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UC San Diego Epilepsy Monitoring Unit on Thornton 2-West PCU

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INTRODUCTION: Thornton 2-West Progressive Care Unit (PCU) is home to a Level 4 Comprehensive Epilepsy Monitoring Unit (EMU) that specializes in patients admitted for Video-Electroencephalogram (VEEG) neurodiagnostic monitoring. Thornton 2-West has six beds available for epileptic patients undergoing seizure studies to either diagnose, or rule out, epilepsy. Epilepsy is defined as when two seizures occur at least 24 hours apart or when one seizure occurs with at least 60% probability of recurrence within the next ten years. Seizures are caused by an imbalance between brain cells that excite or inhibit other cells from sending messages, causing too much or too little brain activity. Seizures can manifest as focal (or partial) with or without loss of awareness, while others are generalized (formerly called grand mal). Seizures are linked with brain structural abnormalities, head injuries, infections, metabolic imbalances, strokes, and genetics.

The National Association of Epilepsy Centers provides guidelines for designating medical institutions from Level 4, the highest level of specialized epilepsy care, to Level 1, primary or emergency care. The UC San Diego EMU is a Level 4 Comprehensive Epilepsy Center due to the neurodiagnostic monitoring capability and advanced treatments including surgical options offered. Our UCSD Comprehensive Epilepsy Center team includes most of the seventy nurses and nursing assistants that work on Thornton 2-West. Staff nurses on Thornton 2-West receive EMU training in New Employee Orientation, EMU VEEG Skills Day, 2-West Skills Day, online learning modules, and a new EMU simulation lab course which was launched this year. Additional EMU staff includes Katie Villarino, RN, the Epilepsy Clinical Nurse Coordinator, Rose Bercow, the Patient Care Coordinator, and several EEG Technicians supervised by Ralph Nowacki, AB, who are trained to read the EEG brainwave tracings. The EMU also includes a

group of epileptologists including Medical Director Jerry J. Shih, MD, Vicente Iraguimadoz, MD, Evelyn Tecoma, MD, PhD, Leena Kansal, MD, David J. Lee, MD, PhD, and June Yoshii, MD. The staff of Thornton 2-West and the EMU work together to care for the complex patients through Phase I and Phase II of the seizure study.

PHASE I VEEG MONITORING

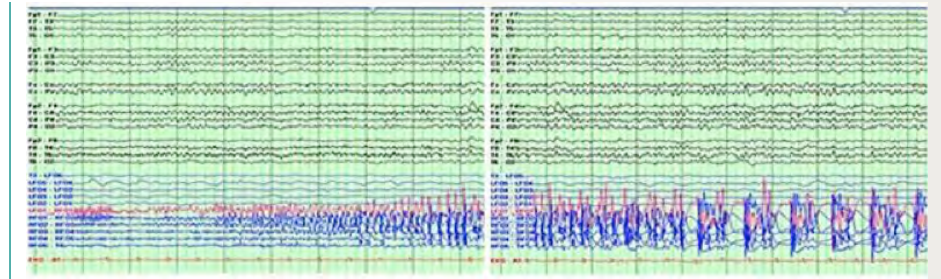
UC San Diego EMU is the premier destination in Southern California for individuals with refractory epilepsy seeking medical or surgical management for their seizures. Phase I of the seizure study utilizes Video-Electroencephalogram (VEEG) monitoring at the telemetry level of care, requiring hospitalization from two to ten days, and continuous VEEG monitoring encompassing 24-hour closed-circuit video recording paired with brainwave recordings from an array of external electrodes. The goal of this phase is to determine the seizures' lateralization and preferably to localize the point of origin of the



Jessica Bejar, BSN, RN, PHN, PCCN started her nursing career on a Comprehensive Transplant Unit at Johns Hopkins. She has worked at UC San Diego Health's Thornton 2-West PCU for the last two years. She earned her Bachelor of Arts in Global Studies from UC Santa Barbara and her Bachelor of Science in Nursing from CSU San Marcos. Jessica loves to precept new nurses and is a Clinical Nurse III candidate, a Public Health Nurse, and a Progressive Care Certified Nurse. Jessica is also the Shared Governance Chair for Thornton 2-West and a member of the Nursing Research & EBP Council.

seizures. To increase the likelihood of capturing seizure events, patients are exposed to common seizure triggers like medication tapering, sleep deprivation, flashing light stimulation, hyperventilation, skipping a meal, and even alcohol consumption. Phase I VEEG is also the gold standard in diagnosing non-epileptic events, which are also called psychogenic events or pseudoseizures. Non-epileptic events are physical manifestations that mimic seizures but have no corresponding abnormal brain activity. A non-epileptic patient's epilepsy drugs are generally discontinued after the diagnostic study, and the recommended treatment is cognitive-behavioral therapy.

Throughout Phase I, nursing considerations involve performing a



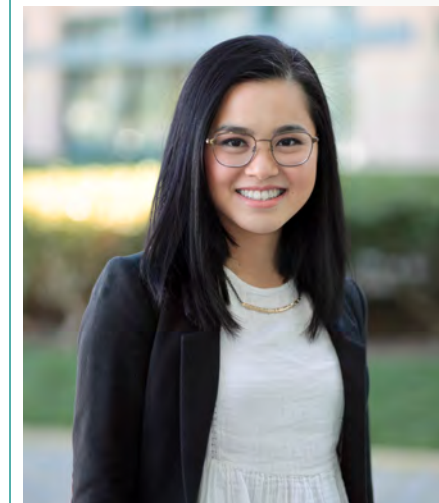
EEG brainwave tracing showing a temporal lobe seizure courtesy of UC San Diego Epilepsy Center website.

neurological assessment every four hours, vital signs every 4 to 8 hours, maintaining the scalp electrodes, and continuous cardiac and oxygen saturation monitoring, as well as inducing seizures with sleep and calorie deprivation, tailored to the individual patient. The patient and video monitor observer each have

a button that sounds an alarm if either suspects that the patient is beginning to have a seizure to alert the nursing staff. While the patient is having the seizure, an EMU nurse assesses the patient to give more information to the epileptologist in determining what area of the brain the seizure is originating from. The



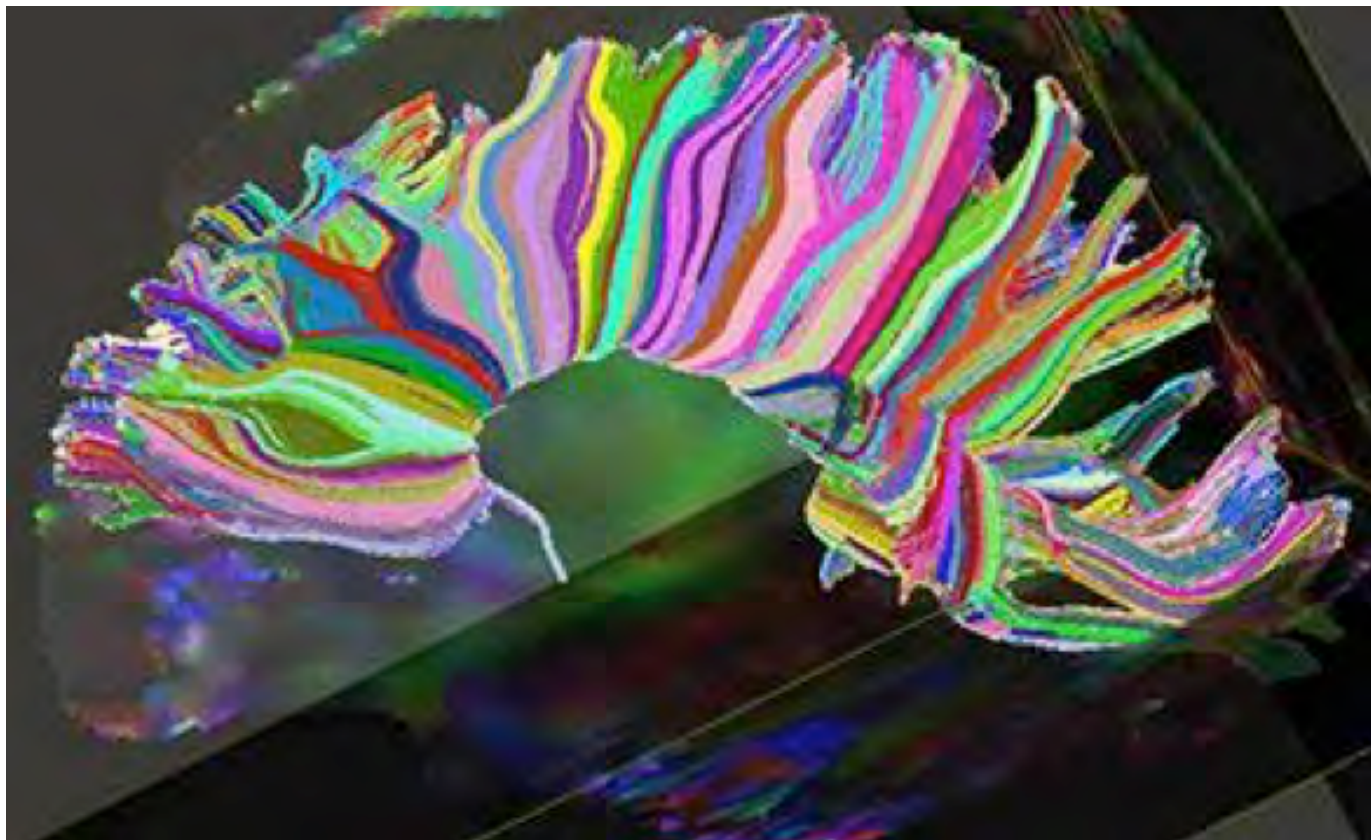
Jacqueline Gerwer, BSPH, BSN, RN is from San Diego and has watched UCSD grow into the hospital it is today. She has always wanted to be a part of the nursing profession and was excited to start the New Grad Nursing Program on July 2017 at UCSD Thornton 2-West PCU. Jacqueline enjoys taking care of the diverse population on UCSD Thornton 2-West PCU; especially the Seizure study and Cystic Fibrosis patients. Jacqueline received a Bachelor of Science in Public Health at the University of Arizona and earned her Bachelor of Science in Nursing at Azusa Pacific University. Jacqueline's future plans are to get her PCCN, precept new nurses, and eventually go back to school to get her MSN.



Anna Melendez, BSN, RN, PCCN is a Progressive Care Certified Nurse at Thornton 2-West. She has been with UC San Diego Health since 2007. Anna earned her Bachelor in Nursing from the University of Santo Tomas in Manila, Philippines and is currently pursuing her Masters in Nursing with specialization in Nursing Informatics. She is an active preceptor, resource, charge nurse, and serves as unit representative to Clinical Informatics Council, UCI/UCSD Shared Nursing Governance (SNUG) Council, Diabetes Initiative Group, and Preceptor Development Support Services (PDSS).



Katie Villarino, BSN, RN, PCCN-CMC earned her Bachelor of Science in Nursing from San Diego State University in 2015. Katie started her journey at UC San Diego Health on Thornton 2-West PCU, and is now the Epilepsy Clinical Nurse Coordinator.



Advanced imaging at UC San Diego Epilepsy Center showing the corpus callosum beneath the cortex of the brain.

nursing assessment includes verifying orientation, sensation, memory, cognition, language capacity, identifying objects, and testing fine and gross motor skills. Additionally, nurses ensure safety equipment is at the bedside and that patients do not form blood clots by encouraging pedicycling and administering lovenox if indicated. Due to the risk of injury from seizure, EMU patients are considered a high fall risk and wear a safety belt when in bed or when sitting in a chair and they require a staff member present when transferring, ambulating, and toileting at all times. When a patient has a seizure, signs and symptoms are particular to the patient, but common changes include a change in heart rate, altered mental status, automatisms (repetitive movements), staring, convulsions, abdominal pain, unusual behavior, and odd sensations. When a seizure lasts for more than five minutes, it is associated with high morbidity and mortality. If a patient's seizures become too long, strong, or frequent, intravenous

medication is given to treat seizures quickly to prevent status epilepticus.

IMAGING/TREATMENT/ CASE CONFERENCE

After a patient complete a Phase I study, a variety of imaging (e.g. MRI, PET, MEG), and a Neuropsychological Evaluation, the patient's case is presented for consideration at UC San Diego's Surgical Epilepsy Case Conference attended by EMU Epileptologists, Neurosurgeons including Sharona Ben-Haim, MD and David Barba, MD, Neuropsychologists including Amanda Gooding, PhD, Carrie McDonald, PhD, and Marc Norman, PhD, and Neuroradiologist, Roland Lee, MD. This discussion determines if the patient should trial more medications, whether surgical intervention is necessary, or further studies such as the Wada test to determine language and memory lateralization, or more detailed intracranial VEEG monitoring is needed in a Phase II study. The goal

of surgical treatment is to cure or decrease the frequency of seizures and options include: Responsive Neurostimulator (RNS), Vagus Nerve Stimulator (VNS), MRI-guided Laser ablation, or Lobectomy depending on the type and origin of the patient's seizures. Other complementary therapies include a ketogenic diet and mind-body practices such as meditation and yoga.

PHASE II INTRACRANIAL MONITORING

Phase II intracranial monitoring involves invasive electrodes implanted in the brain of patients whose seizure origin was difficult to localize in the Phase I study. The electrodes are placed by neurosurgeons in or around the suspected areas of the brain as discussed at the patient's surgical case conference. These electrodes allow for seizures to be captured in "high definition" on the electroencephalogram, fine-tuning the identification of seizure origination. The choices

Common Seizure Semiology by Brain Origin	
Temporal Lobe	Feeling of fear, rising epigastric sensation, feeling of déjà vu
Frontal Lobe	Bicycling of legs, laughing or crying, wild movements of arms and legs
Parietal Lobe	Physical sensations of numbness or tingling, electricity, pressure, pain, vertigo
Occipital Lobe	Visual hallucinations

for monitoring include Stereo-Electroencephalogram (sEEG), subdural grids, strips, and depth electrodes. sEEG monitors electrical activity from superficial to deep in the brain, as electrodes are threaded through a small hole in the skull. In contrast, subdural grids require a craniotomy and cover the surface of the brain with 16 to 64 electrode contacts. Strips contain 1 x 4 or up to 2 x 8 electrode contacts that can be placed on the brain's surface, or may be inserted through burr holes in the skull. Depth electrodes are usually inserted through burr holes and monitor deep brain structures such as the insula or hippocampus. At the end of the Phase II study, functional brain mapping may be performed to identify "eloquent" cortex or areas of the brain that if removed would result in neurological deficits. Brain mapping involves sending an electrical current through one of the electrodes while simultaneously testing the patient's response. For example, when mapping a patient's somatosensory cortex in the parietal lobe, the provider would brush the patient's face/arms/legs. If a loss of sensation is experienced, the patient should be counseled on potentially losing sensation in that area if a resection or ablation was performed there. It is imperative for the nurses to have emergency and safety equipment at the bedside because the likelihood of inducing a seizure is high.

After the Phase II study

electrodes are implanted in the brain, patients spend the first 24 hours when they are most likely to experience complications in the Neuro ICU where they receive frequent neurological assessments. For the remainder of the one to two week seizure study, the patient is downgraded to IMU level of monitoring. Along with the same Phase I nursing safety considerations and equipment management, Phase II study patients require vital signs and neurological assessments every two hours due to the increased risk of injury and complications that come with invasive electrodes. The goal of the Phase II study is to localize the seizure origin point with a high degree of certainty to determine if the patient is a surgical candidate, and what treatment options the physician can offer the patient.

SUMMARY

UC San Diego Comprehensive Epilepsy Center is an essential service improving the lives of epilepsy patients who are often isolated and lack independence. UC San Diego's ability to perform PCU level neurodiagnostic monitoring increases the capacity to diagnose and medically and surgically treat patients at an advanced level. The EMU's multidisciplinary team is dedicated to working together to help these complex patients.

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