



# **NAEAC Webinar: Overcoming Barriers to Ensure Safety in the EMU**

**June 7, 2016**

# Agenda for Webinar



- Introductions
  - Dr. Nathan Fountain, NAEC President, University of Virginia
- SUDEP in Your EMU
  - Dr. Mark Spitz: University of Colorado
- EMU Safety: Role of Staffing
  - Dr. Katherine Noe, Mayo Clinic Arizona
- Q&A

# Sudden Death in Epilepsy (SUDEP) in your EMU

Mark C. Spitz, MD  
Professor of Neurology  
Chief of Epilepsy Division  
University of Colorado



# Disclosure Information

Nothing to disclose

# SUDEP in the ICU

1. The “Colorado Case” from a personal perspective
2. The risk of SUDEP in the EMU
3. How to Convince hospitals to support appropriate surveillance

# The “Colorado Case”

- October 2007
- 57 yo right handed man
- Cryptogenic onset age 7
- Daily aura of stereotypical strange feeling
- 2/week with impairment of consciousness
- Drug resistant
- Referred by community neurologist for surgical evaluation

# In EMU (Continuous Scalp EEG)

- 1<sup>st</sup> 4 days
  - 9 typical subjective auras non-localizable
  - 2 with evolution to dyscognitive seizures with left temporal ictal signature
- 10<sup>th</sup> Seizure
  - Again looked Left Temporal
  - Secondary generalized and led to SUDEP

# University of Colorado

- > 80% Surveillance with EEG tech
- The single tech was in ICU fixing electrodes at the sentinel moment



# Went to Literature

- 2 case reports in abstract form
  - Purves 1992
  - Lee 1998

# Telephoned 4 colleagues

- “We have all had our case”
- We don’t talk about it
  - Embarrassed
  - Large legal settlement with gag order
- We then became very strict with EMU surveillance

# How our case was unique

- Family requested video
- Became a local news story and more details leaked to the internet
- Allowed me to share our experience

# SUDEP Special interest group Philadelphia 2007

- I told of our case
  - I defined it as a SUDEP
  - I said EMU SUDEP was much more common than the literature suggests
  - In the USA we can't study it because of Lawyers
  - It might be investigated in other countries

# Risk of SUDEP or near SUDEP in the EMU

- Pre-surgical 9.7 (5.2-16.7)/patient-years VEEG
- 1/20 years if you have 5 patients continuously monitored

Ryvlin 2013

# Incidence and mechanisms of cardiorespiratory arrests in epilepsy monitoring units (MORTEMUS): a retrospective study

Philippe Ryvlin et al

- Retrospectively collected 25 cases from units In Europe, Israel, Australia and New Zealand
-

It doesn't take long to  
happen

All near SUDEP's had CPR  
in < 3 minutes

Ryvlin 2013

# What to stress to hospitals

- SUDEP in the ICU is not rare
- Large legal settlements
- Potential bad publicity





# **EMU Safety**

## ***Role of Staffing***

**Katherine Noe, MD, PhD**  
**Associate Professor of Neurology**  
**Director, EEG Laboratory**  
**Mayo Clinic Arizona**

**EMU**

**Need to Record  
Seizures in a Timely  
Fashion**

**Risk of Seizure  
Related Morbidity  
and Mortality**

**AED withdrawal, activating  
procedures**

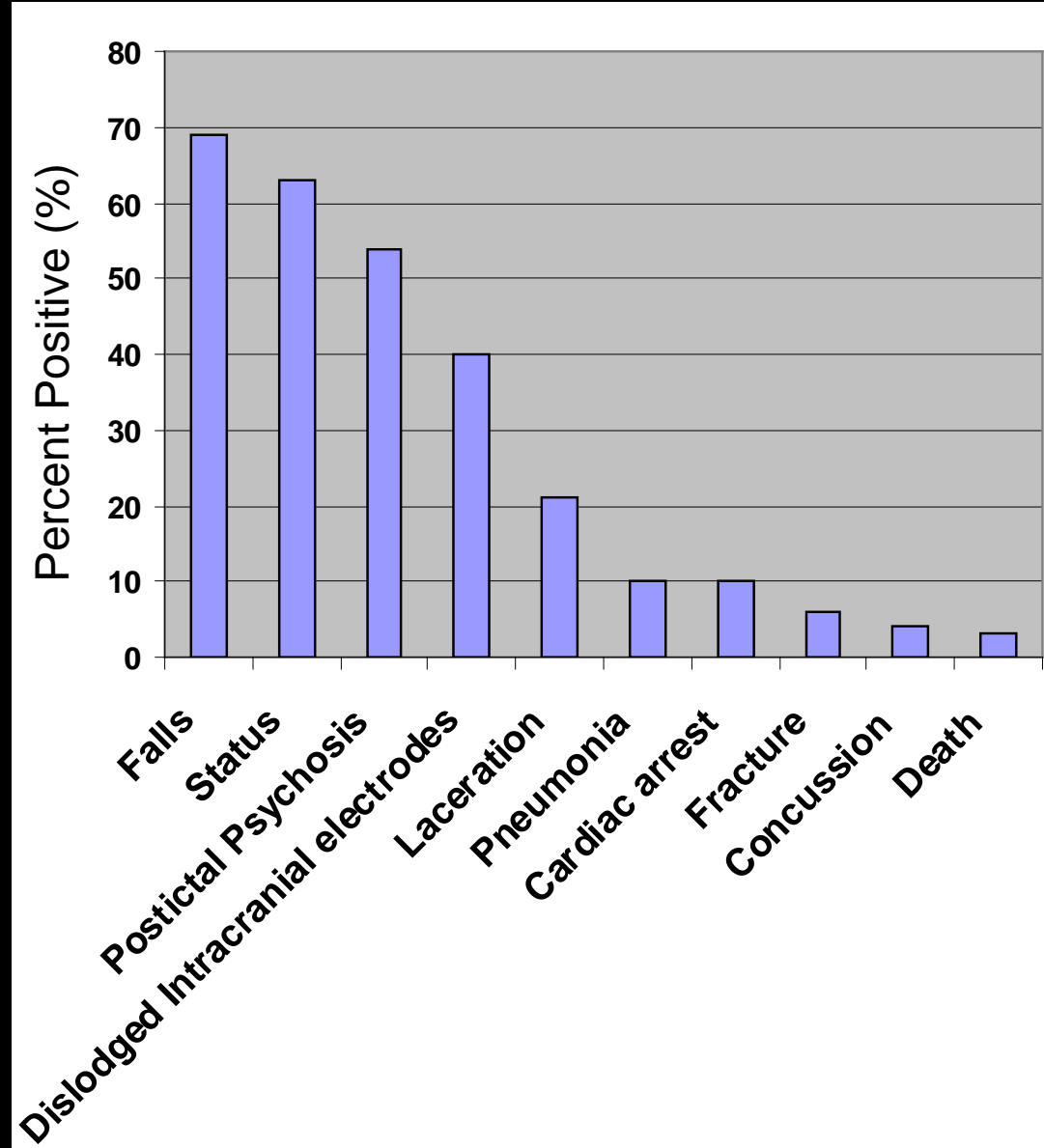
**Monitoring, safety precautions,  
rescue medications**

# Risks of Seizure Activation

- **Seizure emergencies (more severe seizure, clusters, status)**
- **Falls**
- **Orthopedic injury (fracture, dislocation)**
- **Cardiac events**
- **Respiratory events (pulmonary edema, apnea, aspiration, choking)**
- **Post-ictal psychosis**
- **Death**

# Adverse Events in the EMU

- *Shafer P, Buelow J, Ficker D, et al (2011) Epilepsy Behav 20: 502*
- **Self report survey, AES members, 70 epilepsy centers**
- **In the last year...**



# How do we maintain safety?

- **Staff:**
  - Physician availability, training
  - Nursing training, staff:patient ratios
  - Monitoring of EEG, video/clinical status
- **Equipment:**
  - Seizure alarms, bed alarms
  - Monitors for EKG, pulse oximetry
  - Bed rails, safety belts, etc.
- **Medication:**
  - Plans for AED tapering
  - Protocols for rescue medication

# **What determines EMU safety practices?**

- **Accepted standards of care**
- **Government/certifying organization rules**
- **Quality**
- **Cost**
- **Value**
- **Reimbursement**
- **Efficiency**
- **Comparative safety outcomes data**
- **Patient tolerability**

## A consensus-based approach to patient safety in epilepsy monitoring units: Recommendations for preferred practices

Patricia O. Shafer <sup>a,\*</sup>, Janice M. Buelow <sup>b</sup>, Katherine Noe <sup>c</sup>, Ruth Shinnar <sup>d</sup>, Sandra Dewar <sup>e</sup>, Paul M. Levisohn <sup>f</sup>,  
Patricia Dean <sup>g</sup>, David Ficker <sup>h</sup>, Mary Jo Pugh <sup>i</sup>, Gregory L. Barkley <sup>j</sup>

- **AES workgroup**
- **Delphi process used due to lack of evidence to support guidelines (2009)**
- **Multidisciplinary, small and large EMUs**
- **30 recommendations for preferred practices based on consensus**

# Consensus Recommendations

- Strong agreement on need for seizure observation by dedicated providers
- No agreement on need for continuous observation in *all* patients
- Agreement for continuous observation for:
  - *invasive electrodes*
  - *patients at high risk for injury*
  - *patients undergoing AED withdrawal.*
- No agreement on who is watching
- Agreement that family, friends can assist with observation “in some circumstances”



# Consensus Recommendations

- Staff should provide seizure first aid for all seizure types
  - Vital sign monitoring
  - Suctioning, oxygen
  - Monitoring of changes in mental status
- IV access established at admission for all patients
- Staff must have immediate access to emergency medication
- Physician available in-house 24h/day to manage seizure emergency

# **Required Staffing + Protocols**

## ***NAEC Level 4 Epilepsy Center***

- **Continuous patient + EEG observation**
- **Epilepsy staff nurses on site 24/7**
- **24 hour availability of epileptologist**
- **Examination of speech, memory, motor function, level of consciousness during + after seizure**
- **Protocol for intervention after excessive number, duration, severity of seizure**

What is the evidence that  
EMU staffing impacts...

*...missed seizures?*

*...falls?*

*...death?*

# Use of alarms + automated detectors

- *Shin HW, Pennel PG, Lee JW, et al (2012) Epilepsy Behav 23: 458*
- **4:1 RN ratio, video monitor “in view of RN”**
- **Patient activated alarm detected 16/50 CPS, 15/50 GTC, 33/50 PNES**
- **Automated alarm in 15/50 CPS, 15/50 GTC, 5/50 PNES**
- **10% of events missed, no RN response**
  - **11 CPS, 4 GTC, 5 PNES**
- **9/15 missed epileptic seizures had an automated alarm activated**

# Use of Trained Observers

- *Spanaki M, McCloskey C, Remedio V, et al (2012) Epilepsy Behav 25:185*
- **Seizure response before and after change in staffing**
  - Pre: weekday EEG tech, nights/weekends nurse assistant
  - Post: 24/7 EEG tech
- **Outcome**
  - Missed seizures ↓ 77% (p=0.009); 26/492 pts to 6/479 pts

# Unit Staffing Models

- *Kandler R, Lai M, Ponnusamy A, et al. (2013) Seizure 22: 872-6*
- Prospective survey of 27 EMUs in the UK, “up to 5 patients each” over 2 months
- 272 spells, 177 epileptic, 12% adverse events
- 44% of events unattended by staff
- 27% of events attended within 30 seconds
- Dedicated RN staff was the primary determinate of early attendance

# Staffing + Respiratory Events

- **Nursing interventions during seizures:**
  - Supplemental oxygen
  - Oropharyngeal suctioning
  - Lateral decubitus positioning
- **Early intervention in GTC associated with shorter duration of hypoxia and of generalized EEG suppression**
- **EMU SUDEP/near SUDEP correlated with nocturnal GTC, delay in CPR**
- **Recommendations: nighttime staffing, ECG + oximetry alarms**

# Falls

- **Publically reported quality metric**
- **A leading cause of hospital morbidity**
- **Falls occur in 2-12% of all hospitalized patients/3.44 falls per 1000 patient days**
- **1:4 falls associated with injury**
- **Causes of falls in the EMU:**
  - **Seizure**
  - **Post-seizure confusion**
  - **Baseline neurologic deficits**
  - **AED associated instability**



# Falls in the EMU

<i>Study</i>	<i># subjects</i>	<i># falls (%)</i>	<i>Falls/1000 pt days</i>	<i>Adverse Outcomes</i>
Sanders 1996			<b>8</b>	60% abrasion or contusion
Dobesberger 2011	<b>507</b>	<b>17 (3.4%)</b>	<b>6</b>	2 fracture, 1 epidural hem
DiGennaro 2012	<b>54</b>	<b>3 (5.5%)</b>		None
Atkinson 2012	<b>20</b>	<b>6 (3.5%)</b>		1 contusion
Liu 2012	<b>230</b>	<b>3 (1.3%)</b>		3 contusion or abrasion
Arrington 2013	<b>454 (peds)</b>	<b>1 (0.2%)</b>	<b>0.67</b>	
Pati 2013	<b>1116</b>	<b>26 (2.3%)</b>		2 laceration
Spanaki 2012	<b>479</b>	<b>7 (1.5%)</b>	<b>2.3</b>	1 fracture
Spritzer 2015	<b>3092</b>	<b>39 (1.2%)</b>	<b>2.81</b>	None

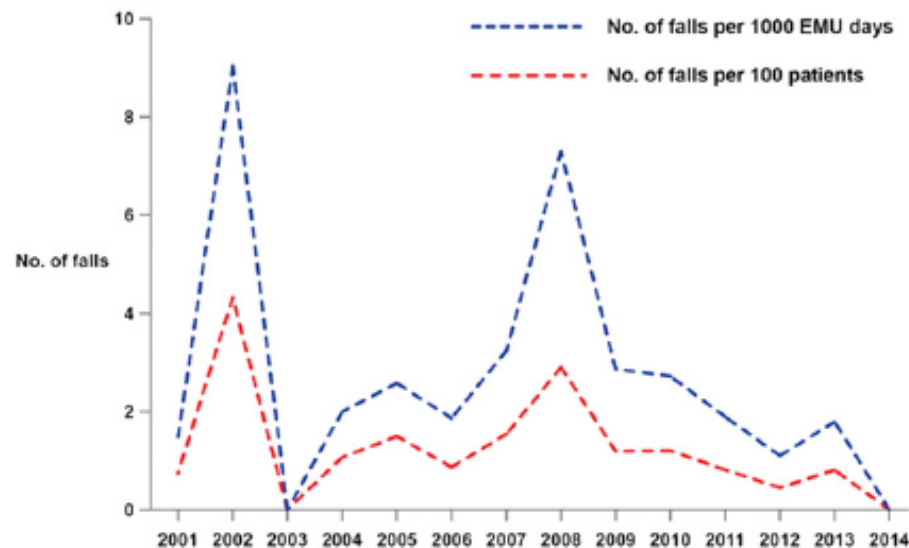
# EMU Bathroom Safety

- 40-74% of EMU falls occur in bathroom
- MCA : Falls in ...
  - 2.9% patients with sz
  - 2.5% of patients with PNES
- Seizures and PNES in the bathroom were significantly more likely to result in a fall
  - Sz: 2/4 (50%) vs. 2/671 (0.3%);  $p=0.0002$
  - PNES: 2/8 (25%) vs. 2/641 (0.3%);  $p=0.0013$

# Preventing Falls in the EMU

**Table 1**  
 EMU safety and fall prevention initiatives at Mayo Clinic Hospital from 2001 to 2014.

Year	Initiative
2001	24/7 continuous observation of video and EEG monitor by trained technicians Individualized tapering of antiepileptic medications based on physician judgment 24/7 continuous staffing by EMU trained nurses, maximum of 4:1 patient:nurse ratio Padded bed rails, rails kept in up position Use of voluntary safety lap belts when in bed Out of bed to stand or walk with 1:1 nursing supervision only Out of bed to chair only with nursing or family supervision and use of voluntary safety lap belts Exercise with supervision only; seated exercise bike
2005	<i>Falling Star Program</i> ; star magnet placed on room door to alert staff that patient is at risk of falls
2007	Hourly rounding by nursing staff Chair alarm in every patient room Updated fall risk signage posted on patient room door <i>Days Without Fall</i> signage in staff area
2010	Patient education video discussing fall risks and prevention shown to every patient on admission <i>Stop, Call Before You Fall!</i> signs added in each patient room 2 persons assisted by nursing staff when out of bed for any patient with a history of drop attacks or seizures with fall Monthly review of falls at unit-based team meetings
2011	Nocturnal bed alarm on all patients Nursing team huddles immediately after every fall Regularly scheduled multidisciplinary safety rounds (epileptologists, EMU nursing staff, unit supervisor, EEG technologists, epilepsy neurosurgeon, neuropsychologists) with open discussion of any safety events or concerns in the EMU including review of all falls
2013	MasterVest™ ceiling lift system for all patients when out of bed, including in chair or in bathroom



**Fig. 3.** Number of falls at Mayo Clinic Hospital per 1000 EMU days and per 100 patients admitted.

# Falls Prevention

- *Spanaki M, McCloskey C, Remedio V, et al (2012) Epilepsy Behav 25:185*
- **Interventions:**
  - Check list to identify high risk patients
  - 24 h observation by EEG technologists
  - Hourly RN rounding, team huddle at shift change
  - Falls prevention agreement signed by patient/family
  - Increased use of restraints in non-invasive monitoring

# Falls Prevention (cont.)

- **Interventions (cont):**
  - Formalized safety education for all EMU staff
  - Root cause analysis after each fall
- **Outcomes:**
  - Falls ↓15% ( $p=0.694$ ); 2.7/1000 pt days to 2.3/1000 pt days

# Keys to Implementing a Safety Plan

- **Commitment from the team**
- **Education of the patient before and during admission**
- **Informed consent/assumption of risk**
- **Written safety policies**

***Thank you!***





# Questions?

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