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Abstract

In this article, we explore water intoxication, a phenomenon in which excess water intake causes a plethora of adverse effects that could eventually lead to death. Causes of drinking surplus amounts of water are plenty and include psychiatric illnesses and misinterpretation of medical advice. Treatment is dependent on the clinical presentation and the condition's chronicity. However, generally speaking the aim is to restore electrolyte balance in the body.

Keywords: Water Intoxication; Water Toxicity; Hydration; Sports; Hyponatremia; Polydipsia

Introduction + Background:

An essential component of life, water, is of the upmost importance for our well-being, constituting 45-75% of our total body weight (1,2). One of the well-established research interests has been in the determination of the appropriate amount of water to be drunk on a daily basis in order to achieve health goals, such as the prevention of chronic illness (3–5).
A 2021 study suggests the possibility of a U-shaped relationship between water intake and prevention of progression of renal disease (6); the relationship between renal disease and water intake has been and continues to be studied (7–9). A rather rare, but life-threatening manifestation (1,10), water intoxication, was first described in the early 20th century (1,11,12).
In addition to excess ingestion and in attempts to tamper with drug screening results; conditions such as beer potomania, paruresis, anorexia nervosa, respiratory tract infections, ADH hormone release, self-remedies for conditions such as UTIs, chronic hiccups, and gastroenteritis, and low levels of dietary solute result in a decreased threshold for water intoxication (4,13–29).
With hyponatremia being the most common electrolyte anomaly reported in hospitalized patients and with a mortality rate of ~34% when symptomatic (30), an understanding of water toxicity, a cause of hypo-osmolar hyponatremia (1,13,31–33), is an essential duty of every clinician. Polydipsia (water intoxication) is, as per our observation, very rarely one of the 5 differential diagnoses assigned to patients; we hypothesize this is because polydipsia, alone, is usually insufficient to induce hyponatremia (15,34–36).
Clinical presentation is usually with anorexia, nausea, vomiting, fatigue, weakness, headache, lethargy, confusion, disorientation, muscle cramps, and irritability (37–41); when untreated, cerebral edema occurs, and this manifests in cerebral herniation, seizures, brain stem compression (which results in respiratory stress), and Severe Posterior Reversible Encephalopathy Syndrome (39,40,42–45).

Causes range from soldiers working under the sweltering heat, over-hydration by athletes, misunderstanding/misinterpretation of medical advice, (1,16,46–48) to psychiatric causes.

Methodology:
This study was approached as a narrative review.
In it, the authors searched in search engines such as Scopus, Google Scholar and PubMed for relevant literature using the aforementioned keywords. This preliminary search rendered over 1,000 research articles and books. Exclusions took place based on language (only English), relevance, accessibility, and peer-review (only peer-reviewed publications were included). The remainder were then further filtered for duplicates and completion.
The findings were then reviewed in this article.

Most susceptible population:
It has been established that the population most susceptible to permanent brain damage or death are menstruat women and prepubescent children, with hypoxia and peptide hormones playing a major role in the manifestation of brain damage (30,49).
Published data indicates females consume more liquids (50–52)

Psychiatric Effects of water intoxication:
Polydipsia (excessive drinking) is associated with hyponatremia. This is prevalent in individuals suffering from schizophrenia, misusing recreational drugs, smokers, and those on concomitant medications (3,14,53–59). Given that the presentation is rather similar to that of many psychiatric disorders and adverse effects of psychotropic drugs, a diagnosis of SIADH may be delayed in psychiatric patients (53). This is of importance as psychiatric patients, in general, are at an increased risk of hyponatremia (60); furthermore, polydipsia is prevalent in a number of psychiatric illnesses, especially schizophrenia (15,38,60,61). A study by Vieweg and colleagues brought attention to the possibility of polydipsia in individuals living with schizophrenia may be driven by, in addition to the symptoms of schizophrenia and/or adverse effects of medications, SIADH, genetic polymorphism, or organic brain anomaly (62).
A 2021 case report illustrated the case of a 34-year old female patient with an extensive psychiatric history who presented with a case of water intoxication (63).

Effects on athletes:
In athletic performance, hydration is essential to performance quality; both over and under-hydration are not of utility and unfavourable (64–73). Exercise-induced hyponatremia (EAH) was first described in 1985 by Noakes and colleagues (69,74,75). Despite nearly 4 decades since that observation, complications continue to manifest (69,76,77).
When advising athletes, it is agreed upon that simply advising them to drink in response to thirst was favourable to attempting to create a hydration plan (70,78,79). Unfortunately, despite knowledge of possible adverse effects, according to Noakes and colleagues, the industry of sports drinks has chosen to omit knowledge of such findings (79).
In 2020, a study looking into water-loading weight loss amongst college wrestlers deemed the practice to be safe (80).
In low hydration states, the probability of increased blood pressure during exercise increases greatly (81).
A connection exists between immune function following exercise and hydration (82).
Efforts need to be made towards aiding athletes in choosing hydration strategies that are customized for them (83).

Treatment:
This differs based on the assessment and presentation (44,53,84–88), but the goal is to restore Na+ levels to

normal.
In *acute* (life-threatening) presentations, hyponatremic encephalopathy is a warranted concern and is justification for emergent interventions with hypertonic solutions so as to reverse cerebral edema (89,90). On the other hand, chronic hyponatremia is better managed when utilizing restriction of fluid as well as addressing any underlying causes (53,90–92).

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