Bilateral loss of cortical SSEP responses is compatible with good outcome after cardiac arrest

**Andreas Bender · Kaitlen Howell · Marcel Frey ·
Ansgar Berlis · Markus Naumann ·
Gernot Buheitel**

Dear Sirs,

Global cerebral ischemia (GCI) following cardiac arrest (CA) is often associated with a poor prognosis and long-term disorders of consciousness. Bilateral absence of cortical responses of the median nerve somatosensory evoked potentials (SSEP) is believed to predict poor outcome with almost 100 % specificity [1–4].

We report a case of a patient with good outcome despite repeatedly absent cortical SSEP responses and without hypothermia.

A 16-year-old student suffered CA while playing soccer. Cardiopulmonary resuscitation began within 3 min. Initial rhythm analysis showed ventricular fibrillation (VF, Fig. 1a). Both pupils were dilated and unresponsive to light. After 25 min of resuscitation, stable cardiac output was reestablished and he was admitted to an intensive care unit. Despite the lack of sedative drugs, he was comatose.

A. Bender (✉) · K. Howell · M. Frey
Department of Neurology, Therapiezentrum Burgau,
Dr.-Friedl-Str. 1, 89331 Burgau, Germany
e-mail: andreas.bender@med.uni-muenchen.de

A. Bender · K. Howell
Department of Neurology, Klinikum Grosshadern,
University of Munich, Munich, Germany

A. Berlis
Department of Diagnostic Radiology and Neuroradiology,
Zentralklinikum Augsburg, Augsburg, Germany

M. Naumann
Department of Neurology, Zentralklinikum Augsburg,
Augsburg, Germany

G. Buheitel
Department of Pediatrics, Zentralklinikum Augsburg,
Augsburg, Germany

The GCS motor score was three and pupils were reactive to light. Because of aspiration pneumonia, the patient was ventilated and sedation was started with propofol, midazolam, and fentanyl for 48 h. Hypothermia was not induced, because this was only optional for children according to the 2005 European resuscitation council guidelines [5]. Neurological assessment after 72 h (with no sedation for the last 24) revealed a GCS of 5 (E1V1M3). At this time, median nerve SSEP were conducted in a specialized neurophysiology lab (>3000 recordings/year). N20 cortical responses were bilaterally absent (Fig. 1b). The EEG showed severe encephalopathy. Serum markers for neuronal damage were not examined. A brain CT scan after 96 h showed slight brain edema and obscuration of the caudate nucleus head (Fig. 1c).

Based on the lack of arousal and the unfavourable SSEP results, the parents were informed about the diagnosis of severe GCI and the nearly inevitable poor prognosis. Because of a myoclonic status of the diaphragm, he was treated with repeated single doses of barbiturates and muscle relaxants on days 4–7. Sedation was discontinued on day 7, but again the patient failed to recover consciousness. On day 9, SSEP were repeated and again showed no signs of cortical N20 responses. He was extubated on day 12. On day 27, he was transferred to a specialized neurorehabilitation center in the minimally conscious state. He remained in inpatient rehabilitation for 7 months with constant improvement of neurological function. He was able to leave the rehabilitation facility on foot together with his mother (Fig. 1d). 3 years after cardiac arrest, the patient now lives at home with his parents (Barthel index 90/100 points). He rates his quality of life as 65 % (EuroQol, ranging from 0 to 100 %). Dysarthria and fine motor control problems are his biggest limitations on participation in life. A mutation in the SCN5A-gene was

Fig. 1 (a) Initial rhythm
analysis with persistent
ventricular fibrillation despite
first shock with 200 J.
(b) Median nerve SSEP on day
3 after cardiac arrest with
bilateral absence of cortical N20
responses. Placement of
electrodes was in
supraclavicular fossa, cervical
C7 and C2, primary sensory
cortex (C3′ or C4′), and
common reference at FpZ,
according to 10–20-system.
Each lane shows two
superimposed SEP recordings,
consisting of 400 averages each.
Note the good technical quality
with reproducible peripheral N9
and N13 responses. (c) Native
cerebral CT scan on day 4
showing slight brain edema as
well as partial loss of signal in
the head of the caudate nucleus.
(d) Patient photographs showing
him climbing stairs (assisted)
3 months post cardiac arrest
(left), starting to enjoy soccer
again (middle), and leaving the
rehabilitation hospital 8 months
after cardiac arrest (right)
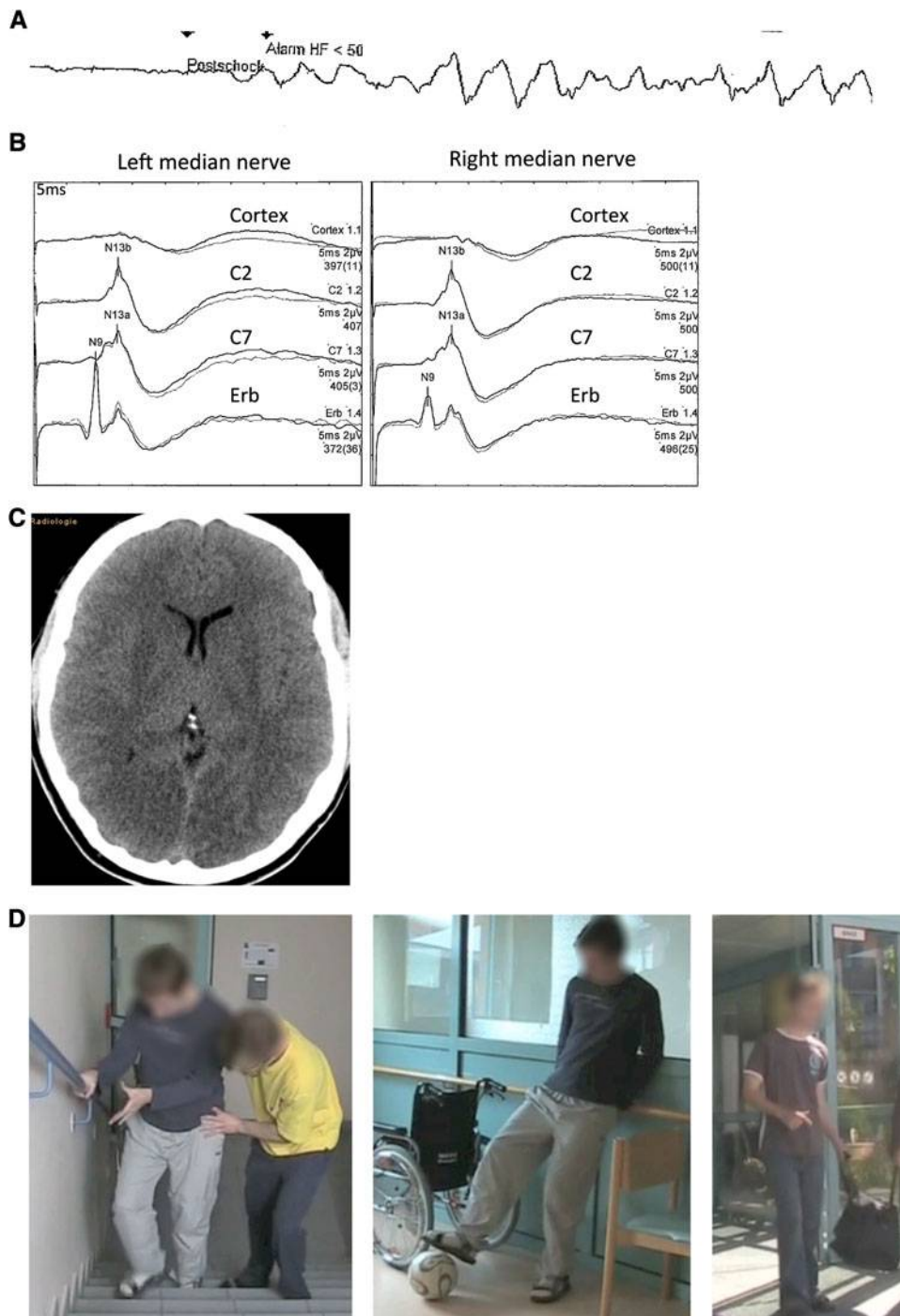
found as the cause for cardiac arrhythmias and he received
an internal defibrillator device.

According to international guidelines, bilateral loss of
SSEP N20 cortical responses virtually rules out good
prognosis with false positive rates between 0 % and 0.7 %
[2, 4, 6]. This single finding in the setting of a comatose
CA survivor is therefore often used as an argument to
withdraw life-sustaining therapy (LST) [7]. Some

uncertainty remains whether therapeutic hypothermia or
stimulus rate may impact SSEP prognostic accuracy [8, 9].
Nonetheless, even up-to-date prospective studies employ-
ing hypothermia in all patients found the specificity of
bilateral absence of N20 to be 100 % [10].

To our knowledge, this is the first well-documented case
with good functional outcome despite two malignant SSEP
results and lack of hypothermia following CA. If the

treating neurointensivists had followed published guidelines, this young man probably would have died after LST withdrawal. This case highlights the potential danger of self-fulfilling prophecies in prognostication of comatose CA survivors and shows the dilemma of presumed 100 %-specificity-parameters.

Conflicts of interest The authors declare that they have no conflict of interest.

Ethical standard All human studies must state that they have been approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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