A 48-year-old man with necrotizing fasciitis, acute renal failure, and post-operative from multiple surgical debridement of bilateral lower extremities underwent polysomnography as part of a research protocol. The patient was undergoing mechanical ventilation and was receiving continuous infusion of sedatives and narcotics for comfort. Intravenous midazolam at 5 mg per hour and fentanyl at 75 micrograms per hour were being administered with a Ramsay sedation level of 2. On examination, the patient had anasarca; he appeared sedated and calm while breathing with the assistance of the ventilator. Cardiovascular examination revealed normal heart sounds and no murmurs, while respiratory examination revealed coarse crackles in the base of the lungs. Abdominal examination was benign except for abdominal wall edema and both legs were in surgical dressings. The patient was arousable but was unable to follow commands. Laboratory examination was abnormal with elevated white cell count and serum creatinine levels, and a metabolic acidosis. A representative segment of his polysomnogram is shown below (figure 1).

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DISCUSSION

Sleep is highly disrupted in critically ill patients. The reasons for such sleep disruption are thought to be related to medications (such as sedatives or pressor agents), mechanical ventilation, pain, noise, and underlying medical illness such as sepsis. Sometimes sleep in such patients cannot be clearly categorized into sleep stages, and in many cases are characterized by a loss of circadian rhythm. Very little is known about the ramifications of such disturbed sleep during critical illness and more research needs to be performed.

Artifacts encumbered while performing sleep studies in a busy intensive care unit is an obstacle for the study of sleep in critically ill patients. In this particular instance, the epoch was characterized by multiple, repetitive, respiratory artifacts (response D). Note how the artifacts are present in multiple channels (EEG, electrooculogram, and electromyogram) and on each occasion coincide with the change in phase of respiration—i.e., at the switchpoints between inspiration and expiration. Such artifacts can occur due to the jumping motion of the ventilator circuitry when it is in close proximity to the EEG leads. The clinical relevance of such artifacts is that they may occur when EEG monitoring is performed in the ICU for other clinical indications such as seizures or coma. One needs to be familiar with discerning such signals as artifacts.

This pattern is not that of cyclic alternating pattern (CAP; response A), although it could be mistaken for the same. CAP is a periodic EEG activity of NREM sleep. CAP is characterized by sequences of transient electrocortical events that are distinct from background EEG activity and recur up to one-min intervals. According to some investigators, such activity may reflect sleep instability, sleep disturbance, or both. Various subtypes of CAP have been described and their significance when they occur in normal subjects is unclear.

Burst suppression (response B) is defined as an EEG pattern characterized by bursts of EEG activity (sharp and slow waves) periodically interrupted by episodes of suppression (activity <10 mV). Typically, the episodes of suppression are longer (typically 5-10 sec) than the bursts of activity (typically 1-3 sec). This pattern is not specific to any etiology but may represent severe diffuse encephalopathy due to trauma, anoxic brain injury, cerebrovascular accidents, hypothermia, and deep sedation (barbiturates, benzodiazepines, or propofol). Our patient was undergoing light sedation as evidenced by the lower Ramsay sedation score (of 2) and by the fact that he was arousable. Moreover, the periods of suppression are not less than 10 mV EEG activity. The clinical relevance of this artifact is also that certain automated monitors are programmed to detect such undulating pattern in EEG as burst suppression which is used as a measure for depth of sedation in critically ill patients (bispectral index monitor). These monitors, when confronted by such respiratory artifacts, may spuriously overestimate the depth of sedation.

This was not seizure activity or repetitive arousals (responses C & E). Repositioning of the ventilator circuit corrected the movement artifact.

REFERENCES