SYNOPSIS

KEY POINT SUMMARY

Contribution of the intensive care unit environment to sleep disruption in mechanically ventilated patients and healthy subjects

Gabor, J.Y., Cooper, A.B., Crombach, S.A., Lee, B., Kadikar, N., Bettger, H.E., Hanly, P.J., 2003 | *American Journal of Respiratory and Critical Care Medicine*. Volume 167, Issue 5, Pages 708-715

OBJECTIVES

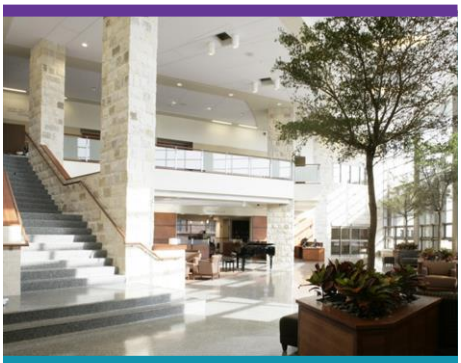
This study had four objectives – determining (a) occurrences of excessive noise and patient care activities over 24 hours, (b) impact of these factors on sleep continuity, (c) monitoring the effect of noise on sleep in healthy individuals and in critically ill patients, and (d) the efficacy of noise-reduction strategies on healthy individuals in single-room ICUs.

Key Concepts/Context

Patients in the ICU often experience sleep disruptions. Although the potential reasons for this disturbed sleep are attributed to patient care activities, noise, effects of medications, the illness itself, and other equipment-related issues, noise has always been considered to be the main factor in the ICU that disrupts sleep. While the general agreement is that ICUs are very noisy, the authors indicate that evidence (correlating noise in the ICU to sleep disruption) in existing literature is not adequate enough to be conclusive. This paper presents the results from a study involving seven critically ill patients and six healthy people who underwent a 24-hour polysomnography (PSG) in two ICUs. The study found that while noise and patient care activities were all-pervasive in an ICU, they were not the major disruptors of sleep in ICU patients.

Methods

A 24-hour continuous PSG study was conducted in two hospitals with a simultaneous monitoring of sounds using a sound meter and an infrared camera, both of which were synced with the polysomnograph. Critically ill patients were studied in the critical care unit of one hospital and healthy individuals were studied in the medical/surgical ICU of another hospital. The critical care unit had 18 beds arranged in (a) semicircular open plan with curtains separating the beds, and (b) a row of two-patient and four-patient rooms. The medical/surgical ICU had 24 beds with (a) 19 beds in a semicircular open plan with curtains separating the beds, and (b) five single-patient rooms. The criteria for selecting critically ill patients for the study included endotracheal intubation and possible mechanical ventilation in the next 24 hours. The exclusion criteria for healthy individuals was an existing medical



The Center for Health Design: Moving Healthcare Forward

The Center for Health Design advances best practices and empowers healthcare leaders with quality research that demonstrates the value of design to improve health outcomes, patient experience of care, and provider/staff satisfaction and performance.

Learn more at www.healthdesign.org

history, sleep disorder, or prior experience in an ICU. The healthy participants were randomly selected to spend 24 hours in one of the two study sites of the medical/surgical ICU and after one week were asked to spend 24 hours in the other site. After each 24-hour period, they were asked to complete a questionnaire on quality of sleep and causes of sleep disruption. Monitoring of the ICU environment involved recording the intensity of the background sounds, the magnitude, source, and disruptive effect of each abrupt sound higher than 10 dB (A), and documenting interactions between patient and care team or visitor. The research participants were seven male patients aged between 24 and 82 and six healthy individuals aged between 23 and 65. The healthy participants were not provided any care during the study period. Data was analyzed statistically – descriptive, paired and unpaired t-tests, one-way analyses of variance, and chi-square tests.

Findings

Overall, the study found that noise and frequent patient care activities were inherent in an ICU. Open-plan ICUs were particularly noisy. The study also determined that sounds and patient care activities contributed to a small percentage of disruption of sleep among patients. Although sounds did disrupt their sleep, the healthy individuals slept better than the patients.

Most measurements of sounds in both open-plan ICUs were similar. The only difference was in the total number of sound peaks per hour of sleep, which was significantly higher in the healthy individuals' study site than in the critical care unit ($p<0.05$). The single rooms recorded significantly lower sound levels as compared to the open-plan ICU at the medical/surgical ICU ($p<0.05$).

As compared to the healthy individuals, the critical patients had an inferior quality of sleep, higher awakening, and shorter sleep time. The patients tended to sleep more during the day, while the healthy individuals slept at night. Both had similar Stage 1 and Stage 2 non-REM and REM sleep percentages, but the patients experienced significantly lower slow wave sleep (SWS) or deep sleep as compared to the healthy individuals ($p<0.05$). The healthy individuals in the single rooms had significantly better total sleep time and slept better at night as compared to those in the open-plan ICU ($p<0.05$).

Healthy individuals were aroused and awakened in the open ICU mainly by sound peaks. In the case of the patients, only a few were awakened or aroused by sound – during 12% of abrupt elevations of 10dBA in sound and during 31% of sound peaks of 75dB or higher. Patients' sleep was disrupted by sound significantly fewer times than that of the healthy individuals ($p<0.05$).

In the patient ICU, no single source was identified as being the sole reason for sound-induced disruption of sleep. In the open-plan ICU with healthy individuals, staff conversations were found to be more disruptive than alarms. Individuals in the single rooms had their sleep disrupted from noises made by staff activities. More than 75% of the arousals and awakenings in the single rooms were linked to the opening of the main door to the ICU (which was near the single rooms).

Nursing activities took place an average of eight times in one hour of sleep. Of these, 18% led to sleep disruption and caused about 7% of the total arousals and awakenings. Other medical care activities and family visits of five minutes or longer caused sleep disruption among patients.

The healthy individuals rated the quality of sleep in the open ICU as worse than that in the single-patient rooms ($p<0.05$) and worse than at home ($p<0.05$). Alarms and conversations (among staff) were considered to be the noises that disrupted sleep, while television, telephones, and pagers were considered to be least disruptive. Individuals in the single rooms did not consider noise to be significantly disruptive to sleep ($p<0.05$).

Limitations

The small sample size was identified by the authors as one of the limitations for this study. They also pointed out that the design of the study limited the healthy individuals from getting acclimatized to the ICU environment, unlike the patients.

Design Implications

This study concludes that noise is not a major cause of sleep disruption among ICU patients. It also shows that ICUs are very noisy, and that single-room ICUs are less noisy than open-plan ICUs.