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Brief report

Prognostic factors after cardiac arrest. Usefulness of early video-electroencephalogram☆

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ABSTRACT

Background and objective: Predictors of unfavourable outcome in patients after cardiopulmonary arrest (CPA) are important to make decisions about the limitation of therapeutic efforts. The aim was to analyse the clinical variables in the prognosis of patients recovered after CPA.
Material and method: Retrospective study on comatose patients with recovered CPA. The variables were: age, sex, Glasgow Coma Score (GCS), pupillary light reflex, other variables related to CPA (cause, duration, witnessed or not witnessed), myoclonic status and electroencephalographic (EEG) patterns.
Results: Fifty patients were studied. The variables associated with mortality were the absence of pupillary light reflex (hazard ratio [HR] 0.277, 95% confidence interval [95% CI] 0.103–0.741, *P* = .01), a low GCS (HR 0.701, 95% CI 0.542–0.908, *P* = .007) and myoclonic state (HR 0.38, 95% CI 0.176–0.854, *P* = .01). We evaluated the EEG patterns in 22 patients. No statistical significance was observed.
Conclusions: The absence of pupillary light reflex, a low GCS and myoclonic state are prognostic factors in patients recovered after a CPA. The EEG patterns showed a nonsignificant association with prognosis.

Factores pronósticos tras paro cardiorrespiratorio. Utilidad del vídeo-electroencefalograma precoz

Palabras clave:
Paro cardiorrespiratorio
Coma anóxico
Electroencefalograma

RESUMEN

Fundamento y objetivo: La valoración de los enfermos tras un paro cardiorrespiratorio (PCR) es importante para la toma de decisiones sobre la limitación del esfuerzo terapéutico. El estudio buscó factores pronósticos en los pacientes tras un PCR recuperado.
Material y método: Estudio retrospectivo de enfermos en coma tras un PCR. Se analizaron la edad, el sexo, el Glasgow Score Coma (GCS), los reflejos pupilares, las variables relacionadas con el PCR (causa, duración, presenciado o no presenciado), el estatus mioclónico y los patrones del electroencefalograma (EEG): mal pronóstico, pronóstico incierto y benigno.
Resultados: Se estudiaron 50 enfermos. Las variables asociadas con mortalidad fueron la ausencia de reflejos pupilares (riesgo relativo [RR] 0,277, intervalo de confianza del 95% [IC 95%] 0,103-0,741, p = 0,01), el GCS bajo (RR 0,701, IC 95% 0,542-0,908, p = 0,007) y el estatus mioclónico (RR 0,38, IC 95% 0,176-0,854, p = 0,01). En 22 pacientes se analizaron los patrones del EEG, sin apreciarse significación estadística.
Conclusiones: La ausencia de reflejos pupilares, la baja puntuación del GCS y el estatus mioclónico son factores de mal pronóstico en pacientes tras un PCR. Los patrones del EEG mostraron una tendencia no significativa de asociación con el pronóstico.

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Introduction

In recent years, rapid and protocolised patient care after cardiopulmonary arrest (CPA) has led to a drastic reduction in mortality rates.[1] However, once cardiopulmonary resuscitation has been successful, it is crucial to establish a prognostic assessment of mortality and of the severity of the subsequent neurological sequelae to assist the medical team in making adequate decisions regarding the medical, ethical and socio-economic issues associated with this type of patient.

The clinical and electrophysiological variables associated with poor prognosis of patients surviving CPA include a low score on the Glasgow Coma Scale (GCS), absence of pupillary light reflexes, absence of motor response to painful stimuli, myoclonic status, increased neuron-specific enolase, poor prognosis patterns from the electroencephalogram (EEG) and the bilateral absence of the N20 component of the somatosensory evoked potentials (SEPs).[2] The abolition of the latter may predict the probability of permanent coma with a specificity of 100%. Therefore, it has a high positive predictive value. However, it does not resolve the problem of determining which patients without altered SEPs will regain consciousness. This test is not always available in critical care units. Moreover, it requires peripheral nerve and spinal cord integrity for correct interpretation.

EEG is a simple test that may be performed at the patient's bedside and is available in most healthcare centres. Its use as a prognostic test in patients with anoxic coma has been evaluated in several studies, and the conclusion was that some EEG patterns are closely associated with a poor prognosis.[3–5] This test increases its prognostic value when performed within the first 5 days of the anoxic episode.[6] The main problem attributed to the prognostic value is the use of concomitant medication, such as benzodiazepines and barbiturates, which could alter the electroencephalographic pattern.[7]

The purpose of this study is to analyse the clinical variables related to a poor prognosis for patients presenting anoxic coma after being resuscitated after a CPA, as well as the prognostic value of early EEG.

Patients and method

This was a retrospective study of patients resuscitated after presenting a CPA who were consecutively admitted to the Intensive Care Unit of the Hospital Universitario Germans Trias i Pujol during the years 2011 and 2012.

Patients who remained in a coma after being resuscitated from CPA were included. Those who regained some level of consciousness at the time of admission were not included.

An analysis was performed on demographic variables (age and gender), variables related to the CPA (aetiology, duration and whether it was witnessed or not), clinical variables within the first 48 h (assessment of level of consciousness via the GCS, presence of pupillary light reflexes and presence of myoclonic status) and electroencephalographic variables.

Myoclonic status was defined as the presence of spontaneous, repetitive, continuous and multifocal myoclonus involving the face, limbs and axial musculature.[8]

For the assessment of patient progress after the first week, the Glasgow Outcome Scale (GOS) was used. Mortality in the Intensive Care Unit and hospital mortality were also assessed.

Video electroencephalogram (video EEG) was performed without sedation (withdrawn at least 2 h before the study), and 18 channels were recorded in accordance with the international 10–20 system, for 30 min. It was also performed during the 3 first days following admission. As stated in the medical history, video EEG was requested for all those patients in a coma of anoxic origin with or without myoclonus, with a maximum interval of 3 days, in accordance with the clinical judgement of the intensive care physician and as long as there was a functional testing unit available at our centre. The electroencephalographic patterns were described in accordance with Young et al.,[9] and they were classified based on whether the prognosis was malignant, uncertain or benign.[6] Burst-suppression pattern, generalised continuous epileptiform activity and suppression of brain activity (<20 μV) were considered EEG patterns for poor prognosis. The interpretation of the EEG patterns was done by the same group of neurologists who were specialised in EEG. The results of the EEG did not lead to a decision to limit therapeutic efforts in any of the cases.

In the first place, we created an analysis of the clinical, demographic and CPA-related variables associated with hospital mortality.

Secondly, the association between EEG patterns and hospital mortality was analysed. Two groups were defined: one of patients with a poor EEG prognosis, and another of patients with uncertain or benign prognostic recordings. Out of all the patients who had undergone EEG, those for whom the test was diagnostic for brain death (along with a clinical examination) were excluded from the analysis.

Our study was duly presented and approved by our hospital Ethics Committee.

Statistical analysis

The relationship between the different independent variables and mortality was assessed using Kaplan–Meier curves and Cox logistic regression. A p value <0.05 was considered statistically significant. The SAS® 9.2 programme was used.

Results

50 patients were included: 33 males and 17 females. Average age was 59 years (range 17–87) and the average GCS at admission was 5 (range 3–14). Pupillary light reflexes were absent in 21 patients (42%), and 22 (44%) presented myoclonic status. CPA was witnessed in 44 cases (88%), with a mean duration of 21 min (range 2–60), including cardiopulmonary resuscitation manoeuvres. An EEG with a prognostic value was performed on 22 patients. Table 1 describes the causes of CPA. The high frequency of CPAs with a respiratory cause is probably influenced by the existence of our hospital Cardiac Unit, which usually admits patients with CPAs of cardiac origin. Table 2 describes the evolution of the GOS until the third month.

Mean ICU stay was 3 days (range 1–87), while the average hospital stay was 6 days (range 1–153). 39 patients died during hospitalisation (78%). The analysis of the factors associated with mortality is described in Tables 3 and 4. The univariate analysis (Table 3) found a significant association with GCS, pupillary light reflexes and CPA duration. However, the latter loses significance in the multivariate analysis (Table 4), and the myoclonic status is added as a factor associated with mortality.

Table 1
Causes of cardiopulmonary arrest.

Causes	n	%
Cardiac	14	28
Respiratory	24	48
CNS	7	14
Metabolic	1	2
Undetermined	4	8

CNS: central nervous system.