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ORIGINAL ARTICLE/ARTICLE ORIGINAL

Predictive patterns of sensory evoked potentials in comatose brain injured patients evolving to brain death

Différents profils de potentiels évoqués somesthésiques chez les patients cérébrolésés dans le coma évoluant vers la mort cérébrale

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KEYWORDS
Brain death;
Organ donation;
Organ transplantation;
Predictive score;
Somatosensory evoked potentials

Summary
Objective. — To assess whether Somatosensory Evoked Potentials (SEPs), recorded within 24 h after ICU admission, are reliable predictors of brain death (BD) in comatose patients with acquired brain injury of various aetiologies.
Methods. — SEPs were classified as absent (A), pathological (P), and normal (N). Considering SEP recordings from both hemispheres, 6 patterns were identified: NN, NP, PP, NA, AP, and AA. The final endpoint was BD.
Results. — Of the 203 patients included in the study, 70 (34%) evolved toward BD. The survival analysis indicated that the combination of SEP patterns in a two-graded scale (grade 1: NN-NP-PP-NA, and grade 2: AP-AA), allowed for prediction of BD with the best accuracy. This aggregation predicted BD with a sensitivity of 75.7% (CI: 64—84), a specificity of

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76.6% (CI: 68—83), a positive predictive value of 64.2% (CI: 53—74) and a negative predictive value of 84.3% (CI: 77—90) in overall patients, and with a sensitivity of 75.0% (CI: 63—84), a specificity of 84.9% (CI: 75—90), a positive predictive value of 77.5% (CI: 63—88) and a negative predictive value of 84.3% (CI: 74—91) when excluding cardiac arrest.
Conclusion. — It is worth including SEPs, in association with other investigations and clinical signs, in prognostic scores of BD. The early identification of patients at high risk of evolving towards BD could help physicians to optimise management.
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MOTS CLÉS
Don d'organes ;
Mort cérébrale ;
Potentiels évoqués somesthésiques ;
Score prédictif ;
Transplantation d'organes

Résumé
Objectif. — Déterminer si les potentiels évoqués somesthésiques (PES), enregistrés dans les 24 h après l'admission en réanimation, sont des indicateurs fiables de la mort cérébrale chez les patients comateux avec des lésions cérébrales acquises de diverses étiologies.
Méthodes. — Les PES ont été classés comme étant absent (A), pathologique (P), ou normal (N). Compte tenu des enregistrements effectués au niveau des deux hémisphères, 6 profils de résultat ont été identifiés : NN, NP, PP, AN, AP, et AA. Le critère d'évaluation finale était la mort cérébrale.
Résultats. — Sur les 203 patients inclus dans l'étude, 70 (34 %) ont évolué vers la mort cérébrale. L'analyse de survie a indiqué que la répartition des résultats en deux classes (classe 1 : profils NN, NP, PP, et NA, et classe 2 : AP et AA) permettait de prédire la mort cérébrale de façon optimale, avec une sensibilité de 75,7 % (intervalle de confiance : [64—84 %]), une spécificité de 76,6 % [68—83 %], une valeur prédictive positive de 64,2 % [53—74 %], et une valeur prédictive négative de 84,3 % [77—90 %] pour l'ensemble des patients. En excluant les arrêts cardiaques, la sensibilité était de 75,0 % [63—84 %], la spécificité de 84,9 % [75—90 %], la valeur prédictive positive de 77,5 % [63—88 %], et la valeur prédictive négative de 84,3 % [74—91 %].
Conclusion. — Inclure les données de PES en association avec d'autres éléments cliniques ou paracliniques peut être utile pour établir un pronostic de mort cérébrale chez les patients en réanimation. L'identification précoce des patients à risque d'évoluer vers la mort cérébrale pourrait aider à optimiser les choix thérapeutiques dans ce contexte.
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Introduction

Acquired brain injuries (ABI) due to cardiac arrest (CA), severe traumatic brain injury (TBI), brain infarction, intracerebral haemorrhage (ICH) and subarachnoid haemorrhage (SAH) are common causes of morbidity and mortality [3,9,10,15,16,18,20,23]. Though some patients suffering from these diseases ultimately have good outcome (low disability), many have poor outcome characterised by severe disability or persistent, severe disorder of consciousness. Moreover, other patients die because of neurological deterioration evolving towards brain death (BD), or because of medical complications not related to their neurological state. To the best of our knowledge, there are currently no well-defined criteria to predict evolution towards BD. Few studies have evaluated predictors of BD in comatose patients [10,15,23]. Humbertjean et al., Galbois et al. and Egea-Guerrero et al. evaluated clinical and cerebral computed tomography (CT) signs, intracranial pressure (ICP) and brain tissue oxygenation as predictors of BD in patients affected by ICH, infarction and TBI. Concerning CA [6,32], previous studies have evaluated clinical signs and investigations essentially as predictors of long-term outcome rather than predictors of BD. Humbertjean et al., Galbois et al. and Egea-Guerrero et al. reported some limitations regarding the specific predictors of BD that they evaluated. We therefore decided to analyse somatosensory evoked potentials (SEPs), because their utility has already been demonstrated in the long-term prognosis of brain injuries of different aetiologies [2] even though in previous work death and unresponsive wakefulness syndrome have usually been grouped together as a single poor outcome category. In BD, previous authors evaluated the possibility of using SEPs only as a confirmatory test after the clinical diagnosis of BD, given that SEPs have excellent sensitivity and specificity; indeed specificity can reach 100% when combined with transcranial Doppler or EEG [4,28,30,31]. However, no studies to date have evaluated SEPs as early predictors of BD in patients with severe ABI.

We aimed to determine whether a specific SEP pattern is more frequently observed in those patients with severe ABI, who deteriorate towards BD early after the onset of coma. In contrast to previous authors [10,15,23] we decided to include patients affected by severe ABI of different aetiologies (CA, TBI, infarction, ICH and SAH) to test whether SEP prediction was affected by the aetiology.

Patients and methods

Study population

We conducted a retrospective cohort study between November 2014 and October 2015 in the Careggi Teaching Hospital

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