OBJECTIVES: Electroencephalography (EEG) is one of the main tools for diagnosis and prognostication of encephalopathy. Our two objectives were to assess: 1) the reliability of intensivists’ interpretations (one trained intensivist and nonexpert intensivists) on specific EEG patterns and 2) the feasibility of performing simplified EEG by a trained intensivist in ICU.

DESIGN: Prospective, single-center study.

SETTING: One French tertiary-care center.

PATIENTS: Thirty-six consecutive ICU patients with encephalopathy.

INTERVENTION: A trained intensivist (1-year specific electrophysiologic course) recorded and interpreted EEGs using a 10 monopod montage at bedside. Then, 22 nonexpert intensivists underwent a 1-hour educational session on interpretation of EEG background (activity, continuity, and reactivity) and common patterns seen in ICU. Trained and nonexpert intensivists' interpretation of EEG recordings was evaluated and compared with an expert neurophysiologist’s interpretation (gold standard). The agreement between the two interpretations was evaluated. Second, the duration of the entire EEG procedure (specifically EEG installation) at bedside was recorded.

MEASUREMENTS AND MAIN RESULTS: Agreements and reliability between the trained intensivist and the neurophysiologist were acceptable for minimal (agreement, 94%; Pearson coefficient, 0.60) and maximal (89%, 0.89) background frequency, burst suppression (agreement, 100%; Kappa coefficient, 1), background continuity (83%, 0.59), and reactivity to auditory stimulus (78%, 0.44). Agreements between the 22 nonexpert intensivists and the neurophysiologist were heterogeneous. As a result, 87% of the 22 nonexpert intensivists obtained an acceptable reliability for the minimum background frequency, 95% for the maximum background frequency, and 73% and 95% for burst suppression and isoelectric background identification, respectively. The median duration of the entire EEG procedure was 47 minutes (43–53 min), including 22 minutes (20–28 min) of EEG installation.

CONCLUSIONS: Intensivists can rapidly learn background activity and identify burst-suppression and isoelectric background. However, more educational sessions are required for interpretation of other EEG patterns frequently observed in the ICU setting.

KEY WORDS: education; electroencephalography; encephalopathy; intensive care unit; interpretation

The main indications for electroencephalography (EEG) monitoring in the ICU are seizure detection, status epilepticus diagnosis, cerebral ischemia detection, and prognostication of coma after cardiac arrest (1–7).
The detection of simple EEG patterns (such as background activity, reactivity background, and continuity background/burst suppression) improves coma diagnosis and prognostication in patients with encephalopathy of anoxic (8–12), septic, or metabolic origin (13–15) (see Table 1). For example, background abnormalities such as delta-predominant activity and lack of reactivity are associated with delirium and 1-year mortality in septic ICU patients (16, 17). In an observational study, EEG was performed in 154 patients for encephalopathy (70% hospitalized in ICU), and all patients presented a slowing background with theta, theta/delta, and delta activities associated with triphasic waves, or Frontal Intermittent Delta Activity (13). Lack of background reactivity in 98 septic or septic shock patients was also associated with an increase in 1-year mortality (15). In a recent systematic review, background reactivity appeared to be associated with favorable neurologic outcome, whatever the etiology (17).

However, performing EEG in the ICU requires specific training for EEG installation, recording, and interpretation. Therefore, teaching EEG techniques and theory to ICU caregivers appears necessary to improve EEG accessibility and interpretation in ICU 24/7.

Previous studies already showed that learning sessions for intensivists improved general critical care EEG knowledge. In the first study, a dedicated short online training with lectures on EEG interpretation and interactive training by an expert neurophysiologist seemed achievable and allowed intensivists to detect artifacts, background symmetry, and deep sedation patterns (18). In another study, a face-to-face training followed by additional e-learning sessions (at days 15, 30, and 90) allowed intensivists to detect EEG patterns such as background frequency, background symmetry, effects of sedation, paroxysmal EEG patterns, EEG artifacts, and isoelectric EEG. Nevertheless, additional training was required for detection of periodic or burst suppression patterns and background reactivity (19). In the present study, the primary objective was to evaluate the efficacy of a 1-hour educational session to enable nonexpert intensivists to accurately identify common EEG patterns (background frequency, background continuity, and background reactivity). The secondary objective was to assess the feasibility of performing a simplified EEG by intensivists in the ICU setting.

MATERIALS AND METHODS

Patients

This prospective single-center study was conducted on consecutive patients admitted to the ICU of the Bichat—Claude-Bernard Hospital, Assistance Publique - Hopitaux de Paris, Paris, France, between January and November 2019. All adult mechanically ventilated patients for whom an EEG was requested for persistent unresponsiveness, defined as persistent coma or fluctuations of consciousness, with a Richmond Agitation-Sedation Scale (RASS) (20) less or equal to –2, were eligible for inclusion. Exclusion criteria were: 1) hospitalization for traumatic brain injury, 2) technical inability to perform EEG or unavailability of EEG, 3) brain death diagnosis, and 4) highly resistant bacterial colonization.

The ethics committee of the French Society of Intensive Care Medicine (SRLF) approved this study (Ethics Committee SRLF 19-24) on July 7, 2019. Procedures were followed in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with
| Description                  | Definition | Background frequency | Continuous/Discontinuous | Burst suppression | Attenuation/Suppression | Background reactivity | Reactive | Unreactive | Change in activity | Prognosis |
|-----------------------------|------------|----------------------|--------------------------|-------------------|------------------------|----------------------|----------|------------|-------------------|-----------|
| Background frequency        | 8–13 Hz    | Alpha                | Alpha                     | Alpha             | Alpha/Theta            | Alpha/Theta          | Reactive | Unreactive | Change in voltage | Poor prognosis |
|                             | 4–7 Hz     | Theta                | Theta                     | Theta             | Theta/Delta            | Theta/Delta          | Reactive | Unreactive | Change in voltage | Poor prognosis |
|                             | 1–3 Hz     | Delta                | Delta                     | Delta             | Delta/Severe           | Delta/Severe         | Reactive | Unreactive | Change in voltage | Poor prognosis |

*Attenuation: periods of lower voltage greater than or equal to 10 µV but less than 50% of the higher voltage background.

*Suppression: periods of lower voltage are less than 10 µV.

*These patterns may be confounded by sedative drugs (propofol).

Adapted from Hirsch et al. J Clin Neurophysiol 2021; 38:1–29 and Hirsch et al. J Clin Neurophysiol 2012; 30:1–27.
the Helsinki Declaration of 1975. Written informed consent was waived as this observational study did not modify standard of care.

EEG Recording
Simplified EEG montage was performed by a trained senior intensivist (1-year specific electrophysiologic course) according to current recommendations (21, 22), using 10 monopods (Fp1, Fp2, T3, T4, C3, C4, O1, O2 with G1, and G2) positioned according to the 10–20 International system (see Supplemental Digital Content 1, http://links.lww.com/CCX/B77). The procedure of EEG installation and recording is resumed in Supplemental Digital Content 2 (http://links.lww.com/CCX/B77). To assure the quality of the EEG recording, impedance of all monopods had to be less than 10 kΩ before starting EEG recording.

Collected Data and Definitions
The following data were collected for each patient: demographics, Charlson score (23), neurological history, and reason for ICU admission. The patient’s condition at ICU admission was assessed using the Simplified Acute Physiology Score II (24), the Sequential Organ Failure Assessment (SOFA) (25), and the Glasgow Coma Scale (GCS) (26). In addition, the following information was collected at the time of the EEG recording: EEG indication, SOFA score, GCS score, RASS score, Full Online of UnResponsiveness score (27) (see Supplemental Digital Content 3, http://links.lww.com/CCX/B77), focal neurological deficit or myoclonus, pupillary reactivity, temperature, heart rate, arterial blood pressure, and pulse oximetry. Regarding EEG feasibility, the following information was collected: time necessary for electrode placement, time for impedance checking, and duration of EEG recording, together with main technical issues encountered.

EEG Interpretation
First, the trained intensivist (1-year specific electrophysiologic course) performed and interpreted each EEG at bedside. Second, an independent neurophysiologist (gold standard) from the Bichat-Claude-Bernard Hospital interpreted each EEG, blinded to the clinical data and outcomes. Third, 22 ICU physicians (four experienced physicians and 18 residents) received a 1-hour educational session in simplified EEG interpretation for specific patterns. This session was a hybrid (face-to-face or videoconference) session, followed by a Questions and Answer session at the end. The session focused on specific EEG patterns observed in ICU patients that are presented in Table 1. After the educational session, each participant received a pdf copy of the file presented during the session. No intensivist had any specific EEG training before the study. After the session, all participants received 36 EEG excerpt sequences from 36 patients by e-mail for interpretation. Only chosen excerpts of EEGs were sent to nonexpert intensivists. Although the neurophysiologist and the trained intensivist also assessed the same chosen excerpts, they initially had access to the entire EEG data. EEG interpretations from the trained intensivist and the 22 ICU physicians were compared with that of the neurophysiologist (Gold standard). EEG interpretation was performed using the terminology defined by the American Clinical Neurophysiology Society (28, 29). Background EEG activity was defined by: 1) the predominant background frequency (minor and major—Hz or isoelectric), 2) the continuity (continuous, discontinuous, or burst suppression) (see Supplemental Digital Content 4, http://links.lww.com/CCX/B77), and 3) the reactivity, defined as a reproducible transient diffuse change in EEG activity (i.e., amplitude and/or frequency) in response to stimulation. The other EEG parameters were also noted using this terminology (see Supplemental Digital Content 4, http://links.lww.com/CCX/B77).

Outcomes
The primary outcome measure was the concordance of interpretation of the simplified EEG between an expert neurophysiologist (gold standard) and intensivists (first the trained intensivist and then the 22 nonexpert intensivists) on three criteria: background activity frequency (Hz), continuity (continuous, discontinuous, or burst suppression), and reactivity to auditory and noxious stimuli (present or absent). The secondary outcome measure evaluated the duration of the EEG process (specifically EEG installation) performed by the ICU intensivist.

Statistical Analysis
The results are reported as medians (first to third quartiles) or number (%). Evaluation of reliability between the neurophysiologist and the intensivists was made
using Cohen kappa coefficient for categorical variables and Pearson correlation for quantitative variables. For background activity frequency, the percentage of agreement was defined as the proportion of interpretation, in which the frequency was greater than or equal to or less than or equal to 2 Hz between the neurophysiologist and intensivists for each EEG. Percent agreement for categorical variables was reported as the proportion of interpretations in which the reported findings were identical.

Regarding the 22 nonexpert intensivists, results were presented as the median (range) of the 22 pairs formed by an individual intensivist and the neurophysiologist. Cohen kappa was calculated for the identical agreement within the pairs and presented as the median (range). Pearson coefficient was calculated for every 22 pairs and presented as the median (range).

The nomenclature used for presenting the strength of reliability of the kappa statistic was (30): less than or equal to 0.40: disagreement (poor, slight, and fair categories); (0.41–0.60): moderate reliability; (0.61–1.0): correct reliability (substantial and almost perfect categories). The nomenclature used for presenting the strength of agreement of the Pearson correlation was (31, 32): less than 0.60: disagreement; (0.60–0.79): moderate reliability; and (0.80–1): correct reliability. Both correct and moderate reliability were considered acceptable in our study, as it was the learning objective after a 1-hour educational session. Statistical analysis was performed with SAS Version 9.4 Software (SAS Institute, Cary, NC).

RESULTS

Patients

Among 41 eligible patients, 36 patients were included and five were excluded (see Supplemental Digital Content 5, http://links.lww.com/CCX/B77). Baseline characteristics are presented in Table 2. Main reasons for ICU admission were cardiac arrest ($n = 16, 45\%$), altered mental status with coma ($n = 6, 17\%$) and encephalitis ($n = 2, 5\%$), cardiac surgery ($n = 5, 14\%$), convulsive status epilepticus ($n = 5, 14\%$), and septic shock ($n = 2, 5\%$). Nine (25\%) and two (5\%) patients had a prior history of epilepsy and stroke, respectively.

EEG Recordings

EEGs were mainly performed for postanoxic encephalopathy prognostication ($n = 15, 42\%$), delayed awakening ($n = 8, 22\%$), status epilepticus/seizure detection ($n = 12, 33\%$), and encephalitis ($n = 1$) (see Supplemental Digital Content 5, http://links.lww.com/CCX/B77). Neurological and extraneurological characteristics at the time of EEG recording are presented in Supplemental Digital Contents 6 and 7 (http://links.lww.com/CCX/B77). All patients were unresponsive, with a median RASS score of –4 and a GCS score of 4. Patients were sedated with propofol and opioids ($n = 26, 72\%$ and $n = 24, 67\%$, respectively), and 14 patients (39\%) were receiving antiepileptic drugs.

Primary Outcome Measure (EEG Interpretation and Agreements)

According to the neurophysiologist’s interpretation (gold-standard), background activity frequency ranged

| Variable                     | All ($n = 36$) |
|------------------------------|---------------|
| ICU admission characteristics |               |
| Age (yr)                     | 53 (40–68)    |
| Sex (male)                   | 26 (72\%)     |
| Admission diagnosis          |               |
| Cardiac arrest               | 16 (45\%)     |
| Cardiac surgery              | 5 (14\%)      |
| Status epilepticus           | 5 (14\%)      |
| Altered mental status        | 8 (22\%)      |
| Septic shock                 | 2 (5\%)       |
| Simplified Acute Physiology Score II | 60 (39–74)     |
| Prior neurological history   |               |
| Epilepsy                     | 9 (25\%)      |
| Stroke                       | 2 (6\%)       |
| Prior medical history        |               |
| Diabetes mellitus            | 8 (22\%)      |
| Cardiopathy                  | 9 (25\%)      |
| Hypertension                 | 6 (17\%)      |
| Immunosuppression            | 5 (14\%)      |
| Chronic renal disease        | 4 (11\%)      |
| Chronic respiratory disease  | 8 (22\%)      |
| Cirrhosis                    | 1 (3\%)       |
| Charlson score               | 2 (0–6)       |

Values are expressed as medians (interquartile) or as number (%).
from 1 Hz (1–2 Hz) (delta activity) to 5 Hz (4–6 Hz) (theta activity), with 5 (14%) cases of isoelectric background. Only four EEG (11%) were both reactive to nociceptive and auditory stimuli. Sleep patterns or seizures were not observed. Epileptiform discharges and beta bands were each observed on four EEG recordings (11%). Burst suppression was observed for one patient (3%).

Reliability between the trained intensivist and the neurophysiologist is presented in Table 3. Agreements rates were 94% for minimum background frequency, 89% for maximum background frequency, and 83% for background continuity. Regarding background reactivity (to nociceptive and auditory stimuli), agreements rates were 75% and 78%, respectively. The trained intensivist observed six EEG with an isoelectric background, whereas the neurophysiologist observed five such cases. Concerning the other EEG patterns (such as epileptic patterns, sleep patterns, and background asymmetry, comparisons are presented in Supplemental Digital Content 8 (http://links.lww.com/CCX/B77). Regarding reliability between the 22 EEG nonexpert intensivists and the neurophysiologist, results between the 22 nonexpert intensivists are heterogeneous (see Supplemental Digital Content 9–14, http://links.lww.com/CCX/B77). As a result, 87% of the 22 nonexpert intensivists obtained an acceptable reliability for the minimum background frequency, 95% for the maximum background frequency, respectively, and 73% and 95% for burst suppression and isoelectric background identification (Table 4 and Fig. 1). In contrast, there was substantial disagreement for both auditory and nociceptive background reactivities and background continuity (Table 4 and Fig. 1).

**Secondary Outcome Measure (EEG Feasibility)**

When EEG was requested by physicians, 24 EEGs (67%) were performed on the same day, and seven EEGs (19%) were performed after 2 days. One EEG was not performed because of technical difficulties in electrode placing. For the 36 EEGs, the total duration of the EEG session (installation and recording) was 47

Table 3: Comparison Between Electroencephalography Interpretations of a Trained Intensivist and a Neurophysiologist

| Variables All (n = 36) | Neurophysiologist Interpretation | Trained Intensivist Interpretation | Agreement | Pearson Coefficienta | Cohen Kappa§ |
|------------------------|----------------------------------|-----------------------------------|-----------|----------------------|--------------|
| Background activity’s frequency | | | | | |
| Minimum (Hz) | 1 (1–2) | 1 (1–2) | 34/36 (94%) | 0.60 |
| Maximum (Hz) | 5 (4–6) | 5 (4–7) | 32/36 (89%) | 0.89 |
| Background continuity | 28 (78%) | 24 (67%) | 30/36 (83%) | 0.59 |
| Burst suppression | 1 (3%) | 1 (3%) | 100% | 1 |
| Isoelectric background | 5 (14%) | 6 (17%) | 35/36 (97%) | 0.89 |
| Background reactivity | | | | | |
| To nociceptive stimuli | 5 (14%) | 15 (42%) | 27/36 (75%) | 0.37 |
| To auditory stimuli | 5 (14%) | 13 (36%) | 28/36 (78%) | 0.44 |

*aEvaluation of agreement is made using Cohen kappa coefficient for categorical variables and using Pearson correlation* for linear variables.

Values are expressed as medians (interquartile) or as number (%).

Percent agreement for the background frequency is defined as the proportion of interpretations, in which the frequency was equal or more or less than 2 Hz between the neurophysiologist and intensivists for each electroencephalography. Percent agreement for categorical variables is reported as the proportion of interpretations, in which the reported findings were identical, presented as median and range of the 22 pairs formed by each individual ICU physician and the neurophysiologist.

Correct agreement: Cohen kappa (0.61–1) or Pearson coefficient (0.8–1).

Moderate agreement: Cohen kappa (0.41–0.60) or Pearson coefficient (0.6–0.79).

Disagreement: Cohen kappa ≤0.4 or Pearson coefficient <0.6.
minutes (43–53 min), including 4 minutes for installation in the room, 16 minutes (12–18 min) for electrode installation, 1 minute for impedance checking, and 20 minutes for recording (Table 5). Overall, 20 of 36 EEG recordings presented any noise or electrodes artifacts, and 16 of 36 EEG recordings presented intermittent and localized muscular artifacts, which did not interfere with the participants’ interpretation.

**DISCUSSION**

In our study, the agreement between a trained intensivist, who had specific training in neurophysiology, and the neurophysiologist was good for minimal and maximal background frequencies, background reactivity to auditory stimuli, background continuity, burst suppression, and isoelectric background identification. However, there was a considerable heterogeneity among the 22 EEG nonexpert intensivists, but the agreement between them and the neurophysiologist was acceptable for background frequency and isoelectric background identification. Finally, a 10 monopod EEG can technically easily be performed at bedside.

First, the trained intensivist identified a higher rate of preserved reactivity to stimuli compared with the neurophysiologist, highlighting the intensivist’s subjectivity for EEG interpretation at bedside. Indeed, EEG reactivity analysis is prone to subjectivity, in a comparative study conducted in 96 postanoxic patients, and the concordance rate between two certified neurophysiologists was 91% for background reactivity (9). In another study conducted on 59 postanoxic patients, three certified experts did not fully agree on EEG reactivity in 44% of cases (33). In another study conducted on 103 patients, the agreement between four experts for identifying an unreactive EEG was fair (kappa coefficient 0.25 and 0.17 for auditory and nociceptive reactivities, respectively) (34). These reports show the lack...
of good interrater agreement between EEG experts, which could explain heterogeneity in an intensivist population, as in our study and another study (19).

Table 5.
Electroencephalography Feasibility

| Variable                          | All (n = 36) |
|-----------------------------------|-------------|
| Time indication—EEG recording (hr)  | 15.6 (8–33.9) |
| Total duration of EEG (min)       | 47 (43–53) |
| Duration of EEG installation (min) | 22 (20–28) |
| Installation duration in the room  | 4 (2–6) |
| Electrode installation            | 16 (12–18) |
| Impedance checking                | 1 (0–3) |
| EEG recording                     | 21 (20–23) |
| Electrode installation problems   | 5 (14%) |
| Impedance validation difficulties | 3 (8%) |
| Main artifacts                    | 9 (25%) |

EEG = electroencephalography.
Values are expressed as medians (interquartile) or numbers (%).

In the aim to decrease heterogeneity, there have been recent attempts to find new methods of EEG analysis with quantitative analysis and machine learning (35).

The variability in accurate identification of EEG patterns between the expert and nonexperts may have several explanations. First, the expert neurophysiologist’s interpretation is usually performed in standardized laboratory conditions (i.e., nonreal time, nonbedside conditions), whereas the intensivists’ interpretation may be confounded by several factors, including clinical symptoms observed at bedside, and other environmental ICU factors. Second, EEG reactivity evaluation has been shown to be associated with significant variability among experts in the ICU setting (33, 34).

Thus, some efforts are needed for background continuity and burst suppression identification, as only 73% of nonexpert intensivists accurately identified burst suppression in our study. These results are in line with those from another study, where only 60% of burst suppression patterns were accurately identified (19).

Finally, our study suggests that, technically, EEGs can be integrated into daily routine use for
prognostication. Indeed, EEG installation in the ICU room (even with dialysis or extracorporeal life support) took 22 minutes, which should be achievable in daily practice. Following ESICM's recommendations (36), EEG is underutilized (37). Here, we show that EEG training of intensivists is feasible and that EEG can be integrated into daily care. This may help promote inclusion of EEG in ICU brain dysfunction multimodal monitoring (especially prolonged or continuous EEG) for prognostication of neurocritical care patients.

The main strength of our study is a real-life evaluation of a 1 hour educational session and EEG feasibility at the bedside in the ICU, with the aim to improve adherence to recommendations (4, 36) on EEG use in the ICU. Our study has also several limitations. First, we did not perform preteaching evaluation, as our primary objective was to evaluate the effect of a simple 1-hour educational session on intensivists without pre-existing knowledge on critical care EEG. Second, only standard (20min) simplified EEG was performed, a duration of recording that might not be sufficient for cerebral monitoring in ICU (especially for seizure detection and sleep patterns) (38, 39). Studies concerning continuous EEG feasibility should be performed. Third, our study showed the known subjectivity of EEG interpretation, and so a second neurophysiologist’s interpretation as gold standard could have been helpful. Fourth, identification of seizures or epilepticus status were not evaluated in our study, as we thought that a 1-hour educational session was not long enough to accurately learn these complex patterns.

Finally, our results could likely be improved with a second or more educational sessions. A previous study suggested that repetitive sessions (e-learning) improved learners’ ability to recognize essential EEG patterns (19) accurately.

Our findings encourage us to continue performing educational EEG sessions. Based on the results of our study, we believe that intensivists should be able to accurately identify background rhythm, reactivity, and burst suppression patterns. Although we aim to increase the number of sessions and gradually increase session levels (i.e., basic, advanced, and expert levels), we believe that several patterns (i.e., seizures, rhythmic patterns, or encephalopathy patterns) may still require a full training in Physiology or a close interaction between intensivists and neurophysiologists at bedside.

CONCLUSIONS

Intensivists nonexpert in EEG can learn background rhythm and recognize isoelectric background or burst suppression. However, one learning session is not enough to master the other patterns, and additional learning sessions may be necessary. EEG can feasibly be integrated into daily care.

REFERENCES

1. Guérit JM, Amantini A, Amodio P, et al: Consensus on the use of neurophysiological tests in the intensive care unit (ICU): Electroencephalogram (EEG), evoked potentials (EP), and electroneuromyography (ENMG). Neurophysiol Clin 2009; 39:71–83
2. Herman ST, Abend NS, Bleck TP, et al: Consensus statement on continuous EEG in critically ill adults and children, part I: Indications. J Clin Neurophysiol 2015; 32:87–95
3. Herman ST, Abend NS, Bleck TP, et al: Consensus statement on continuous EEG in critically ill adults and children, part II: Personnel, technical specifications, and clinical practice. J Clin Neurophysiol 2015; 32:96–108
4. André-Obadia N, Sauleau P, Cheliout-Herault F, et al: Recommandations françaises sur l’électroencéphalogramme. Neurophysiol Clin 2014; 44:515–612
5. André-Obadia N, Zyss J, Gavaret M, et al: Recommendations for the use of electroencephalography and evoked potentials in comatose patients. Neurophysiol Clin 2018; 48:143–169
6. André-Obadia N, Lamblin MD, Sauleau P; French recommendations on electroencephalography. Neurophysiol Clin 2015; 45:1–17
7. Slooter AJC, Otte WM, Devlin JW, et al: Updated nomenclature of delirium and acute encephalopathy: Statement of ten societies. Intensive Care Med 2020; 46:1020–1022
8. Sivaraju A, Gilmore EJ, Wira CR, et al: Prognostication of post-cardiac arrest coma: Early clinical and electroencephalographic predictors of outcome. Intensive Care Med 2015; 41:1264–1272
9. Liu G, Su Y, Jiang M, et al: Electroencephalography reactivity for prognostication of post-anoxic coma after cardiopulmonary resuscitation: A comparison of quantitative analysis and visual analysis. *Neurosci Lett* 2016; 626:74–78.

10. Azabou E, Fischer C, Mauguiere F, et al: Prospective cohort study evaluating the prognostic value of simple EEG parameters in postanoxic coma. *Clin EEG Neurosci* 2016; 47:75–82.

11. Hofmeijer J, Tjepkema-Cloostermans MC, van Putten MJAM: Burst-suppression with identical bursts: A distinct EEG pattern with poor outcome in postanoxic coma. *Clin Neurophysiol* 2014; 125:947–954.

12. Hofmeijer J, van Putten MM: EEG in postanoxic coma: Prognostic and diagnostic value. *Clin Neurophysiol* 2016; 127:2047–2055.

13. Sutter R, Stevens RD, Kaplan PW: Clinical and imaging correlates of EEG patterns in hospitalized patients with encephalopathy. *J Neurol* 2013; 260:1087–1098.

14. Azabou E, Magalhaes E, Braconnier A, et al: Early standard electroencephalogram abnormalities predict mortality in septic intensive care unit patients. *PLOS One* 2015; 10:e0139969.

15. Gilmore EJ, Gaspard N, Choi HA, et al: Acute brain failure in severe sepsis: A prospective study in the medical intensive care unit utilizing continuous EEG monitoring. *Intensive Care Med* 2015; 41:686–694.

16. Legouy C, Girard-Stein L, Bouadma L, et al: Association of standard electroencephalography findings with mortality and command following in mechanically ventilated patients remaining unresponsive after sedation interruption. *Crit Care Med* 2021; 49:423–e432.

17. Azabou E, Navarro V, Kubis N, et al: Value and mechanisms of EEG reactivity in the prognosis of patients with impaired consciousness: A systematic review. *Crit Care Lond Engl* 2018; 22:184.

18. Citerio G, Patruno A, Beretta S, et al: Implementation of continuous qEEG in two neurointensive care units by intensivists: A feasibility study. *Intensive Care Med* 2017; 43:1067–1068.

19. Legriel S, Jacq G, Laloz A, et al: Teaching important basic EEG patterns of bedside electroencephalography to critical care staffs: A prospective multicenter study. *Neurocrit Care* 2020; 34:144–153.

20. Sessler CN, Gosnell MS, Grap MJ, et al: The Richmond Agitation-Sedation Scale: Validity and reliability in adult intensive care unit patients. *Am J Respir Crit Care Med* 2002; 166:1338–1344.

21. Sinha SR, Sullivan L, Sabau D, et al: American Clinical Neurophysiology Society guideline 1: Minimum technical requirements for performing clinical electroencephalography. *J Clin Neurophysiol* 2016; 33:303–307.

22. Alvarez V, Rossetti AO: Clinical use of EEG in the ICU: Technical setting. *J Clin Neurophysiol* 2015; 32:481–485.

23. Charlson ME, Pompei P, Ales KL, et al: A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *J Chronic Dis* 1987; 40:373–383.

24. Le Gall JR, Lemeshow S, Saulnier F: A new simplified acute physiology score (SAPS II) based on a European/North American multicenter study. *JAMA* 1993; 270:2957–2963.

25. Vincent JL, Moreno R, Takala J, et al: The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the working group on sepsis-related problems of the European Society of Intensive Care Medicine. *Intensive Care Med* 1996; 22:707–710.

26. Teasdale G, Jennett B: Assessment of coma and impaired consciousness. A practical scale. *Lancet Lond Engl* 1974; 2:81–84.

27. Wijdicks EFM, Bamlet WR, Maramattom BV, et al: Validation of a new coma scale: The FOUR score. *Ann Neurol* 2005; 58:585–593.

28. Hirsch LJ, LaRoche SM, Gaspard N, et al: American Clinical Neurophysiology Society’s standardized critical care EEG terminology: 2012 version. *J Clin Neurophysiol* 2013; 30:1–27.

29. Hirsch LJ, Fong MKW, Leitinger M, et al: American Clinical Neurophysiology Society’s standardized critical care EEG terminology: 2021 version. *J Clin Neurophysiol* 2021; 38:1–29.

30. Landis JR, Koch GG: The measurement of observer agreement for categorical data. *Biometrics* 1977; 33:159–174.

31. Akoglu H: User’s guide to correlation coefficients. *Turk J Emerg Med* 2018; 18:91–93.

32. Chan YH: Biostatistics 104: Correlational analysis. *Singapore Med J* 2003; 44:614–619.

33. Hermans MC, Westover MB, van Putten MJAM, et al: Quantification of EEG reactivity in comatose patients. *Clin Neurophysiol* 2016; 127:571–580.

34. Westhall E, Rosén I, Rossetti AO, et al: Interrater variability of EEG interpretation in comatose cardiac arrest patients. *Clin Neurophysiol* 2015; 126:2397–2404.

35. Amorim E, van der Stoel M, Nagaraj SB, et al: Quantitative EEG reactivity and machine learning for prognostication in hypoxic-ischemic brain injury. *Clin Neurophysiol* 2019; 130:1908–1916.

36. Claassen J, Taccone FS, Horn P, et al: Recommendations on the use of EEG monitoring in critically ill patients: Consensus statement from the neurointensive care section of the ESIICM. *Intensive Care Med* 2013; 39:1337–1351.

37. Park A, Chapman M, McCredie VA, et al: EEG utilization in Canadian intensive care units: A multicentre prospective observational study. *Seizure* 2016; 43:42–47.

38. Hill CE, Blank LJ, Thibault D, et al: Continuous EEG is associated with favorable hospitalization outcomes for critically ill patients. *Neurology* 2019; 92:e9–e18.

39. Kinney MO, Kaplan PW: An update on the recognition and treatment of non-convulsive status epilepticus in the intensive care unit. *Expert Rev Neurother* 2017; 17:987–1002.