Severe hyponatremia as the initial sign preceding Guillain–Barré syndrome: a case report

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Diagnosis of Guillain–Barré syndrome (GBS) is established clinically and is supported by nerve conduction studies and cerebrospinal fluid examination. Renal function is usually not affected, but recent case reports have established a link between GBS and hyponatremia. A 60-year-old woman presenting with lower back ache since 3 days, became drowsy the next day and developed paraparesis and bulbar symptoms. Her sensorium and power deteriorated progressively over the next 2 days and she was brought to hospital in a drowsy state. She was found to have severe hyponatremia (Na^+ at 113) and nerve conduction study (NCS) was son of AMAN. The patient was started on intravenous immunoglobulin and her sodium levels were corrected, and the patient recovered completely. The occurrence of hyponatremia in patients diagnosed with GBS is well described. However, there have been only two prior case reports in which hyponatremia had been observed before the manifestation of neuromuscular deficits. Our patient case is unique in that severe hyponatremia occurred simultaneously with neurologic symptoms and the diagnosis of GBS. In most cases reported in the literature, hyponatremia was noted after a diagnosis of GBS was established. The mean period of onset of syndrome of inappropriate antidiuretic hormone (SIADH) was 8.8 days after the onset of symptoms of GBS. In conclusion, this presentation raises the possibility that early changes in the autonomic nervous system triggered by GBS might lead to alterations in water and sodium balance that can precede symptomatic changes in the peripheral nervous system. Although rarely, but both GBS and its treatment, intravenous immunoglobulin, should be considered in the differential diagnosis of hyponatremia.

Keywords:
Guillain–Barré syndrome, hyponatremia, secretion of antidiuretic hormone

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Introduction

Guillain–Barré syndrome (GBS) is an immune-mediated polyneuropathy characterized by progressive, ascending, symmetric muscle weakness, and depressed or absent deep tendon reflexes. GBS is a heterogeneous syndrome with at least four subtypes [1]. Diagnosis can usually be established clinically and is supported by nerve conduction studies showing signs of peripheral demyelination and cerebrospinal fluid (CSF) exam with elevated total protein and normal CSF white blood cells (albuminocytologic dissociation).

Renal function is usually not affected, but recent case reports have established a link between GBS and hyponatremia [2–5]. In euvolemic hyponatremia, an increase in total body water content is accompanied by normal total sodium and minimal to moderately increased extracellular fluid volume in the absence of edema. Euvolemic hyponatremia is commonly due to the syndrome of inappropriate secretion of antidiuretic hormone (SIADH). The normal regulation of antidiuretic hormone (ADH) secretion is mediated by the hypothalamus and autonomic nerve fibers. Damage to those structures from the autoimmune process in GBS can alter ADH release patterns leading to autonomic dysfunction and SIADH.

Case presentation

A 60-year-old woman with a past medical history of hypertension was admitted to a neurological intensive care unit after a history of lower back ache since 3 days; she had been on symptomatic management at a local hospital for the same. The next day she became drowsy and developed weakness of both lower limbs, requiring her to be carried to the bathroom. Relatives also noticed that she had difficulty in swallowing liquids and noticed a change in voice. Gradually she became bed bound and poorly responsive to attendees' commands and was rushed to the hospital.

On arrival to the hospital, the patient was very ill. Blood pressure was 150/90 mmHg and the pulse was 100 beats/min and regular. Her oxygen saturation was 98% at room air. Temperature was normal. Other systemic examinations were unremarkable. Blood sugar was 93 mg/dl. ECG was normal.

On higher mental examination she was found to be drowsy, confused, and responded poorly to verbal stimuli. A focused examination showed her fundi to be normal. The pupils were equal and reactive to light. There was bilateral lower motor neuron (B/L LMN) type facial weakness. Cough reflex was weak. Single

breath count was 14. She had weakness in neck flexors. On motor system examination she was hypotonic. Power in the upper limbs was 3/5 and lower limbs was 2/5. Neck was supple. The deep tendon reflexes were not elicitable with normal plantar response. Sensory examination was unremarkable.

Lumbar puncture was performed within an hour of admission and yielded a clear and colorless CSF with an opening pressure of 16 cm of CSF, 72 mg/dl of protein, and 27 mg/dl of sugar (corresponding glucometre random blood sugar (GRBS) of 111 mg/dl). The CSF cell count was five with all cells being lymphocytes, as observed on acid fast bacilli smears.

Meanwhile, blood laboratory results revealed severe hyponatremia at 113 mEq/l, potassium at 3.2 mEq/l, chloride at 78 mEeq/l, blood urea at 23 mg/dl, and creatinine at 0.57 mg/dl. Complete hemogram showed Hb of 12.0, total cholesterol of 14 300, and platelets of 2.57 lakhs. Fasting thyroid-stimulating hormone was 6.64 U/l. The other blood values including liver function tests and glucose levels were normal. She tested negative for human HIV. Fasting serum cortisol was 19.64 U/l. Urinary electrolytes were as follows: Na at 112 mEq/l, K^+ at 9.36 mEq/l, and Cl^- at 113 mEq/l (Figs 1–8). Written consent was taken from the patient for this case report before submission.

Electrodiagnostic studies

Compound muscle action potential (CMAPs) of the left peroneal and bilateral median nerves were not recordable (Fig. 1). Distal latency of the right tibial nerve was increased (170%), and reduced amplitude (36%) and slightly increased F-wave latency was observed, whereas that of the right ulnar nerve showed increased latency (164%) and reduced amplitude (53.6%) with conduction velocity that was not recordable (Figs 2 and 3). Sensory nerve conductions were unremarkable (Figs 4–7). Thus, NCS suggested a mixed axonal demyelinating pure motor neuropathy involving both upper and lower limbs (Tables 1 and 2).

In view of hyponatremia (Na^+ at 113 mEq/l), she was placed on fluid restriction and infused with 3% hypertonic saline. The infusion rate was adjusted on the basis of her clinical response and serial electrolyte levels obtained six hourly. She was started on intravenous immunoglobulin (IVIG) therapy on the fourth day of her illness. It was infused at a dose of 0.4 g/kg daily for 5 days. With hypertonic saline

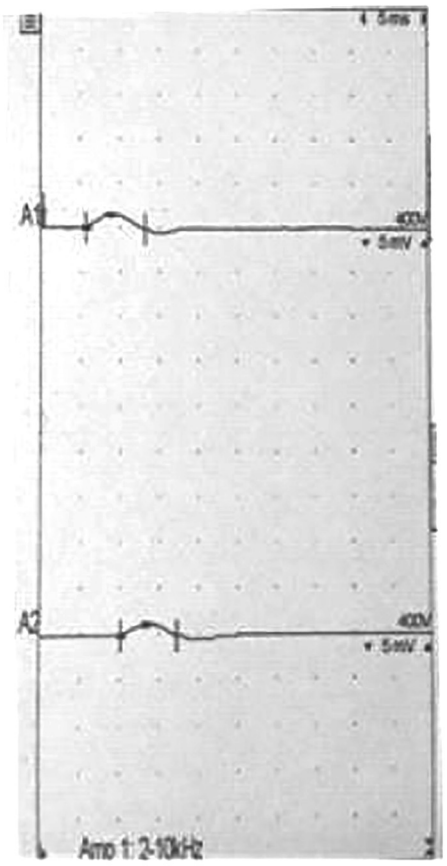
Figure 1

Right peroneal CMAP.

Figure 2

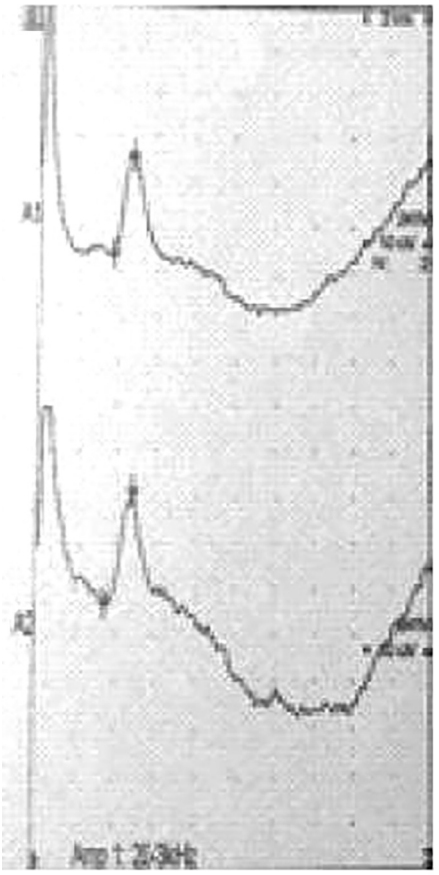
Right tibial CMAP.

Figure 3



Left ulnar CMAP.

Figure 4



Right sural SNAPs.

infusion, the patient's sodium levels continued to increase slowly.

The hypertonic saline infusion was stopped on the third day when the serum sodium was 125 mmol/l. The fluid restriction was continued. She was more alert on day 4 when her serum sodium level had had been gradually corrected to 124 mEq/l.

The patient was discharged on day 9 with grade 4/5 power in her upper and lower limbs and in an alert state. At follow-up after 2 weeks she showed no residual motor deficits.

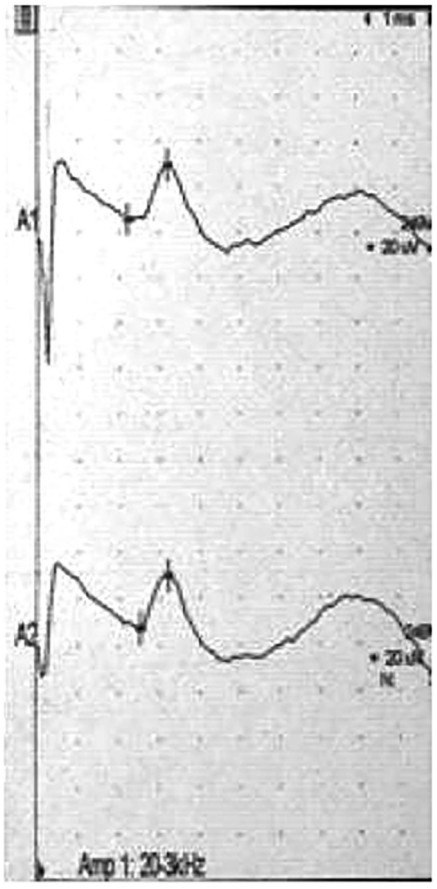
Discussion

The occurrence of hyponatremia in patients diagnosed with GBS is well described [2–5]. In a prospective study of 50 patients diagnosed with GBS, hyponatremia was noted in 48% of cases [6] and motor dysfunction preceded the onset of hyponatremia. There have only been two prior case reports in which hyponatremia was observed before the manifestation of neuromuscular deficits [7,8].

Although the underlying etiology of this phenomenon is presumably related to SIADH, there has been considerable discussion on whether 'pseudohyponatremia' from IVIG administration is also playing a major role. Pseudohyponatremia usually occurs in the presence of increased lipid or protein concentrations when sodium is measured with indirect ion-selective electrodes. Lipids and protein occupy a part of the plasma sample whose aqueous fraction, along with the solutes, is excluded in indirect analytical methods, thereby lowering the sodium that is delivered for analysis. The problem can be avoided by the use of direct ion-selective electrodes [9]. Although IVIG infusions are prone to causing pseudohyponatremia through the delivery of large amounts of proteins [10], more recent studies have shown that the significant alterations in serum sodium levels cannot completely be explained by this mechanism [11].

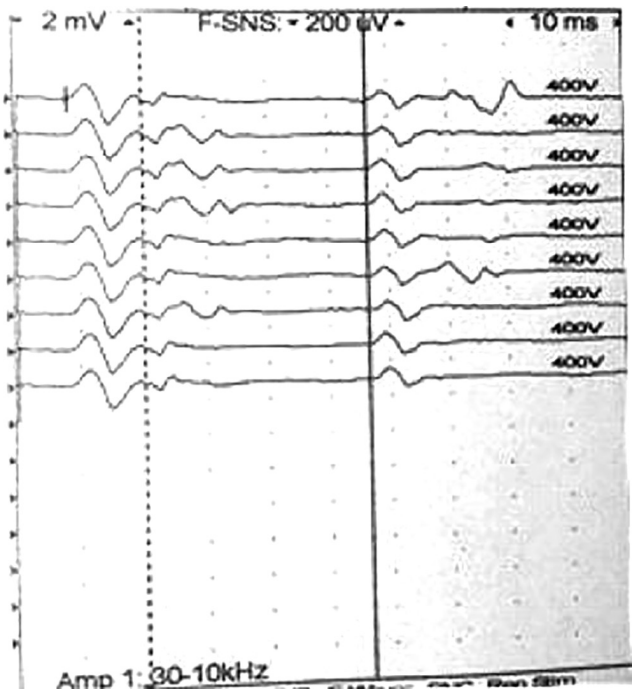
One study examined the effect of IVIG infusion on serum sodium levels measured by direct ion-selective electrodes and found that hyponatremia was also present [12]; this 'true hyponatremia' was related to osmotic translocation of water from the intracellular to the extracellular (intravascular) space mediated by

Figure 5



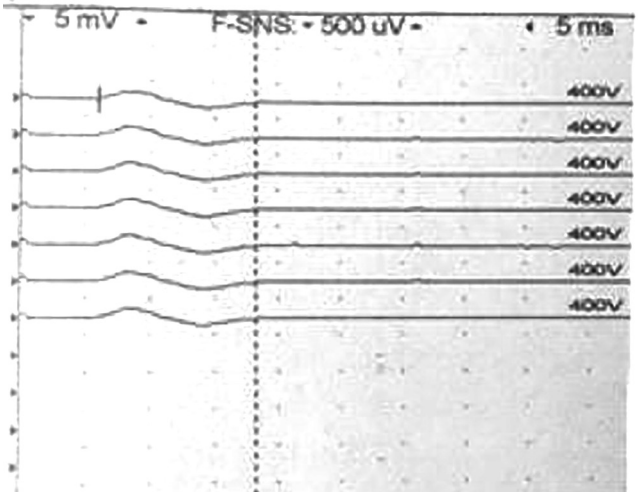
Left ulnar SNAPs.

Figure 6



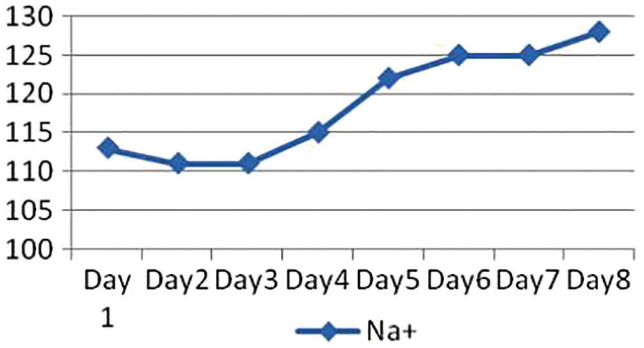
Right peroneal F-wave.

Figure 7



Left ulnar F-wave.

Figure 8



Sodium levels.

Table 1 CMAPs

Nerve	Latency	Amplitude	CV	F-wave
Peroneal R.	9.4 ms	0.9 mV	51 m/s	56.4 ms
Tibial R	13.5 ms	0.9 mV	65m/s	67.4 ms
Peroneal L	NR	NR	NR	NR
Median R	NR	NR	NR	NR
Ulnar R	4.0 ms	2.1 mV	43m/s	32.9 ms
Median L.	NR	NR	NR	NR
Ulnar L	5.6 ms	1.5 mV	NR	NR

Table 2 SNAPs

Nerve	Latency	Amplitude	CV
Sural R.	3.7 ms	22 uV	38 m/s
Sural L	3.7 ms	13 uV	38 m/s
Median R	3.1 ms	27 uV	45 m/s
Ulnar R.	2.7 ms	27 uV	51 m/s
Median L.	2.9 ms	32 uV	48 m/s
Ulnar L	2.2 ms	24 uV	64 m/s

an increase in intravascular osmolality secondary to sucrose-based IVIG infusion.

In our patient the hyponatremia noted at admission initially responded poorly to hypertonic saline infusion and it was only when a higher dose was used to correct the serum sodium that the patient's sensorium and

laboratory values improved. In this case, hyponatremia may be further induced by the amino acid acting as an osmolyte, thereby causing an osmotic water translocation [13].

The pathomechanism of hyponatremia in GBS has not been clearly elucidated, although multiple theories have been discussed, including impaired autonomic nervous function involving the afferent fibers from vascular stretch receptors [5], resetting of the osmostat [14], increased sensitivity of the distal tubular and collecting duct ADH receptors, and ADH independent mechanisms.

Our patient case is unique in that severe hyponatremia occurred simultaneously with neurologic symptoms and the diagnosis of GBS. In most cases reported in the literature, hyponatremia was noted after a diagnosis of GBS was established. The mean period of SIADH was 8.8 days after the onset of symptoms of GBS [6].

Conclusion

This presentation raises the possibility that early changes in the autonomic nervous system triggered by GBS might lead to alterations in water and sodium balance that can precede symptomatic changes in the peripheral nervous system. In addition, patients should be monitored for further hyponatremia induced by IVIG preparations when undergoing GBS therapy. Although rarely, both GBS and its treatment, IVIG, should be considered in the differential diagnosis of hyponatremia.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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