To Sleep, Perchance to Dream…
Should sleep studies be included in the clinical management of MND/ALS?

Lee Guion MA, RRT
Forbes Norris MDA/ALS Research and Treatment Center
San Francisco, CA

December 10, 2010
Aims

- Briefly summarize what we know – and don’t know – about sleep in pALS

- Spark discussion about the best methods for evaluating and treating symptoms of sleep disordered breathing in MND/ALS
Background

- Diaphragm weakness exaggerates normal physiology during REM sleep
  - Suppression of intercostal and accessory muscles
  - Decreased lung volumes
  - Upper airway resistance
  - Decreased muscle tone in throat and upper airway
  - Diaphragm displacement by abdominal contents
Background

- Importance of restful, restorative sleep
  - Psychological and emotional well-being
  - Physiological health
    - Cardiovascular disease
    - Diabetes Mellitus
  - Quality of life
Evaluation of sleep quality

- Patient-reported symptoms
  - Feeling tired upon awakening
  - Difficulty staying awake during the day
  - Difficulty concentrating or with memory
  - Lack of energy or increased fatigue
  - Morning headaches

- Obtained on initial and all subsequent clinic visits
Evaluation of sleep quality

- Maintain high degree of suspicion of nighttime diaphragm weakness with daytime symptoms of poor sleep quality
Evaluation of sleep quality

- What is the best Symptom of early diaphragm weakness in MND/ALS?

- What is the best Method of identifying lung muscle weakness and night time hypoventilation in MND/ALS?

- Why is this important?
Treatment of hypoventilation

- Lung volume replacement with noninvasive ventilation (NIV)
  - AAN Updated Practice Parameter (2009)
  - Cochrane Review of nocturnal NIV in chronic hypoventilation (2009)

- Increasing support for early intervention with NIV to decrease morbidity and increase survival
What we don’t know

- What physiological measures of sleep are the best predictors of hypoventilation in pALS
- And what is the significance of these measures in assessing sleep quality in MND/ALS
Effects of NIV on sleep outcomes in MND/ALS

Methods

- 12 subjects meeting CMS guidelines (US) for initiation of NIV (FVC < 50%, MIP < - 60 cmH2O)
- Home sleep study before beginning NIV
- Home sleep study with NIV
- Total of 24 studies (adequately powered)

Effects of NIV on sleep outcomes in MND/ALS

Methods

- Primary outcome
  - Change in minimum oxygen saturation

- Secondary outcomes
  - Change in mean oxygen saturation
  - Apnea and hypopnea indexes
  - Sleep quality
    - Arousals
    - Restful sleep
    - Sleep architecture (stages)
Effects of NIV on sleep outcomes in MND/ALS

Findings

- Improvement in minimum oxygen saturation with NIV use (7%) throughout night and during REM
- Non-significant improvement in mean oxygen saturation with NIV use (1.5%)
- 8/12 patients had improved sleep efficiency
Effects of NIV on sleep outcomes in MND/ALS

Outcomes

- No statistically significant improvements in secondary outcomes with NIV use
  - Lack of stage 3 (restorative) sleep in MND/ALS with or without NIV use
  - Apnea index
  - Hypopnea index
  - NIV use did not improve sleep arousals, restful sleep, or overall sleep architecture

(all patients able to use NIV ≥ 4 hours/night)
Effects of NIV on sleep outcomes in MND/ALS

- Orthopnea was the best predictor of respiratory impairment (hypoventilation)
Sleep in MND/ALS

Summary

- pALS appear to be unusual in response to nighttime decrease in oxygen saturation
- Oxygen desaturations not directly tied to apnea and hypopnea indexes
- Questionable usefulness of traditional measures of sleep quality (arousals, time in restorative sleep stages) in pALS
Sleep in MND/ALS

Summary

- pALS are heterogeneous and vary in response to diaphragm weakness and nocturnal hypoventilation
- Apneas and hypopneas appear to be rare
- pALS are able to maintain use of extra-diaphragmatic muscles (inspiratory neck muscles) during REM
- Lack of consensus and insufficient data on the physiological significance of sleep changes in MND/ALS
Take home messages

- Detection of diaphragm weakness and night time hypoventilation can be accomplished by
  - Obtaining and recording subjective daytime symptoms of poor sleep quality at each visit
  - Lung function measures upright and supine (FVC, MIP)
  - Reported and observed orthopnea
Recommendations

- Develop international sleep diagnostic protocols for evaluating nocturnal hypoventilation in MND

- Develop international sleep treatment protocols for using NIV, insuring effective pressure support ventilation and volume-replacement therapy

- Expand training of technologists and physicians in sleep medicine to include scoring and interpretation of sleep changes in patients with diaphragm weakness