Noninvasive Access to Brain Compliance Defining Management of Hydrocephalus after Severe TBI

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Introduction

Intracranial hydrodynamic balance remains challenging, even after severe traumatic brain injury (TBI). Totally noninvasive monitoring of intracranial pressure has shown good results for invasive intracranial pressure (ICP) equivalence. The novel device which registers cranial pulses correlated to ICP waveforms may also help the complex management of rehabilitation of patients with neurological disability after severe TBI.
Methods

It is reported the evolution of a patient who suffered severe TBI and his intracranial pressure pulses were noninvasively monitored during pressure adjustment of external ventricular drainage (EVD) at ICU. Its signal was recorded for 10-20 minutes each time, and it was placed on the frontotemporal area. On the second part of the study, after a new ventriculoatrial shunt (VAS) was inserted, the intracranial pulses assisted in shunt pressure adjustments, along with serial tomographic images.
Results

A 37-year-old male patient suffered a motorcycle accident and was found on Glasgow Coma Scale (GCS) 3 at the scene with bilaterally mydriatic pupils. After initial stabilization according to the ATLS protocol, a skull Computed Tomography (CT) imaging showed left acute subdural hematoma with signs of intracranial hypertension. He underwent primary decompressive hemicraniectomy and Tier 1 intracranial pressure measurements.
Results

After performing cranioplasty he evolved with hydrocephalus, and a ventriculoperitoneal shunt was inserted. Because of infection complications a EVD was performed after 4 months, and until that moment he remained comatose. His intracranial pressure pulses were noninvasively monitored for opening pressure adjustment of EVD at ICU.
Results

Noninvasive ICP waveforms monitoring showed altered brain compliance, P2 greater than P1. After infection improvement a ventriculoatrial shunt was inserted with programed pressure valve, and the pressure was adjusted according curves improved. In the nine-month follow-up, he was conscious and obeying commands, still tetraparetic, in rehabilitation center, with normal waveforms.
Results

Brain T2/FLAIR MRI showing hyperintenses corresponding to TBI injuries
Discussion

The noninvasive sensor for intracranial pressure monitoring has shown changes in its pulse morphology that has contributed to patient conduction and could be a useful tool for proper patient management. Noninvasive ICP monitoring can modify the rehabilitation of patients with severe TBI.
Summary Points

- ICP waveforms and noninvasive monitoring of brain compliance may help EVD and pressure valve shunt setup;
- the individualization of the management of opening pressure of EVD drainage and programmable valves can impact the neurological outcome of patients with TBI.