Baby bottle and the risk of water intoxication

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Abstract:
Acute hyponatremia is a state of emergency with high morbidity and mortality. Severe hyponatremia is accompanied by a particular brain edema. As a child, with hyponatremia normally encountered while dehydrated during heavier gastroenteritis. Hyponatremia may also be caused due to oral intake more free water or hypotonic fluids. The authors present two cases of infants (aged 15 months and 12, respectively), which was accompanied by severe hyponatremia (118.2 mmol/L and 120.2, respectively) impaired consciousness, in one of the cases have required temporary artificial ventilation. Cause of severe hyponatremia in both infants was excessive intake of fluids, especially sweetened, which were administered to children for their soothing. For this condition is used term „compulsive water drinking” or „normal children who just like to drink a lot”. Parents of children and pediatricians should be informed of the possibility of water intoxication in an uncontrolled water intake well informed.

Keywords: hyponatremia, water intoxication, polydipsia

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Introduction
Hyponatremia is by definiton a plasma sodium (PNa) of less than 130 mmol/L and reflects a deficiency of sodium relative to water. When the PNa falls acutely to < 130 mmol/L, brain cell swelling may develop and be sufficient to lead to a devastating neurologic outcome. Usually were described the two principal mechanisms that result in hyponatremia, loss of sodium in excess of water and gain of water in excess of sodium. Hyponatremia secondary to excessive oral water intake is rare in the presence of normal renal function. It is occasionally described in psychotic adolescents/adults in whom there may also be a defect of central water regulation associated with the primary disease [1, 2]. A few
cases have been described where fatal hyponatremia was caused by very high water intake as a form of child abuse [3]. With respect to some peculiarities of childhood, we would like present our observation.

**Case 1**
At the age of 7-months was a white boy treated for non-infectious diarrhoea. He was product of a 39-week pregnancy, delivered without complications (birth weight 3550 g, length 51 cm). Short breast-feeding was followed by milk formula. After this diarrhoeal episode the boy used to drink a large amount of sweetened water (daily intake exceeded 1500 ml of fluids, mainly of fruit tea or water flavored with fruit juices).

At the age of 15 months he was admitted to our hospital because vomiting and drowsiness. Physical examination revealed disturbed consciousness (Glasgow coma scale 3), generalized convulsions and prolonged pupil’s reaction to light. His heart rate was 130/minute, respiratory rate 21/minute, blood pressure (BP) 105/55 mmHg and body temperature 37.8 °C. Abnormal laboratory investigations showed hyponatraemia (118.2 mmol/L), mild hypokalemia (3.3 mmol/L), plasma and urine hypoosmolality (260 mOsm/kg H₂O and 100 mOsm/kg H₂O, respectively). By fundoscopy was not found papilledema. The cerebrospinal fluid showed no abnormalities. A brain computed tomography (CT) showed diffuse edema. Therapy was started by infusion of 0.9% saline. The patient required artificial ventilation for 38 hours. During next days was boy in good clinical condition but he needed to drink a large amount of tea (2500 – 2800 ml/24 hours). Under the restriction of fluid intake corresponding to his age, the patient’s diuresis became adequate (600 ml/24 hours) and all abnormal laboratory parameters were in normal range (serum sodium 141.7 mmol/L, serum potassium 4.1 mmol/L, osmolality of first morning urine sample 780 mOsm/kg H₂O). The boy was discharged 10 days after admission with normal neurological examination and without abnormalities on electroencephalography and repeated CT of brain.

**Case 2**
The child was born at 37 weeks of gestational age (birth weight 2750 g, length 49 cm) without perinatal complications. The boy was breast-fed for one month only, then milk formula was administered. Mixed infant diet was introduced since 6 months of age. Approximately since that time, the baby started to reject milk and preferred fruit tea or water sweetened with juices. A higher intake of fluids was required mainly at night (750 – 1000 ml per night, 500 – 700 ml per day).

In the morning at age of 12 months he was sleepy with anorexia, just drank tea. At about 9.00 a.m. he turned up his eyes and did not respond to parents. During transport to hospital appeared generalized seizures. On admission the infant was somnolent (Glasgow coma scale 10) with spontaneous breathing (heart and breath rate 105/minute and 32, respectively) and BP 90/55 mmHg. Initial abnormal laboratory values showed hyponatraemia (120.2 mmol/L) with plasma and urine hypoosmolality (268 mOsm/kg H₂O and 78 mOsm/kg H₂O, respectively). Intravenous fluid therapy was started with 0.9% saline. During next 51 hours the patient was fully stabilized and fluids could be administered per os. The fluid intake was limited to amount corresponding with infant’s age. With this regimen patient’s diuresis was 400 – 600 ml/24 hours and urine osmolality ranged between 278 – 738 mOsm/kg H₂O. Laboratory parameters were in normal range (serum sodium 138.5 mmol/L, serum osmolality 287 mOsm/kg H₂O). The boy was discharged one week after admission and further follow-up showed no changes of his clinical status.

**Discussion**
In routine pediatric practice, children with convulsions caused by hyponatraemia may be divided into three categories. A group of patients affected most involves the youngest infants,
usually at the age less than 6 months, who are
given incorrectly prepared hypotonic feeding [4].
Another group are infants who require and are
really administered high intake of diluted fluids.
These subjects are mostly older infants and
toddlers. Such behaviour of an infant may be
caused by a feeling of hunger, habit/bad habit, or
it is a form of infant’s self-stimulation in the case
of deprivation from your parents/family.
Unfamiliarity and inexperience of parents, as
well as difficult socioeconomic situation of the
family are factors participating most often in the
rise of these forms of hyponatremia. Sometimes
is applied to this group the term „compulsive
water drinking“ or „normal children who just
like to drink a lot“. However, even insufficient
child’s care must be considered in some
situations. Water intoxication is then a form of
the child’s maltreatment. The third group of
infants with hyponatremia is formed by those
who have the normal diet and fluid intake but
who drink a large amount of water in the period
of intercurrent disease accompanied with
dehydration/loss of salt.

Unifying data from our patients presented here
was the fact that they were not given milk since
about 6 months of their age and their families
preferred the supply of fruit tea or sugary drinks
or sorbitol-sweetened water. That led to
malnutrition, chronic over-hydration, polydipsia and slow development of
hyponatremia. This development was silent and
culminated in convulsions in both cases.
Hyponatremic encephalopathy can be difficult to
recognize in infants/toddlers, as the symptoms
can be variable and do not correlate with either
PNa or the rapidity of development of
hyponatremia. The most frequently symptoms of
hyponatremia are nausea, headache, vomiting,
and weakness. Following symptoms are signs of
cerebral herniation with seizures, dilated pupils,
pulmonary edema, respiratory arrest, and
decorticate posturing.

In conclusion, water intoxication accompanied
by hyponatremia can cause serious and life-
threatening condition. The aim of our two case-
reports mentioned above was to draw attention to
the fact that some patients with hyponatremic
convulsions represent a group of children, who
require and have from their families secured
excessive supply of water and diluted juices.
Therefore, parents should be informed about
potential danger of taking in a large amount of
hypotonic fluids in early childhood as well as
about the importance of rational diet.
Pediatrician ought to be aware of possible
development of hyponatremic convulsions
complicating imbalanced diet with a high intake
of water, particularly in children on milk-free
diet [5, 6, 7].

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