**Epilepsy Society of Australia**

**Position Statement:**

**Continuous Electroencephalography Monitoring in the Intensive Care Unit**

**ESA Continuous EEG Taskforce**

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Seizures, predominantly subclinical or electrographic-only seizures, occur in some ICU patients with depressed conscious state; electrographic status epilepticus is present in a proportion of these patients. The prevalence of seizures in ICU patients with depressed conscious state depends on age (neonates > children > adults), the presence of prior clinical seizures (acute symptomatic or epilepsy), and aetiology (highest risk in patients with stroke, encephalitis, traumatic brain injury, hypoxic-ischaemic encephalopathy, neonatal encephalopathies, and intracerebral haemorrhage). Reported prevalence rates for electrographic seizures and status epilepticus are 10-30% and 5% respectively in at risk ICU patients. Seizures in unconscious ICU patients are often not obvious clinically and may only be detected on EEG recordings.

Routine EEG is widely available and effective for the diagnosis of many seizure-related issues in the ICU e.g., detection of frequent seizures or status epilepticus, clarification of frequent clinical or amplitude-integrated EEG phenomena. Additionally, routine EEG may show background abnormalities, interictal epileptiform discharges or rhythmic/periodic patterns which indicate a high likelihood of subsequent electrographic seizures.

Continuous EEG monitoring (cEEG), that is video-EEG recordings of at least 3 hours and typically greater than 12 hours duration, allows detection of infrequent or variable frequency seizures and periods of status epilepticus, determination of seizure burden, and assessment of the response to treatment of seizures.

Numerous cohort studies of cEEG in ICU, mainly in neonatal and paediatric settings, report potential negative outcomes of status epilepticus and high seizure burden, over and above the impact of the underlying condition. However, few studies adequately assess the clinical and economic impact of the practice of cEEG in ICU. Studies in adult ICU patients comparing cEEG with routine EEG have been conflicting, with two large registry studies reporting reduced mortality associated with cEEG, but one randomised study reporting no benefit of cEEG on mortality in patients without prior clinical seizures. Health economic modelling of data from neonatal and paediatric ICUs suggest 24 hours of cEEG monitoring would be cost-effective if electrographic status epilepticus identification and treatment improved patient functional outcomes by as little as 3%. Additional potential benefits of cEEG include evaluation of therapeutic interventions, prevention of inappropriate use of anti-seizure medication, and prognostication of outcome.

Neurological consultation, with or without routine EEG and neuroimaging, remains the gold standard of initial seizure assessment in ICU. Routine EEG in ICU, where indicated, should be performed with video and a view to continuing as cEEG in appropriately selected patients. cEEG in ICU should be considered in patients with clinical or routine EEG risk factors for seizures, and patients in whom routine EEG fails to clarify the clinical question. cEEG in unselected patients in the ICU is not recommended.

cEEG should only be undertaken by appropriately trained and experienced neurophysiology scientists and neurologists, the latter typically being epileptologists with ICU EEG experience. The resources and funding required to implement and maintain a robust cEEG service in ICU are substantial. Although video-EEG monitoring capabilities exist at most tertiary hospitals, this is notionally for epilepsy care in epilepsy monitoring units, not cEEG in ICUs. Furthermore, remuneration for video-EEG monitoring is poor and insufficient for many hospitals to establish or maintain a service. A case should be made by neurologists and intensivists to hospitals and health departments for funding of targeted cEEG of appropriate duration in high-risk ICU patients. Advocacy by professional societies would help promote awareness of the value of targeted cEEG in ICU. One important, presently unmet need for cEEG is for neonates and infants in ICUs, where on-site neurological and neurophysiological service provision is often limited, and management is often undertaken by intensivists using amplitude-integrated EEG and cerebral function monitors, modalities vulnerable to over and under detection of seizures.

High-quality clinical research (multi-centre, age-specific, prospective, randomised, pragmatic, including health economic evaluations) is required to better define the appropriate patient groups for cEEG, the ideal endpoints of monitoring, and the outcomes of detection and treatment of cEEG-based seizures. Until that time, and until adequate resourcing and funding is provided, neurologists and intensivists will need to rely upon interdisciplinary team collaboration and targeted use of existing clinical and EEG services.