The Body’s Canary: Delirium and the Brain

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http://www.youtube.com/watch?v=YvHsFK_G_v8
Learning Objectives

1) Understand that delirium is the final common pathway for diverse causes.

2) Acknowledge how delirium is endemic in hospitalized patients.

3) Appreciate the role of baseline vulnerabilities and precipitating events.

4) Learn non-pharmacological prevention strategies.

5) Review indications for pharmacological interventions in delirium management.
The Canary in the Coal Mine

• The nature of the canary
  • sensitive to asphyxiants in the mine air
  • reactive to asphyxiants by collapsing, dying
The brain: the body’s “canary”

• The nature of the brain
  • sensitive to derangement in any organ
  • reactive by becoming encephalopathic
What delirium looks like

• “Delirium is an acute confusional state defined by fluctuating mental status, inattention, and either disorganized thinking or an altered level of consciousness.”

Pun 2007
Video interlude
Diagnosing Delirium

• Best evidence supports CAM
• Takes five minutes
• Adaptable for ICU
• 94-100% sensitivity; 90-95% specificity

Wong 2010
Four CAM Elements

1. acute onset, fluctuating course
2. inattention
3. disorganized thinking
4. altered level of consciousness

- Diagnosis requires \{1 \& 2\} + \{3 or 4\}

Wong 2010
What Kills Canaries: Cause and Effect

• Cause:
  • a neurobehavioral manifestation of imbalances in metabolism of neurotransmitters normally regulating cognitive function, behavior, and mood

  *Girard 2008*

• Effect:
  • final common pathway: oxidative stress on vulnerable neurons
    • dopamine excess drives hallucinations, agitation
    • acetylcholine deficit produces decreased alertness, attention

  *Caplan 2010*
ICU Syndrome is NOT harmless!

- Delirium independently predicts
  - Increased length of stay -- >10 add’l days
  - Reintubation – three-fold higher rate
- Each add’l delirious day
  - 20% increase in hosp length
  - 10% increase in risk of death
- Harbinger of early death
  - 425 acutely delirious geri ward, nursing home patients
  - OR = 1.86 at 1 yr, 1.76 at 2 yrs

*Pun 2007, Pitkala 2005*
Dying canaries are common….

- Delirium rates in hospitalized patients
  - ED, older patients 17%
  - Acute general hospital admits 37%
  - ICU admits 31%
  - ICU intubated 82%

Han 2011, Eeles 2010, Milbrandt 2004
Not all canaries react the same way….

• Delirium Subtypes
  • Hyperactive – 1.6%
    • Agitation
    • Attention-grabbing
    • Better prognosis
  • Hypoactive – 45.3%
    • Negative sx: Inattention, flat affect, lethargy
    • Unrecognized in vast majority of hosp’d patients
    • Not alarming (enough)
  • Mixed – 54.1%
    • Waxing and waning

Peterson 2006
Delirium Components

• Baseline vulnerabilities – host factors
• Precipitating event – disease onset
• Iatrogenic contributors – inhospitable env’t
Baseline vulnerabilities

- Some canaries are more delicate than others!
  - Dementia
    - Apolipoprotein E4 phenotype
  - Advanced age
  - Medical comorbidities
    - Hypertension
  - Psychiatric comorbidities
    - Depression
  - Substance dependence
    - Nicotine dependence
    - Vasoconstriction
  - Withdrawal
    - Alcoholism
    - withdrawal
Precipitating Events

- **Some canaries are sick!**
  - diseases/trauma
  - acute infection/sepsis
  - seizures
  - head trauma, brain tumors
  - vascular disease

- Disease consequences
  - hypoxia, hypercapnea
  - metabolic & electrolyte disturbances
  - dehydration
  - hyperthermia
Complex Mnemonics vs Common Sense

**DELIRIUMS**
- Drugs, Eyes-ears-sensory deficits, Low O2 states (heart-lungs), Infection, Retention, Ictal state, Underhydration-undernutrition, Metabolic causes

**I WATCH DEATH**
- Infection, Withdrawal from drugs, Acute metabolic disorders, Trauma, CNS pathology, Hypoxia, vitamin Deficiencies, Endocrinopathies, Acute vascular insult, Toxins, Heavy metals

**WHHHHIMPS**
- Withdrawal, Wernicke encephalopathy, Hypoxia/hypoperfusion of brain, Hypertensive crisis, Hyper/hypothermia, intracranial hemorrhage/mass, meningitis/encephalitis, poisons, medications status epilepticus
Iatrogenic Contributors

• **Some hospitals are inhospitable!**
  • treatment consequences
    • deliriogenic medications
      • anesthesia, sedatives, analgesia
  • hospitalization consequences
    • Immobilization, restraints, catheters
  • mechanical ventilation
  • disrupted sleep
    • ICU pts avg 2 hrs uninterrupted sleep/night
      • care activities, excess noise
      • Non-circadian lighting (e.g. windowless rooms, 24-7 lighting)

• **All of the above can be modified or reversed.**
Prevent Canary Death!

- MSHA specifies ventilation standards for modern mines
Prevention is Best Practice

Address environmental, iatrogenic contributors:

1) cognitive stimulation
   • Repeated instructions, frequent reorientation
   • Visits from family, friends

2) sleep hygiene
   • Nonpharmacological sleep protocols
     • Sleep hygiene to normalize sleep-wake cycle
     • Noise reduction

3) early mobilization
   • range-of-motion exercises

4) visual impairment
   • eyeglasses, magnifying lenses

5) hearing impairment
   • hearing aids, earwax removal

6) adequate hydration

7) “just enough” sedation, analgesia
   -- clear targets, smallest effective dose, shortest time necessary
Antipsychotics & Prevention

• prn IV haloperidol reduces agitation, psychosis
  • no RCTs with placebo

• haloperidol does not decrease delirium incidence, but:
  • pre-op, low-dose haloperidol may reduce severity, length of delirium; length of hospitalization
  • prn haloperidol + quetiapine may reduce severity, length of episodes

• conclusions limited by
  • heterogeneous studies
  • non-standardized antipsychotic protocols
  • small studies lacking placebo arms
    • Schrader 2008, Devlin 2011
GABA-sparing Protocols

- Dexmedetomidine = alpha-2 agonist
  - provides light sedation, anxiolysis, sympatholysis without respiratory compromise, delirium exacerbation
  - dexmedetomidine patients had
    - spent less time on ventilator
    - experienced less delirium
    - showed less tachycardia, hypertension
  - no direct benefit on delirium prevention
  - indirect benefit from avoiding deep sedation, using fewer deliriogenic benzodiazepines

- **nota bene**
  - lorazepam only for Etoh withdrawal (benzos are RF for delirium)
  - any drug treating delirium may cause adverse psychoactive effects

Video interlude
In Sum

• “Inattention may be a basic feature of delirium, but it should not be a component of our attitude toward delirium….”

Pun 2007
Bibliography

- Eeles MPE, Hubbard RE, White SV, O'Mahony MS, Sawa GM, Bayer AJ. Hospital use, institutionalisation, and mortality associated with delirium. Age and Ageing 2010; 39:470-475
- Pun BT, Ely EW. The importance of diagnosing and managing ICU delirium. Chest 2007; 132:624-636
- Wong CL, Holroyd-Leduc J, Simel DL, Straus SE. Does this patient have delirium? Value of bedside instruments. JAMA 2010; 304:779-786