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Case Report

A rare case of fatal thalamic hemorrhage with intraventricular extension complicating drowning in an underweight woman

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ABSTRACT

Death from natural diseases prior to or after entering the water is relatively rare but does occur. These underlying natural diseases lead to the incapacitation of the water victims and culminate in accidental or unintentional drownings. People who are unaware or ignorant of their disease status, living in rural areas with nearby open water sources, and belonging to economically backward communities in developing countries are more vulnerable to these unintentional drownings and pose a substantial challenge in determining the cause of death. Here we present a 45-year-old, underweight woman who brought a history of drowning in a pond near her house where she regularly took a bath. The history from the relatives and crime scene investigation was unremarkable. Thalamic hemorrhage, intraventricular hemorrhage, triple vessel atherosclerosis of the heart, and left ventricular hypertrophy suggestive of undiagnosed hypertension were discerned only after the autopsy, besides profound findings of drowning. This report highlights the significance of a meticulous autopsy to explain the cause of death in unwitnessed open water drownings, thus benefitting the bystanders and investigating team.

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1. Introduction

World Health Organization (WHO) defines drowning as “the process of experiencing respiratory impairment from submersion or immersion in liquid.”^{1,2} Globally, drowning is the third most common cause of accidental death, and tragically about 90% of these deaths happen in low- and middle-income countries.³ Males, people with more frequent access to the water or commuting on water, floods, lack of supervision, and drug use are postulated to be the other risk factors for drowning-related deaths.⁴ It is also estimated that females account for one-third of global drowning deaths, especially in low- and middle-income

countries.⁵

The majority of deaths due to drowning are accidental, followed by suicidal and rarely homicidal.⁶ The risk factors of female drowning deaths in low- and middle-income countries like India are proximity to the natural water sources, washing, bathing, and water-related transport.⁷ In addition, victims of lower socioeconomic status and having diagnosed or undiagnosed medical conditions are also more vulnerable to drowning-related deaths.²

Determining the cause of death in drowning deaths is crucial since all bodies recovered from water may not necessarily die due to drowning.⁸ Co-occurring clinically significant natural diseases in drowning deaths present a substantial diagnostic dilemma for a forensic pathologist at the time of autopsy. Further, unwitnessed drowning deaths are even more challenging. Here we present a case

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of a 45-year-old underweight female who was apparently healthy prior to recovery of her body from a pond nearby her house. The diagnosis of thalamic hemorrhage with intraventricular extension, triple vessel atherosclerosis, and left ventricular hypertrophy was established only after the autopsy. To the best of our knowledge, this is the first report to implicate catastrophic thalamic hemorrhage with intraventricular extension in the causation of open water drowning of an underweight female with undiagnosed hypertension.

2. Case History

The corpse of a 45-year-old lady was found floating in a pond near her residence. She was in the habit of bathing in the same pond (shallow water) daily. The relatives denied any history of chronic diseases like diabetes or hypertension. She was not under any mental stress prior to the incident, and the investigation of the crime scene and her house was unremarkable. The family members were clueless since she routinely took baths in the same pond for long years. The body was retrieved and brought to our mortuary for a medicolegal autopsy.

External examination revealed the body to be a thin-built woman, measuring 152 cm in length and weighing 34 kg (BMI=14.7 kg/m²). Hair and clothes were wet. Multiple mud particles were present over the skin of the chest and abdomen. Wrinkling and soddening of the skin over both palms and soles were present. There were no signs of putrefaction. An abrasion, red in color, measuring 3x3 cm, was present over the outer aspect of the left leg, situated 6 cm above the lateral malleolus of the left ankle. There were no other external injuries present over the body.

On the internal examination, the scalp and skull were intact. The brain was congested and edematous. On the cut section, about 40 ml of fresh intraventricular hemorrhage was present in the lateral ventricle on the left side. (Figure 1) Multiple streak hemorrhages were present in the midbrain and pons on further exploration. Copious, fine, white, lathery, tenacious froth was present in the lumen of the trachea, primary and secondary bronchi, and bronchioles. Both lungs were voluminous, hyperexpanded, congested, and edematous. The left lung weighed 420 g, and the right lung weighed 660 g. Rib indentations were present over the lateral surface of both lungs. On the cut section, crepitus was heard, and profuse frothy fluid oozed out on compression. The heart weighed 271 g with intact walls and a competent valve. The left ventricular wall thickness was 1.9 cm, and the right ventricular wall thickness was 0.5 cm.

Histopathological examination of lung tissue showed emphysematous changes, extensive edema, focal hemorrhage, collection of polymorphs in the alveolar space, and occasional alveolar space showed bacterial collection without significant tissue reaction. (Figure 2 A) Section from the left thalamus showed large areas

of fresh hemorrhage (Figure 2 B) and hemorrhages in the midbrain (Figure 2 C) and pons. The left anterior descending artery showed atherosclerosis type 5 with about 80% luminal narrowing. (Figure 2 D) Examination of the Heart and blood vessels confirmed triple vessel atherosclerosis with myxomatous degeneration of the aorta. The rest of the organs were histologically unremarkable. The stomach contained about 800 ml of pale white fluid. The sternal bone marrow and water from the pond were subjected to a diatom test. The acid digestion technique was used to rule out the diatoms. Both samples revealed rod-shaped diatoms. The toxicological screening was negative for any intoxicants or poisons. Based on the history, autopsy findings, histopathology, and toxicology analysis of the viscera, the cause of death was ascertained to be antemortem drowning and its complications with thalamic and intraventricular hemorrhage as a contributory cause.

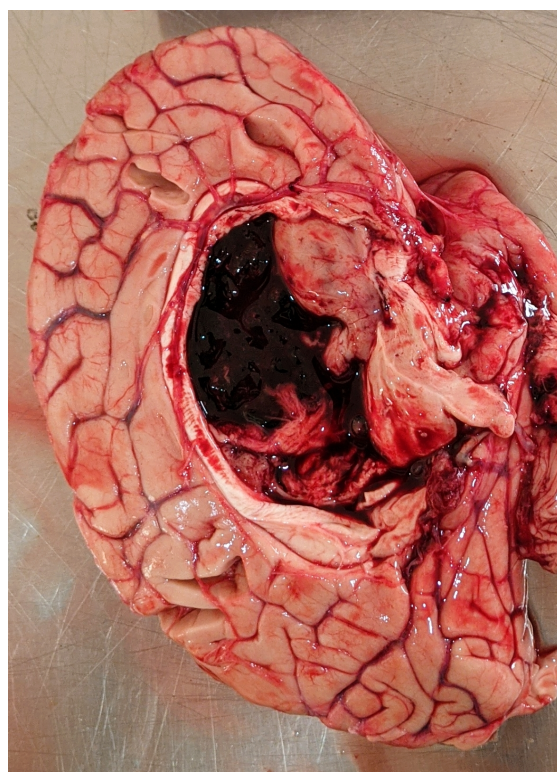


Fig. 1: Gross examination of the left cerebral hemisphere shows fresh hemorrhage filled lateral ventricle

3. Discussion

Victims of drowning are often incapacitated due to life-threatening injuries or diseases before or at the time entering into water or while swimming. Cardiovascular diseases such as myocardial infarction and arrhythmogenic heart disorders (eg. long QT syndrome) are the most common

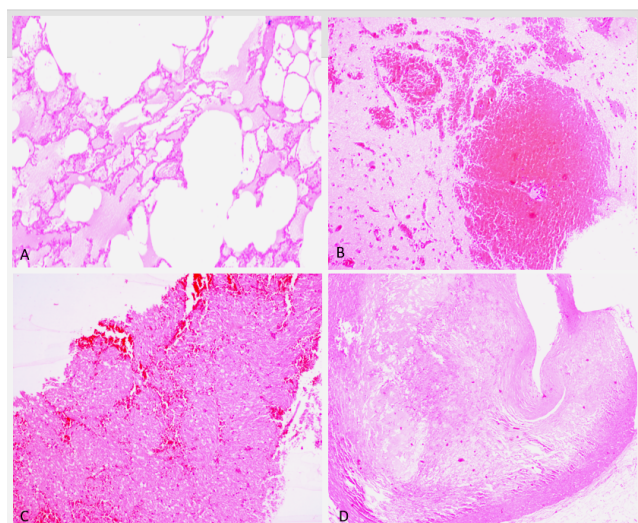


Fig. 2: Histological examination of the lung parenchyma; **A:** shows distended alveolar spaces with intra-alveolar edema (Hematoxylin-eosin stain, 200 \times). Sections from the thalamus; **B:** and midbrain; **C:** exhibit intraparenchymal hemorrhage (Hematoxylin-eosin stain, 200 \times). Section from the left anterior descending artery; **D:** shows features of atherosclerosis with more than 80% luminal narrowing (Hematoxylin-eosin stain, 100 \times)

natural disease pathology contributing to drowning deaths.⁹ It is also known that the combination of cardiac diseases and drowning is considered lethal.⁹ Among central nervous system disorders, epilepsy is more frequently reported to cause drowning deaths.^{4,9,10}

Hypertension is considered a ‘silent disease’ or ‘iceberg disease’ since the majority of the patients with hypertension remain asymptomatic and undiagnosed in their lifetime. The rule of halves in hypertension suggests that half the population with hypertension are undiagnosed, half of those diagnosed are untreated, and half of those treated are not adequately controlled.¹¹ The above circumstance is not uncommon in a developing nation like India, especially among rural women. Most of them are unaware of noncommunicable diseases (NCD) like hypertension and are also ignorant about the importance of early treatment-seeking behavior. Hence, most of them are remain undiagnosed, resulting in significant premature mortality in this population.¹² Hypertension is the most frequent risk factor implicated in spontaneous intracerebral hemorrhages.¹³ Putamen and thalamus are the most common sites for hypertensive intracerebral hemorrhages and pose a threat of significant morbidity and mortality.¹⁴ In our case, the histopathological findings of the brain and heart are also consistent with arterial hypertension. However, the history of the deceased was not remarkable for any diseases in the past. Hence, it is speculated that she suffered from subclinical chronic underlying cardiovascular disease, probably hypertension, and coronary artery disease.

Extensive hemorrhages in the thalamus are known to result in acute severe motor deficits, sensory ataxic hemiparesis with contralateral limbs incoordination, and impairment of consciousness.¹⁵ This may further explain the likely reason for incapacitation led drowning in the present case. In addition, the proximity of the thalamus to the third ventricle (medially) often contributes to the intraventricular extension of bleeding,¹⁶ which is associated with poor prognosis¹³ and consistent with the fatality of the present case. An analysis done by Nam et al. postulated that thalamic hemorrhage might present with concurrent IVH when BMI >25.¹⁶; However, it should be highlighted here that the BMI in the present case was 14.7 kg/m² corresponding to underweight in the BMI range, which is extremely rare to manifest with hypertensive deep intracerebral hemorrhage involving thalamus.¹⁷

Besides hypertension, the intracerebral hemorrhages in the present case may also be triggered by the following mechanisms. Firstly, a study from Japan suggested that the acute change in body temperature following submersion in bathtubs leads to hemodynamic instability by influencing the autonomic system, resulting in blood pressure or heart rate fluctuations, thus culminating in vascular accidents in vulnerable people.¹⁸ Secondly, a study from Austria speculated that the propensity for bleeding increases in drowning victims because of the increased risk of overt disseminated intravascular coagulation induced bleeding that arises from hyperfibrinolysis. This hyperfibrinolysis may be due to the sudden and profound hypoxia in drowning cases, which triggers elevated tissue plasminogen activator (tPA) release in the circulation.¹⁹ The data on drowning deaths among the Indian population is lacking, hence future research is warranted among open water drowning victims.

Findings associated with drowning in the present case suggest that the woman might have died due to drowning, yet it is worth remembering that drowning is a diagnosis of exclusion. The findings such as washer-woman changes, cadaveric spasm, froth in the airways, water in the stomach, emphysema aquosum, and positive diatom test are characteristic but not diagnostic for drowning.⁸ The positive result of the diatom test in the present case should also be cautiously interpreted because the deceased used to take baths regularly in the same pond over the years. This may be associated with antemortem contamination irrespective of the fatal drowning episode.

4. Conclusions

In conclusion, the relatively rare occurrence of invariably fatal hypertensive thalamic hemorrhage with intraventricular extension complicating the drowning of an underweight woman was described in this report. Community health screening and regular health checkups should be encouraged among middle and old-aged adults, especially after 40 years. Unintentional drowning can be

prevented by effective interventions, including restricting access to unsafe open water sources, supervised bathing in the presence of family members or friends, public awareness, and education programs on safe bathing practices. Finally, it should be emphasized here that the autopsy surgeons should be extremely vigilant and carry out meticulous autopsy with ancillary investigations in drowning cases to rule out unusual yet potential underlying natural causes.

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6. Conflict of Interest

The authors declare no conflict of interest.

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