

Comparison Of The Quality Of Death Between Primary Malignant Brain Tumor Patients And Other Cancer Patients: Results From A Nationwide Bereavement Survey In Japan

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Abstract

Purpose: No studies have investigated the association between malignant brain tumor and the quality of dying, which is an important outcome in end-of-life care. This study aimed to clarify whether the quality of dying and related factors in patients with malignant brain tumor differ from those in patients with other malignant diseases.

Methods: This was a secondary analysis of data collected by two nationwide, multicenter, bereavement surveys of palliative care units in Japan. This analysis included 14,171 bereaved family members (160 patients with malignant brain tumors). The quality of dying was examined using the Good Death Inventory (GDI), a validated tool widely used in palliative care settings.

Results: Patients with malignant brain tumors were younger (ES=0.08, $p<0.0001$) and had a longer palliative care unit stay during their end-of-life (ES=0.05, $p<0.0001$) than others. The total GDI score was significantly lower in patients with malignant brain tumors ($\beta=-0.02$, $p<0.0001$). Four GDI items were significantly lower in the malignant brain tumor group: “Being able to stay in one’s favorite place” ($\beta=-0.02$, $p=0.03$); “Trusting the physician” ($\beta=-0.02$, $p=0.003$); “Being independent in daily activities” ($\beta=-0.02$, $p=0.01$); and “Feeling that one’s life is worth living” ($\beta=-0.02$, $p=0.001$).

Conclusion: This study showed that the quality of dying of patients with malignant brain tumors was lower, suggesting the need to review care for patients with malignant brain tumors based on their characteristics. Care that values personal dignity and early end-of-life decision-making can be more important to improve the quality of dying in patients with malignant brain tumors.

Introduction

Malignant brain tumors, compared with other malignant diseases, are known to cause significant morbidity and mortality that decrease patients’ quality-of-life (QOL) [1, 2]]. Due to the high symptom burden and the fatal illness, the supportive care and/or end-of-life (EOL) care needs of patients with malignant brain tumors may differ from those of patients with other cancers [3–6]]. Previous studies have reported that patients with primary malignant brain tumors require more support for decision-making and physical symptoms than other patients with cancer during EOL care due to cognitive/functional impairment [7–10]. However, the QOL at EOL, more specifically, the quality of dying, of patients with malignant brain tumors has not been sufficiently investigated.

It is important to evaluate the outcomes of care to improve them [11, 12], and QOL at EOL or the quality of dying may be one of the core outcomes in palliative care. However, studies that have evaluated the outcomes of EOL care for malignant brain tumor patients are limited. Sizoo and colleagues measured the health-related QOL (HRQOL) of high-grade glioma patients at EOL retrospectively by proxy report [13]. They found that HRQOL was poor and deteriorated as death approached, but their study was limited by its heterogeneous sample, and it therefore remains unclear whether there are any specific issues in patients with malignant brain tumors considering the characteristics of the disease [13]. The concept of

QOL at EOL and that of quality of dying are different, and measuring each independently is known to be important for good understanding of the dying experience [14]. Additionally, a systematic review of the EOL phase of patients with malignant brain tumors suggested that there is a need for more studies focusing on the prevalence of problems and the needs of patients with malignant brain tumors at EOL [15].

The aim of this study was to clarify whether the quality of dying and factors related to it of patients with malignant brain tumors differ from those of patients with other malignant diseases using a nationwide, multicenter, bereavement survey of palliative care units (PCUs) in Japan.

Methods

This study was a secondary analysis of combined data from The Japan HOspice and Palliative Care Evaluation study 3 (J-HOPE3) and J-HOPE4. These J-HOPE studies were nationwide, cross-sectional, anonymous, self-reported questionnaire surveys of bereaved family members after the loss of a close relative in Japan. J-HOPE3 and J-HOPE4 were carried out in May 2014 and July 2018, respectively. The details of J-HOPE3 and J-HOPE4 have been described in the protocol papers of the studies [16, 17]. Briefly, in the present study, data of 133 and 187 PCUs, which were members of Hospice Palliative Care Japan (HPCJ) who participated in J-HOPE3 and J-HOPE4, respectively, were used. The inclusion criteria were: 1) death of a family member due to cancer; 2) the patient was aged ≥ 20 years (the age at which one is considered an adult in Japan); and 3) the bereaved family member was aged ≥ 20 years. The exclusion criteria were: 1) the patient received palliative care for < 3 days; 2) the bereaved family member was unavailable or could not be identified; 3) treatment-associated death (i.e. death during a chemotherapy cycle or medical error) or occurrence of death in the intensive care unit; 4) potential participants were likely to suffer extraordinary emotional distress as a result of their participation (i.e. history of mental diseases), as determined by the primary physician and a nurse; and 5) the potential participant was incapable of completing the self-reported questionnaire because of health issues, such as cognitive impairment or a visual disability. Questionnaires were sent to the bereaved family members identified by each participating institution. Returning a completed questionnaire was considered to indicate individual consent to study participation. This study was approved by the institutional review boards of Tohoku University (J-HOPE3: No. 2013-1-334; J-HOPE4: No. 2018-2-290) and all participating institutions.

Measurements

Patient background data were collected from the participating institutions of this study. The data included the deceased patients' age, sex, primary tumor site, date of last admission to a PCU, and date of death. In this study, the patients were divided into two groups based on the answers regarding the primary tumor site: the brain tumor group for primary malignant brain tumors and the other cancer group.

The questionnaire sent included items regarding sociodemographic background, such as the bereaved family member's sex, age, time since loss, and relation to the deceased. In addition, the item/scale mentioned below was included.

Quality of dying

The Good Death Inventory (GDI) short version was used to evaluate the quality of dying. This scale was developed based on the constructs of QOL at EOL extracted from qualitative and quantitative studies in Japanese subjects as a scale to evaluate the quality of dying of cancer patients through bereaved family assessment. The GDI consists of 18 items overall. For each item, the respondents were asked to rate their life in a hospice/palliative care unit on a 7-point scale from "1. totally disagree" to "7. very much agree", with a higher score indicating a higher rating. The reliability and validity of this scale have been verified [18].

Analysis

First, to clarify the characteristics of the brain tumor group, the *t*-test, Chi-squared test, or Fisher's exact probability test was conducted comparing the brain tumor group and the other cancer group for socio-demographic items. Second, the *t*-test was used to compare the scores of each of the 18 items of the GDI between the brain tumor group and the other cancer group. Effect sizes (ESs) were calculated based on the definition of Cohen et al. Next, considering potential bias, multiple regression analysis was used to adjust demographic factors that were found to be significantly different between the brain tumor group and the other cancer group. Finally, interaction term tests were conducted by two-way analysis of variance to determine whether there were associations of demographic items between the brain tumor group and the other cancer group. A *p*-value < 0.05 was considered significant, and all tests were two-tailed. SAS software (Japanese ver. 9.4; Cary, NC; BMDP, Los Angeles, CA) was used for the analyses.

Results

The data collected from 14,275 bereaved family members from 133 and 187 PCUs from J-HOPE3 and J-HOPE4, respectively, were used for the analysis. The characteristics of the deceased patients and their bereaved family members are summarized in Table 1. In total, 160 of the patients had malignant brain tumors, and 14,011 had other cancers. With regard to the primary tumor site in the other cancer group, 22.7% had lung cancer, and 14.5% had tumors of stomach or esophagus. There were significant differences between the malignant brain tumor group and the other cancer group in patients' age (brain tumor group: 67.1 ± 14.0 years [mean ± standard deviation (SD)] vs the others: 75.0 ± 11.4 years), duration of last admission to a PCU (brain tumor group: 55.1 ± 46.4 days vs the others: 36.5 ± 46.0 days), and relationship to the deceased (ES = 0.04, *p* < 0.0001).

Table 1
 Characteristics of patients and bereaved family members

	Brain tumor		Other cancers		ES	p
	n	%	n	%		
Patients						
Sex						
Male	90	56.3	7644	54.6	0.0003	0.67
Female	70	43.8	6367	45.4		
Age, y (mean ± SD)	(67.1 ± 14.0)		(75.0 ± 11.4)			< .0001
< 40 y	8	5.0	90	0.6	0.08	< .0001
40–49 y	11	6.9	310	2.2		
50–59 y	25	15.6	919	6.5		
60–69 y	37	23.1	2866	20.3		
70–79 y	48	30.0	4392	31.1		
≥ 80 y	31	19.4	5538	39.2		
Duration of admission, w (mean ± SD)	(55.1 ± 46.4)		(36.5 ± 46.0)			< .0001
< 1 w	9	5.6	1737	12.3	0.05	< .0001
1–2 w	17	10.6	2789	19.8		
2 w – 1 m	40	25.0	3980	28.2		
1–2 m	41	25.6	3244	23.0		
2–3 m	28	17.5	1228	8.7		
≥ 3 m	25	15.6	1137	8.1		
Primary cancer sites						
Lung	-	-	3206	22.7		
Stomach, esophagus	-	-	2042	14.5		
Colon, rectum	-	-	1775	12.6		
Liver, bile duct, pancreas	-	-	2844	20.2		
Breast	-	-	635	4.5		

SD: standard deviation; ES: effect size

	Brain tumor		Other cancers			
Prostate, kidney, bladder	-	-	1010	7.2		
Head and neck	-	-	535	3.8		
Uterus, ovary	-	-	682	4.8		
Leukemia	-	-	90	0.6		
Others	-	-	1290	9.1		
Bereaved family members						
Sex						
Male	53	34.0	4723	34.3	0.01	0.42
Female	103	66.0	9036	65.7		
Age, y (mean ± SD)	(61.4 ± 12.5)		(62.1 ± 12.1)			0.44
< 40 y	10	6.3	837	5.9	0.01	0.76
40–49 y	22	13.8	1611	11.4		
50–59 y	41	25.6	3470	24.6		
60–69 y	42	26.3	4119	29.2		
70–79 y	34	21.3	3120	22.1		
≥ 80	11	6.9	958	6.8		
Relationship with patients						
Spouse	83	53.2	5913	42.9	0.04	< .0001
Children	39	25.0	5487	39.8		
Daughter-in-law or son-in-law	8	5.1	804	5.8		
Parents	11	7.1	268	1.9		
Siblings	10	6.4	904	6.6		
Others	5	3.2	416	3.0		
SD: standard deviation; ES: effect size						

Table 1
(Continued)

	Brain tumor		Other cancers			
	n	%	n	%	ES	p
Duration of bereavement, m (mean ± SD)	(302.2 ± 112.6)		(92.8 ± 659.4)			0.86
< 6 m	23	14.4	2046	14.5	0.02	0.50
6–9 m	93	58.1	8568	60.7		
9 m – 1 y	38	23.8	2994	21.2		
1–2 y	6	3.8	353	2.5		
≥ 2 y	0	0.0	154	1.1		
Education						
Less than high school	13	8.4	1345	9.8	0.01	0.74
High school	74	47.7	6228	45.3		
Junior college, vocational school	35	22.6	3005	21.9		
University, college	32	20.6	2985	21.7		
Graduate school	0	0.0	132	1.0		
Others	1	0.6	41	0.3		
Physical health status during caregiving period						
Good	29	18.7	3436	24.9	0.01	0.34
Moderate	87	56.1	7399	53.5		
Not good	31	20.0	2464	17.8		
Bad	8	5.2	520	3.8		
Mental health status during caregiving period						
Good	11	7.1	1818	13.2	0.02	0.08
Moderate	75	48.7	6368	46.3		
Not good	48	31.2	4494	32.7		
Bad	20	13.0	1061	7.7		
Frequency of attending patient (days/week)						

SD: standard deviation; ES: effect size

	Brain tumor		Other cancers			
None	107	68.2	8990	65.1	0.01	0.38
1–3 d	17	10.8	2095	15.2		
4–6 d	27	17.2	2047	14.8		
Every day	6	3.8	667	4.8		
Presence of other caregivers						
Present	121	77.6	9990	72.5	0.01	0.16
Absent	35	22.4	3793	27.5		
Presence of people who listen to one's worries or problems						
Present	103	64.4	8775	62.0	0.004	0.57
Absent	57	35.6	5370	38.0		
Religious belief						
None	59	38.8	4808	35.2	0.01	0.62
Buddhism	78	51.3	7784	57.0		
Christianity	5	3.3	315	2.3		
Shinto	3	2.0	370	2.7		
Others	7	4.6	375	2.7		
SD: standard deviation; ES: effect size						

The results of bivariate and multivariate analyses are shown in Table 2. On the *t*-test, the total GDI score was significantly lower (ES = 0.04, $p < 0.0001$) in the malignant brain tumor group (mean \pm SD: 77.3 \pm 14.8, 95%CI: 74.8–79.9) compared to the other cancer group (mean \pm SD: 77.3 \pm 14.8, 95%CI: 74.8–79.9). In addition, there were significant differences between the malignant brain tumor group and the other cancer group in the following 8 GDI items: “Being able to stay in one’s favorite place” (ES = 0.03, $p = 0.003$); “Trusting physician” (ES = 0.03, $p = 0.002$); “Not being a burden to others” (ES = 0.02, $p = 0.04$); “Being independent in daily activities” (ES = 0.08, $p < 0.0001$); “Feeling that one’s life was completed” (ES = 0.04, $p < 0.0001$); “Saying what one wants to dear people” (ES = 0.07, $p < 0.0001$); “Knowing what to expect about one’s condition in the future” (ES = 0.06, $p < 0.0001$); and “Feeling that one’s life is worth living” (ES = 0.01, $p = 0.001$). Regarding the results of multiple regression analysis adjusting the outcomes by patients’ age, duration of last admission, and the bereaved family member’s relationship to the deceased (Table 3), the GDI total score remained significantly lower in the malignant brain tumor group than in the other cancer group ($\beta = -0.02$, $p < 0.0001$). Similarly, the following 4 GDI items had significantly lower scores in the malignant brain tumor group on multivariate analysis: “Being able to stay in one’s

favorite place” ($\beta=-0.02$, $p = 0.03$); “Trusting physician” ($\beta=-0.02$, $p = 0.003$); “Being independent in daily activities” ($\beta=-0.02$, $p = 0.01$); and “Feeling that one’s life is worth living” ($\beta=-0.02$, $p = 0.001$).

Table 2
Association between brain tumor and quality of dying and death

GDI items	Brain tumor			Other cancers			ES	p
	Mean	±	SD	Mean	±	SD		
Being free from physical distress	5.3	±	1.4	5.2	±	1.4	0.01	0.33
Being able to stay in one’s favorite place	4.4	±	1.6	4.8	±	1.6	0.03	0.003
Having some pleasure in daily life	4.1	±	1.6	4.2	±	1.6	0.01	0.37
Trusting physician	5.2	±	1.4	5.5	±	1.2	0.03	0.002
Not being a burden to others	4.1	±	1.7	4.4	±	1.6	0.02	0.04
Spending enough time with one’s family	5.0	±	1.5	5.0	±	1.4	0.00	0.79
Being independent in daily activities	1.5	±	0.9	3.0	±	1.9	0.08	<.0001
Living in calm circumstances	5.4	±	1.4	5.4	±	1.2	0.01	0.54
Being valued as a person	6.0	±	1.0	6.0	±	1.0	0.01	0.51
Feeling that one’s life was completed	4.1	±	1.9	4.7	±	1.7	0.04	<.0001
Receiving enough treatment	4.7	±	1.6	4.9	±	1.5	0.01	0.08
Dying a natural death	4.9	±	1.7	5.0	±	1.5	0.01	0.30
Saying what one wants to dear people	3.4	±	1.9	4.5	±	1.6	0.07	<.0001
Knowing what to expect about one’s condition in the future	3.5	±	1.8	4.4	±	1.7	0.06	<.0001
Dying without awareness that one is dying	3.7	±	1.7	3.5	±	1.6	0.01	0.28
Not exposing one’s physical and mental weakness to family	4.5	±	1.5	4.6	±	1.5	0.00	0.55
Feeling that one’s life is worth living	4.4	±	1.4	4.8	±	1.3	0.01	0.001
Supported by religion	2.7	±	1.8	2.9	±	1.8	0.01	0.08
Total score of 18 items	77.3	±	14.8	82.6	±	13.8	0.04	<.0001

GDI: Good Death Inventory; SD: standard deviation; ES: effect size

Table 3
Results of multivariate linear regression analysis

	β	p	Adjusted R ²
Being able to stay in one's favorite place	-0.02	0.03	0.02
Trusting physician	-0.02	0.003	0.002
Not being a burden to others	-0.01	0.09	0.03
Being independent in daily activities	-0.02	0.01	0.02
Feeling that one's life was completed	0.01	0.41	0.01
Saying what one wants to dear people	-0.01	0.42	0.03
Knowing what to expect about one's condition in the future	-0.001	0.86	0.03
Feeling that one's life is worth living	-0.02	0.001	0.04
Total score of GDI	-0.03	< .0001	0.02
Adjusted by patient age, duration of last administration, bereaved family members' relationship to the deceased.			
GDI: Good Death Inventory			

Finally, interactions were examined by two-way analysis of variance to determine whether the factors associated with the GDI in patients with malignant brain tumors differed from those in other cancer patients, and there were no significant differences in the interaction terms.

Discussion

This study examined the differences in sociodemographic characteristics, the quality of dying, and factors related to the quality of dying between patients with malignant brain tumors and those with other malignant diseases. The major findings were: 1) patients with malignant brain tumors were younger, the last stays in PCUs were longer, and primary caregivers were more often parents; and 2) regarding quality of dying, the total GDI score and 4 items from the GDI scale, namely, "Being able to stay in one's favorite place", "Trusting physician", "Being independent in daily activities", and "Feeling that one's life is worth living," were significantly lower in the malignant brain tumor group than in the other cancer group. To the best of our knowledge, this is the first large-sample study that focused on the quality of dying of primary malignant brain tumor patients and compared them with patients with other cancers.

First, in the present study, patients in the brain tumor group were younger and had a longer PCU stay during their EOL period than the other cancer group. The results of this study may reflect the characteristics of patients with primary malignant brain tumors. Malignant brain tumors generally affect younger patients and have a lower 5-year survival rate [2]. Regarding the longer stay in PCUs, the poor activities of daily living of the patients and the difficulty choosing home care due to the caregiver burden

on the family may have affected the PCU length of stay. Several studies have reported that the decreased functional independence of malignant brain tumor patients leads to their hospitalization more often than other patients with cancer [19–21]. In addition, a higher percentage of patients' parents and spouses were their primary caregivers. This might be due to the younger age of patients in the brain tumor group. Spouses and parents of patients have been reported to suffer more in their grieving process over bereavement than other relatives (e.g. child of deceased, siblings) [22]. Moreover, some studies have reported that the deceased patient's poor quality of dying and higher care burden may lead to pathological grief in their caregivers [9, 23–26]. Future research should clarify the impact of the relationship between the brain tumor patient and the primary caregiver on grief and depression of the bereaved.

Second, there were significantly lower scores overall and for a few items of the GDI in patients with primary malignant brain tumors. These results are consistent with previous findings that the QOL of patients with primary malignant brain tumors tends to be lower than in other cancer patients [1, 4, 13, 15], which may lead to a lower evaluation of the quality of dying. Most patients with primary malignant brain tumors have a decreased level of consciousness more than one month before death and a loss of independence [19]. These characteristics may have been reflected in the present results, with the lower scores for "Being independent in daily activities" and "Feeling that one's life is worth living". These two items are items that are also related to personal dignity. Chochinov et al. stated that personal dignity may be influenced by factors including the patient's independence, concerns regarding symptom distress, autonomy, spiritual well-being, and ability to communicate effectively with others. [27–30]. Personal dignity is considered to be important for improving quality of dying; therefore, we believe that care that values personal dignity is necessary to improve the quality of dying of brain tumor patients. Sizoo et al. suggested the importance of satisfaction with the physician providing EOL care and communication ability during EOL care for a dignified death in high-grade glioma patients [31]. In the present results, the score for "trusting physician" was lower in the malignant brain tumor group, which suggests that there may be room for improvement.

In addition, the present results suggest that patients with primary malignant brain tumors tend to have difficulties regarding staying or dying in their preferred place. This might reflect the difficulty in EOL discussions in primary malignant brain tumor patients, which previous studies have pointed out [15, 32]. However, the target of the present study was patients who died in PCUs. In most facilities in Japan, one of the criteria for admission to a PCU is that the patient and his/her family have been informed of the disease and the severity of the condition, and that the patient desires and agrees to be admitted to the ward where basically no aggressive cancer treatments are provided [33]. Therefore, the difficulty of primary malignant brain tumor patients of dying in their preferred place may be underestimated, and in other general settings, more patients might not achieve death in their preferred place. Studies have reported that EOL decision-making is often a challenge for primary malignant brain tumor patients [10, 15, 32]. This is due to the typical symptoms of malignant brain tumor that affect communication from an early stage of the disease. Therefore, early EOL discussion and decision-making are needed. However, studies have shown that primary physicians tend to avoid disclosing the exact diagnosis, especially their

severe prognosis to patients with malignant brain tumor [34]; in addition, they frequently did not discuss EOL preferences with their patients [32]. Previous studies of cancer patients have shown that patients who engage in EOL discussions tend to receive care consistent with their wishes, and that the quality of EOL care and the QOL of patients and caregivers are improved [35–37]. Healthcare providers need to consider timely interventions such as providing appropriate information to patients and their families so that they can have adequate discussions and make decisions regarding their EOL care preferences.

Limitations

Several limitations of this study warrant consideration. First, this study involved patients with primary malignant brain tumors who died in a hospice/palliative care ward. Patients admitted to a hospice/palliative care ward were likely to have been able to discuss their EOL wishes, including expressing their intention to enter the ward. This may have positively affected the quality of care received by the patients and their assessment of achieving a desired death. Second, background factors of patients with brain tumors, such as the grade of the brain tumor, the time when the level of consciousness decreased, and the time when the physical function (performance status) decreased were not examined. Third, bereaved families who were in a significantly worse physical or mental condition may not have participated in the study. Fourth, because this was a cross-sectional study based on a survey at a single point in time, causal inferences between variables cannot be made. Fifth, recall bias may have occurred in the evaluation of patients, such as the quality of care and achievement of desired death, because the bereaved family members evaluated them in retrospect as proxies. However, the bereaved family survey is a valid method for evaluating end-of-life care because terminally patients with cancer are too ill to participate in the surveys[38]. The sixth issue is the representativeness of the subjects in this study. Among the member facilities of the Japan Hospice and Palliative Care Association, it can be assumed that those facilities that are particularly active in evaluating care and providing feedback on the results participated in this study. This may have affected their involvement with patients and bereaved families before and after bereavement, and their outcomes.

Conclusion

This study showed that the quality of dying of patients with malignant brain tumors was lower than that of patients with other cancers. In particular, the following four items were significantly lower: “Being able to stay in one’s favorite place”; “Trusting physician”; “Being independent in daily activities”; and “Feeling that one’s life is worth living.” These results suggest the necessity of reviewing care practices for patients with malignant brain tumors according to their characteristics. Care practices that value personal dignity and early EOL decision-making can be more important to improve the quality of dying in patients with malignant brain tumors. Future studies may be needed to establish EOL care suited to patients with malignant brain tumors and evaluate their effects on the quality of dying.

Statements And Declarations

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Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Author Contributions

All authors contributed to the study conception and design. Material preparation, and data collection and analysis were performed by Maho Aoyama, Kento Masukawa, and Ikuko Sugiyama. The first draft of the manuscript was written by Maho Aoyama, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval

This study was approved by the institutional review boards of Tohoku University (J-HOPE3: No. 2013-1-334; J-HOPE4: No. 2018-2-290) and all participating institutions.

Consent to participate

A document explaining the aim and procedure of this study was sent along with questionnaire, and the return of a completed questionnaire was considered as consent to participate in this study.

Consent to publish

Not applicable.

References

1. Stahl P et al (2020) Health-related quality of life and emotional well-being in patients with glioblastoma and their relatives. *J Neurooncol* 149(2):347–356

2. Gately L et al (2017) Life beyond a diagnosis of glioblastoma: a systematic review of the literature. *J Cancer Surviv* 11(4):447–452
3. Barbaro M et al (2022) Causes of Death and End-of-Life Care in Patients With Intracranial High-Grade Gliomas: A Retrospective Observational Study. *Neurology* 98(3):e260–e266
4. Giammalva GR et al (2018) *End-of-Life Care in High-Grade Glioma Patients. The Palliative and Supportive Perspective*. *Brain Sci*, 8(7)
5. Philip J et al (2018) A proposed framework of supportive and palliative care for people with high-grade glioma. *Neuro Oncol* 20(3):391–399
6. Pace A et al (2017) European Association for Neuro-Oncology (EANO) guidelines for palliative care in adults with glioma. *Lancet Oncol* 18(6):e330–e340
7. Walbert T (2014) Integration of palliative care into the neuro-oncology practice: patterns in the United States. *Neurooncol Pract* 1(1):3–7
8. Gofton TE, Graber J, Carver A (2012) Identifying the palliative care needs of patients living with cerebral tumors and metastases: a retrospective analysis. *J Neurooncol* 108(3):527–534
9. Sterckx W et al (2013) The impact of a high-grade glioma on everyday life: a systematic review from the patient's and caregiver's perspective. *Eur J Oncol Nurs* 17(1):107–117
10. Crooms RC et al (2020) *Palliative Care in High-Grade Glioma: A Review*. *Brain Sci*, 10(10)
11. Donabedian A (1988) The quality of care. How can it be assessed? *JAMA* 260(12):1743–1748
12. Donabedian A (1988) Quality assessment and assurance: unity of purpose, diversity of means. *Inquiry* 25(1):173–192
13. Sizoo EM et al (2014) Measuring health-related quality of life in high-grade glioma patients at the end of life using a proxy-reported retrospective questionnaire. *J Neurooncol* 116(2):283–290
14. Patrick DL, Engelberg RA, Curtis JR (2001) Evaluating the quality of dying and death. *J Pain Symptom Manage* 22(3):717–726
15. Sizoo EM et al (2014) The end-of-life phase of high-grade glioma patients: a systematic review. *Support Care Cancer* 22(3):847–857
16. Aoyama M et al (2017) The Japan HOspice and Palliative Care Evaluation Study 3: Study Design, Characteristics of Participants and Participating Institutions, and Response Rates. *Am J Hosp Palliat Care* 34(7):654–664
17. Masukawa K et al (2018) The Japan hospice and palliative evaluation study 4: a cross-sectional questionnaire survey. *BMC Palliat Care* 17(1):66
18. Miyashita M et al (2008) Good death inventory: a measure for evaluating good death from the bereaved family member's perspective. *J Pain Symptom Manage* 35(5):486–498
19. Oberndorfer S et al (2008) The end-of-life hospital setting in patients with glioblastoma. *J Palliat Med* 11(1):26–30
20. Sizoo EM et al (2014) Seizures in patients with high-grade glioma: a serious challenge in the end-of-life phase. *BMJ Support Palliat Care* 4(1):77–80

21. Pace A et al (2009) End of life issues in brain tumor patients. *J Neurooncol* 91(1):39–43
22. Stroebe M, Schut H, Stroebe W (2007) Health outcomes of bereavement. *Lancet* 370(9603):1960–1973
23. Fujisawa D et al (2010) Prevalence and determinants of complicated grief in general population. *J Affect Disord* 127(1–3):352–358
24. Aoyama M et al (2018) Factors associated with possible complicated grief and major depressive disorders. *Psychooncology* 27(3):915–921
25. Miyajima K et al (2014) Association between quality of end-of-life care and possible complicated grief among bereaved family members. *J Palliat Med* 17(9):1025–1031
26. Finocchiaro CY et al (2012) The burden of brain tumor: a single-institution study on psychological patterns in caregivers. *J Neurooncol* 107(1):175–181
27. Chochinov HM (2013) Dignity in care: time to take action. *J Pain Symptom Manage* 46(5):756–759
28. Chochinov HM et al (2007) Burden to others and the terminally ill. *J Pain Symptom Manage* 34(5):463–471
29. Chochinov HM (2002) Dignity-conserving care—a new model for palliative care: helping the patient feel valued. *JAMA* 287(17):2253–2260
30. Chochinov HM et al (2002) Dignity in the terminally ill: a developing empirical model. *Soc Sci Med* 54(3):433–443
31. Sizoo EM et al (2013) The end-of-life phase of high-grade glioma patients: dying with dignity? *Oncologist* 18(2):198–203
32. Sizoo EM et al (2012) Decision-making in the end-of-life phase of high-grade glioma patients. *Eur J Cancer* 48(2):226–232
33. Tsuneto S (2013) Past, present, and future of palliative care in Japan. *Jpn J Clin Oncol* 43(1):17–21
34. Yamamoto F et al (2011) A survey of disclosure of diagnosis to patients with glioma in Japan. *Int J Clin Oncol* 16(3):230–237
35. Wright AA et al (2008) Associations between end-of-life discussions, patient mental health, medical care near death, and caregiver bereavement adjustment. *JAMA* 300(14):1665–1673
36. Wright AA et al (2010) Influence of patients' preferences and treatment site on cancer patients' end-of-life care. *Cancer* 116(19):4656–4663
37. Mack JW et al (2010) End-of-life discussions, goal attainment, and distress at the end of life: predictors and outcomes of receipt of care consistent with preferences. *J Clin Oncol* 28(7):1203–1208
38. Teno JM (2005) Measuring end-of-life care outcomes retrospectively. *J Palliat Med* 8(Suppl 1):S42–S49