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A systematic review on the effect of light therapy in sundowning behavior of patients with dementia

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Abstract

Dementia is a cognitive disorder that affects daily living of the individual. According to DSM V criteria, it is defined as the evidence of significant cognitive decline from a previous level of performance in one or more cognitive domains which interferes in everyday activity with no other structural, metabolic or psychiatric cause. However, during the course of dementia, 90% of patients suffer from behavioral and psychological symptoms of dementia (BPSD). The sundowning or nocturnal delirium is a form of BPSD which can affect patients with dementia particularly those of advanced stage. Presently, there are no established guidelines for the management of symptoms of sundowning in patients with dementia and efficacy of pharmacologic and nonpharmacologic treatments are not yet established. One of the nonpharmacologic treatment is bright light therapy. We performed a systemic review of published literature on the effects of bright light therapy on sundowning in patients with dementia. We found only two randomized controlled trials utilizing the standard 10,000 lux lamp among dementia patients. Based on the two studies, bright light therapy had no significant beneficial effect on the sundowning behavior.

Keywords: Light Therapy, Sundowning Behavior, Dementia

INTRODUCTION

Dementia is becoming a highly prevalent cognitive disorder that affects daily living in the contemporary world. Diagnostic and Statistical Manual of Mental Disorders (DSM) V defined dementia as the evidence of significant cognitive decline from a previous level of performance in one or more cognitive domains which interferes in everyday activity when there is no other structural, metabolic or psychiatric cause. This disorder has doubled its global incidence with 9.9 million new cases each year worldwide.[1] Further, between 2015-2050, the incidence is predicted to increase by 223% in lower to middle income countries such as the Philippines.[1] In terms of death rates, in 2016, dementia has become the 5th leading cause of death globally accounting for 2.4million deaths per year.[2]

Previous reports also indicate that aside from symptoms of cognitive decline and decline in performance of cognitive domains, approximately 90% of patients with dementia suffer from behavioral and psychological symptoms of dementia (BPSD). The sundowning or nocturnal delirium is a form of BPSD which can affect patients with dementia particularly those of advanced stage.[3] During sundowning, symptoms such as confusion, agitation and aggression typically emerge in the late afternoon when light exposure is diminished as well as during winter months when there is less sunlight.[4] It is also believed that sundowning hastens the progression of cognitive impairment resulting in hospitalization and caregiver burnout.[4]

Presently, there are no established guidelines for the management of symptoms of sundowning in patients with dementia. Pharmacological interventions were used however their effectiveness was limited and the risk of interaction to other medications is high.[3] Currently, non-pharmacological interventions emerged as a potentially safer alternative and one of it is light therapy. However, the efficacy of light therapy is not well established. Hence in this review, we seek to investigate the effects of bright light therapy in sundowning behavior of patients with dementia.

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METHODS

A protocol was developed in conducting this systematic review comprising of a step-by-step procedure using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram to identify and appraise all relevant studies. Identification of relevant studies from 2010 to 2022, using the following databases, PubMed and Google Scholar was performed (Figure 1). The inclusion criteria which comprises patients diagnosed with dementia, >60 years old, with sundowning behavior and had undergone standard light therapy at ≥10,000 lux lamp as nonpharmacologic treatment were included in the study. The exclusion criteria were those patients <60 years old, not demented, with no sundowning behavior and light therapy. Studies whose population had comorbid conditions causing memory loss (e.g. traumatic brain injuries or seizures) were excluded as well as studies that utilized other forms of light therapy such as color therapy, heliotherapy, wave therapy. Further, studies included were on randomized controlled trial (RCT) design, published in English and peer-reviewed. The search terms of dementia, light therapy, sundowning behavior and its keyword combinations were used (Figure 1).

The reviewers compiled recorded findings into a descriptive table detailing nine categories: design type, quality of evidence, study population, intervention and sample size, outcomes, measurement tools, point estimate, clinical significance, and statistical significance (Table 1).

RESULTS

Analysis of the included literature

The database searches retrieved a total of 902 articles. There were 73 articles that met pre-established inclusion criteria and were subsequently reviewed. Of the analyzed studies, 32 of the studies followed a randomized controlled study design, involving the application of the intervention without random assignment of participants to conditions or orders of conditions. Two studies were RCT, in which group allocation (control or intervention) was determined through a process of randomization. RCTs are considered level I evidence, one of the highest levels of evidence in intervention studies.

Table 1 shows the summary of results from the two studies included in this review including details about the sample size, bright light condition, and study outcomes. It also includes the evaluation using the Cochrane risk-of-bias tool for randomized trials.

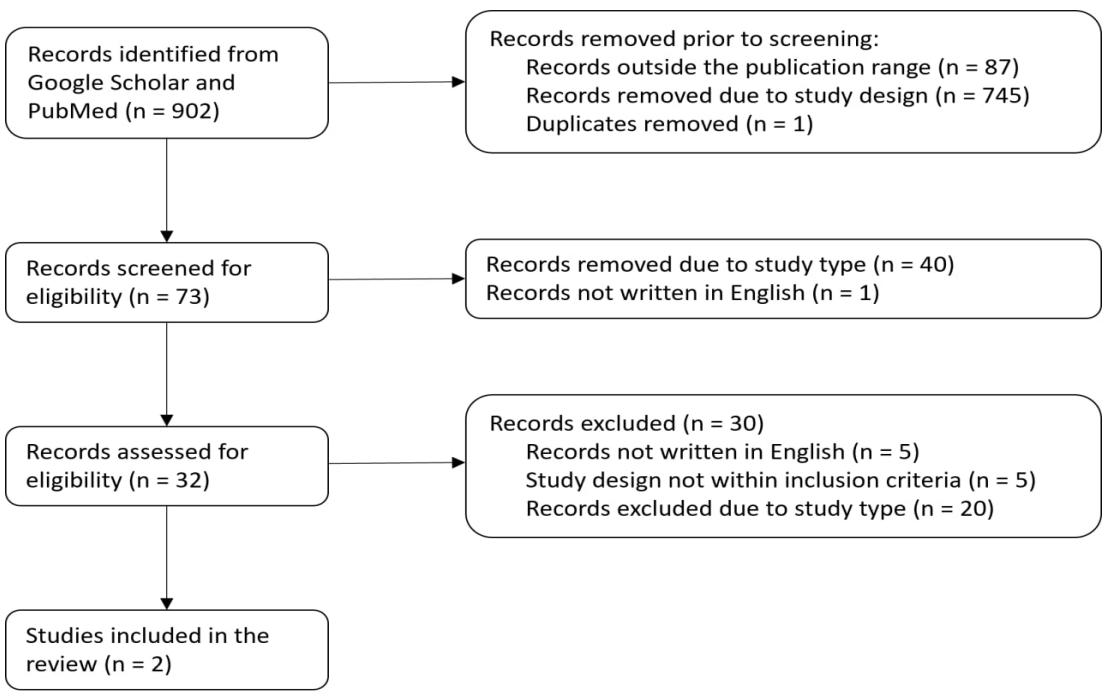

Figure 1. PRISMA flow diagram.

Table 1: Summary of findings of included studies

Author & Year Published	Population (N)	Bright Light Condition	Outcomes Assessment	Study Outcomes	RoB 2
Lyketsos *et al*. (1999)[6]	15	BLT for 1h q AM 10,000 lux lamp at 3ft	(i) hours of sleep (ii) Behave-AD (iii) CSDD	slight improvement in nocturnal sleep, slight improvement in mean Behave-AD scores; not statistically significant	low
Burns *et al*. (2009)[7]	48	BLT for 2h q AM 10,000 lux lamp	(i) CMAI (ii) CRBRS (iii) MMSE (iv) CSDD (v) MOUSEPAD	improved CMAI, CRBRS, CSDD but no statistically significant difference with control group	low

*BLT=Bright Light Therapy; AD=Alzheimer's Disease; CSDD=Cornell Scale for Depression in Dementia; CMAI=Cohen-Mansfield Agitation Inventory; CRBRS= Crichton Royal Behavior Rating Scale; MMSE= Mini Mental Status Examination; Manchester and Oxford Universities Scale for the Psychopathological Assessment of Dementia (MOUSEPAD)

Risk of bias analysis

The risk of bias for both studies was low across all five domains. Shown in Table 2 is the summary of risk of bias analysis.

DISCUSSION

Our review shows that the evidence for beneficial effect of bright light therapy in sundowning behavior of patients with dementia from randomized controlled clinical trials is limited. This explains why recommendations based on evidence for the bright light therapy is also limited. However, though the evidence of benefit is limited, our review also show that the risk of bias in the studies is also low.

Lyketsos *et al*.[6] was the first to test the efficacy of bright light therapy using a randomized, controlled, crossover clinical trial. The investigators enrolled fifteen patients with dementia, all of whom met the DSM-IV criteria for dementia with a score of >4 on the Behavioral Pathology in Alzheimer Disease scale (Behave-AD) and have shown agitated behaviors. Of the 15 patients enrolled, eight completed the entire trial. Of the seven early dropouts, two requested to withdraw from the study due to lack of efficacy and requested for other treatment for agitation allowed for in the trial. Patients were randomized to either the bright light therapy, in which they were exposed to 10,000 lux full spectrum lamps at 3 feet for 1 hour; or the control condition, in which the patients were exposed to a dim, digital, low-frequency blinking light. This is a standard control used in studies of bright light therapy for seasonal affective disorders. The outcomes of the

Table 2: Summary of risk of bias analysis using the RoB 2 Method

	Domain 1 Randomization	Domain 2.1 Effect of Assignment	Domain 2.2 Effect of Adherence	Domain 3 Attrition	Domain 4 Detection	Domain 5 Reporting
Lyketsos *et al.* (1999)[6]	low	low	low	low	low	low
Burns *et al.* (2009)[7]	low	low	low	low	low	low

*RoB-Risk of bias

study were measured by: (1) mean nocturnal hours of sleep; (2) the Behave-AD; and (3) the Cornell Scale for Depression and Dementia (CSDD).The results of the study indicate that improvements in nocturnal sleep hours are possible for patients when treated with bright light therapy. There was also slight improvement on the mean Behave-AD scores. However, there were no findings that indicate significant benefit of bright light therapy for the behavior or mood of the patients. The authors reported that these slight but not statistically significant improvements may also be attributable to the fact that all patients received a considerable amount of attention from the study staff, as well as practiced better sleep hygiene.

In a similar study of Burns *et al*., 48 patients diagnosed with dementia were recruited, in which 22 patients were randomly given bright light therapy while 26 patients were randomly given standard light conditions. Of the 48 patients recruited, one patient withdrew from treatment after three days as the bright light therapy triggered her memories from World War II. Another patient was hospitalized three days after receiving treatment due to unrelated causes. Remaining patients were then exposed to full spectrum bright light therapy 10,000 lux for two hours between 10 AM and 12 noon, while the control was exposed to standard fluorescent tube light at 100 lux for two hours in the same time frame. Patients wore an actigraph device to monitor sleep activity and dementia assessment scales were used such as Mini Mental Status Examination (MMSE), Cornell Scale for Depression in Dementia (CSDD), Crichton Royal Behavioral Rating Scale (CRBRS), Manchester and Oxford Universities Scale for the Psychopathological Assessment of Dementia (MOUSEPAD), and Cohen-Mansfield Agitation Inventory (CMAI) on week 4 and week 8, while any change in the psychotropic medication was noted. Of the 48 patients recruited, 43 patients (90%) tolerated light exposure for a minimum of 90 minutes per day, four (8%) tolerated a minimum of 60 minutes per day, and one (2%) tolerated 30-60 minutes per day. Two patients, both of whom received placebo, died between week 4 and week 8. Results of the study showed that there were no significant differences between the bright light therapy group and the placebo group. All of the patients had at least one agitated behavior, as rated on the CMAI at baseline, and 25 (52%) experienced sleep disturbance, according to the MOUSEPAD settings. Between-group comparison of agitation as measured by CMAI was not significant. Moreover, the CRBRS change score showed a significantly greater increase in the placebo than in the bright light therapy group at week 4 but not at week 8. In addition, the difference between the groups on the MOUSEPAD, MMSE, and CSDD measurements were also not statistically significant.[7]

In conclusion, this systematic review shows that bright light therapy has no significant beneficial effect and may not be an effective treatment for sundowning behavior in patients with dementia. Thus, use of bright light therapy for sundowning behavior treatment in patients with dementia is not supported by evidence.

DISCLOSURE

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Conflict of interest: None

REFERENCES

1. Prince M, Wimo A, Guerchet M, G Ali, YT Wu, M Prina. World Alzheimer Report 2015. The Global Impact of Dementia. Alzheimer's Disease International. 2015.
2. GBD Dementia Collaborators. Global, regional, and national burden of Alzheimer's disease and other dementias, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol* 2019;18:88-106. DOI 10.1016/S1474-4422(18)30403-4
3. Blais, J, Zolezzi, M. Sadowski CA. Treatment options for sundowning in patients with dementia. *Mental Health Clinician* 2014;4: 189-95. DOI 10.9740/mhc.n204525
4. Canavelli M, Valletta M, Trebbastoni A, *et al*. Sundowning in dementia: Clinical relevance, pathophysiological determinants and therapeutic approaches. *Front Med* 2016; 3:73. DOI 10.3389/fmed.2016.00073
5. Gnanasekaran G. Sundowning as a biological phenomenon: current understandings and future directions: an update. Aging Clin Exp Res 2016; 28(3): 383-92. DOI 10.1007/s40520-015-0431-3
6. Lyketsos C, Veiel L, Steele C. A randomized, controlled trial of bright light therapy for agitated behaviors in dementia patients residing in long term care. *Int J Geriatr Psychiatry* 1999; 14: 520-5. DOI 10.1002/(SICI)1099-1166(199907)14:7<520
7. Burns A, Allen H, Tomenson B, Duignan D, Bryne J. Bright Light therapy for agitation in dementia: a randomized controlled trial. Int Psychogeriatr 2009; 21 (4): 711-21. DOI 10.1017/S1041610209008886