Sleep Deprivation and Delirium

Mouhamad Ghyath Jamil, MD, FCCP
CCM, Pulmonary & sleep Medicine
Director sleep Medicine unit
Director Home Mechanical Ventilation
Director Tele-ICU
King Faisal Specialist Hospital & Research Center
Sleep Deprivation and Delirium

* Delirium and Sleep (Prevalence, Epidemiology)
* Physiologic Consequences of Sleep Deprivation
* Clinical similarities between delirium and sleep deprivation
* Exploring the mechanistic relationship between delirium and sleep deprivation
* Investigation of the relationship between sleep deprivation and delirium
* Management of sleep deprivation
* Conclusions
Clinical syndrome characterized by acute onset of fluctuating disturbance in consciousness, inattention, and cognitive dysfunction

I. Agitated (hyperactive delirium)
II. Withdrawn (hypoactive or quiet delirium)
III. Both agitation and withdrawal at times

Delirium has been shown to occur in up to 80% of critically ill patients. An independent predictor of adverse ICU outcomes, including:

i. Increased risk of death
ii. Longer hospital stay
iii. Higher costs
Epidemiologic

- Risk factors for the development of delirium.
  - Advanced age
  - Pre-existing cognitive impairment
  - Electrolyte disturbance
  - Medication
  - Sleep deprivation, common in ICU patients, may also be a contributing factor
Altered Sleep Patterns in the ICU

Normal sleep architecture

Non REM sleep
- N1: 2%-5%
- N2: 45%-55%
- N3: 10%-23%

REM sleep: 20%-25%
Severe sleep fragmentation

Disturbed sleep

The sleep typical of a critically ill patient is characterized by a predominance of:

- wakefulness and light sleep (sleep stages I and II),
- A relative lack of rapid eye movement (REM) and deep sleep (III/IV)


Sleep deprivation is known to lead to several clinical and physiologic manifestations also found in delirium; however, its role in the development of ICU delirium is controversial.

Few data to directly link the consequences of altered sleep patterns in the ICU to increased patient morbidity or mortality, it is important to recognize the physiologic consequences of poor sleep.

Difficulties of appropriate clinical trial design rather than an absence of an impact of sleep disruption on patient morbidity and mortality.
Sleep Patterns

- Immune Function
- Hormonal Function
- Pathways of Metabolism
- Catecholamines Levels
- Neurocognitive Function
- Pulmonary Mechanics
- Control of Breathing
Factors that Affect Sleep in the ICU

- Ambient Noise
- Modifiable Environmental Factors
- Procedures
- Ambient Light
- Equipment Alarms
Modifiable Patient Factors

- Mechanical Ventilation
- Medications used for Sedation and Analgesia.
Box 1. Factors affecting sleep in the ICU

Patient factors
Underlying medical illness, including existing sleep disturbance (sleep apnea, periodic limb movements, narcolepsy)
Current illness (severity of illness)
Treatment of current illness
  Medications and side effects
  Need for and mode of mechanical ventilation
Pain
Anxiety
Agitation

Environment factors
Ambient light
Ambient noise
Equipment (television, ventilator, monitoring equipment)
Alarms (ventilator, telemetry, oximetry)
Procedures (blood draws, electrocardiograms, radiologic studies)
Nursing: bathing, cleaning, monitoring, vital signs, medication administration
Beepers, conversation
Clinical similarities between delirium and sleep deprivation

The central components of delirium
- Inattention
- Fluctuating mental status
- Cognitive dysfunction
  - characteristic of patients with sleep deprivation
Intense dreaming and nightmares are often reported by patients in the ICU.

Schelling and colleagues reported that 64% of patients who had acute respiratory distress syndrome recalled traumatic nightmares during their stay in the ICU.

Between 40% and 57% of the delirious ICU patients report vivid dreams as one of the main contributors to their spectrum of fluctuating levels of consciousness, paranoid delusions, and hallucinations.
Studies of the effects of sleep loss have mostly included healthy volunteers. Negative effects on mood, loss of vigor, fatigue, and impaired cognition have also been observed after all forms of experimental sleep deprivation.

- hypoactive (quiet) delirium (Sleepiness, microsleeps)
- Paranoid delusions and auditory and visual hallucinations
- Attention and memory impairment neurocognitive dysfunction
- psychotic behavior
Mood disturbance and subjective sleepiness return to baseline quickly once recovery sleep begins

Some performance tasks are slower to recover

Healthy volunteers sleep deprived for up to 48 hours, have a continued abnormality in psychomotor vigilance even after 5 nights of recovery sleep

A similar delay in psychomotor recovery occurs with delirium.

Patients who were delirious in the hospital are observed to recover to their baseline mental status prior to discharge and may even return to work, but with demonstrable impairments in task performance and thought processing when tested months later


Exploring the mechanistic relationship between delirium and sleep deprivation

- Malfunction of specific regions of the cerebral cortex and related structures of the brainstem
- Prefrontal cortex
- Anterior cingulate
- Basal ganglia
- Parietal lobes
- Superior colliculus
- Thalamic pulvinar
- Cholinergic innervation
- Excess of dopaminergic stimulation
Clinical and physiologic similarities shared by delirium and sleep disruption

Clinical features
- Inattention
- Fluctuating mental status
- Impaired cognition, specifically those relating to executive function (memory, planning, creative thinking, judgment)
- Delayed recovery after the insult is removed

Risk factors
- Intensive care unit admission
- Mechanical ventilation
- Pain
- Stress
- Pre-existing cognitive impairment
- Advanced age
- Alcoholism
- Depression
- Sepsis
- Head trauma

Medications
- Sedatives, especially γ-aminobutyric acid agonists such as benzodiazepines
- Anticholinergics
- Sympathomimetics
- Corticosteroids
- Anticonvulsants

Pathophysiology
- Cholinergic deficiency
- Dopaminergic excess
- Altered metabolism at specific regions of the central nervous system
  - Prefrontal cortex
  - Posterior parietal cortex
Is sleep deprivation a risk factor for delirium?

- Helton and colleagues:
  - 62 critically ill medical and surgical patients during their first 5 days in the ICU
  - Goal: the intention of correlating patients’ sleep deprivation with the development of mental status changes
  - Control: medications and conditions that would affect mental status

Sleep deprivation was determined by the number of uninterrupted sleep cycles (75-minute periods of time without interruption) – compared with what would be normal for the patient at home.

**Conclusion:**

1. They found that mental status changes were more likely in patients with greater sleep deprivation.
2. More rigorous investigation utilizing polysomnography and objective measures of delirium in critically ill patients are needed.
Investigation of the relationship between sleep deprivation and delirium

* Polysomnography (PSG) needs to be performed over a 24-hour period
* Vasoactive medications
* Sedatives
* Analgesics
* As these medications are weaned, patients’ sleep patterns will also change
Investigation of the relationship between sleep deprivation and delirium

* interpretation of PSG in the ICU is challenging
  1. Manual scoring system for PSG may not be as reproducible as spectral analysis of EEG in mechanically ventilated critically ill patients
  2. Encephalopathy is common in the ICU and can cause EEG patterns similar to slow-wave sleep
1. Sedatives can also cause profound effects on the EEG, producing a decrease EEG amplitude and an increase in frequency – which may be erroneously scored as wakefulness if using standard R&K criteria.

2. Short periods of EEG burst suppression may also occur secondary to benzodiazepines and propofol administration on PSG epochs otherwise scored as stage I or stage II sleep.
<table>
<thead>
<tr>
<th>Medications that can cause delirium and their effects on sleep</th>
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<td>Nonsteroidal anti-inflammatory agents</td>
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<td>Cardiac drugs</td>
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<td>Tricyclic antidepressants</td>
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<td>Selective serotonin reuptake inhibitors</td>
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<td>Sedative/hypnotics</td>
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<td>Benzodiazepines</td>
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Numerous studies have confirmed that the development of delirium during a hospital course is associated with:

- Increased length of stay in the hospital
- Worse physical and cognitive status upon discharge and for at least 12 months thereafter
- Higher mortality


Outcomes of Delirium

- Distress among family members and caretakers
- Distress in those patients with recall of their experience
- Institutional care following their acute illness
- Poor neurocognitive outcomes
- Long-lasting, possibly permanent deficits after discharge from the hospital
- Higher incidence of dementia in follow-up of patients who became delirious while in the hospital
- Higher 1-year mortality

Delirium and some associated risk factors. A possible relationship between delirium and some of its associated risk factors, including sleep deprivation. ICU, intensive care unit.
pharmacologic and nonpharmacologic strategies should be undertaken to treat sleep deprivation

1. controlling the patients’ environment
   a) Maintaining a quiet, dark room during the night, and reducing sleep interruptions during the nocturnal hours
   b) During the day, however, light levels should be maintained and patients kept awake if possible as one strategy to consolidate sleep at night
1. A review of possible pre-existing sleep disorders and medications that could disrupt sleep should routinely be conducted.
2. For patients who require mechanical ventilation, attempts should be made to minimize discomfort.
3. Short-acting hypnotics and sedating antipsychotics and anti-depressant medications have been used off-label for this purpose but increase the patients’ risk of developing delirium.
4. Nocturnal propofol may be a reasonable agent for patient on MV.

Delirium is highly prevalent among critically ill patients.
Severe sleep deprivation is an important problem for critically ill patients as it has been shown to have both short-term and long-term effects on patients’ quality of life.
Sleep deprivation research has revealed many similarities, both clinically as well as experimentally, with delirium.
Sleep deprivation itself is a potentially treatable cause of significant patient discomfort with an established link to adverse ICU quality of life.
Further research is needed to determine the exact role sleep deprivation plays in its pathogenesis.
THANK YOU