Understanding sleep disturbance in the context of malignant brain tumors: a qualitative analysis

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Abstract

Background. Sleep is an important element in health-related quality of life of cancer patients and caregivers. This study aimed to explore the experience of sleep disturbance in people with malignant brain tumors (BT) and their family caregivers.

Methods. Participants were recruited from ambulatory neuro-oncology clinics. Semi-structured interviews were conducted with 24 patients (67% with high-grade gliomas) and 14 caregivers. Data were analyzed thematically using a framework synthesis.

Results. We identified six themes relating to perceptions of the nature, impact, causal factors, and interventions for sleep disturbance, beliefs about sleep and impact, and personal coping strategies. Participants described their sleep disturbance in terms of insomnia symptoms; most commonly difficulties initiating and maintaining sleep. Participants had varied views on causal factors including the BT diagnosis and treatment and caregiver burden. However, excessive thinking and BT-related anxiety were evident in both patients and caregivers. The described impact on daytime functioning due to non-restful sleep and fatigue appeared to be significant and many participants needed daytime naps, although they understated the impact on individual functioning. Some participants were reluctant to seek help from clinicians for sleep disturbance due to previous experiences where sleep disturbance was overlooked, or because they held negative views toward pharmacological interventions. Participants reported various coping strategies, ranging from relaxation-promoting techniques to behaviors to distract thinking at night that may instead disturb sleep.

Conclusions. Psychological factors contribute to sleep disturbance in patients with BT and caregivers. This population may benefit from information about sleep disturbance and interventions targeting anxiety.

Keywords

sleep disturbance | glioma | brain tumor | caregivers | supportive care

Sleep disturbance is an important element of health-related quality of life (HRQoL). Sleep disturbance refers to a perceived or actual disturbance in sleep quantity, pattern, quality, and/or movement during sleep resulting in dissatisfaction and interference during the daytime.¹ Its impact on the immune system, cognitive functioning, physical and psychological health, and a sense of well-being is more profound in people with chronic medical conditions, including cancer.²⁻⁴

Although sleep disturbance is increasingly recognized as a stand-alone issue, sleep disturbance in people with brain tumors (BT) remains under-explored. The presence of sleep disturbance, evident within the HRQoL outcomes of many clinical trials in people with malignant BT, may not be explained by mechanisms of disrupted sleep seen in benign BT affecting the neural substrates involved in the regulation of sleep.⁵ The most severe and common problems in BT are a symptom cluster of sleep disturbance, fatigue, and daytime drowsiness⁵ also linked to reduced quality of life and overall survival.⁶ Sleep in people with malignant BT is complex with many possible etiological factors related to both general impacts of a cancer diagnosis and factors unique to BT (eg, cranial irradiation, rapid progression, intracranial pressure, or corticosteroids).^{7,8} However, the patterns and impact of sleep disturbance for people with BT are not well understood. There is even less information on sleep disturbance of family caregivers.

This study explores the experience and perceived impact of sleep disturbance in people with primary or secondary (metastatic) malignant BT and their family caregivers from the qualitative component of our mixed-method study investigating the prevalence and risk factors for sleep disturbance in this population.

Materials and Methods

These qualitative data were collected as part of a cross-sectional, mixed-method study consisting of a series of self-reported outcome measures. Participant recruitment, study procedures, and quantitative results have been described elsewhere.⁹ Local health districts' human research ethics approval was obtained. The research team comprised six females including: one palliative care specialist and researcher, one psycho-oncology researcher, one psychology-trained doctorate candidate, two medical oncologists, and one radiation oncologist, experienced in clinical and/or qualitative research.

Participants

Eligible participants were aged 18 years or more with a confirmed diagnosis of a primary malignant or metastatic BT who were able to complete the study independently in English; and their primary adult (18+ years) family caregivers also required sufficient English skills. We used "participants" to refer to the whole group; otherwise, "patient" or "caregiver" is used instead.

Procedures

We recruited participants from four outpatient cancer centers in Sydney and Perth, Australia, from November 2015 to March 2018. Participants were introduced to the main study and offered an optional interview as part of the study. Participants who consented to participate in both components were contacted for the interview after they completed the questionnaires. Of 81 patients and 44 caregivers who participated in the main study, 24 patients and 14 caregivers were interviewed by the researcher (M.S.J.) in person or via telephone. All caregivers and 22 of 24 patients were interviewed without another person present; two patients required occasional assistance from their caregiver in explaining the question(s) or finding words as part of their answer.

Interview Schedule

The primary objective was to explore the sleep experience of patients and caregivers, including their perceptions of the nature and impact of sleep disturbance, potential etiological factors, and views on treatment options for sleep disturbance. Participants were identified as good sleepers or poor sleepers based on the Pittsburgh Sleep Quality Index (PSQI) global score (the PSQI global score of >5 identified the presence of sleep disturbance).¹⁰ Interviews were guided by the semi-structured interview schedule corresponding to group assignment ([Supplementary Table 1](#)).

Analysis

Stratified purposive sampling was used to ensure a range of experiences were explored. Participant recruitment continued until data saturation was achieved.¹¹ Data saturation can be assured if three further interviews do not generate new themes.¹² Around 8-10 interviews per group ("good sleepers" [patients], "poor sleepers" [patients], and "caregivers") were deemed sufficient.¹³ Each interview was audio-recorded and transcribed verbatim. We used thematic analysis with the application of a framework synthesis.¹⁴ We identified *a priori* themes relevant to the research questions and theoretical framework, and inductively identified themes arising from the data via indexing, sorting, and developing thematic categories using the framework matrix chart.¹⁴⁻¹⁶ The transcripts were blind, double-coded, and thematic matrix charts developed by two researchers (M.S.J.; H.M.D.). All authors had a role in data synthesis and interpretation. All qualitative data analysis was managed in Microsoft Excel and NVivo qualitative data analysis software (QSR International v12 Pro, 2019). We followed the consolidated criteria for reporting qualitative research (COREQ) guideline.¹⁷

Results

A total of 38 (24 patients and 14 caregivers) interviews were conducted with individual participants. The median duration of interviews was 12 minutes (range = 6-36).

Demographic and clinical details are presented in Table 1. The majority of patients were male (58%), married (88%), had diagnosis of high-grade gliomas (ie, grades 3-4; 67%), and were receiving chemotherapy at the time of interview (63%). Their mean age was 53 years (SD = 12.9) and median duration since diagnosis 21 months (range = 2-384). Caregivers were mostly female (64%) and retired or on leave from paid employment (64%). Their mean age was 59 years (SD = 11.3) and median duration of care 13 months (range = 3-72). Sixteen patients (67%) and 10 caregivers (71%) were identified as poor sleepers through the PSQI cutoff of >5.

We identified six key themes related to patterns of sleep disturbance, perceptions of impact of sleep disturbance, causal factors, and seeking help from healthcare professionals for sleep, beliefs about quality sleep, and coping strategies. Each theme is discussed below and depicted in Table 2 with exemplar quotations.

Description and Patterns of Sleep Disturbance

Patterns of sleep (poor, good, or changed)

Patterns of sleep disturbance described by most participants were insomnia symptoms, such as difficulty initiating sleep, difficulty maintaining sleep (broken or light sleep), and early sleep termination (waking up in earlier than desired). Frequent nocturnal urination was given as a reason for waking at night, though many participants did not attribute waking to a specific cause. Participants reported poor sleep quality, noted as difficulty getting up in the morning, and feeling tired upon waking. Some patients described night-time restlessness, both psychological and physical, as a reason for getting out of bed and moving around at home. BT diagnosis did not appear to worsen sleep disturbance for those with existing sleep disturbance, and few others continued to be good sleepers. However, some patients described their sleep-wake time had shifted earlier than pre-diagnosis.

Sleep was influenced by multiple factors

Participants described a range of factors as contributors to sleep disturbance, from external and seasonal disturbances (warm weather, noise, snoring, and other disturbance from bed partner), symptoms of BT (hemiparesis, pain, or headache), to comorbid illness (breathing difficulty, menopause, itchy or aching body, mood disturbance, or medications). Daytime physical activity and physical exhaustion were reported to make both patients and caregivers fall asleep quickly.

Caregiver burden affecting sleep

Caregiver sleep was affected by the patient's condition and sleep patterns and disturbance, although some reported the caregiving role did not change sleep patterns. Caregiver sleep may have been disturbed due to their worry, checking on the patient during sleep, the patient's poor sleep (often requiring company while awake), patient snoring, having

different sleep-wake hours from patients, or times when the patient was sick. Caregivers also reported a lack of rest time during the day, even when feeling excessively tired from the constancy of care and other caring duties, such as dependent children and house chores, affecting their sleep.

Secondary Sleep Disturbance Due to Psychological Distress or Anxiety

Underlying worry about cancer

Both patients and caregivers reported difficulty falling asleep and having underlying worries, low mood, and anxiety related to BT. Lying in bed was the time they would think about BT-related deficits or loss, treatment, and the current situation and future, with accompanying feelings of uncertainty exacerbating their level of anxiety. One patient believed not having cancer-related worry was the reason for their good sleep.

Stress

For caregivers, financial burden was a stressor contributing to insomnia. For patients, work-related stress was a potential cause for insomnia due to thinking at night and arousal.

Overthinking at night; "overactive brain"

Participants described their "overactive brain" during the night-time, constantly thinking about various things, mostly planning for the next day or things they want to do. Some appeared to be extra-sensitive to noise and unable to relax. Participants also described being anxious and imagining the worst things that could happen.

Perception of Impact of Cancer and Treatment on Sleep

Both patients and caregivers perceived that the BT diagnosis and treatment impacted sleep both directly and indirectly.

Caregiver's sleep is affected during the early stage of diagnosis

Caregivers perceived uncertainty about the diagnosis, prognosis, and treatment options all contributed to their anxiety. Early after diagnosis, while patients were hospitalized for neurosurgery, they were often overwhelmed by the amount of information. Caregivers reported having better sleep as they settled into the next phase of treatment after this adjustment period.

Impact of cancer treatment on sleep

Patients had noticed changes in sleep patterns or disturbance during various cancer treatments and medications, although this was not universal with some reporting no change in sleep during treatment. While

Table 1. Demographic and Clinical Information of Participants

ID	Age, y	Sex	Marital status	Diagnosis	Time since diagnosis, mo	Treatment	Medications ^b	PSQI/SD group	Care-giver ID	Age, y	Sex	Employment	Duration of care, mo	PSQI/SD group
Pt 1	66	M	Married	PBT (Grade IV)	2		Anti-emetic, anti-convulsant	PS	Cr 1	63	F	Retired	3	PS
Pt 2	59	M	Single	MBT	11		Anti-convulsant	PS	Cr 2	79	F	Retired	12	GS
Pt 3	47	M	Married	PBT (Grade IV)	4	Chemotherapy ^a	Anti-emetic	PS	Cr 3	45	F	Leave of absence	4	GS
Pt 4	55	M	Married	PBT (Grade II)	240		Anti-convulsant	PS	Cr 4	51	F	Leave of absence	9	PS
Pt 5	62	F	Married	PBT (Grade IV)	7	Chemotherapy	Anti-convulsant	PS	Cr 5	64	M	Part-time/casual	12	PS
Pt 6	36	F	Married	PBT (Grade III)	28	Chemotherapy	Anti-convulsant	GS	Cr 6	35	M	Full-time	29	GS
Pt 7	24	M	Single	PBT (Grade IV)	41	Chemotherapy		PS						
Pt 8	61	F	Married	MBT	25	Chemotherapy (Olaparib)		PS	Cr 8	66	M	Retired	40	PS
Pt 9	53	M	Married	MBT	2		Corticosteroids anti-convulsant anti-emetic	PS						
Pt 10	55	M	Married	PBT (Grade II)	71		Anti-convulsant	GS	Cr 10	52	F	Full-time	72	PS
Pt 11	55	M	Married	Primary CNS Lymphoma	9	Whole-brain radiation, R-MVBP (chemo)	Opioid dependence, anti-convulsant corticosteroid, anti-emetic	PS						
Pt 12	44	M	Married	PBT (Grade II)	36			GS						
Pt 13	34	F	Married	PBT (Grade IV)	17	Chemotherapy	Anti-emetic	PS						
Pt 14	30	F	Single	PBT (Grade IV)	5	Chemotherapy		GS						
Pt 15	56	F	Married	PBT (Grade III)	9	Chemotherapy	Anti-convulsant	GS						
Pt 16	61	M	Married	PBT (Grade III)	384			GS	Cr 16	59	F	Part-time/casual	14	PS
Pt 17	50	F	Married	PBT (Grade II)	86	Chemotherapy		PS	Cr 17	57	M	Retired	72	PS
Pt 18	74	M	Married	PBT (Grade III)	12	Chemotherapy	Anti-convulsant	GS	Cr 18	69	F	Retired	12	GS
Pt 19	43	F	Married	PBT (Grade III)	36			PS						
Pt 20	71	M	Married	PBT (Grade III)	36	Chemotherapy		PS	Cr 20	71	F	Retired	36	PS
Pt 21	53	F	Married	PBT (Grade IV)	11	Chemotherapy	Anti-convulsant, anti-depressant, anti-emetic	PS	Cr 21	54	M	Full-time	10	PS
Pt 22	70	M	Married	PBT (Grade IV)	41	Chemotherapy (Lomustine)	Corticosteroids, sedative (melatonin)	PS	Cr 22	58	F	Retired	42	PS
Pt 23	46	M	Married	PBT (Grade III)	93	Chemotherapy	Anti-convulsant corticosteroids	GS						
Pt 24	61	F	Married	PBT (Grade IV)	7	Chemotherapy		PS						

^aChemotherapy agent was Temozolomide, unless specified otherwise.

^bMedications that can potentially alter sleep are listed.

Note. Treatment and medications were current at the time of interview.

Abbreviations: Pt, patient; Cr, caregiver; M, male; F, female; PBT, primary brain tumor; MBT, metastatic brain tumor; PSQI, Pittsburgh Sleep Quality Index; SD, sleep disturbance; PS, poor sleeper (PSQI > 5); GS, good sleeper (PSQI ≤ 5).

Table 2. Themes Identified From Patients and Caregivers' Experience and Perception of Sleep Disturbance With Exemplary Quotations

Themes	Sub-themes	Exemplar quotes
Description and patterns of sleep disturbance	Patterns of sleep (poor, good, changed)	I can't sleep in the nights [. . .] I don't have too much trouble falling asleep at night but I wake up at midnight, two o'clock and I often spend a long time trying to get back to sleep. [. . .] I'd wake up too early as well. (Pt 4) I stay up for an hour or two and then lay down and I'll be in sleep again five minutes and then I'm awake again in five minutes, sort of thing. (Cr 8) Ah, a lot of times I'd love to sleep in little bit later, but I can't, my body just doesn't want to sleep in, I just wake up because I've headache and I want to stay in bed, and sometimes I just do have to because I'm not feeling 100%, but generally, nah . . . I wake up tired. (Pt 17) well, much the same as normal, except that I do go to bed a little bit earlier, because I get tired a little earlier. (Pt 18)
	Sleep was influenced by multiple factors	I'd still go to sleep because I was exhausted from doing everything during the day. [. . .] sometimes when you get into bed at night-time, your legs just constantly ache. So sometimes that will keep me awake. (Cr 10) I always just try to make myself as tired as I can, and then hopefully when I do go to bed, I get maybe 4 or 5 hours during the whole night. If I'm lucky. (Pt 9) I have had tingling feet, extremities really, that has a time if you wake at night, getting quite strong cramps in my leg and hands. (Pt 22)
	Caregiver burden affecting sleep	I'm constantly on the job looking after him so it's very tiring, and sometimes I get very tired and cranky in the evening, so sometimes that affects my sleep pattern. (Cr 20) Only in that I have to be alert to what's going on, particularly when he used to have seizures quite frequently, so I used to listen out for any movements in the bed, while we were sleeping. (Cr 20) I'm back to how I used to be when my children were young—you sort of sleep with one ear open. [. . .] because I've got to do everything, like he used to share all the household chores and things like that, so usually by the end of the day I'm really, really tired. (Cr 18)
Secondary SD due to psychological distress or anxiety	Underlying worry about cancer	The fact that I am dying, I found it a bit confronting at times, you know. So, there's always a level of anxiety and worry and which is better on some days and worse on others. (Pt 22) I never, never ever had trouble sleeping. And since all this happened, I just I can't sleep because I'm concerned. [. . .] When I start thinking about it again, it pulls me down again . . . it's a big burden that we're carrying both of us. (Cr 5) So I'm constantly on a level where I'm thinking—what's going to happen next? And this sickness, this cancer, causes that too, because you don't know what's around the corner. (Cr 17)
	Stress	You're paying for parking, medications, and private health cover. You always seem to be paying for things and it all adds up to stress and stops you from sleeping [. . .] Medicare don't cover most of that, [. . .] I mean she got \$1000 worth of bills, which was unexpected, all because of the reaction to the treatment. [. . .] And in the background, it's always there. (Cr 17) Because work could be a bit stressful at time. You have things like that in your mind, which of course doesn't help when you try to rest [. . .] it just keeps you awake at night. (Pt 2)
	Overthinking at night; "overactive brain"	I've just got an overactive brain, and I think of everything else. Trying to solve the world and it doesn't help. You can't relax. [. . .] And I don't know how to switch it off. You know, they don't have a light switch that you can flick off (laughs). (Pt 24) Mostly if I can't sleep at night and I am anxious then obviously I think the worst about everything and I get depressed, you know [. . .] if you are lying there thinking all night, then you start to imagine worst. (Pt 22) Everything starts going through my mind about the next day [. . .] then I have trouble switching off. It's the planning, [. . .] that starts from the time I'm making sure he[patient]'s organised with what he needs to take, [. . .] transport for him to some things. [. . .] Like foreboding, like something is going to happen. (Cr 16)
Perception of impact of cancer and treatment on sleep	Caregiver's sleep is affected during the early stage of diagnosis	At the earlier stages of his illness it was very disturbing. But we've sort of grown into this new lifestyle, and come to accept that this is the way we live now, and that's calmed me down quite a bit, so I sleep better now. (Cr 20) when PATIENT first became ill, my sleep patterns did change a bit when he was in hospital [. . .] initially, trying to work out what the problem was [. . .] Like there was new information every day [. . .] I'd say the first few weeks it did affect my sleep because you were worrying, what's going on, what is it, something's causing it. (Cr 10)

Table 2. Continued

Themes	Sub-themes	Exemplar quotes
	Impact of cancer treatment causing or worsening sleep disturbance	<p>The only sleep difficulties I have had, is when I've been on steroids for my brain tumor, and then I couldn't sleep. That's the only time. During the day, I'd try to have a sleep, but I couldn't, I was so high all the time. (Pt 8)</p> <p>Oh it's just harder to go to sleep. [. . .] I always wake up, I wake up, I lay there for a while, just thinking. Because my mind, my body is tired, but my mind is wide awake. [. . .] just with all the medications that I've been on, because I'm taking medications for pain and then steroids and anti-seizure drugs, there's just something to relieve the pain and then there's something to keep you awake, so the body's just fighting itself. (Pt 9)</p> <p>I'm sleeping alright, especially when I stopped the chemo. Now for two or three weeks I'm off these things, I'm fine. (Pt 15)</p>
	Indirect effects of cancer treatment on sleep	<p>I try and have a nap, well, I don't always have a nap, but I do get very tired in the afternoon and I'd say it's due to the chemo, because that makes you unwell. [. . .] and it lingers afterwards as well like sleep wise. I just feel really um . . . tired a lot. (Pt 5)</p> <p>when I haven't quite got the balance of dexamethasone right, I was extremely, extremely irritable, like unreasonable to [caregiver], unreasonable to the dog and basically ready to lose my temper at moment's notice, but [caregiver] tells me that I improved since then. (Pt 22)</p>
Perception or experience with seeking medical help for sleep disturbance	Participant not actively seeking help for sleep	<p>I probably should go and talk to somebody about it, but I have a different GP to [patient], so I probably need to go and see my GP, but it's time factors and things. (Cr 16)</p> <p>I think I sort of shrugged it off. I suppose [. . .] occasionally I used to mention it, and they weren't really concerned about it. (Pt 24)</p>
	Unwilling to take supportive care medications	<p>I didn't want it, I didn't want to become reliant on them, I wanted to be able to sleep on my own. (Pt 13)</p> <p>I've been to the doctor and he has given me, what's it called, melatonin is it? [. . .] which I think helps me fall asleep faster, but it doesn't seem to let me sleep all the way through. I've been unable to sleep all the way through now for some years. (Cr 8)</p> <p>No, I don't want the tablets to sleep. I got enough, enough with the treatment at the moment. (Pt 11)</p>
	Willing to seek help from health professionals for sleep problem in the future	<p>If it was affecting my life long term, like day after day, week-in week-out, month-in month-out, I think it would get to a point where I'd look into what the problem was or something to help me sleep. [. . .] Just the GP I suppose. (Pt 12)</p> <p>if I sort of had an ongoing thing that was really stopping me from sleeping, I would talk to my GP about it. [. . .] I guess if it created a pattern [. . .] gone through a week without a good sleep . . . (Cr 18)</p>
	Interventions provided by health professionals	<p>Looking at the dosage of dexamethasone has been the main, has been the main thing, so getting that balance right. (Pt 22)</p>
Belief about sleep and impact on health and functioning	Sleep knowledge and sleep hygiene	<p>it would be don't take computer bed, don't put the TV on when you go to bed, because it's stimulating my mind and I should be winding down. Sleep harm, that's what it's called. (Pt 17)</p> <p>Whatever you call your body rhythms all that [. . .] you try to hopefully go to bed about the same time and get up about the same time so you're in the regular pattern. (Pt 2)</p> <p>I think having a positive outlook to life—and even now I've still got a positive outlook, I've got no idea what my prognosis is. (Pt 18)</p>
	Belief about impact of lack of sleep on health and functioning	<p>Well it affects me, because like yesterday, I was tired. We went to the shops for little of walk, I said [CAREGIVER] I can't. I'm way too tired, [. . .] So we went home. If I had, if it wasn't something like that, I probably walked a bit longer. (Pt 5)</p> <p>I think it's important as a caregiver that you do get sleep, because if the caregiver becomes ill themselves, who is going to look after the patient. So I think it's very important that the caregiver gets enough sleep. [. . .] if you're a caregiver and you're not getting the amount of sleep you need, that can impact on your health, which then impacts upon the person you're caring for. (Cr 10)</p> <p>I probably think, "oh I wish I could just lie down and go to sleep," but it's not something I do. I just sometimes think it'd be nice to have some quiet time, probably, even just to close the eyes for a while. Some self-time, I suppose. (Cr 16)</p>
	Belief about quality sleep	<p>I'd love eight hours uninterrupted straight sleep every night. (Pt 17)</p> <p>hopefully have a minimum seven or eight hours of resting sleep really. That would be my dream to be able to do that at least a few days a week anyway. (Pt 2)</p>

Table 2. Continued

Themes	Sub-themes	Exemplar quotes
	Participants talk about sleep disturbance but try to minimize its impact	Often, I must admit, these days I wake up and I feel “Oh is it the end of the night already?” that’s how I feel. [. . .] I’d like to not have to get out of bed and get up (laughs) but I’ve got stuff on, so most days I just get up and getting moving, get on with it. As you do. (Cr 16) I’m at that point where I cope, and I just get on with it. You do. I guess I probably out of a week I would have a couple of nights of fairly sound sleep, which gets me through the week. [. . .] Not like a major, major issue for me. It’s frustrating as much as anything. It’s still stressful, it’s still always there, but you learn to deal with it. (Pt 9) It’s expected I guess, obviously my wife’s not going to be normal so I’m just coping day to day trying the best I can. [. . .] I’m not complaining. PATIENT’s been tired obviously . . . But that’s okay at least well, she’s here. I’m not complaining, that’s okay. We are adjusting. (Cr 5) Yeah, it’s all part of it, I don’t have a good sleep. And the way my situation is at the moment, it probably doesn’t help. But I’m working with it. (Pt 24)
Coping and strategies to improve sleep	Helpful strategies	I believe in God, so I have faith and then I just say a few prayers and then hopefully fall asleep. (Pt 5) I just do like some breathing techniques to not worry about it. Or just try to think of something different that’s not actually that important. And then I tend to drift off. (Pt 6) when I’m feeling overwhelmed some days I practice some mindfulness and stop trying to think ahead and come back to the now and that’s calming, that really helps that. (Cr 16) No, just lay there and try to, I wouldn’t say meditate, but slow down, just try to slow down. (Pt 23) Sometimes, I’d have a Panadol and that would just calm me, or I could go to sleep. (Pt 8)
	Strategies not deemed helpful	I am thinking about trying to get back to sleep [. . .] I watch, tend to check that clock and see, how many hours do I have before . . . to get, actually wake up. (Pt 17) If I can’t sleep. If I get up and have a bowl of cereal, that tends to get me back to sleep. Like, if I ever have trouble sleeping because I’m thinking about something whatever, food tends to help me. A full tummy tends to help me get back to sleep, I find. (Pt 12)
	Distracting from thinking	Yeah, I’ve counted sheep or all sorts of things. I’ve tried all of that (Pt 17) I think about things that I like to do. Like travelling or being able to get my driver’s license back? Things like that. (Pt 2)

Abbreviations: Pt, patient; Cr, caregiver; Dex, dexamethasone.

people reported varied impacts of chemotherapy, radiation, and anticonvulsants on sleep (eg, inducing excessive drowsiness or sleeplessness), corticosteroids (dexamethasone) reportedly increased the level of alertness during the day and night and caused “active brain” which stopped patients from napping or sleeping at night. Rarely, insomnia was reported to continue after dexamethasone use tapered off.

Indirect effects of cancer treatment on sleep

Despite mixed reports of effects on sleep, cancer treatment may have contributed to sleep disturbance by inducing other symptoms and affecting mood and coping. Patients linked chemotherapy to fatigue, lack of motivation, and low mood. Patients reported that dexamethasone increased their appetite, which led to waking at night to eat. Being irritable and emotional was another complaint attributed to dexamethasone.

Perception or Experience With Seeking Medical Help for Sleep Disturbance

Participant not actively seeking help for sleep

Overall, many participants did not discuss sleep disturbance with a healthcare professional. Patients perceived

sleep disturbance as secondary to their cancer diagnosis and treatment, and thus that treatment for sleep disturbance was not needed or not severe enough to raise in a consultation. Caregivers reported they lacked time to seek help for sleep disturbance. Some participants had spoken to clinicians, but felt that the clinicians overlooked sleep disturbance or failed to provide any intervention, resulting in participant dissatisfaction with consultations.

Unwilling to take supportive care medications

Participants indicated reluctance to take pharmacological interventions for sleep disturbance and negative perceptions toward pharmacological interventions. Reasons included wanting to be able to sleep without any pharmacological assistance, or a preference for a minimal number of medications and only intermittently using sedatives (“keeping the system clean”). Some participants had been offered medication that was ineffective in maintaining sleep, adding to their reluctance to try additional medications.

Willing to seek help from health professionals for sleep problem in the future

Participants were willing to seek medical help for sleep disturbance, particularly if their sleep disturbance met

strict criteria of being ongoing, frequent (4-5 nights per week), or developing a pattern or functional problem. They planned to seek help from medical oncologists, their GP, and psychologists.

Interventions provided by health professionals

Clinicians commonly recommended reducing or tapering dexamethasone dose to reduce sleep disturbance. Some clinicians regularly checked on patient's sleep, encouraging patients to raise sleep-related issues. Other patients were not informed about the link between BT and sleep disturbance. In some cases, basic information about healthy sleep habits (eg, avoiding caffeine), relaxation, and stretching were offered by clinicians.

Beliefs About Sleep and Impact on Health and Functioning

Sleep knowledge and sleep hygiene

Participants shared their views about what generally helps with sleeping well and what does not. Positive attitude and outlook, avoiding worrying about BT, regular sleep-wake patterns, going to bed early, and increasing physical activity were considered sleep facilitators. Participants were aware of general triggers for disturbed sleep, such as aging, menopause, having young children, psychological arousal, watching TV, mobile phone, or computer, caffeine, female gender, or smoking. Interestingly, participants had mixed views on the impact of BT on sleep; some blamed the BT for causing their sleep problem, whereas others believed sleep disturbance was more attributable to things listed above and that their sleep had not changed after diagnosis.

...the only way to improve that [sleep] is the cure of cancer. (Cr 5)

Beliefs about impact of sleep on health and functioning

Participants, particularly those with persistent fatigue, believed that having good sleep was essential for good health, caregiving, and daytime functioning. Patients reported poor sleep could lead to headaches, fatigue, and lightheadedness, affecting mood and coping with treatment. However, the perceived impact for patients was lessened by not working. Although daytime fatigue negatively affected functioning, patients who napped during the day could "get through the day" or compensate or "catch up" on sleep. In some cases, napping disturbed night-time sleep.

Belief about quality sleep

Many participants mentioned around 8 hours of sleep as necessary for quality sleep. Also believing, ideally, sleep should initiate almost instantly. Having dreams may indicate or impact deep sleep. However, participants viewed the most important elements of quality sleep as no nocturnal waking, and feeling refreshed upon waking up, so daytime functioning is intact.

Participants talk about sleep disturbance but minimize its impact

In contrast, many participants dismissed the idea that sleep disturbance would cause stress and/or have a significant impact on their lives. They were not satisfied with the current sleep patterns or quality, or felt "constantly tired." However, participants minimized the impact, by being "too busy to think about" sleep disturbance or asserting that it was "certainly not enough to bother" them. Many stated they would "just get on with it" and "[get] used to not being able to sleep through the whole night," or their sleep disturbance was "[not] any different to anybody [. . .] normal things to be."

Coping and Strategies to Improve Sleep

Participants employed a range of coping strategies. We categorized strategies as "helpful" or "not deemed helpful" in promoting good sleep or healthy sleep habits (regardless of their perceived effectiveness), and strategies to distract participants from thinking at night.

Helpful strategies

Helpful strategies included practicing relaxation techniques (including patting a pet or reading), controlling discomfort or pain, daytime exercise, saying prayers, using pharmacological aids (paracetamol or melatonin), or other general "sleep tips," such as drinking warm milk, avoiding caffeine, or changing diet. Participants would try breathing exercises, mindfulness meditation, relaxation, or lying still in bed unless needing to use the toilet, although the majority did not have formal sleep training. Some reported relaxation techniques were not always effective.

Strategies not deemed helpful

Some patients used strategies which are known to disturb sleep as coping strategies, including eating, drinking alcohol, watching TV or listening to the radio to distract from thinking and relax.^{18,19} Also, "thinking about getting back to sleep" while checking on the time and seeking the caregiver for companionship were thought to disturb sleep for themselves and also their caregivers.

Distracting from thinking

Patients tried counting sheep or thinking about nice things they hoped to do (eg, traveling or getting their driver's license back) to distract them from thinking and worrying in bed.

Discussion

Our findings indicate that sleep disturbance in people with BT and family caregivers resembled insomnia manifesting as a complex intersection of psychological and

physiological (psychophysiological) symptoms also seen in other cancer populations, rather than a neurological side effect of the BT or specific tumor treatment. In some, disrupted sleep patterns, initially induced by treatment or corticosteroids, persisted and were exacerbated by reluctance of patients to raise sleep as a problem. Patients and caregivers tended to minimize the impact of sleep disturbance on their daily lives. Both patients and caregivers displayed overthinking and various symptoms of anxiety at night. Psychophysiological insomnia is a common type of sleep disturbance in cancer patients that results from heightened arousal, somatized tension, nervousness, and anxiety.²⁰ A BT diagnosis and treatment could act as psychophysiological stressors leading to selective attention toward stressors (cancer worry, fear, impact, or symptoms), and in turn, inhibit de-arousal which is important for sleep onset and maintenance.²¹ Caregivers also reported the impact of the early post-diagnosis phase and care burden on sleep. A theme of shock receiving the diagnosis of BT has been previously demonstrated in high-grade glioma patients and caregivers, reflected as uncertainty, anxiety, feelings of being overwhelmed and powerless, and loss of safety in daily life.²² The processes of accepting the diagnosis, adopting new and changed care roles at odds with preexisting roles, dealing with neurocognitive symptoms with limited capability and information, and telling others of the diagnosis all contribute to psychological distress in caregivers.²²

In people with cancer, insomnia may also occur as adjustment disorder in reaction to the diagnosis or treatment and generally abates within 1 month.²⁰ However, insomnia can persist longer due to fears of cancer progression or recurrence and future uncertainty,²³ although further research is warranted to identify and understand a subgroup more susceptible to develop persistent sleep disturbance. Early cognitive-behavioral interventions, such as those targeting fear of cancer recurrence or progression, anxiety control, and acceptance (eg, "ConquerFear" intervention was effective in reducing anxiety and distress in a mixed cancer sample²⁴), may similarly benefit BT patients and caregivers for sleep.

Interestingly, patients and caregivers minimized the impact of sleep disturbance, despite describing the disturbance and perceived causal factors and general impact on functioning and life in detail. Various explanations are possible; the actual severity and impact may be small, or underestimated due to assumptions reflected in their tendency to not actively seek medical attention for sleep disturbance. Patients and caregivers may learn to regard sleep disturbance as a low priority in the context of a life-threatening illness. Clinical practice mainly focuses on treatment plans and outcomes for BT and may not consistently integrate interventions to identify and reduce symptoms, such as sleep disturbance or fatigue.^{25,26}

A developmental pattern of cancer-related insomnia may also play a role. In a longitudinal study of 465 women with breast cancer, insomnia was assessed over a period of 18 months from the pre-operation baseline.²⁷ The trajectory of insomnia severity peaked at 2 months followed by a gradual decline. The increased insomnia severity was associated with chemotherapy at 2 months and radiation therapy overall, but the people on these treatments showed

a similar trajectory (peaks during 2-6 months and a decline until 10-14 months).²⁷ However, the authors noted a possible effect of corticosteroids (eg, dexamethasone) used as antiemetic agents on sleep disturbance in these women.²⁷ Our sample was mostly on adjuvant chemotherapy treatment or follow-up at the time of interview. The severity and perceived impact of sleep disturbance may have been captured during the post-peak phase in the developmental trajectory for insomnia, while tumor-induced symptoms and adverse effects of treatment, particularly corticosteroids, were also likely to be small (4 of 24 patients were on corticosteroids at the time of interview).

In contrast, a subgroup of participants attributed sleep disturbance, along with other deficits and problems, to BT. This may reflect frustration caused by limited daily functioning and social activities from persistent fatigue and disturbed sleep-wake patterns. People with gliomas describe fatigue as the most severe, debilitating symptom.²⁸ In our sample, many patients used daytime napping to manage fatigue, which then sometimes disturbed night-time sleep. Sleep disturbance from night-time anxiety can also aggravate fatigue, forming a vicious cycle. This is consistent with findings of our main study that those with sleep disturbance had increased severity of depression, anxiety, pain, and fatigue and poorer functional status; and that fatigue and functional status had the strongest associations with sleep disturbance in our larger sample.⁹

Among coping strategies described, the most helpful were relaxation strategies. These included some key techniques used in intervention programs to promote relaxation and reduce stress and arousal, such as breathing exercises, mindfulness training, and meditation,^{29,30} as well as behavioral interventions, such as yoga or increased daytime exercise. Using qualified instructors to teach patients and caregivers these cognitive-behavioral techniques may be useful to enhance the effectiveness and empower individuals. A dyadic yoga program focused on breathing, mindfulness, and relaxation in people with newly diagnosed high-grade gliomas and family caregivers is feasible and reduced the PSQI score in patients, indicating a small clinical improvement in sleep.³⁰

Our finding that caregivers' sleep was affected by their caring burden illuminated the findings of our main study—that levels of stress and burden are associated with sleep disturbance in caregivers.⁹ Stress reduction can help improve caregiver sleep and quality of life. Caregivers' of individuals with high-grade gliomas have tried exercise, massage, and meditation to reduce their stress.³¹ However, caregivers preferred a home-based intervention program.³¹ Also, flexible and short sessions may be necessary because caregivers lack time and have competing priorities.

Other coping strategies may have contrary or controversial effects on sleep. The essence of all reported coping strategies was for people to distract themselves from overthinking and cancer worry. However, monitoring thoughts (ie, metacognition) and forcing the self away from BT-related thinking to sleep (ie, intrusive thoughts) may lead to increased attention, stress, and arousal.³² Also, drinking alcohol, watching TV, or eating at night-time are generally perceived as contributing to poor sleep hygiene and disruptive to sleep.²⁰ The effectiveness of lying in bed

while awake and having warm milk is unclear. However, people may benefit from the psychological (placebo) effect these traditional strategies have on falling asleep ("stimulus association"³³). In addition, beliefs about quality sleep could be problematic in some individuals. They reported that immediate sleep onset and 8 hours of unbroken sleep (with or without dreams) would be characteristic of quality sleep. These unhelpful cognitions and behaviors are common in other populations and can be addressed by basic sleep education or cognitive-behavioral interventions.

Our findings have several important clinical implications. Firstly, people who held negative views toward pharmacological interventions for sleep disturbance were reluctant to raise sleep disturbance with a healthcare professional. Secondly, people were unaware that a diagnosis of BT and/or treatment side effects can cause sleep disruption, which may further aggravate the issue of underreporting of sleep disturbance. Thirdly, routine screening for sleep disturbance, fatigue, and anxiety may be useful to prevent the development of persistent, vicious symptom clusters. Finally, patients and caregivers should be educated about the importance of sleep, potential risk factors for sleep disturbance during cancer treatment, and when or where to seek help.

Limitations

This was a sub-study of a cross-sectional study for which participants needed an adequate level of cognition and independence. We used stratified purposive sampling to capture both good and poor sleepers to broaden the perspective and identify key differences between them. Accordingly, our sample does not represent the whole spectrum of the BT or caregiver population. Also, non-English-speaking patients were excluded. Obtaining respondent validation could have been useful to expand the generalizability of our findings by conducting a "member-checking" interview with patients, caregivers, or health professionals in neuro-oncology to establish the level of agreement between their perception of sleep disturbance and our analysis of the qualitative data.

For future studies, longitudinal assessments of sleep disturbance, psychological comorbidities (anxiety, depression, and stress) using diagnostic criteria, BT progression, and treatment will be useful to understand the evolution of the symptoms and effects of treatment and identify characteristics of those more vulnerable to develop persistent sleep disturbance. Further research is warranted to assess the extent to which psychological factors contribute to sleep disturbance, and how these factors interact with clinical features of malignant BT, and more importantly whether these are amenable to treatment with non-pharmacological interventions for sleep disturbance in both patients and their caregivers. Our findings suggest cognitive-behavioral therapy and relaxation therapy for cancer-related insomnia may be as useful and effective in the BT population as other cancer populations. Future studies should examine the feasibility, particularly in people with advanced BT, and effectiveness to identify the most suitable intervention(s).

Conclusion

This study qualitatively explored the experience and perception of people with BT and their family caregivers of sleep disturbance. Insomnia symptoms were the most commonly reported type of sleep disturbance, with a negative impact on daytime functioning and feelings of fatigue and low mood. Underlying cancer-related worry and nighttime thinking suggested psychophysiological insomnia. Some patients and caregivers performed a range of relaxation techniques for coping strategies, although some also displayed cognition and behaviors which are known to be unhelpful for promoting good sleep. Interventions targeting fear of cancer recurrence, anxiety, and cognitive-behavioral aspects of insomnia and sleep education may be beneficial. Further research is needed to explore the trajectory and perceived impact of sleep disturbance, longitudinal associations with BT treatment, comorbid psychological symptoms over the course of illness, and to identify the most appropriate interventions.

Supplementary material

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