PROVINCIAL EPILEPSY MONITORING UNIT (EMU) GUIDELINES FOR ONTARIO

Epilepsy Implementation Task Force

Version 1.0 | Critical Care Services Ontario | January 2014

CCSO Critical Care Services Ontario

This document is a product of Critical Care Services Ontario (CCSO)

The Provincial Epilepsy Monitoring Unit (EMU) Guidelines for Ontario is the result of a collaborative effort between CCSO, the Epilepsy Implementation Task Force (EITF), and Provincial Neurosurgery Ontario (PNO). The EITF was established in June 2013 to develop and implement a provincial framework to maximize value from the system of epilepsy care in Ontario. Their first task was to develop protocols for Epilepsy Monitoring Units in Ontario for diagnostic evaluation for epilepsy surgery in patients with medically refractory epilepsy. The EITF works in collaboration with PNO to support equitable and timely access to neurosurgical care, including epilepsy surgery, and to help maintain the province's neurosurgical capacity.

How to Use This Document

This document outlines protocols and provides guidelines for EMUs for diagnostic evaluation for epilepsy. It can be used as a guide for neurosurgical centres with EMU beds. The protocols are based on current processes in existing EMUs and represent expectations for the highest standards of epilepsy care.

These protocols are recommendations only.

For information about this document, please contact:
Critical Care Services Ontario
Phone: 416-340-4800 x 5577
Email: ccsadmin@uhn.ca
Website: www.criticalcareontario.ca

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Name	Title/Role	Organization
Dr. Sharon Whiting	Paediatric Neurologist	Children's Hospital of Eastern Ontario
Dr. Carter Snead	EITF Co-Chair, Neurologist	The Hospital for Sick Children
Brenda Flaherty	EITF Co-Chair Executive VP & Chief Operating Officer	Hamilton Health Sciences
Srini Bulusu	Charge Technologist	Children's Hospital of Eastern Ontario
Dr. Jorge Burneo	Adult Neurologist	London Health Sciences Centre
Elizabeth Ferguson	Director, Centre for Brain & Behaviour, Trauma, Adolescent Medicine, Inpatient Surgery	The Hospital for Sick Children
Dr. Cristina Go	Paediatric Neurologist	The Hospital for Sick Children
Dr. Rajendra Kale	Adult Neurologist	The Ottawa Hospital
Dr. Rajesh RamachandranNair	Paediatric Neurologist	McMaster Children's Hospital
Elyse Sandison	EEG Technologist	London Health Sciences Centre
Nat Shampur	Charge Technologist, Neurophysiology	University Health Network
Dr. Michelle Shapiro	Adult Neurologist	Hamilton Health Sciences
Rohit Sharma	Charge Technologist	The Hospital for Sick Children
Dr. Taufik Valiante	Adult Neurosurgeon	University Health Network
Dr. Richard Wennberg	Adult Neurologist	University Health Network

Please see Appendix 4 for the EITF membership

Disclaimer: *The contents of these guidelines may change over time. Clinicians and hospital administrators should use sound judgment for individual patient encounters. Critical Care Services Ontario, the Epilepsy Implementation Task Force, and Provincial Neurosurgery Ontario strongly recommend evidence-based practices.*

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Provincial Epilepsy Monitoring Unit (EMU) Guidelines for Ontario
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Acronyms

ABC	Antecedent – Behaviour – Consequence
ACGIH	American Conference of Governmental Industrial Hygienists
AED	Anti-Epileptic Drug
APBN	American Board of Psychiatry and Neurology, Inc.
BP	Blood Pressure
CAET	Canadian Association of Electrophysiology Technologists
CBRET	Canadian Board of Registration of Electroencephalograph Technologists, Inc.
CCOT	Critical Care Outreach Team
CCSO	Critical Care Services Ontario
CNN	Certification in Neuroscience Nursing
CPO	College of Psychologists of Ontario
CPSO	College of Physicians and Surgeons of Ontario
CSCN	Canadian Society of Clinical Neurophysiologists
DSM	Digital Switch Matrix
DZP	Diazepam
ECG or EKG	Electrocardiogram
EEG	Electroencephalography
EITF	Epilepsy Implementation Task Force
EMG	Electromyogram
EMU	Epilepsy Monitoring Unit
EOG	Electro-Oculogram
HR	Heart Rate
HV	High Voltage
ICU	Intensive Care Unit
IN	Intranasal
IV	Intravenous
LZP	Lorazepam
MD	Medical Doctor
MRP	Most Responsible Physician
NAS	Network-Attached Storage
OCSWSSW	Ontario College of Social Workers and Social Service Workers
PNO	Provincial Neurosurgery Ontario
PNES	Psychogenic Non-Epileptic Seizure
PPE	Preventive Protective Equipment
PR	Per Rectum
PTZ	Pan-Tilt Zoom
Q12H	Every 12 Hours
RET	Registered Electroencephalography Technologist
RN	Registered Nurse
RR	Respiratory Rate
SAN	Storage Area Network
SL	Sub-Lingual
VPN	Virtual Private Network

Background and Relevance

Epilepsy Monitoring Unit (EMU) – Consists of inpatient beds in a hospital dedicated to monitoring of patients with epilepsy, and suspected epilepsy, using simultaneous recording of video and EEG over extended periods of time, and a multidisciplinary team of Epileptologist(s), EEG Technologist(s), nurses, Neuropsychologist(s) and Medical Social Worker(s)/Clinical Psychologists/Psychiatrist/Community Epilepsy Liaison. The EMU is part of a comprehensive epilepsy program.

The Epilepsy Implementation Task Force (EITF) was established in June 2013 as a sub-committee of Provincial Neurosurgery Ontario (PNO) to develop and implement a provincial framework to maximize value from the system of epilepsy care in Ontario, this will include:

- Improving access to care by coordinating resources and wait lists
- Establishing standardized protocols across centres and
- Developing supports for primary care providers

Critical Care Services Ontario (CCSO) supports provincial planning activities of PNO, including the EITF.

One of the first tasks of the EITF is to improve coordination of epilepsy care through the development of provincial clinical protocols. This document outlines protocols and provides guidelines for EMUs for diagnostic evaluation for epilepsy, and considers the following:

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Indications for EMU Admission

Diagnosis

- Identification of epileptic paroxysmal electrographic and/or behavioral abnormalities. These include seizures, overt, clinical and subclinical and documentation of interictal epileptiform discharges, EEG and or behavioral abnormalities to assist in the diagnosis of seizures.
- Diagnosis of paroxysmal non-epileptic events
- Proper diagnosis of the epilepsy syndrome can then help direct the management and determine if patient can benefit from epilepsy surgery, further medication management, diet therapy and neurostimulation devices

Classification

- Patients with a diagnosis of epilepsy but poor classification of the clinical seizure types
- Patients with a diagnosis of epilepsy for further classification of epilepsy syndrome

Epilepsy Surgery

- Patients with documented epilepsy in whom epilepsy surgery is being considered. These patients should be evaluated by an Epileptologist either before or during admission to the EMU to decide on drug tapering, deciding on the types of seizures to be recorded, and the optimal number of seizures to be recorded.

Treatment

- To modify treatment in a safe environment (rapid modification of antiepileptic drugs)
- To initiate immunomodulatory treatment (particularly immunoglobulin treatment) that requires intravenous access, vital signs and EEG monitoring

EMU Personnel – Roles, Qualifications & Responsibilities

1. EMU Epileptologist

Qualifications and Training:

1. Clinical fellowship training in epilepsy and video-EEG for at least 12 months in a specialized center in Canada, the USA or abroad;
2. Recognized as a neurologist by the College of Physicians and Surgeons of Ontario (CPSO); and
3. Certification for EEG reporting (EEG examination by the Canadian Society of Clinical Neurophysiologists or APBN exam in Epilepsy) is mandatory. Neurologists who have/had been reporting Video EEG recordings without supervision in any jurisdiction in Canada or the USA anytime in or before 2013 are exempt from EEG/epilepsy examination.

Role of the Medical Director in the EMU:

- The Medical Director of an EMU is an EMU Epileptologist who will provide leadership to the multidisciplinary team of health professionals and ensure day-to-day functioning of the EMU according to provincial guidelines. The Medical Director is responsible for the quality of care delivered in the EMU beds ensuring evidence-based care.

Responsibilities:

- Process of admission (which includes pre-admission tapering of medications and ensuring that rescue medications like LZP/DZP instructions are given to patient/caregivers), and changing of medication during the admission (may be needed to enable recording of habitual events/seizures). In situations where the most responsible physician (MRP) is not an Epileptologist, the MRP will assume this specific role in collaboration with the Epileptologist.
- Initiation of recordings (discuss with EEG Technologist regarding need for extra scalp electrodes like extra sub-temporal/midline, etc., EMG channels, EOG, etc. are needed for the particular patient)
- Decide on duration of recordings
- Review of recordings
- Communication with patients and family (paediatrics)
- Preparation of video-EEG reports and discharge summaries
- Caring for medical issues that may arise during admission
- Discussing results of studies in seizure conferences to decide treatment (medical or surgical) and/or referral to a major epilepsy center (when the case requires intracranial evaluation or surgical treatment not available in the system)

2. EMU Technologist

Qualifications and Training:

1. Epilepsy Monitoring Technologist (EMU Tech) should be a Registered Electroencephalograph Technologist (RET) certified by the Canadian Board of Registration of Electroencephalograph Technologists, Inc. (CBRET Inc.). CBRET Inc. is the only national organization that provides a qualifying examination.
2. Electroencephalograph (EEG) Technologists in Canada are trained either through college-based diploma programs in Electrophysiology or in hospital-based EEG training programs:
   i. **Hospital-Based Programs:** Must include 10 hours of structured learning per week for students in training, have at least one (1) CBRET Inc. Registered Technologist, have a full-time or major part-time Electroencephalographer who is an M.D. and a certified member of the Canadian Society of Clinical Neurophysiologists (CSCN).
   ii. **College-Based Diploma Programs:** Diploma program must include a minimum of 500 hours of EEG instruction. (Refer to www.cbret.org)

Role of the EMU Technologist in the EMU and Responsibilities:

➤ *Please refer to Mizrahi (1999) for further details regarding EMU Technologist role and responsibilities*

Patient Set-Up for Epilepsy Monitoring

- Introduce patients to the physical layout of the EMU
- Explanation of electrode application and recording procedures

Electrode Application

- Electrode application is done using the international 10-20 System of Electrode Placement and/or the extended 10-10 System Electrode Placement systems are to be used to determine the location of electrode positions utilized for the localization of abnormal waveforms and seizures during an EMU study

➤ *Please refer to Jasper (1958) for further details regarding the 10-20 System of Electrode Placement and Chatrian (1985) for the extended 10-10 System Electrode Placement*

- In addition to the 21 standard electrodes, apply extra leads for artefact monitoring and for further localization as required. These include, but are not limited to Electro-oculogram (EOG), Electrocardiogram (EKG) and Electromyogram (EMG).
- A system reference electrode is required for recording and its position/location must be identified and annotated at the start of the EMU recording. To prevent contamination of the EMU recording, the choice of system reference should be carefully selected such that it is not located near the epileptogenic area of interest.
- To prevent leakage current entering the patient, the application of a ground electrode is a must for EMU recording. The technologist must ensure that there is only one ground electrode on the patient to avoid the potential risk of a ground loop.

➤ *Please refer to www.caet.org for minimal technical guidelines for EEG*

- It is recommended that, in order to lower impedances, each electrode site should be rubbed with an abrasive skin preparation prior to lead application. The impedances should be at acceptable levels that are between 1000-5000 ohms.

Caution: When using skin abrasive products, care must be taken to prevent skin rupture and bleeding.

- Signal quality of EMU recordings is improved by stable electrode application. Depending on the lab's electrode application policies, either a water-soluble conductive paste (short-term studies) or an ether-based and ether-free product such as collodion (long-term studies) may be used for electrode application. However, for the best quality electrode application and signal quality, collodion is recommended for adhesion to scalp. Extreme caution must be exercised with handling and storage of collodion.

Note: Collodion is a safe product to use for electrode application as long as vapors are below Ontario Regulations (see below). Table 1 provides the occupational exposure values for both ethanol and ethyl ether as specified in the regulation respecting Control of Exposure to Biological or Chemical Agents – made under the Ontario Occupational Health and Safety Act.

- The Time-Weighted Average Exposure Value (TWAEV) is the maximum allowable average concentration of the substance in the air, calculated for an 8-hour day or 40-hour workweek. The Short-Term Exposure Value (STEV) is the maximum average concentration of the substance in the air, for any 15-minute period. Both values are presented in parts per million (ppm).

Table 1

Agent	TWAEV (ppm)	STEV (ppm)
Ethanol	1000	-
Ethyl Ether	400	500

- When using collodion for electrode application, proper ventilation must meet established standards for safety (see Appendix 1 for products Material Safety Data Sheet [MSDS] attachments)
- Therefore, a separate preparation room with a system of local exhaust to control emissions is required for safe electrode application. Ideally, the exhaust hood should be located to the side of the patient's head to draw collodion vapors away from both staff and patients. It is recommended that the exhaust ventilation unit have a 120 cubic feet per minute (CFM) fan @ 0.8 external static pressure (esp).
- Another alternative is to limit the use of collodion by using smaller quantity (single-use) tubes to control fume dispersion/accidental spillage
- A carbon filter mask with particulate respirators with nuisance level organic vapour control may also be used in conjunction with the local exhaust system to limit exposure to emissions
- To protect exposure to skin, impervious clothing including gloves, gowns, and lab coats as appropriate is recommended
- Eye protection in the form of chemical safety goggles, glasses or full-face shield is recommended. A properly maintained eyewash station must be installed in the collodion application room.

➤ *Please refer to Jarrar, Buchhalter, Williams, McKay and Luketich (2011) for further details regarding electrode application*

Patient Safety

- During application of electrodes on the patient (while the patient is seated or lying on bed), standard precautions to prevent accidental falls and injuries are to be taken. It is highly recommended to cover the patient's eyes while using collodion with an air pump to prevent accidental spraying.
- Electrodes must be applied in a systematic fashion to prevent entanglement utilizing cable management techniques like cable ties, wraps and cable tube covers to prevent accidental strangulation during sleep while in the EMU in accordance to hospital's entanglement policies
- The electrode amplifier must be properly secured and wrapped in a heatproof pouch to prevent accidental burn to the patient or accidental disconnection of electrodes during monitoring
- All EMU beds must be equipped with proper safety bumper pads to protect the patient during seizures
- Mittens may be used with difficult patients to prevent accidental and/or intentional disconnection of electrodes
- Use of a head wrap, burn net or conforming bandage to secure electrodes is highly recommended with difficult patients to prevent accidental and/or intentional disconnection of electrodes. If used, daily scalp checks are required to assess for development of pressure sores.
- Patients on whom medication is being tapered during EMU stay must have an IV in place along with an EKG and O2 saturation monitor
- Age appropriate restraints (if needed) to be used as required following hospital's restraint policies
- All rooms must be equipped with a 'Nurse Call' button at the bedside, separate from seizure push-button marker

Initiate EMU Equipment for Continuous Video EEG Monitoring: Day 1

- Following electrode application and verification of acceptable impedances, a 10-minute baseline EEG should be recorded to test the integrity of the electrode application (e.g. rule out salt bridges and electrode artefacts)
- During this recording, HV and photic stimulation may be performed as part of the baseline set-up
- Once the patient is settled in the EMU the seizure safety guidelines are reviewed with the patient and/or attendant. Patient and/or attendant are instructed on the importance of completing the seizure log sheet for documentation.
- The push-button alarm is tested by the patient and/or caregiver
- Both the video and infrared camera (including audio) are tested prior to the start of the EMU recording
- The EMU Tech then initiates the EMU equipment for day 1 continuous video EEG monitoring

Review and Mark Seizures, Push-Button Events and Automatic Seizure and Spike Detections for EMU Epileptologist: Day 2

- The EMU Tech checks EMU patients in the morning and rechecks at the end of their shift, reviews patient seizure and push button log, re-gels and/or reapplies any electrodes that have become loose, detached or are otherwise not functioning properly
- This sequence must be carried out every day that the patient is in the EMU, until he or she is discharged

Data Management: Archival and Pruning EEG and Video Segments for Storage

- All EEG and video data is reviewed, marked and annotated by the EMU Tech for Electroencephalographer or clinical Neurophysiologist to review

- Following data interpretation, relevant EEG or entire EEG file and video segments are archived to a centralized server as per naming conventions used in the individual institutions. Data management on recording stations need to be managed as needed (e.g. local copies on acquisition station hard drives may need to be deleted based-on available space) to continue uninterrupted recording and prevent lack of storage space locally. Each EMU acquisition unit must have enough storage space to store data on the local hard drives for a minimum of 7 days.
- Provide both technical and computer back-up for problems that may arise during the monitoring session
- EMU Technologists should be assigned to take care of the EMU patients during their stay. It is recommended that an EMU Tech be on-call to provide both technical and computer support to resolve issues during the monitoring session. This support is necessary to prevent data loss and decreased hardware and software downtime during an EMU session when several patients are monitored simultaneously.
- VPN (virtual private network) access from home to the EMUs is desirable (using local hospital clients and guidelines). This enables remote review for troubleshooting should problems arise afterhours.

Clean and Discharge Patient

- The EMU session is stopped following directive from the clinical team managing the patient (e.g., once the desired number of seizures is captured and the clinical question for the EMU admission has been answered).
- Using appropriate PPE (preventive protective equipment), electrodes are removed using appropriate techniques (e.g., collodion remover is recommended as a safe acetone-free solution to remove electrodes). **Caution: The use of Acetone is discouraged.**

Caution: Proper care and precaution must be utilized to prevent any spills to patient's eyes when using any solution to remove electrodes from the scalp.

- EMU Technologists should wear gloves and goggles when removing electrodes from the scalp
- The patient's hair should be washed and dried by an EMU Tech once all the electrodes are removed from the scalp in a paediatric setting. In the adult EMU setup, the patient will wash and clean the scalp/hair after the EMU Tech removes the electrodes. If required, the nurse will assist the EMU Tech and patient with electrode removal.

Electrode Sterilization

- When reusable electrodes are used, appropriate sterilization techniques are to be used (as per electrode manufacturer's recommendations)

EMU Equipment

- See 'EMU Equipment' section below

3. EMU Nurse

Qualifications and Training:

1. It is expected that at least 1 member of the nursing team be a Registered Nurse (RN)
2. Direct patient care may be provided by a Registered Nurse or a Registered Practical Nurse
3. Specialized training in EMU patient care management
4. Certification in Neuroscience Nursing (CNN) through Canadian Nurses Association preferred

Responsibilities:

Orientation to the EMU

- Review of safety guidelines
- Roles of the team members
- Tour of the unit
- Safety checks as per organizational policy – i.e., all equipment, including O2 and suction is functioning and available

EMU Scalp Pre-Admission

- Although the EMU Nurse may not be directly involved with the patient prior to admission, it is recommended the EMU Nurse be aware of the recommendations found in the 'Safety in the EMU' section of this document (page 25)

EMU Scalp Recording Admission

- Discuss admission process with family and reviews orientation pamphlets/letters of information if available
- Review preadmission weaning of medication
- Document health history and nursing assessment, including:
  - Vital signs, baseline O2 saturation, documented weight
  - Documented developmental age
  - Comprehensive medication and seizure history (pre-seizure activity (aura), usual seizure activity, condition after seizure, history of status epilepticus, post-ictal psychosis, typical triggers)
  - Documented allergies (e.g. some patients allergic to Phenytoin and benzodiazepines)
  - Medication reconciliation with pharmacy
  - Ensure diet, activity restrictions noted
- Vital sign monitoring to include temperature, HR, RR and BP – frequency to be determined by patient stability and patient care orders
- Ongoing safety monitoring as per organizational policies
- Paediatrics – ensure caregiver over 18 years of age present at all times if nurse not in room
- Ensures non-medical staff participating in seizure observation have received instruction regarding seizure observation and their role in maintaining safety
- Ensure appropriate patients have an IV (may be saline lock) in place along with an EKG and O2 saturation monitor. On some patients, the EKG lead on EEG recording may be sufficient as only monitoring tool.

  Note: There is no evidence to support all patients must have an IV, EKG and O2 saturation, and this is not practical in paediatrics and for those patients with pseudo-seizures

- IV and seizure drug knowledge: maintain current knowledge of IV assessment and maintenance skills, maintain current knowledge of relevant neurological medications (uses, side effects, etc.) and administer as ordered
- Taper and administer medications as ordered by physician/Nurse Practitioner
- Ensure specific rescue medication on chart with individualized protocol for when to administer and when to notify physician/Nurse Practitioner
- Ensure rescue medication available on unit Q shift
- Seizure safety and management: ensure environment is checked according to organizational policies to maintain a safe environment for the patient. Apply bumper pads to bed/crib as ordered, review safety measures with families (i.e., bed in lowest position, call bell within reach and functioning, bathroom emergency bell), ensure family, volunteer or staff supervise patient constantly – alarms must be on at all times.
- Ensure that a 'Falls Risk Assessment' is done upon admission and re-evaluated again with AED reduction – ensure patient wears non-slip footwear
- If restraints in place, document according to organization's Patient Restraint Policy
- Seizure record – review proper documentation with caregivers Q shift
- Recognize basic EEG monitoring issues and liaise with EMU Technologist or other appropriate personnel to problem-solve as they arise
- Ensure patient is always on the video feed (if available) from patient monitoring room, a nurse or appropriate caregiver is in the room for observation
- Ensure best patient safety practice by intervening for patient and equipment safety during active and/or violent ictal and/or postictal seizure stages
- Ensure that the emergency call button to the Security Department is functioning at times – it is necessary to use for the protection of all involved in the case of a violent or acting out seizure stage
- Ensure orders regarding length of time patient allowed to be disconnected from main recording unit for ambulatory monitoring devices
- Monitor patient safety while in the shower (i.e., securely covers/protects EEG cables/electrodes and recording box during showering)
- Manage seizures and status epilepticus using organizational standardized, evidence-based order sets and clinical pathways
- Ensure leads MRI-compatible if MRI is required
- Review discharge summary with family written by physician/Nurse Practitioner prior to discharge, including follow-up instructions and appointments
- Ensure medication reconciliation is complete and patient has clear instructions regarding anticonvulsant therapy

4. Neuropsychologist

The Neuropsychologist is a core member of the epilepsy monitoring unit and comprehensive epilepsy program.

Qualifications and Training:

1. Training and experience in clinical neuropsychology relevant to epilepsy
2. Registered with the College of Psychologists of Ontario (CPO) for the practice of clinical neuropsychology

Role of Neuropsychologist within the EMU:

- Patients who are deemed potential surgical candidates by an Epileptologist based-on clinical evaluation and video EEG monitoring will be referred to the Neuropsychologist for assessing the neuropsychological profile, need for further investigations, and the potential for post-operative neuropsychological deficits
- Patients who had undergone epilepsy surgery will be evaluated to assess the post-operative neuropsychological profile, treatment recommendations and monitoring will be provided (if required)
- In addition, Epileptologists may request neuropsychological evaluation of patients with complex epilepsy who are not surgical candidates depending on the medical condition and management plan

5. Medical Social Worker/Clinical Psychologist/Psychiatrist/Community Epilepsy Liaison

The Medical Social Worker/Clinical Psychologist/Psychiatrist/Community Epilepsy Liaison is a core member of the epilepsy monitoring unit comprehensive care team.

Qualifications and Training

Medical Social Worker:

- Training and experience in clinical social work relevant to intractable epilepsy
- Master in Social Work
- Registered as a social worker with the Ontario College of Social Workers and Social Service Workers (OCSWSSW)

Clinical Psychologist:

- Training in Clinical Psychology
- Doctoral degree in Psychology
- Registered with the College of Psychologists of Ontario (CPO) for the practice of Clinical Psychology

Psychiatrist:

- Training and experience in neuropsychiatry, consultation-liaison psychiatry, or psychiatry in those with epilepsy
- Registered as a Fellow of the Royal College of Physicians and Surgeons of Canada (FRCPC)
- Maintains an active license to practice psychiatry from the College of Physicians and Surgeons of Ontario (CPSO)

Community Epilepsy Liaison:

- This will be a staff member from the local Community Epilepsy Agency who has specialized training in epilepsy with knowledge of available community services and the day-to-day psychosocial needs of affected patients/families. This person will be a point of contact between the community and local EMU.

Role of Medical Social Worker/Clinical Psychologist/Psychiatrist/Community Epilepsy Liaison within the EMU:

- All patients deemed as potential candidates for epilepsy surgery, based-on seizure conference recommendation, will undergo evaluation by a Medical Social Worker and/or a Clinical Psychologist to assess the patient's psychosocial situation. In addition, Epileptologists may request the support of social work/psychology/psychiatry for assessment and intervention on behalf of patients with complex epilepsy who are not surgical candidates depending on the medical condition and management plan.

Responsibilities:

The Medical Social Worker will:

- Work collaboratively with the Epileptologist and epilepsy surgeon to understand the patient and family's social and emotional needs and how they impact the patient's medical condition and attitude toward medical treatment

- Work with patients and families to understand their beliefs about the illness
- Work as a resource to the interdisciplinary team in responding to challenging patient and family situations
- Support patients and families when required, to help manage feelings of anxiety regarding treatments including surgery, enabling the patient to obtain the greatest benefit from medical treatment
- Work with the team in order to assist the patient in understanding a complex condition such as epilepsy
- Address patient and family needs related to resources, funding and advocacy
- Provide individual, couple and family therapy as needed to support the wellbeing of the patient
- Assist with the transition service from paediatric to adult epilepsy care
- On discharge, arrange for referral to Community Epilepsy Agency for community-based support services

The Clinical Psychologist will:

- Assess and diagnose psychological disorders and/or adjustment issues, and report this to the multidisciplinary epilepsy team
- Diagnose Conversion Disorder or other diagnoses in cases of Psychogenic Non-Epileptic Seizures (PNES)
- Provide short-term treatment while an in-patient, if feasible, to the patient and/or family
- Alleviate anxiety regarding treatments including surgery, enabling the patient to obtain the greatest benefit from medical treatment
- Help the patient understand and accept his/her medical condition
- Treat patient's mood disorders, other psychological co-morbidities, and problems with self-esteem and independence
- Assess and treat patients with psychogenic non-epileptic spells, and facilitate a referral for treatment/ Community Epilepsy Agency for PNES at the time of discharge
- On discharge, arrange for appropriate psychological or mental health treatment, and referral to Community Epilepsy Agency

The Psychiatrist will:

- Enable the Epileptologist and epilepsy surgeon to understand the biopsychosocial contributors to the patient's presentation as it pertains to their epilepsy care
- Offer recommendations to the Epileptologist regarding further assessments, investigations, medication changes/interactions/side effects, or therapy options to optimize patient-centered care
- Provide a biopsychosocial psychiatric evaluation of patients with complex epilepsy who are not surgical candidates
- Provide psychiatric assessment, psychotherapy, and recommendations for ongoing follow-up options as appropriate for continuity of care
- Enable the patient and their family to understand the biopsychosocial contributors to the patient's presentation as it pertains to their epilepsy care

The Community Epilepsy Liaison will:

- Work in collaboration with the EMU Nurse, Social Worker and/or Mental Health Professional to provide psychosocial support pre- and post-surgery
- Guide patients/families through the surgical decision-making process and assist them with generating questions in preparation for neurosurgical appointment
- Help patients/families to prepare for their visit to the EMU (what to expect during their stay)

- Provide patients/families with support to reduce their fear of surgery and to dispel any misconceptions
- Connect patients/families with peer support and community-based surgery support groups to provide opportunities to share experiences about surgery
- Make weekly visits to the EMU to provide continuity of care to patients who are being monitored
- Help patients/families navigate community resources (disability, medication subsidies, respite, funding for medical devices, workplace accommodation, financial, etc.)
- Assist patients/families with support as they adjust to life post-surgery with reintegration into community, school and workplace
- Provide on-going support for patients who have been evaluated in the EMU who are not candidates for surgery, including patients with PNES

EMU Equipment

The equipment used for EMU monitoring should consist of the following and meet the minimal technical guidelines for EEG recording as mandated by the Canadian Society of Clinical Neurophysiologists (CSCN) task force.

Each EMU is comprised of a digital recording unit and review station.

EEG Amplifier Specifications

- Minimum of 40 differential amplifier channels for EEG
- The amplifier box should have battery back-up and storage capacity for 20 to 30 minutes (or up to 500MB/1GB) of EEG data collection while the patient is disconnected from the main acquisition station (e.g., patient going to washroom/for short breaks etc.). This allows for the continuity of the EEG monitoring.
- For hospitals doing subdural strip or grid or depth electrode monitoring, a minimum of 128 channel capability for intracranial EEG recording is recommended along with a Digital Switch Matrix (DSM) application embedded in the acquisition software (for electrical stimulation studies). A constant current, biphasic pulse generator is used for eloquent cortex functional mapping.
- Minimum of 4 channels of auxiliary inputs for EKG, EOG, EMG and Respiration Monitoring
- Sampling rate of 500 Hz or higher for analog to digital conversion
- Digital Precision of 16 bits or greater, to resolve voltage to 0.5 µV, is recommended
- Common mode rejection should be 100 dB or greater at each amplifier output. Inter-channel cross-talk must be less than 1%, 40 dB down or less

➤ *Please refer to McLachlan & Young (1999) for further details regarding EEG amplifier specifications*

PC and Peripheral Device Specifications

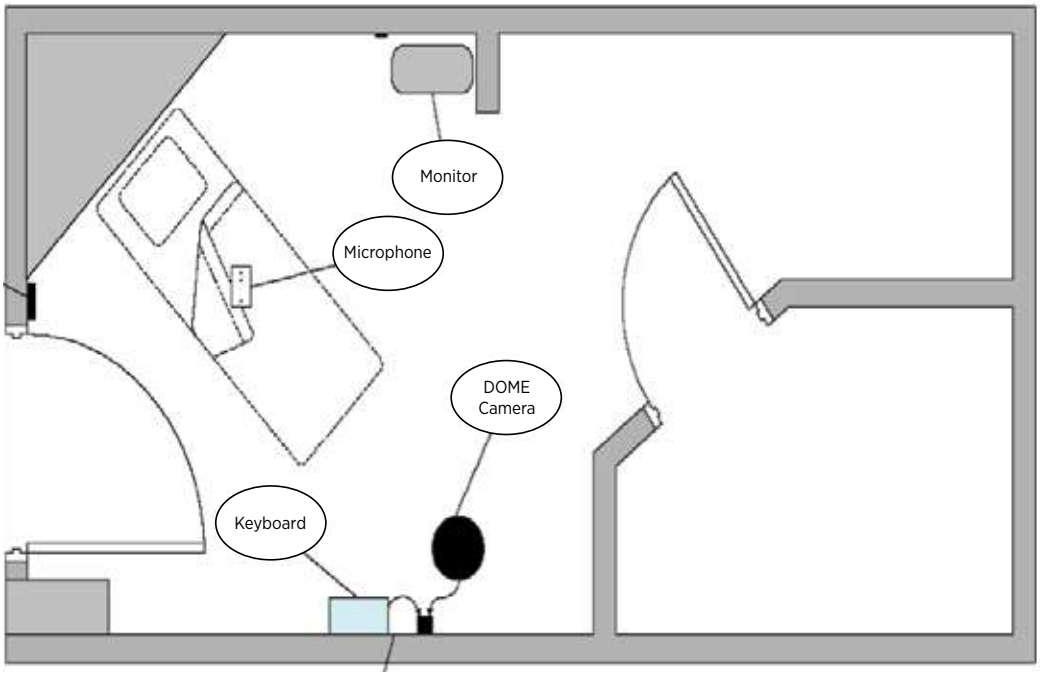
- Local hard drive should have appropriate storage capacity
- Dual (full body and face) remotely adjustable PTZ (pan-tilt-zoom) high-definition colour video camera recording synchronized MPEG4 compressed video is preferred/recommended, or, a standard definition video camera (Mono) with PTZ & MPEG 4 as a minimum requirement
- Infrared imaging capability for low light conditions
- High quality omni-directional microphone for good quality sound pick-up
- Impedance testing function of recording amplifier
- Manual push-button alarm in patient's room with markers annotated digitally on the EEG recording, and alarms at nursing station and remote viewing site
- Continuous video and optional EEG streaming at nurses' station with software to adjust camera position
- Adjustable camera position controls in patient's room
- Remote viewing capability of both real-time, elapsed and downloaded data
- Continuous seizure, spike detection and option for compressed spectral array software

Optional:

- Dual screen monitors at review stations for simultaneous video and EEG display, minimum 18 inches for video display and 21 inches for EEG display can enhance data review

- Recommended wired high-speed network (GB backbone) connection to a Storage Area Network (SAN) for long-term data storage

Figure 1: Sample EMU Room Setup



Technological Considerations

➤ *Please refer to McLachlan & Young (1999) for further details regarding technological considerations*

Network and Storage

- All EMU EEG data that is recorded is considered part of the patient's hospital records. Data retention of patient health records is guided by the Public Hospitals Act Reg. 965 (20 (3)) and Personal Health Information Protection Act (13 (1-2)). While local hospital policies vary, it is recommended to store full EMU EEG files in accordance with these Acts.
- Local hospital policies of data retention also vary. Therefore, in accordance with these Acts, a patient's EMU EEG data and pruned video data must be retained and stored for a minimum of ten (10) years past the patient's eighteenth (18th) birthday, or as long as necessary to allow an individual to exhaust any recourse he or she may have with respect to request for access of their personal health information.
- All EMU data must be stored on a centralized, encrypted and password protected server. There are many different types of servers that can be utilized. Consultation and recommendations by the Information Services Department will determine the ideal server required for each EMU lab. It is recommended that a SAN be the first choice in the type of server utilized.

Note: If a SAN is not utilized by the hospital(s), the IT Department's Network-Attached Storage (NAS) is an alternate storage option.

Safety in the EMU

Areas for Consideration

1. Screening procedures
2. Drug withdrawal
3. Monitoring and response to events including seizures
4. Communication with all members of the team, ICU
5. Discharge planning

- Prolonged video-EEG monitoring is an acceptably safe procedure for both adults and paediatric patients. It has been estimated that about 1 death/year occurs while monitoring more than 5000 patients per year.

➤ *Please refer to Noe and Drazkowski (2009), Atkinson, Hari, Schaefer and Shah (2012), Arrington, Ng, Troester, Kerrigan and Chapman (2013) and Phillips (2008) for further details regarding prolonged video-EEG monitoring safety*

- Though rare, adverse events can occur from issues such as falls, cardiac arrhythmias, and postictal psychosis

➤ *Please refer to Shafer et al. (2011), Dobesberger et al. (2011), Noe and Drazkowski (2009) and Atkinson, Hari, Schaefer and Shah (2012) for further details regarding adverse events*

- Rates of status epilepticus in EMUs have been reported to range from 0-3%

➤ *Please refer to Noe and Drazkowski (2009), Dobesberger et al. (2011), Yen et al. (2001) and Rose et al. (2003) for further details regarding rates of status epilepticus*

The American Epilepsy Society formed a working group to review best practices regarding safety of patients admitted to EMUs.

➤ *Please refer to Shafer et al. (2012) for details on best practices, admission & patient safety*

Summary of Recommendations

1. **Pre-Admission**
    a. Each patient at admission should have a care plan, level of activity, level of monitoring, mechanisms for drug withdrawal and discharge plans
    b. Establishment of a chain of command and decision making of patient care must be known by all members of the team
2. **Admission and Monitoring**
    a. Safety procedures related to electrode placement and technology issues – see role of EMU Technologist
    b. Education of patients and families, caregivers regarding seizure observation and safety issues
    c. Protocols in place to respond to seizures and medical events – see role of the EMU Epileptologist
    d. Seizure precautions and seizure first aid, monitoring of vital signs – see role of the nurse
    e. Communication between members of the team, on call physicians, referring physicians
3. **Discharge Planning**
    a. Seizure conference and follow-up in comprehensive epilepsy clinic

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Appendix 1: Product Material Safety Data Sheet (MSDS) Attachments

MSDS – GALENOVA COLLODION FLEXIBLE (CAT # CO610-050 2011 04 29)

MSDS – MAVIDON COLLODION KEGOC (CAT MD0002–6T 2013 06 20)

Appendix 2: Suggested Management of Acute Seizures during EMU Admission

Adult Patients (an example of acute management of generalized tonic-clonic seizures)

1. Time seizure
2. If longer than 3 minutes or cluster of seizures* (without recovery in between):
   a. ABC (assessment of airway, respiration, circulation)
   b. Midazolam 5mg each cheek
   c. If seizure does not stop within 1-3 min: call MD on call and obtain IV access
3. If cluster of seizures (with recovery in between):
   a. ABC (assessment of airway, respiration, circulation)
   b. Lorazepam 2mg tablet sublingual once
   c. May repeat if necessary after 5 minutes
   d. If cluster continues, call physician on call and obtain intravenous access
4. If respiratory/cardiac system is compromised, call your emergency response team to assess need of intubation or transfer to ICU
5. Initiation of intravenous treatment: at the discretion of physician on call

** Cluster of seizures: more than 3 seizures within 30 minutes*

Paediatric Patients

During an EMU admission, the patient's anti-epileptic drugs (AEDs) might be tapered/given at a lower dose to enable seizures to occur. This is especially done when the patient has infrequent seizures.

For the patient's safety, all patients admitted to the EMU should be assessed as to their need of IV access (i.e., IV saline lock).

Seizure management in infants (age >1 month), children and adolescents:

For seizures lasting >5 minutes or presence of clusters of seizures (more than 3 seizures in 30 minutes):

1. ABC (assessment of airway, respiration, circulation)
2. Consider the following medications:

Lorazepam		Diazepam		Midazolam
IV: 0.1mg/kg		IV: 0.3mg/kg		Intranasal: 0.2mg/kg
Buccal/SL: 0.1mg/kg				Buccal: 0.5mg/kg
PR: 0.1mg/kg	**or**	PR: 0.5 mg/kg	**or**	
IV/PR/SL max: 4mg/dose		IV max: <5yrs: 5mg/dose ≥5yrs: 10mg/dose PR max: 20mg/dose		IN max: 5mg (1ml)/nostril Buccal max: 10mg (2ml)

May repeat another dose if seizures continue after 5 minutes. Consider loading with IV fosphenytoin, IV phenytoin or IV phenobarbital if seizures continue after another 5 minutes (initiate status epilepticus treatment).

If respiratory/cardiac system is compromised, call your emergency response team to assess need of intubation or transfer to ICU.

Appendix 3: Ontario Epilepsy Centres Providing Further Information Regarding Monitoring

Organization Name	Contact Person and Title	Contact Information
University Health Network (UHN)	Dr. Richard Wennberg Epileptologist	(416) 603-5927
	Nat Shampur EMU Technologist	(416) 603-5800, ext. 6144
The Hospital for Sick Children (Sick Kids)	Dr. Cristina Go Epileptologist	(416) 813-7654, ext. 228101
	Rohit Sharma EMU Technologist	(416) 813-6545
London Health Sciences Centre (LHSC)	Dr. Jorge Burneo Epileptologist	(519) 663-3464 jorge.burneo@lhsc.on.ca
	Elyse Sandison EMU Technologist	elyse.sandison@lhsc.on.ca

Appendix 4: Epilepsy Implementation Task Force (EITF) Membership

Name	Title/Role	Organization
Dr. Carter Snead (Co-Chair)	Paediatric Neurologist	The Hospital for Sick Children
Brenda Flaherty (Co-Chair)	Executive Vice President & Chief Operating Officer	Hamilton Health Sciences
Dr. Jorge Burneo	Adult Neurologist	London Health Sciences Centre
Dr. Sandrine De Ribaupierre	Paediatric Neurosurgeon	London Health Sciences Centre
Pat Elliot-Miller	CNE and VP Patient Services	Children's Hospital of Eastern Ontario
Liz Ferguson	Director, Centre for Brain and Behaviour	The Hospital for Sick Children
Laurie Gould	EVP Patient-Centred Care	London Health Sciences Centre
Dr. Ayman Hassan	Neurologist	Thunder Bay Regional Health Sciences Centre
Kathryn LeBlanc	Director, Neurosciences	Hamilton Health Sciences
Dr. Athen MacDonald	Paediatric Neurologist	Kingston General Hospital
David McNeil	Vice President Clinical Programs/CNO	Health Sciences North
Janet Newton	Clinical Director	University Health Network
Kirk Nylen	Manager, Knowledge Translation/Ops	Ontario Brain Institute
Dr. Rajesh RamachandranNair	Paediatric Neurologist	McMaster Children's Hospital / HHS
Mary Secco	Executive Director	The Epilepsy Support Centre, London
Dr. Laurene Sellers	Family Practice Physician	
Dr. Michelle Shapiro	Adult Epileptologist	Hamilton Health Sciences
Rosie Smith	Director of Adult Services	Epilepsy Toronto
Mike Tierney	VP Clinical Programs	The Ottawa Hospital
Dr. Taufik Valiante	Adult Neurosurgeon	University Health Network
Dr. Sharon Whiting	Paediatric Neurologist	Children's Hospital of Eastern Ontario