

Yoga Program for High-Grade Glioma Patients Undergoing Radiotherapy and Their Family Caregivers

Integrative Cancer Therapies
2018, Vol. 17(2) 332–336
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DOI: 10.1177/1534735417689882
journals.sagepub.com/home/ict


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Abstract

Background: Despite their high symptom burden and poor prognosis, evidence-based supportive care interventions for adults with high-grade glioma (HGG) and their caregivers are lacking. Thus, we aimed to establish feasibility of a patient-caregiver dyadic yoga program (DYP) for newly diagnosed HGG patients and their family caregivers targeting quality-of-life (QOL) outcomes. **Method:** In this single-arm pilot trial, dyads participated in a 12-session DYP program across the course of patients' radiotherapy. The intervention focused on breathing exercises, gentle movements, and guided meditations. We tracked feasibility data and assessed levels of cancer-related symptoms (MD Anderson Symptom Inventory [MDASI]), depressive symptoms (Centers for Epidemiological Studies-Depression scale), fatigue (Brief Fatigue Inventory), sleep disturbances (Pittsburgh Sleep Quality Index [PSQI]), and overall mental and physical QOL (36-item Short-Form Survey [SF-36]) at baseline and post-DYP, which was at the end of radiotherapy. **Results:** We approached 6 dyads of which 5 dyads (86%) consented and completed all 12 sessions and pre/post assessments. All patients (mean age: 52 years, 80% female, 80% grade IV) and caregivers (mean age: 58 years, 80% female, 60% spouses) perceived benefit from the program. Paired *t* tests revealed a marginally significant, yet clinically meaningful, decrease in patient's cancer symptoms ($t = 2.32$, $P = .08$; MDASI mean; pre = 1.75, post = 1.04). There were clinically significant reductions in patient sleep disturbances (PSQI mean: pre = 10.75, post = 8.00) and improvements in patient and caregiver mental QOL (MCS of SF-36 mean: pre = 42.35, post = 52.34, and pre = 45.14, post = 51.43, respectively). **Conclusions:** This novel supportive care program appears to be safe, feasible, acceptable, and subjectively useful for HGG patients and their caregivers. There was also preliminary evidence regarding QOL treatment gains for both patients and caregivers.

Keywords

high-grade glioma, family caregivers, dyadic intervention, quality of life, yoga

Submitted September 12, 2016; accepted December 5, 2016

Introduction

Although adults with high-grade glioma (HGG) experience high symptom burden, evidence-based supportive care interventions are generally lacking. Fatigue and sleep disturbances are reported in 60% to 100% of HGG patients; clinical depression rates are as high as 38% and 95% for experiencing depressive symptoms, and 50% of this population experiences neuropsychological deficits.¹⁻³ A high symptom burden is associated with poor quality of life (QOL) as well as a high need of care and support from their family. Caregiving is emotionally and physically taxing, and family caregivers report clinical levels of anxiety, depression, sleep disturbances, and fatigue at similar to patient

rates.^{4,5} Given the high symptom burden in both patients and caregivers, a *dyadic* supportive care approach may be beneficial beyond patient-oriented interventions that are the standard of care.^{6,7} Thus, we seek to examine the feasibility and preliminary efficacy of a dyadic yoga program (DYP) in 5 HGG patients and their caregivers. Yoga, an ancient

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mind-body practice that targets physical, psychological, and spiritual health, may be an especially beneficial supportive care strategy given the multifaceted needs of HGG patients. It has been shown to improve physical, psychological, and even cognitive symptoms mainly in patients with breast cancer.⁸⁻¹¹ Thus, there is reason to believe that an Indian yoga program comprising *asanas* (postures done with awareness), *pranayama* (voluntarily regulated nostril breathing exercises), and meditation and relaxation techniques might be ideal to manage the complex symptom burden of HGG. Using a single-arm design, we incorporated this program into patients' standard radiotherapy (RT) treatment plans, as the program may be particularly useful at this time to buffer treatment side effects and psychological distress that ensues.

Methods

Participant Eligibility

Patients had to have a (1) diagnosis of HGG to be treated with a minimum of 4 weeks of RT treatments, (2) Karnofsky Performance Status of ≤ 80 , and (3) family caregiver (eg, spouse, sibling, adult child) who is willing to participate. Both patients and caregivers had to be (1) at least 18 years old, (2) able to read and speak English, and (3) able to provide informed consent. Exclusion criteria included the following: (1) regularly (self-defined) participated in a yoga practice in the year prior to diagnosis, (2) had a physician-rated life expectancy of less than 6 months, and (3) experienced cognitive deficits that would impede the completion of self-report instruments as determined by the treating clinical team.

Procedure

Prior to enrollment, the MD Anderson Institutional Review Board approved all procedures. Research staff identified potentially eligible patients through the institution's electronic medical records system. During clinic visits, research staff approached patients and caregivers, ensured study eligibility, and obtained written informed consent prior to data collection. Both patients and caregivers completed survey measures within the first week of patients' RT (T1) and during the last week of RT (T2). Feasibility data were tracked over the course of the study. Participants received a \$20 gift card after each completed assessment.

DYP Program

Dyads attended 2 or 3 weekly session (60 minutes each) over the course of patients' 5 to 6 weeks of RT. This dosage was based on our previous investigation with couples coping with lung cancer.¹² All sessions were attended by both members of the dyad. The intervention was implemented by

a certified yoga instructor. Vivekananda Yoga is an integrated yoga program consisting of a combination of a set of *asanas*, *pranayama*, meditation, and yogic relaxation that are based on principles of stimulation and relaxation taken from ancient Indian texts called *Upanishads*. These practices are interspersed with the goal of creating greater relaxation and internal awareness so that participants develop insight in recognizing inherent tensions and stress responses and learn ways to relax them.¹³ The program consisted of 4 main components: (1) joint loosening with mindfulness training, (2) *asanas* with deep relaxation techniques, (3) *pranayama* with sound resonance, and (4) meditation/guided imagery focusing on love and compassion for self and family caregiver and acceptance of change (within self, the relationship, and physical functioning). With this traditional Indian yoga practice in mind, the underlying philosophy of this dyadic intervention was based on the principles of interdependence: reciprocal support, teamwork, and equity, which were interwoven in all aspects of the program (eg, partner and partner-facilitated postures, physical touch). Sessions 1 to 4 focused on gradually introducing the various practices. The remaining sessions (session 5-12) focused on refining the skills and answering questions related to the program and participants' experiences. Practices included available modifications based on participants' physical limitations. Starting with session 1, instructors conveyed the notion that the practice is intended to target the needs of *both* members of the dyad. Participants received printed materials at session 1 and a DVD with the entire program at session 5. Dyads were encouraged to practice on their own (individually and/or together) on the days when they do not meet with the instructor. All sessions were video-recorded to ensure treatment fidelity.

Measures

Both patients and caregivers completed the following standard self-report symptom and QOL measures at T1 and T2. Patients completed the MD Anderson Symptom Inventory (MDASI) consisting of 13 items assessing *symptom severity* and 6 items assessing *symptom interference* with daily life.¹⁴ The total and subscale scores are presented here, and Cronbach's α of the total score for this sample is .78. *Depressive symptoms* were assessed with the Centers for Epidemiological Studies–Depression measure (CES-D; $\alpha = .92$). A score of ≥ 16 is considered the cutoff to screen for depressive disorder.¹⁵ *Sleep disturbances* were assessed using the Pittsburgh Sleep Quality Index (PSQI), an 18-item questionnaire that assesses various domains of sleep. The total score is presented here with a Cronbach's α of .90. A global score of > 5 indicates clinically significant sleep disturbances.¹⁶ *Fatigue* was assessed using the 9-item Brief Fatigue Inventory (BFI; $\alpha = .88$). Higher scores on these measures denote greater symptom burden. A score of > 3

indicates clinically significant fatigue.¹⁷ Overall *QOL* was measured with the Medical Outcomes Study 36-item Short-Form Survey (SF-36), which assesses 8 distinct domains of *QOL* yielding mental and physical composite summary scores (MCS and PCS with Cronbach's α s of .85 and .75, respectively).¹⁸

Sample Characteristics and Feasibility Data. Demographic items (eg, age, education, race/ethnicity, etc) were included in the baseline questionnaires. Patients' medical data were extracted from their medical records. Feasibility data were kept regarding consent rates, class attendance, completion of questionnaires, and attrition. Participants completed weekly program evaluations assessing perceived benefit, usefulness, and exertion pertaining to skills covered that week. Data on home practice were also collected on a weekly basis.

Data Analyses

We calculated descriptive statistics of consent rate, class attendance, assessment completion, and program evaluations and examined paired (pre/post) *t* test-analyses separate for patients and caregivers for each outcome. We calculated Cohen's *d* for each paired difference by dividing the mean difference by the standard deviation of the difference and interpreted the effect size in terms of Cohen's taxonomy ("small" effect, $d \leq 0.2$; "medium" effect, $d \leq 0.5$; and "large" effect, $d \leq 0.8$).¹⁹ We examined clinically meaningful changes based on recommendations in the literature of a difference of 0.5 SD in the pre/post assessment.

Results

Recruitment and Sample Characteristics

Five of 6 consecutive and eligible dyads approached consented (83%) and 100% completed the DYP program. One couple refused participation due to a lack of interest. Sample characteristics for patients and caregivers are shown in Table 1. Briefly, patients (mean age: 52 years) were primarily female ($n = 4$), Hispanic ($n = 3$), had grade IV disease ($n = 4$), and participated with their spouse ($n = 3$). Caregivers were mainly female ($n = 3$), Hispanic ($n = 4$), with a mean age of 58 years. Regarding symptom burden at baseline, 2 patients met clinical cutoffs for depressive symptoms, and all patients and caregivers met clinical cutoffs for sleep disturbances.

Session Attendance, Perceived Benefit, and Program Evaluation

All dyads completed all 12 DYP sessions. Each week, participants practiced a mean of 1.63 times (SD = 1.31; range 0-4) outside of class instruction. Participants rated

Table 1. Patient and Caregiver Demographics and Patient Medical Factors.

Variable	Patient (n = 5)	Caregiver (n = 5)
Gender, n (%)		
Female	4 (80)	3 (60)
Mean age, years \pm SD (range)	51.94 \pm 20.20 (20-69)	58.16 \pm 10.15 (48-73)
Length of marriage if married to caregiver, years \pm SD (range)	37.18 \pm 12.44 (23-44)	
Ethnicity, n (%)		
Non-Hispanic/White	1 (20)	1 (20)
Latino/Hispanic	3 (60)	4 (80)
Missing	1 (20)	0
Highest level of education, n (%)		
Some college or higher	4 (80)	5 (100)
Household income, n (%)		
50000 or more	3 (60)	4 (60)
Declined to answer	2 (40)	1 (20)
Employment status, n (%)		
Full-time	0	1 (20)
Retired	2 (40)	1 (20)
Missing	1 (20)	0
Time since diagnoses, months \pm SD (range)	4.17 \pm 3.35 (1.86-10.0)	
WHO grade, n (%)		
IV	4 (80)	
KPS, n (%)		
90	4 (80)	

Abbreviations: SD, standard deviation; WHO, World Health Organization; KPS, Karnofsky Performance Status.

the program as "very useful" (67%) or "useful" (33%). All participants indicated that each aspect of the practice (ie, breathing exercises, physical exercises, relaxation, and meditation) was beneficial. On a 0 to 10 Borg Rating of Perceived Exertion Scale, participants rated the sessions from "really easy" to "moderate" effort (patients: mean = 2.00, SD = 1.00; caregivers: mean = 2.20, SD = 0.84).

Preliminary Efficacy Findings

Table 2 presents means and standard deviations for each outcome measure at T1 and T2 as well as paired *t* test results, *P* values, and effect sizes for patients and caregivers. For patients, paired *t* tests revealed statistically marginal yet clinically statistical improvements in MDASI total score ($d = 1.03$) and PSQI scores ($d = 1.17$). There were also clinically significant improvements in the MCS ($d = 0.60$). Effects for CES-D was medium. Caregivers also reported a clinically significant reduction in perceived patients' MDASI scores ($d = .67$). Caregivers had clinically significant improvements in MCS ($d = 0.64$), yet they had

Table 2. Raw Means of Outcomes at Each Assessment Point and Paired *t* Tests and Effect Sizes for Patients and Caregivers.

Measure	Patients							Caregivers						
	Baseline		Post Program		<i>t</i>	<i>P</i>	<i>d</i>	Baseline		Post Program		<i>t</i>	<i>P</i>	<i>d</i>
	Mean	SD	Mean	SD				Mean	SD	Mean	SD			
BFI	1.49	1.02	1.51	1.64	-0.03	.98	0.02	1.07	.73	1.42	1.30	-0.49	.65	0.21
CES-D	15.80	6.1	13.81	4.99	1.32	.26	0.59	12.00	2.34	14.40	1.14	-2.33	.08	1.04*
MDASI	1.78	1.33	1.04	0.93	2.32	.08	1.03*	2.31	1.75	1.67	0.98	1.49	.20	0.67
MDASI-SS	1.66	1.44	1.28	1.06	1.79	.15	0.81*	2.09	1.49	1.20	.87	2.77	.05	1.25*
MDASI-Int	1.77	1.57	0.37	0.58	1.77	.15	0.79	2.4	2.77	1.77	1.15	0.71	.51	0.32
MCS	42.35	22.43	52.34	7.00	-1.35	.25	0.60	45.14	8.04	51.43	6.39	-1.45	.22	0.64
PCS	50.03	13.68	50.56	8.91	-0.14	.88	0.07	57.51	3.95	55.83	4.34	1.07	.34	0.48
PSQI	10.75	2.06	8.00	1.41	-1.35	.10	1.17*	10.40	2.07	11.20	3.03	-1.09	.34	0.49

Abbreviations: *d*, Cohen's *d* (small effect, $d \leq 0.2$; medium effect, $d \leq 0.5$; and large effect, $d \leq 0.8$).¹⁹ BFI, Brief Fatigue Inventory; CES-D, Centers for Epidemiological Studies–Depression; MDASI, MD Anderson Symptom Inventory Core Symptoms and Interference Total Score; MDASI-SS, MDASI Core Symptom Severity Subscale; MDASI-Int, MDASI Interference Subscale; MCS, SF-36 Mental Health Component Summary; PCS, SF-36 Physical Health Component Summary; PSQI, Pittsburgh Sleep Quality Index.

*Significant paired *t* test at $P \leq .1$.

marginally significant increases in CES-D scores. Other effects, albeit not clinically or statistically significant, were in the opposite direction, indicating small deterioration in PCS, PSQI, and BFI scores.

Discussion

The primary purpose of this pilot study was to examine the feasibility a couple-based yoga program for patients with HGG undergoing RT and their caregivers. Results suggested that it was feasible to successfully incorporate a dyadic intervention into patients' 6-week RT treatment plan as supported by adequate consent, retention, and adherence rates. The program was also well accepted with all participants rating it as useful, beneficial, and efficacious in improving their overall well-being. Considering the historically high symptom burden of brain tumor patients, the program was well tolerated and no adverse events were reported. Of note, the program was implemented by a certified yoga instructor with extensive experience in working with cancer patients. Patients should only be instructed by certified practitioners to ensure safety. Our findings also suggest preliminary intervention efficacy. For patients, we revealed a clinically significant reduction in cancer-related symptoms as well as sleep disturbances with observed large effect sizes. Caregivers shared the perception of a reduction in patient cancer symptoms. We also found clinically significant improvements in patient mental QOL in addition to medium effect sizes for indicators of psychological distress. For caregivers, although a significant improvement in mental QOL was revealed (medium effect), there was a worsening in various measures of QOL, particularly depressive symptoms.

While the intervention may result in improved aspects of QOL and buffering deterioration for patients and possibly for caregivers, without comparison to a usual care control group conclusions regarding efficacy cannot be drawn from these data. Patients may improve as a function of time, although this is unlikely given RT-related toxicities.²⁰ Only a randomized controlled trial design with adequate statistical power and control group(s) can establish treatment efficacy. It is interesting that caregiver's mental aspect of QOL improved while there was also evidence for an increase in depressive symptoms. Possibly, because the intervention taught mindfulness and acceptance skills, caregivers may have experienced anticipatory grief associated with coming to terms with the poor prognosis of HGG. In addition to lack of control group, the sample size was very small limiting the robustness of reported means. The sample had a high performance status, and it is unknown how patients with a lower status would tolerate the intervention. Although the current sample included minorities, our participant population had a high level of education and household income.

In conclusion, a dyadic mind-body intervention delivered to glioma patients and caregivers while undergoing RT was feasible and potentially effective. This novel intervention study laid the important initial groundwork for examining the role of dyadic behavioral interventions in the symptom management of glioma patients. Development of a randomized controlled trial is warranted to establish treatment efficacy in HGG. Future research designs that compare this yoga therapy either head-to-head or jointly with Western-based behavioral medicine including neurocognitive rehabilitation, neurorehabilitation, education, and cognitive behavioral therapy²¹⁻²⁴ may be of particular interest as these modalities are currently considered the standard of care.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: NIH/NCCIH 1 K01 AT007559, Principal Investigator: Kathrin Milbury.

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