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Case Report

SIADH induced by pneumonia in a patient with Shy-Drager syndrome

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SUMMARY

Patients with Shy-Drager syndrome have impaired baroreceptor-mediated vasopressin release when in an upright position. We report a case of Shy-Drager syndrome in which the syndrome of inappropriate secretion of antidiuretic hormone (SIADH) developed with pneumonia. It has been speculated that pneumonia-induced SIADH is caused by baroreceptor-mediated vasopressin release. Our case presents the possibility that pneumonia-induced SIADH is caused by non-baroreceptor-mediated ADH release.

Key Words : baroreceptor-mediated vasopressin release, Shy-Drager syndrome, syndrome of inappropriate secretion of antidiuretic hormone (SIADH).

INTRODUCTION

Orthostatic hypotension in patients with Shy-Drager syndrome (SDS) is partly caused by the impaired baroreceptor-mediated release of vasopressin (i.e., antidiuretic hormone [ADH]) when the patient is in an upright position[1~4]. On the other hand, there is speculation that the syndrome of inappropriate secretion of antidiuretic hormone (SIADH), induced by pneumonia or intrathoracic disease, is caused by inflammation that has extended to the baroreceptors, by changes in pulmonary blood flow, or by an abnormal respiratory pattern[5,6]. However, the exact pathophysiology of SIADH induced by pneumonia or intrathoracic disease remains unknown[7]. ADH release is inhibited by the afferent pathway of baroreceptors of the carotid sinus and the left atrium/ventricle ; this pathway extends to the hypothalamus by way of the vagus and nucleus tractus solitarius[8] (Fig. 1). An impairment in these inhibitory tracts may cause SIADH ; however, we were only able to find one previously reported case of such an impairment[9]. We report an interesting case of Shy-Drager syndrome in which SIADH developed with pneumonia.

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CASE REPORT

A 71-year-old Japanese man had presented with orthostatic hypotension since he was 67 years old. His symptoms included a mask-like face, urinary retention, constipation, and rigidity at the age of 70. He had a positive Myerson's sign. He could not walk without using handrails because of postural instability. He underwent some medical study at another hospital. The tilt test was positive. Urodynamics revealed a neurogenic bladder pattern. Single photon emission computed tomography revealed no evidence of decreased blood flow in the cerebellum or brain stem. Therefore, he was diagnosed as having Shy-Drager syndrome and treated with levodopa/carbidopa. He spoke softly in a monotone, presented with bulbar palsy, and was confined to a wheelchair at the age of 70.

In June 2009, at the age of 71, he was admitted to our hospital because of pneumonia. On admission, he was alert, could not stand up. His blood pressure was 150/74 mmHg ; heart rate was 89 beats per minute

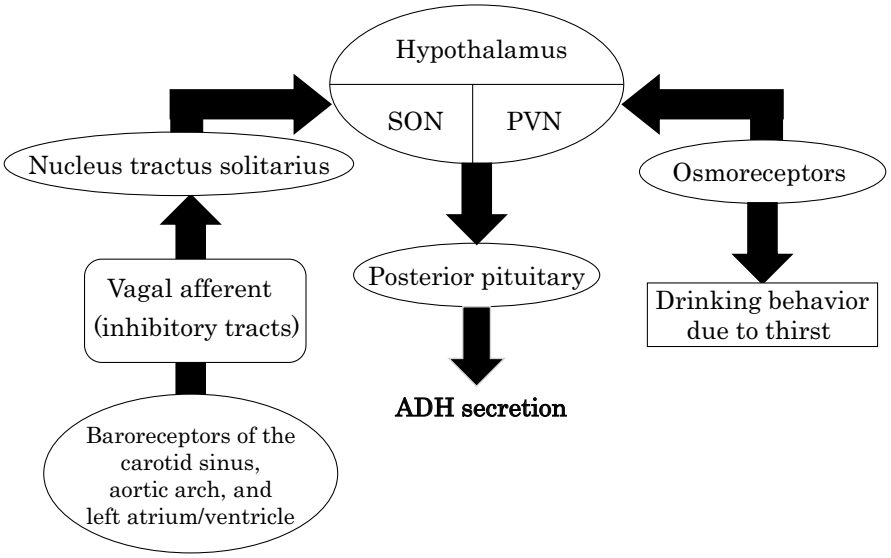

Fig. 1 The regulation of ADH secretion
Abbreviations : ADH, antidiuretic hormone ; PVN, paraventricular nucleus ; SON, supraoptic nucleus.

and regular ; and respiratory rate was 20 per minute. Body temperature was 38.0℃. SpO_2 ranged from 95% to 97% under 5 /min oxygen. Tongue and oral mucosa were slightly dry. Coarse crackles were heard bilaterally in his anterior chest. There was no edema in his limbs. Chest X-ray revealed consolidations in both lungs. Arterial blood gas analysis revealed a pH of 7.454 ; PaO_2, 80.9 mmHg ; $PaCO_2$, 52.3 mmHg ; and HCO_3^-, 35.9 mEq/L under 5 L/min oxygen. A complete blood count revealed elevated WBCs (predominantly neutrophils) and an elevated C-reactive protein level. Sputum and blood cultures revealed nonspecific findings. His urine was negative for the presence of antigens for *Streptococcus pneumonia* and legionella. Liver and renal functions were within normal limits. We diagnosed him as having aspiration pneumonia induced by dysphagia.

Before admission, his serum sodium concentration ranged from 136 to 137 mEq/L. On admission, blood tests revealed he had hypotonic hyponatremia (his serum sodium concentration was 132 mEq/L ; serum osmolality, 278 mOsm/L) ; hypouricemia (serum uric acid concentration, 1.3 mg/dL) ; hyperosmonuria (urine osmolality, 970 mOsm/L) ; increased urinary sodium excretion (urine sodium concentration, 86 mEq/L) ; inappropriate secretion of ADH (plasma ADH concentration, 5.6 pg/mL) ; and suppressed plasma rennin activity (PRA, 0.2 ng/mL/hr). Furthermore, his blood data did not indicate adrenal insufficiency (basal plasma cortisol concentration, 15.6 μg/dL) ; non-thyroid illness (FT_4, 1.03 ng/dL ; FT_3, 1.83 pg/ml ; TSH, 1.53 μU/mL) ; or dehydration (hematocrit, 38.0 ; blood urea nitrogen, 17 mg/dL ; creatinine, 0.6 mg/dL) (Table 1). He therefore apparently developed SIADH as a result of pneumonia.

He improved through the administration of oxygen, antibiotics, and fluid replacement. Serum sodium concentration, serum osmolality, serum uric acid concentration, PRA, urine osmolality and plasma ADH concentration improved gradually (Table 2). Because of dysphagia and increased airway secretions, a tracheostomy was performed and feeding by nasogastric tube was established during his hospitalization. He was finally transferred to a long-term care sanatorium.

DISCUSSION

The patient initially did not have SIADH, but presented SIADH with pneumonia. He did not take any medicines known to cause SIADH. There is one report of L-dopa inhibiting ADH secretion[10]. Our patient had taken levodopa/carbidopa before admission, and he received levodopa intravenously during his hospitalization. Therefore, it seems this drug would not have contributed to his developing SIADH. Head computed tomography (CT) did not reveal any evidence of an intracranial space-occupying lesion. Body CT did not detect a malignancy. The only other cause of SIADH would be pneumonia.

Table 1 Laboratory data on admission

White blood cell count	13000/μL	CRP	4.5 mg/dL
Neutrophil	90%	Fastin plasma glucose	126 mg/dL
Lymphocyte	7.0%	Osmolality	278 mOsm/L
Monocyte	3.0%	ADH	5.6 pg/mL
Hemoglobin	11.3 g/dL	Cortisol	15.6 μg/dL
Hematocrit	38.0%	ACTH	48.2 pg/mL
Platelet	22.2×10^4/μL	Plasma renin activity	0.2 ng/mL/hr
Total protein	5.9 g/dL	Aldosterone	46 pg/mL
Albumin	2.46 g/dL	Epinephrine	<0.01 ng/mL
Na^+	132 mEq/L	Norepinephrine	0.02 ng/mL
K^+	3.9 mEq/L	Dopamine	<0.02 ng/mL
Cl^-	98 mEq/L	FT_4	1.03 ng/dL
Blood urea nitrogen	17 mg/dL	FT_3	1.83 pg/mL
Creatinine	0.6 mg/dL	TSH	1.53 μIU/L
Uric acid	1.3 mg/dL	Urine Na^+	86 mEq/L
Aspartate aminotransferase	19 IU/L	Urine K^+	44.7 mEq/L
Alanine aminotransferase	9 IU/L	Urine Cl^-	154 mEq/l
Lactate dehydrogenase	297 IU/L	Urine uric acid	54.4 mg/dL
Alkaline phosphatase	136 IU/L	Urine creatinine	130.9 mg/dL
γ-Glutamyltranspeptides	20 IU/L	Urine osmolality	970 mOsm/L
Total bilirubin	0.5 mg/dL		

Table 2 Laboratory data before and after SIADH treatment

	on admission	3 weeks after admission
Serum Na (mEq/L)	132	135
Serum Osmolality (mOsm/L)	278	289
Serum Uric Acid (mg/dL)	1.3	1.5
Urine Na (mEq/L)	86	88
Urine Osmolality (mOsm/L)	970	528
Plasma ADH (pg/mL)	5.6	2.4
PRA (ng/mL/hr)	0.2	1.6

Abbreviations : ADH, antidiuretic hormone ; PRA, plasma renin activity

Orthostatic hypotension in an upright position in people with SDS is thought to result from impaired baroreceptor-mediated ADH release[1~4]. It is speculated that pneumonia-induced SIADH may be caused by another modulating baroreceptor[5,6]. The modulating baroreceptor would reduce the inhibition of baroreceptor-mediated ADH release through the vagus and nucleus tractus solitarius (Fig. 1).

Why did pneumonia affect our patient's baroreceptor-mediated ADH release (which had previously been impaired when in an upright position) ? One possibility is that pneumonia-induced SIADH is caused by non-baroreceptor-mediated ADH release. CO_2 retention may cause non-baroreceptor-mediated ADH release-there is one report of plasma ADH levels increasing in hypercapnic edematous patients with COPD[11]. There is an emerging awareness that interleukin-6 has a role in the non-osmotic release of ADH[12]. There is one report that plasma ADH responds to hypertonic saline infusion in people with SDS[3]. Therefore, ADH secretion, despite low plasma osmolality, may result in a dysfunction of the osmoreceptors of the hypothalamus that respond to low plasma osmolality[9]. It is possible that a yet-to-be-deter-

mined mechanism exists for non-baroreceptor-mediated ADH release.

In summary, we report an extremely interesting case of Shy-Drager syndrome in which SIADH developed with pneumonia. The details of the pathophysiological mechanism by which SIADH develops concomitantly with pneumonia may be elucidated in the future.

REFERENCES

1) Puritz R, Lightman SL, Wilcox CS, et al : Blood pressure and vasopressin in progressive autonomic failure. Brain **106** : 503-511, 1983.
2) Williams TDM, Lightman SL, Bannister R : Vasopressin secretion in progressive autonomic failure : evidence for defective afferent cardiovascular pathways. J Neurol Neurosurg Psychiatry **48** : 225-228, 1985.
3) Senda Y, Koike Y, Oiso Y, et al : Plasma vasopressin response to orthostasis and hypertonic saline infusion in progressive autonomic failure. Rinshou Shinkeigaku (Clin Neurol) **28** : 1282-1289, 1988 (in Japanese, abstract in English).
4) Kaufmann H, Oribe E, Miller M, et al : Hypotension-induced vasopressin release distinguishes between pure autonomic failure and multiple system atrophy with autonomic failure. Neurology **42** : 590-593, 1992.
5) Cogan E, Debieve MF, Philipart I, et al : High plasma levels of atrial natriuretic factor in SIADH. N Engl J Med **314** : 1258-1259, 1986.
6) Kamoi K, Ebe T, Hasegawa A, et al : Hyponatremia in small cell lung cancer. Mechanisms not involving inappropriate ADH secretion. Cancer **60** : 1089-1093, 1987.
7) Hanagiri T, Muranaka H, Hashimoto M, et al : A syndrome of inappropriate secretion of antidiuretic hormone associated with pleuritis caused by OK-432. Respiration **65** : 310-312, 1998.
8) Konagaya Y, Konagaya M, Takayanagi T : Anterior pituitary dopamine receptor function in Shy-Drager syndrome. Rinsho Shinkeigaku (Clin Neurol) **24** : 920-924, 1984 (in Japanese, abstract in English).
9) Sone H, Okuda Y, Bannai C, et al : Syndrome of inappropriate secretion of antidiuretic hormone (SIADH) and Gerhardt syndrome associated with Shy-Drager syndrome. Intern Med **33** : 773-778, 1994.
10) Puritz R, Lightman SL, Wilcox CS, et al : Blood pressure and vasopressin in progressive autonomic failure. Brain **106** : 503-511, 1983.
11) Farber MO, Roberts LR, Weinberger MH, et al : Abnormalities of sodium and H_2O handling in chronic obstructive lung disease. Arch Intern Med **142** : 1326-1330, 1982.
12) Swart RM, Hoorn EJ, Betjes MG, et al : Hyponatremia and inflammation : the emerging role of interleukin-6 in osmoregulation. Nephron Physiol **118** : 45-51, 2011.