SLEEP

Sleep is a basic need for human survival and is essential to healing and recovery from illness and injury. As well, many vital physiological processes are defined in terms of their relationship to a circadian rhythm and are thus intimately involved in the sleep state. However, sleep disturbances are all too common in hospitalized patients, with repeated arousals and disruptions occurring, on average, every 20 minutes in the ICU setting. As a consequence, these patients have difficulty attaining the deepest stages of sleep (delta wave sleep) and REM sleep. To compensate for these disturbances, these patients often attempt to sleep during the daytime. Daytime sleep, which accounts for over 50% of sleep attained in the critically ill, is unfortunately lacking in REM and delta wave sleep. The deeper stages of sleep are noted for physiological stability and sympathetic-parasympathetic balance.

Sources of Sleep Disturbances

Though internal factors (pain, discomfort, and anxiety) have been shown to result in sleep deprivation, external factors (lights on at night, staff noise) have been shown to be the primary reason for arousals and sleep fragmentation. Decibel evaluations of the ICU have consistently noted staff noise levels in the range of 70-80 decibels or greater. To put this in perspective, a power lawn mower’s noise levels are in the range of 65-95 decibels. Nighttime staff communication is the most disruptive noise, as sounds associated with words or meanings are more likely to result in awakenings. Numerous medications have been shown to disturb sleep, mostly through excessive daytime somnolence and disturbances of REM. These include beta-blockers, diuretics, ACE-inhibitors, calcium channel blockers, and benzodiazepines. Additionally, each nighttime diagnostic test,
nursing intervention and respiratory evaluation and treatment causes arousal and disturbance of sleep.

Consequences of Sleep Disturbances

Though the neurocognitive consequences (delirium, anxiety, and irritability) are most obvious, sleep deprivation can lead to increased energy expenditure, lowered seizure threshold, and an inability to regulate body temperature. Sleep deprivation suppresses antibody responses and cell mediated immunity. Decreased functional vital capacity, blunted hypercapnic and hypoxic ventilatory responses, and impaired respiratory muscle endurance have been demonstrated with sleep deprivation. Loss of normal day-night cues from sleep deprivation results in disturbed heart rate variability, increased sympathetic activity, and elevated blood pressure. Once sleep patterns return towards normal (as patient leaves ICU), REM rebound occurs with its associated hemodynamic lability, increase in arrhythmias, and myocardial ischemia. This may explain, or contribute to, early post-operative myocardial infarction and death.

Prevention of Sleep Disturbances

Conversations at night near patient rooms should be minimized. Bedside alarms should not be placed at the head of the bed or in patient room, but rather at central telemetry type stations so that these frequent “false alarms” are not audible to the patient. Routinely measuring vital signs throughout the night and early morning chest radiographs and phlebotomies should be abandoned in the patient who is not unstable or deteriorating. Scheduled baths and linen changes at night should be rescheduled to daytime hours. Lights in patient rooms should be turned off and those in the units should be dimmed during nighttime hours (make day, day and night, night).
Pharmacological Management of Sleep

Benzodiazepines
Benzodiazepines, although available in short acting formulations, have significant effects on the respiratory system and suppress deep stages of sleep. These agents are especially worrisome in patients with chronic obstructive pulmonary disease and or hypoventilation syndromes. Benzodiazepines may exacerbate underlying hypercapnia, induce upper airway hypotonia, and increase the number of duration of apneic events.

Diphenhydramine
Diphenhydramine is an anti-histamine and sedating drug with strong anti-cholinergic properties and is the agent most likely to be associated with adverse events when utilized for sleep promotion. Paradoxical excitement, visual hallucinations, and delirium are the most common adverse events associated with its use. As well, the increased daytime somnolence and decreased overall alertness following its nighttime use, should limit the use of this agent to severe pruritus and anaphylaxis.

Choral hydrate
Chloral hydrate has been used for years to sedate children for prolonged imaging studies, as well as inducing sleep for polysomnography in both children and adults. This agent induces sleep effectively and without respiratory depression at hypnotic dosing. Given the absence of effect on respiratory rate, PaCO2, PaO2, it is a preferred sleep agent in our surgical and trauma ICUs.

Zolpidem
Zolpidem, a non-benzodiazepine hypnotic, has several characteristics that make it useful for the short term use on an inpatient setting. Zolpidem preserves stages 3 and 4 sleep, as
well as REM, and has no significant residual (or “hangover”) effects. It has also less cognitive impairment and memory loss than the benzodiazepines.

*Mirtazapine*

Mirtazapine, a noradrenergic, serotonin-2 (5-HT2) anti-depressant, has been shown to have excellent sleep promoting effects. Its stimulation of the 5-HT2 receptor is thought to mediate its effect on sleep promotion and restoration of sleep architecture. Improved sleep latency, increased time spent in deep stages of sleep, and increased total sleep time has been demonstrated.

*Trazodone*

Trazodone is another anti-depressant shown to markedly improve sleep quality (even in non-depressed individuals) by both subjective measures as well as EEG. In addition, it has demonstrated excellent restoration of sleep hygiene in those experiencing post-traumatic stress disorders.

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**Agents used for sleep in the hospitalized patient**

<table>
<thead>
<tr>
<th></th>
<th>Initial dosing</th>
<th>Renal dosing</th>
<th>Hepatic dosing</th>
<th>Adverse events/comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloral hydrate</td>
<td>500 mg qhs (may increase to 1000 mg)</td>
<td>Avoid with CrCL &lt;50</td>
<td>Avoid with severe impairment</td>
<td>Leukopenia, GI distress</td>
</tr>
<tr>
<td>Zolpidem</td>
<td>5 mg qhs (may increase to 10 mg)</td>
<td>Not defined</td>
<td>Start at 5 mg with severe impairment</td>
<td>Depression, aggressive behavior, myalgias, amnesia</td>
</tr>
<tr>
<td>Mirtazapine</td>
<td>15 mg qhs (may increase to 30 mg)</td>
<td>Not defined</td>
<td>Avoid with severe impairment</td>
<td>Available as dissolvable tablet; avoid with acute depressive disorder; increased appetite, mild anxiolytic effect</td>
</tr>
<tr>
<td>Trazodone</td>
<td>50 mg qhs (may increase to 100 mg)</td>
<td>Not defined</td>
<td>Avoid with severe impairment</td>
<td>Avoid with acute depressive disorder; neutropenia, anemia, extrapyramidal symptoms</td>
</tr>
</tbody>
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REFERENCES


