Lt. Col. Van Arman, has served as the Medical Director of the Fort Drum Traumatic Brain Injury (TBI) clinic since 2011. The Fort Drum TBI clinic is a multi-disciplined team who work collectively with their patients returning them to optimal health and functioning following concussive events.

She received her Family Nurse Practitioner Degree from the Uniformed Services University of the Health Sciences in 2007. In 2010, she was selected the Warrior Transition Unit Primary Care Manager of the Year.
SLEEP DISORDERS AMONG MILITARY MILD TBI PATIENTS

Photo credit: Mass Communication Specialist 1st Class Peter D. Blair

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LEARNING OBJECTIVES

• The attendee will be able to identify the risk factors and prevalence of mental disorders, sleep disorders, and TBI in military populations.
• The attendee will be able to describe the effects of sleep disorders in military populations.
• The attendee will be able to put into practice the findings of this research.
• The content presented expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the Department of the Army, Department of Defense, nor the U.S. government.
• I have no financial obligations to disclose.
• The description of programs in this presentation is for descriptive purposes only and not intended to promote any individual program.
OUTLINE

• Importance of sleep
• Etiology of sleep disorders in Military
• Physiologic differences between TBI brains and non TBI brains in sleep
• Common Sleep disturbances in TBI population
• Treatment in primary care setting for sleep disorders
• Current and future research for sleep disorders
INCIDENCE OF SLEEP DISORDERS IN MILITARY

• #1 Post deployment disorder among all Service members
• #2 Disorders among > 300,000 TBI military members (after headaches)
• 97.4% TBI pts with sleep complaints
• 55% objective insomnia
• 34.5% with sleep apnea
• 85.2% day time hypersomnia
• 54.3% sleep fragmentation (Next Slide)
• Blunt trauma- more likely to induce Sleep Apnea
• Blast trauma – more likely to induce insomnia
SLEEP FRAGMENTATION

• Sleep arousals: 529

Photo Credit: Author
PILOT SLEEPINESS

- 72% pilots admitted to flying so drowsy they could’ve “easily fallen asleep”

- 45% pilots acknowledge they “dozed off” while flying in cockpit
USMA SLEEP STATISTICS

• Pre- West Point, individuals sleeping 8.39 hours per night

• During Cadet Basic Training, sleep amount fell 39% to 5.67 hours nightly sleep

Photo Credit: Associated Press
SLEEP IS A MILITARY PROBLEM

• 3 hours sleep on average for Soldiers on deployment and field training exercises

• Fragmented

• Unsure when they will be awoke
ETIOLOGY OF SLEEP DISORDERS IN MILITARY

- Deployment Brain- Quick Reaction Force
- Culture of Caffeine
- Punishment- extra duty 0600-2400
- Crowded sleeping conditions, loud noise exposure, irregular sleep/wake cycles increase risk/onset sleep disorders.
CAFFEINE

- Energy drinks $27.5 billion
- Energy drink consumption > 5000% since 1999
SLEEP DISORDERS- “MILITARY PROBLEM”

• Sleep disorders: “A military problem”
• “QRF Brain”
• Regular sleep
• Fragmented sleep
• Unpredictably fragmented sleep

Sleep deprivation = > faulty 700 genes r/t stress and immunity dysregulated

• Dr. Robert Sapulsky
IMPORTANCE OF SLEEP

• “Glymphatic System”
• Sleep flushes out brain toxins- amyloid beta
• Effects of sleep deprivation (Mc Kinley article)
• Poor sleep predicts worse outcomes 1 year out from concussion
• REM Sleep critical for survival
• Good sleep = Protective against development of PTSD
EFFECTS OF SLEEP DEPRIVATION

• Increased reaction times (slower response time)
• Decreased accuracy
• Decreased attention
• Alterations in mood
• Prolonged sleep deprivation
• 17 hrs awake performance BAC of 0.05%
• 24 hrs awake performance = BAC of 0.10%
"If you have less than six hours of sleep for six days in a row you have a cognitive impairment of 20 percent – that you are cognitively impaired as if you had a .08 percent alcohol level,…We never will allow a soldier in our formation with a .08 percent alcohol level, but we allow it every day to make those complex decisions."
DISRUPTION OF NORMAL SLEEP-WAKE CYCLE

• Desynchronizes hormones normally produced during various cycles of circadian rhythm.
• Normal healing/remodeling prolonged, impeded with ineffective sleep
• reduced capacity to learn and impaired attention
  = translates: “I can’t remember anything”, “I can’t focus on anything”
EFFECTS OF SLEEP DEPRIVATION

- Vicious cycle: Chronic Pain - Impaired sleep
- Impaired sleep alters pain perception
- Creates neuropathways of perceived heightened pain perceptions
- Cognitive function decline
- After a concussion may play role in development of PTSD
TBI EFFECTS ON SLEEP

Too long in Stage 1 sleep
Too many awakenings and stage shifts
Reduced Delta and REM sleep
Decreased sleep efficiency
Lower evening Melatonin levels
Lower CSF hypocretin-1 levels (posterior hypothalamic dysfunction)
NEW TBI FINDINGS

• “Neural Signature” Honeycombed pattern unique to combat blasts vs. concussions from sports or car crashes
• Scientists noticed pattern difference in amyloid precursor protein- transmitted between neurons. Proteins glob up at points of breaks in axons.
• Car Crash concussion-those globs are big, bulbous
• In Blast concussions- smaller, honeycombed near blood vessels
SLEEP DEPRIVATION AND CONCUSSIONS

• Negative impact on recovery from TBI (impedes restorative processes that occur during sleep)
• Symptom exacerbation (pain, irritability and cognitive/memory dysfunction)
• Functional deficits (e.g., social functioning, response to rehabilitation, return to work, etc.)
• Sleep disorders can disrupt neural remodeling following a blast or traumatic brain injury
COMMON SLEEP DISORDERS

Photo credit: Mass Communication Specialist 1st Class Peter D. Blair

Photo Credit: Author
SLEEP ASSESSMENT - INCLUDE

• Observe them in waiting room- sleeping?
• Examine nose and oral cavity
• Caffeine types, times, frequency
INSOMNIA

- Most common sleep disturbance prevalence rate 21-93% following concussions.
- PTSD alone = 66% with insomnia.
- TBI alone = 75% with insomnia.
- PTSD + TBI = 93% with insomnia.
INSOMNIA PROBLEMS

• Can interfere with cortical plasticity and are not FDA approved for chronic insomnia or other persistent symptoms of concussion
• Use of these drugs for longer than 30 days can lead to tolerance or dependence
• Benzodiazepines are contraindicated as their use may impede neuronal recovery
PRIMARY CARE WORK UP- INSOMNIA

- Labs: 0800 Cortisol levels, LH, FSH, TSH, FT4, T3, 0800 Testosterone (males), 0800 estradiol (females)
STIMULUS CONTROL AND SLEEP HYGIENE
BEST TREATMENTS FOR INSOMNIA IN THE PRIMARY CARE SETTING

**Stimulus control**
- No electronics
- Get out of bed 15-20 min if can’t fall asleep
- Return to bed (bedroom) only when sleepy
- Eye mask, white noise, ear plugs

**Sleep Hygiene**
- No caffeine 6 hours before bed time
- Exercise in morning-OUTSIDE
- Cool temp in bedroom
PRIMARLY CARE PHARMACOLOGICAL TREATMENT OF INSOMNIA

- (no drugs < 3 months)
- 2 weeks at a time, no more than 30 days
- CONTRAINDIATED: benzodiazepines
INSOMNIA- OTC ANTIHISTAMINES

- Histamine promotes alertness
- Antihistamine blocks alerting effect
- Side effects: Daytime sleepiness
- Memory deficits, confusion
- Potential difficulty with urination

- NOT recommended for Tx of insomnia
INSOMNIA - ANXIETY PREDOMINANT

- Non-Benzodiazepine Receptor Agonists - CAREFUL: TBI Patients brains may be more sensitive to side effects
  - Zolpidem (ambien)
  - Zaleplon (sonata)
  - Eszopiclone (Lunesta)
  - 4.5% increase in mortality with sleep medications (as few as 18 doses per year)
  - Only increase sleep time by 30 min of avg.
INSOMNIA- TRICYCLIC ANTIDEPRESSANTS

• Avoid!
• Anticholinergic effects - *Cognitive impairment
• CYP2D6 inhibition *Increases TCA levels:
  Fluoxetine (Prozac), Paroxetine (Paxil), Bupropion (Wellbutrin), Duloxetine (Cymbalta), Sertraline (Zoloft)

Doxepin (Silenor)- may be acceptable. Few anticholinergic side effects
INSOMNIA- MELATONIN AGONIST

- Melatonin receptor agonist: Ramelteon (Rozerem)
- Week 1 = 15 more min
- By 6th month, only achieved 9 more min of sleep
MELATONIN

- Used for Circadian Rhythm Sleep-Wake Disorders: shift work, jet lag, time zone changes

- Melatonin: (0.5 mg – 5mg) 5-6 hours before **Time patient normally goes to sleep (or Dim Light Melatonin Onset –DLMO)

- Gives 38 more minutes of sleep
INSOMNIA TREATMENT - HERBALS/NUTRACEUTICALS

- Valerian Root
- Kava
- Hops
- Passion Flower
- Chamomile
- Marijuana

NOT Recommended by American Academy of Sleep Medicine due to lack of efficacy and safety data.
SLEEP APNEA

- Typical TBI Soldier with Obstructive Sleep Apnea.
  - slender
- No history of previous sleep disorder prior to head trauma
OBSTRUCTIVE SLEEP APNEA

- 34.5% of service members with concussion.
- 2x greater incidence in PTSD than civilian population (13.8% vs 6.8%)
- Presentation: witnessed pauses in breathing, gasping or choking.
- Excessive sleepiness
- Gold Standard diagnosis: Polysomnography
Non-Pharmacologic

Body Position Therapy
Oral Appliances
Positive Airway Pressure therapies (CPAP, BiPAP)

**DUAL:**

PAP plus modafinil or armodafinil for residual daytime hypersomnia in TBI population
NIGHTMARES

- Unpleasant dreams that involve fear or anxiety, full alertness on awakening with little confusion
- Difficulty falling back to sleep
- When it is not a problem
- Sleep Study for Atypical parasomnias: violence, sleep walking outside
NIGHTMARES - PRAZOSIN

- Alpha-1 Adrenoreceptor agonist - Blocks noradrenaline
- Dampens sympathetic response that contributes to PTSD pathophysiology
- Low incidence of side effects if titrated slowly
- Start with 1 mg at bedtime x 2 nights then increase to 2 mg
- Increase weekly as needed for max at 5mg midmorning, and 20mg at bedtime
NIGHTMARES- NON-PHARMACOLOGICAL

• Cognitive Behavioral Therapy- uncovers, alters, corrects distortions of thinking
• Imagery Rehearsal Therapy- type of CBT
  - write down content of nightmare while awake, changing the dream story
  - daily 10-20 min practice

(not enough data supporting hypnosis)
EFFECTS OF PRAZOSIN ON TBI SLEEP

- Headaches per month 12.4 → 4.8
- Headache intensity 7.1 → 4.1
- Daytime sleepiness (Epworth) 16.1 → 7.3
- % subjects restful sleep 7.0% → 87.8%
- Montreal Cognitive (MOCA) score 24 → 28

(data courtesy of DVBIC)
RESTLESS LEG SYNDROME

• Diagnosis needs all 4 components:
  1. Urge to move/creepy crawly feelings in arms and legs?
  2. Is it worse at night
  3. Does it interfere with falling asleep?
  4. Does it feel better with moving around?
ERECTILE DYSFUNCTION

- US incidence 22% males with ED
- 2011 > 3,000 active duty air force males prescribed phosphodiesterase inhibitors
- Anecdotal findings Fort Bragg, Fort Drum - different risk factors than civilian male population
BRUXISM

3 combat deployments
6 crowns, 3 wisdom teeth extracted

Photo Credit: Author
BRUXISM

• 1. Clenching jaw, 2. Grinding teeth
• Resulting in pain in head, neck and jaw
• Erosion worsened by Soldier’s consumption sugary/energy drinks
• Bupropion (Wellbutrin) worsens nighttime teeth grinding
• Israeli pilot study 67% pilots, 27% non pilots
CURRENT AND FUTURE DISORDER TREATMENT
STIMULANTS

- Ok's use of Stimulants AFTER Sleep study ruling out sleep disorder for following:
  - Fatigue
  - Cognitive difficulties (concentration, memory, decision making)

VA/DoD Clinical Practice Guideline for Management of Concussion/mTBI
NOOTROPICS

- Cognitive enhancers: Piracetam, Oxiracetam
- Stimulants: Dextroamphetamine (Adderall), Methylphenidate (Ritalin)
- Long term use may decrease brain neuroplasticity
TRANSCRANIAL DIRECT CURRENT STIMULATION (TDCS)

Photo Credit: Richard A. McKinley, USAF
TDCS

• If placed over frontal cortex improve cognitive abilities like working memory, visual motor coordination (areas most degraded by sleep deprivation)
• Can enhance ability to learn: make and retain memories of new skills, material
• Enhances memory and attention
TDCS VS. CAFFEINE STUDIES

- Meta analysis of caffeine on cognitive performance: 100-300mg mood improvement
- > 400mg caffeine, mood deterioration
- Benefits of caffeine decline over time and duration of use
- While it may help you stay awake, it may not improve decisions
- TDCS effects last 2-3 more hours than caffeine
HORIZON< 1 YEAR- INSOMNIA TX

- Insomnia- new medication Suvorexant
- SOMENO: specialized sleep mask, heater facemask, dampens surrounding noise, EEG device to track sleep phases and blue light – automatically brightens while sleep is lightest for optimal wake up.
HORIZON IN 5 YEARS- SLEEP APNEA

- Sleep Apnea - medication that prevents upper airway from relaxing and blocking breathing
STELLATE GANGLION BLOCK- CONTROL PTSD SYMPTOMS

Stellate Ganglion block on 6th cervical vertebrae level
70% clinical improvement in the PCL scores (more than 10 points from baseline)
Effects lasted 3-6 months after procedure
PRIMARY CARE SLEEP RECOMMENDATIONS

• Shift in viewing issues as sleep disorders to “promotion of sleep health”
• Increasing self awareness through personal sleep devices and applications
• Download F.LUX: program that makes digital screens BLUE
• Personal Sleep Trackers: Up Band, Fit Bit, Sleep App
TO REQUEST SLEEP KITS: EMAIL INFO@DVBIC.ORG
DEFENSE CENTER OF EXCELLENCE
CLINICAL RECOMMENDATIONS

- June 2014 “Management of sleep Disturbances following a concussion/mild TBI” aimed toward Primary Care Providers
REFERENCES


REFERENCES (CONT.)


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