J Neurol (2001) 248 : 430–432
© Steinkopff Verlag 2001

T. Stojkovic
M. Verdin
J. F. Hurtevent
E. Laureau
R. Krivosic-Horber
P. Vermersch

Guillain-Barré syndrome resembling brainstem death in a patient with brain injury

Received: 24 May 2000
Received in revised form:
27 November 2000
Accepted: 13 December 2000

Sirs: The diagnosis of brainstem death requires demonstration of absent brainstem function despite the artificial maintenance of circulation and gas exchange. Before the diagnosis can be entertained, it is necessary to identify the disorder that has resulted in brain injury and to exclude reversible causes of coma, such as a drug, alcohol intoxication and acute metabolic disturbances [14]. In addition, several neurological diseases may present with clinical signs resembling brainstem death. We report a patient with an extradural haematoma due to head trauma who later developed fulminant demyelinating neuropathy simulating brainstem death.

A 47-year-old man with a history of alcohol abuse was admitted after suffering a head injury. On admission, he was confused, with a left hemiplegia and symmetric and reactive pupils. A bilateral Babinski sign was present. His Glasgow Coma Scale score was 13 (eyes open, 4; verbal response, 4; motor response, 5). His neurological status rapidly deteriorated until intubation and artificial ventilation were required. His Glasgow Coma Scale score was then 5. Cranial computed tomography revealed a right parieto-occipital and orbital fracture, a right acute extradural haemorrhage and multiple intracerebral haematomas. He underwent craniotomy for removal of the right extradural haematoma.

During the following days he was conscious, reactive to auditory stimulation and had moderate left hemiparesis. A second cranial CT showed complete resolution of the extradural haematoma but persistence of the intracerebral haematomas. Due to a pulmonary infection he was kept on intubation and artificial ventilation and received intravenous thiamine due to his history of alcohol abuse. Eight days after surgery he suddenly developed a right mydriasis and tetraparesis. Neurological tests conducted 12 h after withdrawal of the sedative midazolam showed the absence of corneal, oculocephalic and oculovestibular reflexes and tendon reflexes. There was no response to visual, auditory or painful cutaneous stimulation. Twelve hours later he had dilated pupils and no pupillary reaction to light. In the absence of spontaneous respiration, he was maintained on full ventilatory support. Brain magnetic resonance imaging showed a regression of the intracerebral haemorrhage, the disappearance of the extradural haematoma and no lesion in the brainstem. Electroencephalography demonstrated low-voltage activity consisting mostly of theta activity in the range of 4–5 Hz which was unreactive to painful and auditory stimulation. Short-latency somatosensory evoked potentials after stimulation of the median nerve at the wrist showed an absence of brachial-plexus response, prompting us to conduct nerve conduction studies. Motor nerve conduction velocity revealed multifocal conduction slowing, conduction blocks and reduced compound muscle action potential amplitudes (Table 1).

Sensory amplitudes were reduced in the median nerves. Elec-

Tab. 1 Nerve conduction study results; normal values in parentheses (*NO* not obtained)

Nerve	LD (ms)	Amplitude[a]	Conduction velocity (m/s)	F-wave latency (ms)
Motor studies				
Right median				
Wrist	4.6 (≤4)	2.56 (≥5)	38 (≥48)	NO
Elbow	–	1.6	–	–
Left median				
Wrist	8.4 (≤4)	1.12 (≥5)	29.4 (≥48)	NO
Elbow	–	0.6	–	–
Left peroneal				
Ankle	6 (≤5)	0.76 (≥2)	21 (≥40)	NO
Knee	–	0.7	–	–
Right peroneal				
Ankle	5 (≤5)	0.3 (≥2)	22 (≥40)	NO
Knee	–	0.2	–	–
Left posterior tibial				
Ankle	9.8 (≤5)	1.10 (≥2)	30 (≥40)	98 (≤55)
Knee	–	1	–	–
Sensory studies				
Right median	5 (≤4)	6.8 (≥12)	48 (≥48)	–
Left median	7 (≤4)	4.6 (≥12)	50 (≥48)	–
Left peroneal	5 (≤5)	20 (≥10)	43 (≥42)	–
Left sural	3 (≤5)	16 (≥10)	43 (≥42)	–

[a] Of compound muscle (mV) or sensory nerve (μV) action potential

tromyography revealed fibrillation potentials in the tibialis anterior, rectus femoris and first dorsal interosseous muscles. No voluntary motor units were obtained. All these results were consistent with a demyelinating neuropathy. Cerebrospinal fluid analysis showed increased protein concentration at 1.97 g/dl and 2 white blood cells/mm^3. At that time, routine biochemistry and haematology were normal. PaO_2 and $PaCO_2$ levels were 85 and 40 mmHg, respectively. Urine porphobilinogen was negative. Serological screening for several neurotropic viruses was negative. Tests for antibodies to *Campylobacter jejuni*, *Borrelia burgdorferi* and gangliosides were negative. However, a bronchopulmonary infection due to *Klebsiella pneumoniae* was noted, requiring intravenous treatment with piperacillin and tazobactam.

The patient was treated with a 5-day course of intravenous immunoglobulin (0.4 g/kg per day). Four days after the end of the treatment cranial nerve function respiratory functions, and limb movements subsequently began to recover. Six months after the relapse he was able to walk unaided and presented disturbances of recent memory as sequelae of the head injury.

Craniocerebral injuries are frequently observed in neurosurgery and vary in seriousness. Widespread oedema raising intracerebral pressure as a result of head trauma can lead to circulatory arrest and brain death. The extent of the cerebral injuries in our patient led to this case of Guillain-Barré syndrome (GBS) being initially misdiagnosed. GBS was supported by the evidence of slowing of motor nerve conduction velocity, the presence of multifocal conduction blocks and the transiently high concentration of CSF protein.

GBS presents with a variety of clinical signs, ranging from mild peripheral neuropathy to a severe form resembling brainstem death, as reported here. Several authors have reported this unusual presentation of a severe GBS [1, 4, 8, 10, 11], including quadriplegia and total paralysis of all cranial nerve functions. In these cases, as in our case, the absence of an isoelectric electroencephalographic pattern, as required for the diagnosis of brain death, and the simultaneous absence of brainstem function suggested a possible peripheral cause. The electrophysiological characteristics were consistent with demyelinating neuropathy cases [4, 8] or axonal polyneuropathy [6]. It was concluded that despite clinical appearance of cerebral death electrophysiological data were required to confirm the diagnosis [13]. However, in contrast to the previous cases referred to above, our patient had a brain injury which could have explained the clinical deterioration. While he initially had multiple intracerebral haemorrhages, brain magnetic resonance imaging performed after surgery showed their regression and an absence of brainstem lesions. Moreover, the lack of brachial response on somatosensory evoked potentials, in contrast to a normal brachial response in patients with brain death [3], pointed to a disease of the peripheral nerve system. Nerve conduction studies revealed a demyelinating neuropathy and reduction in compound muscle action potential amplitudes, the latter having been shown to be useful in determining the prognosis [2, 9]. In our patient the duration of the disease may have been shortened by intravenous immunoglobulins, which have been shown to be effective in GBS [10]. The presumed mechanisms by which intravenous immunoglobulins acts include blockade of Fc receptors, regulation of B and T cells, and modulation of idiotypical interactions [7].

While the association of GBS and head injury is exceptional, such a case has previously been reported in a patient who developed GBS following head trauma [5]. The authors suggested that immunogenic myelin protein, released after a head injury, might have led to the production of antibodies directed against a component of peripheral myelin protein, thus explaining the occurrence of a demyelinating neuropathy. However, given the frequency of head injury, GBS might be expected to occur more frequently than appears to be the case.

In conclusion, electrophysiological studies, such as somatosensory evoked potentials and electromyography, are important in patients with de-efferented states resulting from GBS and can help to avoid confusion with brainstem death.

References

1. Bakshi N, Maselli RA, Gospe SM, Ellis WG, McDonald C, Mandler RN (1997) Fulminant demyelinating neuropathy mimicking cerebral death. Muscle Nerve 20:1595–1597
2. Brown WF, Feasby TE, Hahn AF (1993) Electrophysiological changes in the acute axonal form of Guillain-Barré syndrome. Muscle Nerve 16:200–205
3. Chiappa KH, Hill RA (1998) Evaluation and prognostication in coma. Electroencephalogr Clin Neurophysiol 106:149–155
4. Coad NR, Byrne AJ (1990) Guillain-Barré syndrome mimicking brainstem death. Anaesthesia 45:456–457
5. Duncan R, Kennedy PGE (1987) Guillain-Barré syndrome following acute head trauma. Postgrad Med J 63:479–480
6. Feasby TE, Gilbert JJ, Brown WF, Hahn AF, Koopman WF, Zochodone DW (1986) An acute axonal form of Guillain-Barré polyneuropathy. Brain 109:1115–1126
7. Hartung HP, Pollard JD, Harvey GK, Toyka KV (1995) Immunopathogenesis and treatment of the Guillain-Barré syndrome. II. Muscle Nerve 18:154–164
8. Hughes R, McGuire G (1997) Neurologic disease and the determination of brain death. The importance of a diagnosis. Crit Care Med 25:1923–1924
9. Italian Guillain-Barré Study Group (1996) The prognosis and main prognosis indicators of Guillain-Barré syndrome: a multicentre prospective

study of 297 patients. Brain 119:2053–2061
10. Kotsoris H, Schleifer L, Menken M, Plum F (1984) Total locked-in state resembling brain death in polyneuropathy. Ann Neurol 16:150
11. Marti-Masso JF, Suarez J, Lopez de Munain A, Carrera N (1993) Clinical signs of brain death simulated by Guillain-Barré syndrome. J Neurol Sci 120:115–117
12. Plasma Exchange/Sandoglobulin Guillain-Barré Syndrome Trial Group (1997) Randomised trial of plasma exchange, intravenous immunoglobulin, and combined treatments in Guillain-Barré syndrome. Lancet 349:225–230
13. Vargas F, Hilbert G, Gruson D, Valentino R, Gbikpi-Benissan G, Cardinaud JP (2000) Fulminant Guillain-Barré syndrome mimicking cerebral death: case report and literature review. Intensive Care Med 26:623–627
14. Williams MA (1997) Brain death determination in adults: more than meets the eye. Crit Care Med 25:1787–1788

T. Stojkovic (✉) · P. Vermersch
Department of Neurology
University Hospital of Lille
59037 Lille Cedex, France
Tel.: +33-3-20 44 57 65
Fax: +33-3-20 44 44 84
e-mail: t-stojkovic@chru-lille.fr

M. Verdin · R. Krivosic-Horber
Department of Anaesthesiology and Intensive Care Unit
University Hospital of Lille
59037 Lille Cedex, France

J. F. Hurtevent · E. Laureau
Department of Neurophysiology
University Hospital of Lille
59037 Lille Cedex, France