

rienced headache, lethargy, and projectile vomiting. Physical examination revealed sleepiness and flapping, temperature of 37.4 °C, blood pressure of 180/120 mmHg, rhythmic heart sound with pan-focal systolic murmur (III/VI), and unremarkable pulmonary auscultation and abdominal examination. Normal neurological examination, with no meningeal signs. Laboratory test results included: blood glucose 82 mg/dL, urea 158 mg/dL, creatinine 14.16 mg/dL, GOT 61 U/L, GPT, 279 U/L, LDH 864 U/L, GGT 298 U/L, CRP 42.9, hemoglobin 12.0 g/dL, WBCs 5.38 10⁹/L with normal differential, and platelet count 167 10³/L. All other laboratory parameters were within normal ranges. Ophthalmoscopy: right eye with normal disc and macula, nasal bleeding, and temporal superior arcade with cotton wool exudates; left eye with normal disc. Patient was diagnosed of grade III hypertensive retinopathy. No pathological findings were made in CT and MRI of the brain. Diagnosis of accelerated arterial hypertension led to start intravenous antihypertensive treatment that achieved optimal control of pressure values, but neurological symptoms persisted. Cerebrospinal fluid (CSF) pressure was increased to 33 mg (normal, up to 20 mmHg), with leukocytosis (36 WBCs/mm³) with a predominance of lymphocytes (70%), increased protein levels (87 g/dL), and low glucose (84 mg/dL). Serologic testing was positive for *Brucella*, Bengal rose, agglutination with anti-brucella antibodies 1/160, and immune capture with anti-brucella antibodies > 1/5120. CSF and blood cultures were positive for *Brucella spp.* Neurobrucellosis was diagnosed, and specific antibiotic therapy was started with doxycycline, rifampin, and trimethoprim-sulfamethoxazole. After five days of treatment, patient experienced a clear improvement, showing no fever or symptoms.

Incidence of brucellosis in Europe is low. In Spain, however, brucellosis is the main zoonosis, and endemic areas continue to exist, particularly in rural cattle-raising areas.¹ Clinical signs of brucellosis are very diverse, and genitourinary, gastrointestinal, and cardiological manifestations are most common. Central nervous system involvement by brucellosis (neurobrucellosis) is uncommon and mainly causes meningeal signs, although papilledema, optic neuropathy, radiculitis, and stroke may also occur.^{2,3} Cases of neurobrucellosis have been reported in patients with CKD living in endemic areas.⁴ In our patient, the condition occurred as intracranial hypertension and fever.

Diagnosis of neurobrucellosis should be considered in a patient with CKD who also has fever of unknown origin and neurological signs. When the disease is suspected based on clinical signs, serologic tests allow for confirming diagnosis, and germ isolation from culture is an even more definitive evidence, as in the reported case. While this is an uncommon condition, it should be kept in mind because early diagnosis and treatment decrease the high mortality associated to neurobrucellosis. Long-term treatment should be administered with two or three antibiotics able to cross the blood-brain barrier. Our patient received treatment for three months and has no neurological sequelae.

Diagnosis of neurobrucellosis should be considered in a patient with CKD who also has fever of unknown origin and neurological signs. When the disease is suspected based on clinical signs, serologic tests allow for confirming diagnosis, and germ isolation from culture is an even more definitive evidence, as in the reported case. While this is an uncommon condition, it should be kept in mind because early diagnosis and treatment decrease the high mortality associated to neurobrucellosis. Long-term treatment should be administered with two or three antibiotics able to cross the blood-brain barrier. Our patient received treatment for three months and has no neurological sequelae.

1. Serra Álvarez J, Godoy García. Incidence, etiology and epidemiology of brucellosis in a rural area of the province of Lleida. *Rev Esp Salud Publica* 2000; 74 (1): 45-53.
2. McLean DR, Russell N, Kahn MY. Neurobrucellosis: Clinical and therapeutic features. *Clin Infect Dis* 1992; 15: 582.
3. Yetkin M, Bulut C, Erdinc F, Oral B, Tulek N. Evaluation of the clinical presentations in neurobrucellosis. *Int J Infect Dis* 2006;10 (6): 446-52.
4. Tuba Turunç, Yusuf ZD, Hikmet A, Funda T, Nurhan Ö, Hande A. Brucellosis in cases of end-stage renal disease. *Nephrol Dial Transplant* 2008.

J. Roig, F. Sarró, M. Borrás and E. Fernández
 Servicio de Nefrología. Hospital Universitario Arnau de Vilanova. Lleida.
Correspondence: Jorge Roig Cárcel.
 roig3921@hotmail.com. Hospital Arnau de Vilanova. C/ Rovira Roure, 80. 25007 Lleida. España.

Hypokalemia, distal renal tubular acidosis, and Hashimoto's thyroiditis

Nefrología 2008; 28 (5) 569-570

To the editor: Renal tubular acidosis (RTA) is defined as the inability of renal tubule to acidify urine regardless of any reduction in glomerular filtration

rate. Type I or distal RTA is a subtype characterized by an impaired hydrogen ion (H⁺) secretion in the distal convoluted tubule. This defect may be inherited or acquired, and causes H⁺ retention, with the resultant decrease in plasma bicarbonate and alkaline urine.^{1,2} Most common cause of RTA I include diabetes mellitus, Sjögren's syndrome, multiple myeloma, primary amyloidosis, sarcoidosis, kidney transplant, obstructive uropathy, sickle cell disease, calcium metabolism disorders, and certain drugs.^{1,2}

Thyroid hormone increases membrane cell Na⁺, K⁺-ATPase pumps.³ In hypothyroidism, content and function of these pumps are reduced, which causes a decreased elimination of H⁺, exacerbating the acidotic state caused by RTA. Hypocalcemia in hypothyroid patients is caused by type I RTA.³⁻⁶

Two patients with hypocalcemia due to renal tubular acidosis secondary to Hashimoto's thyroiditis are reported below. We suggest that this association is mediated by autoimmune mechanisms.

PATIENT 1

A 29-year-old female patient with progressive muscle weakness and quadriplegia, hyperchloremic metabolic acidosis with normal anion gap, and severe hypokalemia, which was corrected with intravenous potassium with clinical improvement. RTA type I, with high titers of anti-peroxidase antibodies (100 U/mL) and > 100 mU/mL of thyroid-stimulating hormone (TSH), was diagnosed. Despite adequate alkali administration, acid-base status was corrected when thyroid function was normalized. After treatment with levothyroxin and potassium citrate, the patient has been asymptomatic for the past 8 years.

PATIENT 2

A 30-year-old female patient with growth retardation due to type I RTA diagnosed in adolescence was admitted to hospital for a spontaneous hip fracture. Patient reported marked fatigue, weakness (quadriparesis), and muscle cramps for the past two years. Labora-

tory tests results: TSH > 100 mU/mL, high titers of anti-peroxidase antibodies (300 U/mL), and low free thyroxin levels (table). Treatment was started with levothyroxin 150 mg/day and calcium citrate. Densitometry showed severe osteoporosis. Patient has not relapsed after 7 years of hormone replacement therapy.

Hashimoto's thyroiditis is an autoimmune disease, and type I RTA has also been related to autoimmunity.^{6,8} Antibodies directed against collecting tubule cells could play an outstanding role in this setting, affecting acid-base status and potassium balance. These are the first cases reported in the literature of hypokalemic paralysis caused by type I RTA as a presentation form of Hashimoto's thyroiditis.

Taking into account that Hashimoto's thyroiditis is the most common cause of hypothyroidism, with a 1% prevalence, type I RTA could be an underdiagnosed associated condition with variable grades of clinical expressivity.

1. Berl T, Schrier R. Pathogenesis and management of metabolic acidosis and alkalosis, in Schrier R (ed): Renal and electrolyte disorders (4 edn). Boston, MA, Little, Brown and Company 1992, 175-181.
2. Rose BD, Post TW. Metabolic acidosis, in Rose BD, Post TW (ed): Clinical physiology of acid-base and electrolyte disorders (5 edn). New York, NY, McGraw-Hill 2001, 612-22.
3. Clausen T. Clinical and therapeutic significance of the Na⁺,K⁺ pump+. *Clin Sci (Lond)* 1998; 95: 3-17.
4. Oster R, Michael UF, Perez GO, Sonnenborn RE, Vaamonde CA. Renal acidification in hypothyroid man. *Clin Nephrol* 1976; 6: 398-403.
5. Chan A, Shinde R, Cockram CS, Swaminathan R. *In vivo* and *in vitro* sodium pump activity in subjects with thyrotoxic periodic paralysis. *Br Med J* 1991; 303: 1096-1101.
6. Clausen T. Na⁺,K⁺ pump regulation and skeletal muscle contractility. *Physiol Rev* 2003; 83: 1269-1324.
7. Kamel KS, Briceno LF, Sanchez MI et al. A new classification for renal defects in net acid excretion. *Am J Kidney Dis* 1997; 29: 136-46.
8. Pessler F, Emery H, Dai L et al. The spectrum of renal tubular acidosis in Sjögren syndrome. *Rheumatology (Oxford)* 2006; 45: 85-91.

B. C. Finn, P. Young, J. E. Bruetman, M. Forrester, F. Lombi, V. Campolo Girard, H. Pereyra and H. Trimarchi
Hospital Británico de Buenos Aires.

Correspondence: Pablo Young. *pablo-young2003@yahoo.com.ar. Hospital Británico de Buenos Aires. Perdriel, 74. 1280 Buenos Aires. Argentina.*

Hyponatremia secondary to cerebral salt-wasting syndrome associated to bacterial meningitis

Nefrología 2008; 28 (5) 570-571

To the editor: Hyponatremia is the most prevalent water and electrolyte disorder in standard clinical practice.¹ The cerebral salt-wasting syndrome (CSWS) is an uncommon cause of hyponatremia. The case of a male patient with bacterial meningitis who developed hyponatremia secondary to CSWS is reported below.

CASE REPORT

A 21-year-old male patient with an unremarkable history was admitted to the intensive care unit (ICU) with a diagnosis of meningococcal meningitis associated to sepsis with multiorgan failure that required mechanical ventilation, hemodynamic support with dopamine, treatment with human recombinant activated C protein, and anticonvulsant drugs due to a secondary irritative focus. Empiric treatment was started with ampicillin, cefotaxime, vancomycin, and dexamethasone, and was switched to cefotaxime alone after the causative germ was isolated (*Neisseria meningitidis*) and the results of susceptibility testing were known. Serum creatinine (SCr) levels at ICU admission were 3.2 mg/dL, and normalized after two days (0.9 mg/dL). Once hemodynamic stabilization, renal function control, and spontaneous breathing had been achieved, the patient was moved to the ward.

During the final days of stay at the ICU, a progressive decrease in natremia was documented (see table I), associated to polyuria of 4-5 liters daily, with normal serum levels of antidiuretic hormone (ADH) and high levels of brain natriuretic peptide (pro-BNP). Adequate intravenous volume replacement with physiological saline based on uri-

nary sodium loss allowed for normalization of natremia and a normal volume status (table I).

DISCUSSION

In patients with central nervous system diseases, hyponatremia does not have to be necessarily related to a syndrome of inappropriate ADH secretion (SIADH), but may be secondary to a CSWS.^{2,3} Subarachnoid hemorrhage is the most common cause of CSWS, but this has also been reported to be associated to meningitis of an infectious origin. A new case of CSWS occurring in a young adult after resolution of a bacterial meningitis is reported.

Diagnosis of CSWS requires the presence of an inappropriate diuresis for circulating sodium levels and volume depletion.⁴ Diagnostic suspicion of CSWS is essential for hyponatremia control, because its treatment is totally different from that of SIADH. While volume and sodium replacement is essential in CSWS, SIADH responds to water restriction.⁵ In the case reported, CSWS was suspected based on the existence of polyuria associated to hyponatremia and elevated natriuresis. Elevated serum levels of pro-BNP confirmed diagnosis of CSWS. The increase in pro-BNP serum levels secondary to the inflammatory process in the central nervous system could be related to the inappropriately high natriuresis.

To sum up, occurrence of hyponatremia combined with increased natriuresis and volume depletion in patients with central nervous system disease should raise the suspicion of a CSWS.

1. Gross P, Ketteler M, Hausmann C, Reinhard C, Schömig A, Hackenthal E, Ritz E, Rascher W. Role of diuretics, hormonal derangements, and clinical setting of hyponatremia in medical patients. *Klin Wochenschr* 1988; 66: 662-669.
2. Attout H, Guez S, Series C. Cerebral salt wasting syndrome in bacterial meningitis. *Ann Endocrinol (Paris)* 2007; 68: 395-397.
3. Oster JR, Pérez GO, Larios O, Emery WE, Bourgoignie JJ. Cerebral salt wasting in a man with carcinomatous meningitis. *Arch Intern Med* 1983; 143 (11): 2187-2188.
4. Sterns RH, Silver SM. Cerebral salt wasting versus SIADH: what difference? *J Am Soc Nephrol* 2008; 19 (2): 194-196.
5. Levine JP, Stelnicki E, Weiner HL, Bradley JP, McCarthy JG. Hyponatremia in the postop-