

Case report

An autopsy case of fatal water intoxication with postmortem computed tomography findings of diluted intestinal content and hemodilution



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ABSTRACT

No specific pathognomonic tissue changes establish death from water intoxication, which makes a postmortem diagnosis of water intoxication difficult. We report an autopsy case of fatal water intoxication in which the postmortem computed tomography (PMCT) examination showed findings suggestive of antemortem excessive water drinking, such as diluted intestinal contents and hemodilution. A 52-year-old man who had schizophrenia was found dead in his house. He frequently complained of polydipsia, and drank a large amount of water and vomited before his death. PMCT findings showed distention of the duodenum with low radiodensity content (7 HU). In addition, the right atrium showed a low radiodensity content (46 HU). Autopsy results showed moderate congestion in all the organs, a large amount of light-brownish liquid in the duodenum and upper jejunum, and aspiration pneumonia. Electrolyte concentrations of sodium in the vitreous humor of the right and left eyes were 105 and 107 mEq/L, respectively, and neither drugs nor alcohol was detected in the blood. On the basis of the autopsy and biochemical findings, we determined water intoxication as the cause of death. An evaluation of PMCT findings of cases of various causes of death indicated that the radiodensities of the right atrium and duodenal content in our case were lower than those of the cases of various causes of death, except for fresh water drowning. The present case showed that PMCT provides supplementary findings regarding antemortem excessive water drinking. In addition, PMCT may provide findings to consider death from water intoxication before autopsy.

1. Introduction

Water intoxication is characterized by hyponatremia due to excessive water intake, and it is common among schizophrenic patients [1–3]. Moreover, cases of child abuse by forced water intoxication occur [4–7]. Water intoxication is associated with a substantial risk of mortality, and many fatal cases have been reported [7–11]. Clinically, water intoxication can be easily diagnosed by results of a biochemical analysis and an assessment of the patient's history and behavior. However, postmortem blood electrolyte levels do not accurately reflect antemortem levels [9]. In addition, no specific pathognomonic tissue changes establish death from water intoxication [8], which makes a postmortem diagnosis of water intoxication difficult. The vitreous humor is presumed to be more available for postmortem biochemistry analysis, because there are fewer postmortem influences [10,11]; however, the vitreous humor is not always sampled in daily forensic practice.

Recently, the role of postmortem computed tomography (PMCT) as an adjunct to conventional autopsy has been well documented [12],

although only clinical cases and animal models have been reported in terms of water intoxication [13,14]. We present an autopsy case of fatal water intoxication in which the PMCT examination showed findings suggestive of antemortem excessive water drinking, such as diluted intestinal contents and hemodilution. In addition, we compare the PMCT findings of our case with those of cases of various causes of death, and discuss a possible role of PMCT in diagnosing water intoxication.

2. Case report

A 52-year-old man was found dead in his house. He had been receiving medical treatment for schizophrenia, hypertension, and hyperlipidemia. According to his family, he frequently complained of polydipsia a few weeks before his death, and he repeatedly drank a large amount of water and vomited. He was immediately transported to an emergency hospital, but he did not respond to cardiopulmonary resuscitation.

Unenhanced PMCT was performed 13 h after his death. The main

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Table 1
Results of the radiographic measurements in 15 cases. M, male; F, female.

Case	Age (years)	Sex	Postmortem period (h)	Cause of death	Radiodensity of the duodenal content (HU)			Radiodensity of the heart chamber and the great vessels (HU)		
					Descending part	Horizontal part	Ascending part	Right atrium	Inferior vena cava	Aortic arch
1	52	M	14.5	Water intoxication	7	9.7	11.7	46	48	43
2	62	M	42	Intracerebral hemorrhage	39.3	43	50.3	73	71	75
3	44	M	21	Ischemic heart disease	39.3	43.3	49	61	69	59
4	56	M	40	Ischemic heart disease	32	34	33	63	62	53
5	44	M	52	Aortic dissection	41	43.7	41.3	62	69	N/E
6	45	M	28	Subarachnoid hemorrhage	31	46	45	58	64	62
7	56	M	14	Cervical spine fracture	38.3	43.3	45	61	60	57
8	69	M	48	Subdural hematoma	46	53	53	61	62	55
9	66	M	36	Heat stroke	34	27	25	57	63	N/E
10	27	M	32	Acute ethanol intoxication	23	18	21	71	69	67
11	59	M	27.5	Psychotropic drug poisoning	37	45	38	62	75	69
12	42	M	29	Drowning (fresh water)	11.7	14.3	12.3	45	57	57
13	82	F	27	Drowning (fresh water)	9	15.7	12.3	49	52	33
14	73	F	11	Drowning (fresh water)	8.7	13	17	44	43	40
15	71	F	12	Drowning (fresh water)	16	19	18	46	43	44

N/E: not examined

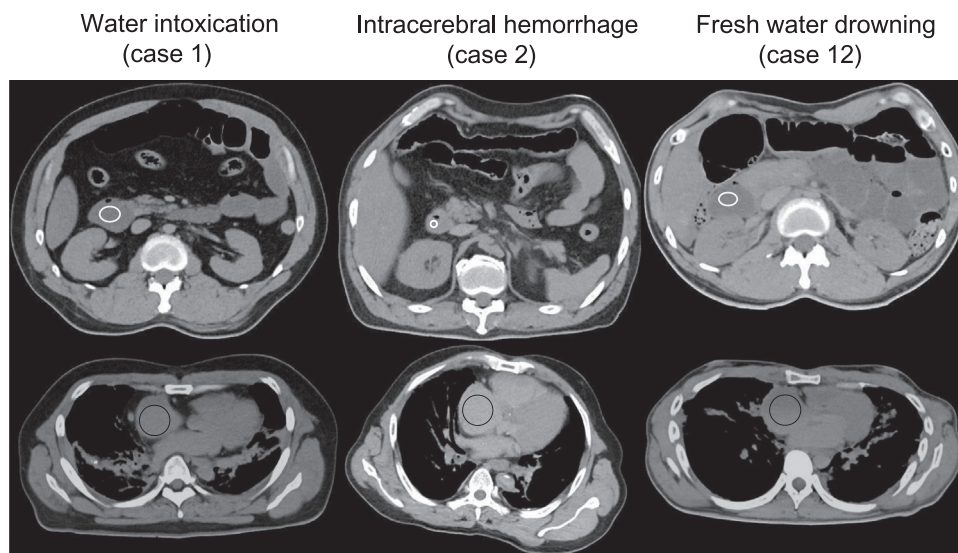


Fig. 1. Representative postmortem computed tomography images. The attenuation of the circled areas (upper row: descending part of the duodenum, lower row: the right atrium) was measured in each case. The values of attenuation of the descending part of the duodenum were 7 HU (case 1), 39.3 HU (case 2), and 11.7 HU (case 12). The values of attenuation of the right atrium were 46 HU (case 1), 73 HU (case 2), and 45 HU (case 12).

findings from the computed tomography (CT) images included ground glass opacity with consolidation in both lungs, distention of the duodenum, and a pooling of low radiodensity content in the duodenum (descending part: 7 HU). There were no fluids in the maxillary or sphenoidal sinuses on PMCT. Physical examination did not show any injuries. The deceased was 171 cm tall and weighed 84 kg, with a body mass index of 28.7 kg/m².

A forensic autopsy was performed approximately 14 h after death. Internally, all the organs were moderately congested. Seven hundred mL of cadaveric blood was obtained when the heart was removed, which retained fluidity. The heart weighed 494 g without fibrotic spots. The coronary arteries had partial stenosis in the peripheral site of the right coronary artery, but no thrombus was observed. The left and right

lungs were edematous and weighed 479 and 505 g, respectively. In the abdominal cavity, there was a large amount of light-brownish liquid in the duodenum and upper jejunum, although only 50 mL of red-brownish liquid was observed in the stomach. The liver was moderately yellowish and weighed 2366 g. The other organs showed no remarkable pathological findings. Histopathology findings of the lungs showed extensive edema in the specimens of both lungs, and partial neutrophilic infiltration with brown-colored vomitus and fibrin deposition were observed in the specimen of the right lower lung. Other histopathological findings included fatty infiltration in the hepatocytes and mild hyaline arteriosclerosis in the kidney. Neither drugs nor alcohol was detected in the blood. The serum electrolyte concentration of sodium was 85 mEq/L. Electrolyte concentrations of sodium in the

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