden M. Health-related quality of life in patients with high-grade gliomas: a quantitative longitudinal study. *J Neurooncol*. 2015;124(2):185-95.
22. Chiu N, Chiu L, Zeng L, Zhang L, Cella D, Popovic M, et al. Quality of life in patients with primary and metastatic brain cancer in the literature as assessed by the FACT-Br. *World J Oncol*. 2012;3(6):280-5.
23. Binh BV, Anh DT, Dinh DT, Trung TQ. A survey on quality of life of cancer patients and some related factors at Hanoi Medical University Hospital in 2015 [Internet]. Hanoi, Vietnam: BỆNH VIỆN QUÂN Y 103; 2015 [cited 2017 May 18]. Available from: <http://www.benhvien103.vn/vietnamese/bao-cau-hoi-nghi-khoa-hoc-chao-mung-65-nam-truyen-thong-bvqy103/hoi-nghi-khoa-hoc-dieu-duong/2015-12/1380.prt>. (in Vietnam).
24. Noh SM, Chung SJ, Kim KK, Kang DW, Lim YM, Kwon SU, et al. Emotional disturbance in CADASIL: its impact on quality of life and caregiver burden. *Cerebrovascular Dis*. 2014;37(3):188-94.
25. Chow R, Tsao M, Pulezas N, Zhang L, Sahgal A, Cella D, et al.

- Do patients with brain metastases selected for whole brain radiotherapy have worse baseline quality of life as compared to those for radiosurgery or neurosurgery (with or without whole brain radiotherapy)? *Ann Palliat Med*. 2016;5(1):1-12.
26. Pulenzas N, Ray S, Zhang L, McDonald R, Cella D, Rowbottom L, et al. The brain symptom and impact questionnaire in brain metastases patients: a prospective long-term follow-up study. *CNS Oncol*. 2016;5(1):31-40.
27. Baker PD, Bambrough J, Fox JRE, Kyle SD. Health-related quality of life and psychological functioning in patients with primary malignant brain tumors: a systematic review of clinical, demographic and mental health factors. *Neurooncol Pract*. 2016;3(4):211-21.
28. Teke F, Bucaktepe P, Kibrisli E, Demir M, Ibiloglu A, Inal A. Quality of life, psychological burden, and sleep quality in patients with brain metastasis undergoing whole brain radiation therapy. *Clin J Oncol Nurs*. 2016;20(5):AE-2. doi: 10.1188/16.CJON.AE-02.
29. Niedermaier T, Behrens G, Schmid D, Schlecht I, Fischer B, Leitzmann MF. Body mass index, physical activity, and risk of adult meningioma and glioma: a meta-analysis. *Neurology*. 2015;85(15):1342-50.