



## A European survey on current practices in epilepsy monitoring units and implications for patients' safety



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### ABSTRACT

**Objective:** This study aimed to survey current practices in European epilepsy monitoring units (EMUs) with emphasis on safety issues.

**Methods:** A 37-item questionnaire investigating characteristics and organization of EMUs, including measures for prevention and management of seizure-related serious adverse events (SAEs), was distributed to all identified European EMUs plus one located in Israel (N = 150).

**Results:** Forty-eight (32%) EMUs, located in 18 countries, completed the questionnaire. Epilepsy monitoring unit beds are 1–2 in 43%, 3–4 in 34%, and 5–6 in 19% of EMUs; staff physicians are 1–2 in 32%, 3–4 in 34%, and 5–6 in 19% of EMUs. Personnel operating in EMUs include epileptologists (in 69% of EMUs), clinical neurophysiologists trained in epilepsy (in 46% of EMUs), child neurologists (in 35% of EMUs), neurology and clinical neurophysiology residents (in 46% and in 8% of EMUs, respectively), and neurologists not trained in epilepsy (in 27% of EMUs). In 20% of EMUs, patients' observation is only intermittent or during the daytime and primarily carried out by neurophysiology technicians and/or nurses (in 71% of EMUs) or by patients' relatives (in 40% of EMUs). Automatic detection systems for seizures are used in 15%, for body movements in 8%, for oxygen desaturation in 33%, and for ECG abnormalities in 17% of EMUs. Protocols for management of acute seizures are lacking in 27%, of status epilepticus in 21%, and of postictal psychoses in 87% of EMUs. Injury prevention consists of bed protections in 96% of EMUs, whereas antisuffocation pillows are employed in 21%, and environmental protections in monitoring rooms and in bathrooms are implemented in 38% and in 25% of EMUs, respectively. The most common SAEs were status epilepticus reported by 79%, injuries by 73%, and postictal psychoses by 67% of EMUs.

**Conclusions:** All EMUs have faced different types of SAEs. Wide variation in practice patterns and lack of protocols and of precautions to ensure patients' safety might promote the occurrence and severity of SAEs. Our findings highlight the need for standardized and shared protocols for an effective and safe management of patients in EMUs.

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## 1. Introduction

Long-term video-electroencephalography monitoring (LTM) in epilepsy monitoring units (EMUs) is an essential investigation for diagnosis of recurrent spells, classification of epileptic seizures, and presurgical evaluation of patients with intractable localization-related epilepsy [1,2]. Since the optimal yield is to obtain the maximal amount of information by recording seizures while minimizing the stay in the hospital, provocative procedures to elicit seizures, such as tapering of antiepileptic drugs, sleep deprivation, and hyperventilation, are commonly used. However, this practice may expose patients to potentially serious adverse events (SAEs) that have recently caught attention and raised concerns about patients' safety in EMUs [3–14]. The International League Against Epilepsy [1], the American Clinical Neurophysiological Society [15], and the National Association of Epilepsy Centers [16] have issued guidelines and recommendations regarding the clinical indications and the requirements for LTM in EMUs, which only marginally dealt with safety issues. Indeed, although EMUs have been operating for more than two decades and are increasing in number worldwide, there is no regulation at present on how to ensure patients' safety in EMUs [17].

The European Epilepsy Monitoring Unit Association (EEMA) was created to share the knowledge of the appropriate utilization of EMUs and to promote optimal quality of care in the best interest of the patients. In this framework, the task force on “Safety in EMU” of the EEMA has explored the current situation in Europe by submitting a survey to European EMUs with the aim to collect information on current practices, with a particular focus on safety issues. In this paper, we report the results of this survey.

## 2. Methods

The survey was designed by the “Safety in EMU” task force of EEMA (GR, SB, MPC, SC, HS, PK, WEB, and DV). Final approval of the survey was obtained after discussions among all members of the task force and the board of EEMA (AGN, BS, ET, GR, and PR). The survey used a 37-item questionnaire with multiple choice answers (see Supplementary material) and was sent via e-mail to the physicians of 150 EMUs identified in Europe and Israel according to a previously described procedure [18]. The survey was launched on October 15, 2012 and concluded on December 15, 2012. To avoid that more than one person from the

**Table 1**  
General characteristics of EMU.

	Total N (%) of responders						
In your EMU you monitor: N (%) of responders	48 (100)	Adults 6 (13)	Children 6 (13)	Both 36 (74)			
How many physicians staff the EMU in your center?	47 (98)	1–2 15 (32)	3–4 16 (34)	5–6 9 (19)	>6 7 (15)		
What is their level of medical training?	48 (100)	Neurology residents 22 (46)	Neurophysiology residents 4 (8)	Neurologists not trained in epilepsy 13 (27)	Child neurologists 17 (35)	Neurologists trained in epilepsy 33 (69)	Neurophysiologists trained in epilepsy 22 (46)
How many EMU beds operate simultaneously?	47 (98)	1–2 20 (43)	3–4 16 (34)	5–6 9 (19)	>6 2 (4)		
Please indicate the average number of admissions in your EMU.	47 (98)	<50/year 8 (17)	50–150/year 17 (36)	150–250/year 13 (28)	>250/year 9 (19)		
Are intracranial recordings performed at your center?	48 (100)	Yes 37 (77)	No 11 (23)				
What are the types of invasive studies?	37 (77)	Foramen ovale electrodes 6 (16%)	Epidural electrodes 1 (3%)	Subdural electrodes 29 (78%)	Depth electrodes 27 (73%)		
Do you have any standardized form for preadmission screening that considers seizure frequency, seizure types, episodes of seizure clusters or status epilepticus, previous injuries, and psychiatric disturbances?	48 (100)	Yes 27 (56)	No 21 (44)				
Do you have any preliminary assessment of possible comorbidities (for instance, osteoporosis and cardiorespiratory compromise) that may render seizure provocation potentially harmful?	48 (100)	Yes 31 (65)	No 17 (35)				
Do you require a signed informed consent form prior to the video-EEG monitoring procedure?	48 (100)	Yes 40 (83)	No 8 (17)				
Do you have a standardized protocol to ensure patient safety after being discharged from the EMU?	48 (100)	Yes 42 (88)	No 6 (12)				
If yes to the previous question, which protocol do you use?	48 (100)	In-hospital stay for AED reintroduction 36 (75%)	Protocol for contacting on-call physicians (after discharge from the hospital) 20 (42%)	Others 3 (6%)			

The numbers in the columns indicate the number and the percentage (in italics within parentheses) of centers that responded.

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