SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The purpose of this study was to evaluate the relationship between postoperative rest and bright light exposure.

The Usefulness of Bright Light Therapy for Patients after Oesophagectomy

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Key Concepts/Context

While the use of light therapy in healthcare settings has been shown to be effective for the adjustment of the sleep-awake rhythm, it has not been applied to postoperative patients. Light is expected to be useful for the postoperative adjustment of the circadian rhythm by increasing the level of awakening during the daytime and inducing sleep during the nighttime in patients under postoperative management in the ICU after major anesthesia and surgery. It is hypothesized that the use of bright light might decrease the presence of postoperative delirium.

Methods

This is a randomized controlled trial to verify the usefulness of bright light therapy for patients following oesophagectomy surgery to use the index acquired through physical activity, autonomic activity, incidence of postoperative arrhythmia, and level of acute delirium.

Sample

The participants were oesophagectomy patients who were removed from their ventilators the day after surgery. Ten patients were in the study group and 12 patients were in the control group.

Setting

Hospital in Japan

Metrics and Measurement

After extubation, we assigned the participants to either the exposure group or control group. At day 2 after surgery the exposure group underwent two hours of bright light exposure for four days. In both groups we monitored physical activity and autonomic activity. In addition, we scored the participants on the NEECHAM scale and evaluated their postoperative delirium and postoperative arrhythmia.

DESIGN IMPLICATIONS

The results of this study suggest that postoperative bright light therapy might be useful for adjusting the rest-activity cycle and improving the bed rest of patients. More studies need to be conducted before it should be considered a conclusive finding.

After extubation, we attached an Active tracer to the right ankles and a Memory-heart-rate metre to each of the participants to measure the physical activity and autonomic nervous system index. We continuously measured the amount of activity and RR interval data until 10:00 a.m. on day 6 after surgery. We defined the measurement period as the stage patients remained in a state of bed rest. We terminated the measurement when they were ambulated.

Data Analysis

For the time-series data of the composite acceleration of movements measured from each group, a frequency analysis was calculated based on the maximum entropy method using Memcalc. Of the multiple sine curves that were obtained we calculated the cycle with the highest power spectrum that had a peak within the circadian spectrum (20-28 hours).

For RR interval data obtained from the Memory-heart-rate metre, we conducted frequency analyses based on the maximum entropy method for every five-minute segment using Memcalc. From the low-frequency elements (LF) that consisted of the range from 0.04 to 0.15 Hz and the high-frequency elements (HF) that consisted of the range from to 0.4 Hz, we calculated the HF, which is an index of parasympathetic nervous system activity and the ratio between LF and HF (LF/HF), which is an index of sympathetic nervous system. Because correct analyses of data on heart rate fluctuations and artefacts are not possible in cases of arrhythmia, we performed filtering using the filter function of Memcalc to remove the artefacts from the arrhythmia data.

We performed statistical analyses on a computer using SPSS. We used a two-sample t-test, the Mann-Whitney U test, and Fisher's exact test. A statistically significant difference was considered to be present at a p value of 0.05 or below.

Findings

One out of 10 patients in the study group and five out of 12 patients in the control group presented with postoperative delirium as defined in the DSM-IV-TR. Of these patients, symptoms were protracted over several days for one patient, whereas the symptoms disappeared within one day for the remaining five patients. The main symptoms of postoperative delirium included dangerous actions caused by disorientation, persecutory and delusional statements, and complaints of hallucinations. There was no significant difference in the occurrence rate of postoperative delirium. Additionally, neither of the two drop-out cases demonstrated postoperative delirium.

In the frequency analysis of the amount of activity, the study group exhibited a cycle that was closer to 24 hours than the control group exhibited. This indicates that bright light entrained the circadian rhythm in postoperative patients. In the same

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way, this result suggests the possibility that bright light exposure adjusted the postoperative patients' rest-activity cycle.

We predicted that the High Frequency (HF) [activity] would increase at night in the study group, but there was no actual difference between the two groups. Because the vagus nerve runs through the manipulated region in surgical resection for oesophageal cancer, there is a substantial possibility that the vagus nervous system will be affected after surgery and skew the results.

Limitations

Although four out of 26 cases were excluded as subjects, because there was no significant difference in any of the background factors we believe there was no bias in the samples. The causes of the two drop-out cases included the participants' postoperative conditions, the brightness of the light used exceeding the expectations held by the participants when they received explanations before surgery, a feeling of fatigue due to the starting date of the intervention being the day following extubation, and a visual sense of being oppressed, leading to intensified feelings of irritation due to the exposure device being self-standing. If possible, it would have been preferable to install the bright light exposure device as a ceiling attachment to provide light under more natural conditions. An additional limitation of the research design was that it was difficult to implement a double-blind method because the details of the intervention were visually apparent. In this trial, we tried to determine the usefulness of bright light therapy in the acute stage. However, due to the scale of this study and manpower limitations, it was difficult to increase the sample size. Therefore, the results of this study did not achieve a sufficient statistical power.