Feasibility of Light and Music Therapy in the Elderly for the Prevention of Hospital-Associated Delirium

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ABSTRACT

Hospital-associated delirium is common in older adults, especially those with dementia, and is associated with high morbidity and mortality. We performed a feasibility study in the emergency department (ED) to examine the effect of light and/or music on the incidence of hospital-associated delirium.

Patients aged ≥ 65 who presented to the ED and tested positive for cognitive impairment were enrolled in the study (n = 133). Patients were randomized to one of four treatment arms: music, light, music and light, and usual care. They received the intervention during their ED stay. In the control group, 7/32 patients developed delirium, while in the music-only group, 2/33 patients developed delirium (RR 0.27, 95% CI 0.06–1.23), and in the light-only group (RR 0.41, 95% CI 0.12–1.46), 3/33 patients developed delirium. In the music + light group, 8/35 patients developed delirium (RR 1.04, 95% CI 0.42–-2.55).

Providing music therapy and bright light therapy to ED patients was shown to be feasible. Although this small pilot study did not reach statistical significance, there was a trend towards less delirium in the music-only and light-only groups. This study lays the groundwork for future investigation into the efficacy of these interventions.

KEYWORDS: emergency department; geriatrics; delirium; dementia; quality improvement

INTRODUCTION

Delirium is a significant cause of morbidity, resulting in functional decline among hospital patients, especially older adults with dementia.[1-5] Delirium in older adults is independently associated with longer hospital length of stay,[5,6] increased mortality,[4,6,7] and increased rates of cognitive decline.[8]

Two non-pharmacologic interventions that have been trialed in delirium prevention are music therapy and light therapy. These studies have shown mixed results, with a trend toward positive outcomes.[9-16] However, few studies have explicitly looked at preventing hospital-associated delirium through interventions in the ED, and none have examined music or light therapy in the ED setting. Here, we present a pilot study investigating whether music and/or full-spectrum light provided in the ED would reduce the incidence of delirium within the first 24 hours of hospital admission.

METHODS

Setting

This was a pilot randomized controlled trial from August 2021 through December 2021 in an academic ED, Beaumont Hospital, Royal Oak, Michigan.

Recruitment

Patients were eligible for inclusion if they were 65 or older, were assigned an Estimated Severity Index (ESI) of 2-5 at triage and could either consent or have a legally authorized representative available to consent for them. The hours of enrollment and intervention were 10 am to 6 pm, Monday through Friday. Patients were excluded from the study if they were on isolation precautions due to suspected SARS-CoV-2 infection, legally deaf, intoxicated, or presented with a psychiatric chief complaint. Although patients discharged from the ED were ultimately excluded from the study, expected disposition was not considered an enrollment criterion.

Patients who consented underwent a cognitive assessment with the Short Blessed Test[17] (SBT). Those who tested positive for potential cognitive impairment (SBT score >4) were enrolled in the trial. Enrolled patients were randomized to one of the four trial arms using the MinimPy software in a 1:1:1:1 allocation ratio.[18] The hospital's Institutional Review Board approved this study.

Intervention

Patients were enrolled in one of four groups: 1) music; 2) light; 3) music and light; 4) usual care. Upon enrollment, all enrolled patients were screened for delirium by the Confusion Assessment Method[19] (CAM) by the research assistant.

Music was provided with a wireless speaker that was placed on a table next to the patient's bed. Music was stored on a memory card compatible with the available wireless speaker. Two playlists were available: one containing classical music and one containing non-vocal jazz music. Patients were allowed to choose which playlist they were given; the classical playlist was chosen if they could not choose or expressed no preference. Playlists were chosen to

standardize the music intervention across participants. Each playlist was approximately 2 hours in length and repeated until turned off. The average length of time of the intervention was four hours. Similarly, Light therapy was provided by a full-spectrum lightbox set up on a table next to the patient's bed. Lightboxes were designed to mimic natural light with a color temperature of 6,500K. Brightness was set to 5,000 lux. All interventions were discontinued when the patient left the ED.

All patients received standard medical care provided by the ED physician and subsequent hospital staff after admission. Neither patients nor ED staff were blinded to the patient's treatment arm; however, hospital staff taking care of the patients on the inpatient floors after admission were blinded to the intervention. An additional CAM screen was performed by the inpatient nurse upon each patient's arrival to their inpatient floor.

Evaluation

The age, sex, presentation date and time, and ESI were collected prospectively for all patients screened for inclusion. For those who met inclusion criteria and consented, the following items were collected prospectively: their medical record number, the SBT result, the CAM result, and the start time of the intervention. Enrolled patients were subjected to a retrospective chart review to collect the following data: race, insurance payor, point of origin, past medical history, disposition, admission diagnosis, acute care unit to which the patient was admitted, and the level of care under which the patient was admitted. To determine the incidence of delirium, data was collected on the result of the initial inpatient CAM, as well as the use of medication, physical restraints, video or human monitoring, or activation of the hospital's Rapid Response Team (RRT) for reasons of "delirium", "agitation", "mental status change", or "encephalopathy".

Outcome

A multi-modal definition of delirium was employed to accurately capture all patients who experienced delirium within the first 24 hours of admission. A diagnosis of in-hospital delirium was made if the patient required benzodiazepine or antipsychotic use, physical restraints, video or human monitoring, or RRT activation for the reasons listed above within the first 24 hours, had a positive CAM upon arrival to the floor after a negative CAM in the ED, or had a diagnosis made of "delirium", "altered mental status", or "metabolic encephalopathy" added to their chart within the first 24 hours of admission. Patients were excluded from analysis if they were discharged from the ED or if they tested positive for delirium while in the ED based on the initial CAM obtained upon enrollment in the study.

STATISTICAL ANALYSIS

Descriptive statistics (mean, median, proportion, standard deviation) were calculated for all patient characteristics. The admission diagnosis category was determined by mapping the ICD-10 code used for the admission diagnosis to one of the delineated domains. Modified Charlson Comorbidity Index[20,21] (CCI) scores were calculated by assigning past medical history diagnoses as abstracted from the chart to each domain comprising the CCI. Estimated Severity Index (ESI) scores were assigned at ED triage.

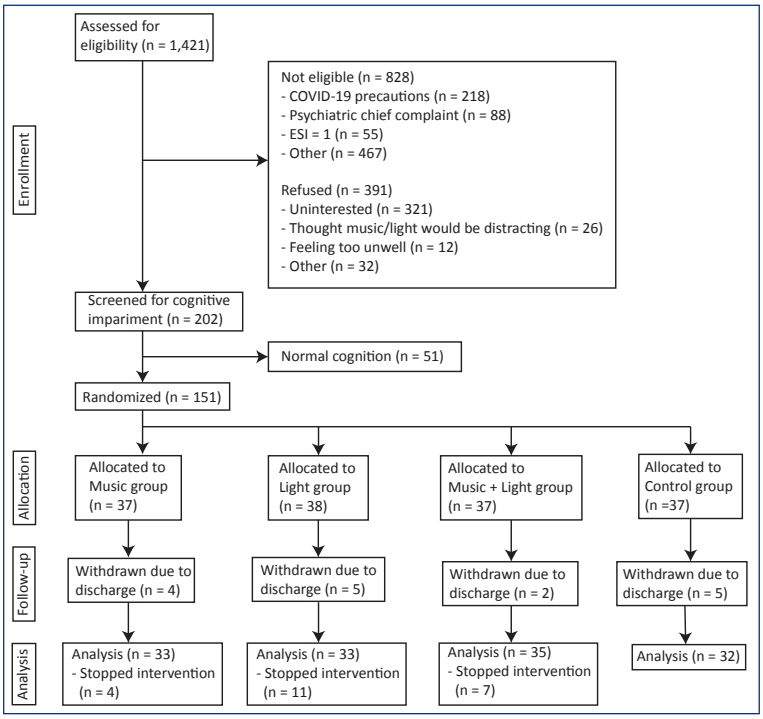
Medians were compared using the Kruskal-Wallis H test with Bonferroni adjustment for multiple groups. Differences in proportions among patient characteristics and differences in the incidence of delirium between groups were compared using Fisher's Exact Test. Significance was calculated as $\alpha = 0.05$. All statistical analyses were performed in STATA.[22]

RESULTS

Recruitment and patient characteristics

We screened 1,421 patients for study eligibility between August 2021 and December 2021. Of these, 593 were eligible to participate, and 202 consented to the study. Of those who consented, 51 patients demonstrated normal cognition by the Short Blessed Test (SBT) and were eliminated from the study. The remaining 151 patients were randomized to one of four treatment arms. Allocation and participant flow can be seen in the CONSORT diagram (See **Figure 1**).

Figure 1. CONSORT diagram showing patient flow through the study



ESI: estimated severity index

Table 1. Characteristics and Outcomes of Patients Enrolled in the Pilot Study

	Music (n=33)	Light (n=33)	Music + Light (n=35)	Control (n=32)	p value
Age, median (IQR)	84 (11)	83 (8)	83 (13)	84 (12)	0.96
Female, n (%)	17 (51.5)	20 (60.6)	23 (65.7)	22 (68.8)	0.52
Race					0.98
White	24 (72.7)	24 (72.8)	26 (74.3)	25 (78.1)	
Black	9 (27.3)	9 (27.3)	8 (22.8)	7 (21.9)	
Asian			1 (2.9)		
Charlson Comorbidity Index					0.75
≤4	18 (54.6)	17 (51.5)	20 (57.1)	14 (43.8)	
>4	15 (45.5)	16 (48.5)	15 (42.8)	18 (56.3)	
Estimated Severity Index					0.39
2	17 (51.5)	14 (42.4)	21 (60.0)	21 (65.6)	
3	15 (45.4)	16 (48.4)	13 (37.1)	11 (34.4)	
Point of Origin					>0.99
Extended Care Facility or Clinic	4 (12.1)	5 (15.2)	5 (14.3)	4 (12.5)	
Home	29 (87.9)	28 (84.9)	30 (85.7)	28 (87.5)	
Medicare Insurance	27 (81.82)	29 (87.9)	28 (80.0)	28 (87.5)	0.78
Admission Diagnosis Domain					0.037
Cardiac	10 (30.3)	3 (9.1)	5 (14.3)	4 (12.5)	
Gastrointestinal	3 (9.09)	2 (6.1)	3 (8.6)	1 (3.1)	
Respiratory	4 (12.1)	4 (12.2)	2 (5.7)	8 (25.0)	
Genitourinary	5 (15.2)	1 (3.0)	2 (5.7)	4 (12.5)	
Neurologic				2 (6.3)	
Other	11 (33.3)	23 (69.7)	23 (65.7)	13 (40).6	
Level of Care					0.13
General Medical	30 (90.9)	30 (90.9)	27 (77.1)	30 (93.8)	
Progressive Care	2 (6.1)	3 (9.1)	8 (22.9)	2 (6.2)	
Intensive Care	1 (3.1)				
Short Blessed Test Score, median (IQR)	13 (13)	12 (12)	8 (13)	13 (11)	0.41

IQR: interquartile range; n: number; %: percent.

Patient characteristics are shown in **Table 1**. Patients were predominantly female, White, and presented from home. Baseline health as measured by the Charlson Comorbidity Index was similar across groups.

Primary objective

We performed an intent-to-treat analysis on the incidence of delirium within 24 hours in each group. Two patients in the Music group became delirious within 24 hours; three became delirious in the Light group, eight in the Music + Light group, and seven in the Control group. These differences were not statistically significant (p=0.125). When patients who requested that the intervention be stopped were dropped from the study, the differences remained not significant (p=0.460).

Pairwise comparisons also did not show significance; however, the trend was toward a benefit from the intervention in the Music and Light groups. The relative risk of developing delirium in the Music group compared with the control group was 0.27 (95% CI 0.06–1.23), the relative risk for the Light group compared to the control group was 0.41 (95% CI 0.12–1.46), and the relative risk for the Music + Light group compared to the control group was 1.04 (95% CI 0.42–2.55).

Completion rates and participant adherence

A small number of patients who were randomized to receive music and/or light therapy requested that the intervention be stopped before leaving the Emergency Department. Four patients requested the intervention be discontinued in the Music group, 11 in the light group, and 7 in the Music + Light group. Of the latter, five patients requested that only the light be stopped, and two patients requested that both the light and the music be stopped. The patients' primary reason for requesting that the intervention be stopped is that the light therapy was too bright, followed by finding the light and/or music was distracting when they wished to do something else, like sleep or read. We found that if the room light was kept on when patients were receiving light therapy, they found the light treatment more tolerable. There were no incidences of ED providers requesting the intervention be discontinued. Using an intent-to-treat analysis that includes those patients who chose to discontinue the therapy, the mean duration of the intervention was 7.16 h and the median duration was 4.94 h.

DISCUSSION

Our data indicate that providing full-spectrum light and music therapy to older adult patients in the ED is feasible and can be incorporated into routine ED care. The intervention was received positively by ED staff and the majority of patients. Of those patients who did not qualify for the intervention, the most common reason was that the patient was on isolation precautions due to suspected SARS-CoV-2 infection. As the COVID-19 pandemic eases, this should cease to be a significant factor in adopting interventions such as these. Alternatively, a strict sanitation regime could be adopted that would allow equipment to be used for multiple patients sequentially without concern for their infectious status.

The primary difficulty we encountered was patients either declining enrollment or requesting that the intervention be stopped because they found the intervention to interfere

with how they wished to occupy themselves while waiting for their work up to be complete. Of these, the most common reasons were that they wanted to watch television and therefore were uninterested in music, or they found the light too bright, especially if they wished to sleep. We also found that the majority of the complaints about the brightness of the light were among those patients for whom the room lights were turned off. When room lights were left on, very few patients requested that the lights be turned off. The primary benefit of providing full-spectrum light is not providing light in general, but providing wavelengths of light that trigger an appropriate circadian response,[23,24] leaving the room light on is a simple way to improve compliance with the provided light therapy.

This small pilot study was designed to test feasibility rather than produce robust results. Consequently, it is unsurprising that none of the results reached statistical significance. However, there was a definite trend toward a positive impact in the Music and the Light arms. We plan to investigate further the potential of these interventions in a full-scale study in the future.

Limitations

Music therapy may be more challenging to implement in patient care areas divided by curtains or in a hallway, which can be mitigated by providing headphones. Additionally, our method of diagnosing hospital-associated delirium by retrospective chart review may have missed some cases of delirium, as the hypoactive subset of delirium does not usually prompt pharmacologic intervention or restraints.

CONCLUSION

We found that providing music players and lightboxes to older adults in the ED was feasible, and the reactions by patients and providers were generally positive. Although the results were not statistically significant, there was a trend towards a positive result in the Music and Light groups, indicating that these practical, low-cost interventions can have an outsized effect on lowering the burden of morbidity and mortality associated with delirium.

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