

## DROWNING AND ITS MEDICOLEGAL IMPORTANCE

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### ABSTRACT

Drowning is a mode of asphyxial death due to aspiration of water or other fluid into respiratory tract. For death it is not necessary that the whole body is submerged in the liquid, it is sufficient if the face and nostrils are submerged in the liquid. Drowning in India is mostly suicidal attempted by non swimmer. Accidental drowning occurs commonly. Drowning is a major cause of accidental death worldwide, with the highest rates among children. About 1, 50, 000 person die from drowning each year around the world. In 2015 approximate 3,60,000 deaths from drowning have recorded. It is 3rd leading cause of unintentional injury related death, accounting for 7 % of all injury related death. Medico-legal aspect of drowning is very important to know whether death was caused by drowning, whether drowning is ante-mortem or post-mortem etc.

**Keywords:** Drowning, Death, Dead body, Water, Medico-legal etc.

### INTRODUCTION

According to the WHO drowning is major public health problem worldwide. In 2015 approximate 360,000 deaths from drowning have recorded. It is 3rd leading cause of unintentional injury related death, accounting for 7 % of all injury related death. Low and middle-income countries account for over 90 % of unintentional drowning deaths.<sup>1</sup> Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid. Implicit in this definition is that a liquid-air interface is present at the entrance to the victim's airway which prevents the individual from breathing oxygen. Outcome may include delayed morbidity, delayed or rapid death or life without morbidity.<sup>2</sup> About 150,000 person die from

drowning each year around the world.<sup>3</sup> Drowning is classified as typical and atypical, the term typical drowning indicates obstruction of air passage and lungs by inhalation of fluid is known as wet drowning. Typical signs of drowning are found at autopsy. The term atypical drowning indicates conditions in which there is very little or no inhalation of water in the air passages such as dry drowning, hydrocution etc.<sup>4</sup> Suicidal and accidental drowning seen commonly in our country, woman may fall accidentally into a well while drawing water from it, children may fall in ponds or lakes while playing near their banks. Murder by drowning is very rare, except in the case of infants and children.<sup>5</sup>

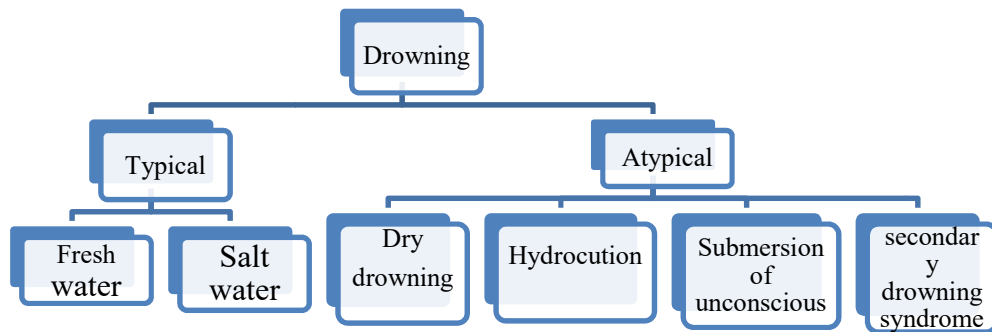
So Medico-legal aspect of drowning is very important to know whether death was caused by drowning, whether drowning is ante-mortem or post-mortem, the drowning was suicidal, homicidal or accidental, what is the time for the body was in the water etc. These medico-legal questions are very helpful to solve any court case.<sup>6</sup>

### AIM AND OBJECTIVES

1. To explain drowning.
2. To explain medico-legal aspect of drowning.

**DEFINITION-** Drowning is when death caused by the submersion of the body in water (or any liquid). The cause of death is irreversible cerebral anoxia because the atmospheric air is prevented from entering the lungs.<sup>7</sup>

### CLASSIFICATION<sup>8</sup>-



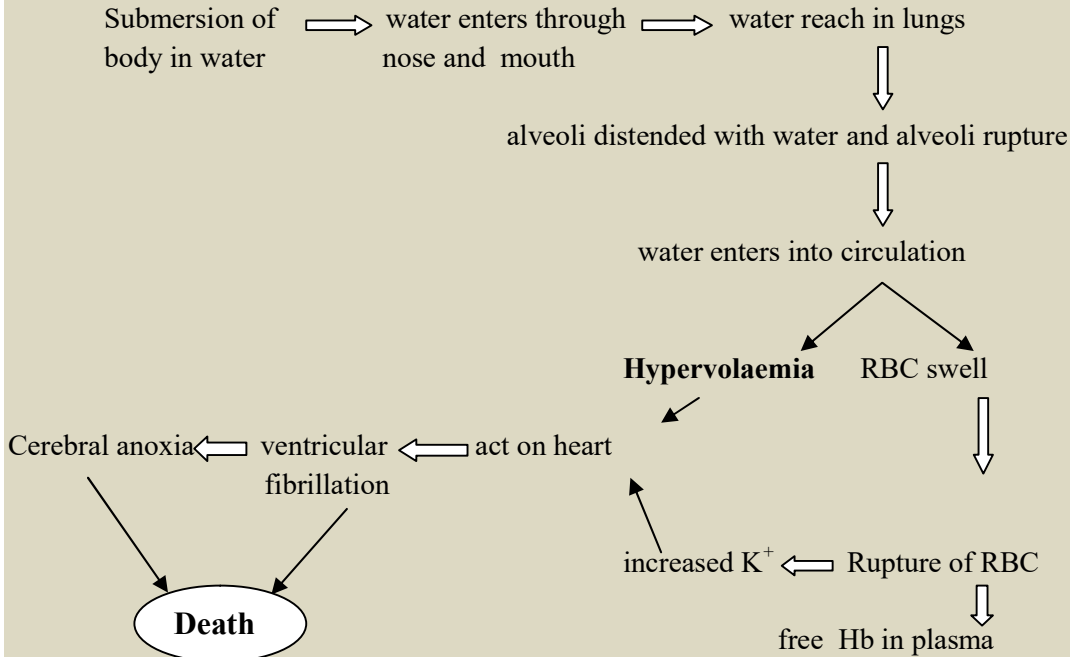
### MECHANISM<sup>9</sup>-

A fully conscious body suddenly and unexpectedly falls into water-

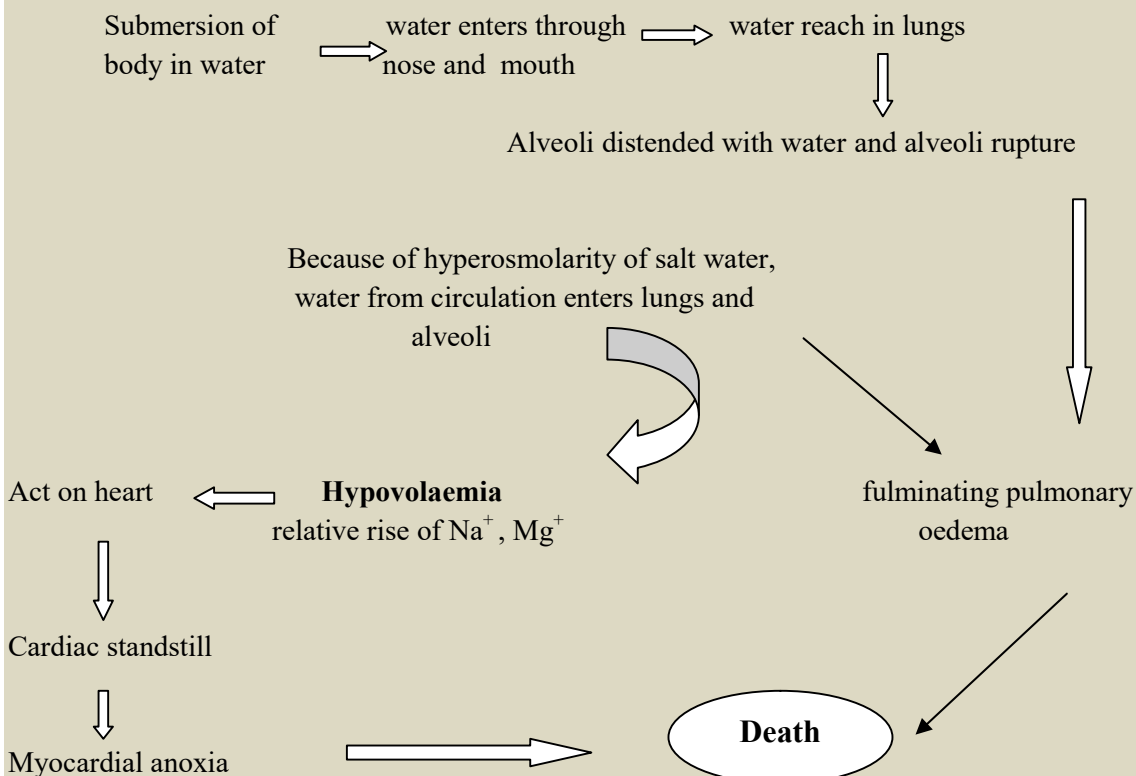
1. Sinks to depth (proportionate to the momentum of body obtained during the fall i.e. mass x velocity)
  2. Immediately rises to the surface ( due to Buoyancy i.e. floating power of the body and struggling movements of limbs)
  3. Cries and shouts for help (when his mouth is at the level of water surface)
  4. Drain water enters into the stomach and lungs.
  5. Violent expiratory efforts ( due to coughing)
  6. Some air is expelled from the lung
  7. More water enters the lungs (air space is occupied by water)
  8. Body becomes heavier & Increase in body weight
  9. Sinks to depth
  10. The repetition of steps 2 to 9 i.e. Alternate rising and sinking, three or four times, until all the air is expelled from lungs and its place is occupied by water
- The loss of consciousness and sinks to bottom to die

**PATHOPHYSIOLOGY<sup>10,11</sup>** - The pulmonary alveolar lining is semi-permeable. If water enters the alveoli an exchange of water takes place through the alveolar lining. The extent and direction of this exchange depends on the differences between the osmotic pressure of the blood and the water.

**1. Pathophysiology in fresh water drowning-**



**2. Pathophysiology in salt water drowning-**



**Fatal period**

- Fresh water drowning: 4-5 min.
- Sea water drowning: 8-12 min.

**Cause of Death<sup>12</sup>-**

- a) Asphyxia: Most common cause of death.
- b) In fresh water drowning, death results from ventricular fibrillation. While in salt water, it is due to cardiac arrest from fulminant pulmonary edema and associated changes.
- c) Vagal inhibition due to impact with water.
- d) Laryngeal spasm.
- e) Concussion/head injury,

**Apoplexy:** Subarachnoid hemorrhage from rupture of Berry aneurysm or cerebral hemorrhage by rupture of cerebral vessels from sudden on-rush of blood to the brain due to excitement or sudden fall from height into cold water.

**f) Secondary causes-**

Septic aspiration pneumonias

Sudden bursting of aneurysm

**AUTOPSY FINDINGS<sup>13,14</sup>****External appearance:-**

1. Clothes are wet.
2. Cutis anserina-Skin is cold, wet and pale. Skin may show **cutis anserina** i.e. appearance of gooseflesh or goose skin. It is a state of puckered and granular appearance of skin with hairs standing on end due to contraction of erector pilorum muscle.
3. Washerwoman's hand: Prolonged immersion in water leads to maceration of skin due to imbibitions of water. There is whitening, bleaching and wrinkling of skin particularly on palmar surface of hands and sole of feet.
4. Eye- Pale, half open conjunctiva may be congested and suffused with blood, pupils are dilated.
5. Tongue- Swollen and sometimes protruded.
6. Froth- A fine, white, leathery, tenacious froth is seen at the mouth and nostrils. (A diagnostic sign of drowning.)
7. Cadaveric spasm: Grass, mud, sand etc. may be clinched in hands. Presence of cadaveric spasm indicates person was alive when he was drowned.

8. Post-mortem lividity is light pink in colour may be seen in head, neck and chest, as the upper part of body becomes much heavier.
9. Rigor mortis sets in and passes off early due to exhaustion from struggling under water.

**Internal appearance<sup>15,16,17</sup>:-**

1. Brain- Hyperemic, swollen with flattening of gyri.
2. Lungs- Distended like balloons, pale grey colour with reddish stains, oedematous. Large patches of shiny, pale pink haemorrhage known as Paltauf's haemorrhage may be seen sub-pleurally.
3. The larynx, trachea and bronchioles contain profuse and persistent fine white lathery froth with foreign particles and diatoms are also seen. Finding of diatoms from the distant body tissues, brain, bone marrow, liver, spleen, kidney etc also. Finding of similar type of diatom from the water of drowning is considered to be the surest sign of ante-mortem drowning.
4. Liver, spleen, kidneys- Engorged with dark fluid blood and deeply congested. Blood remains fluid due to mixing with water.
5. Stomach and duodenum- may show presence of water with mud in 70 % cases and in 30 % cases may also be seen in small intestine. Stomach contains algae, weeds, mud sand, diatoms etc
6. Middle ear cavities may show haemorrhage due to pressure changes across the lining of the middle ear cavity.
7. Heart shows the sign of asphyxia.

**MEDICOLEGAL ASPECTS OF DROWNING**

1. Most drowning deaths are suicidal or accidental in nature<sup>18</sup>.
2. Accidental drowning can occur in toddlers and children by fall in bath tub, bucket, swimming pool etc.
3. Accidental deaths can also occur in recreational activities such as boating, diving, hypoxic lap etc.
4. Accidental deaths can be related with fishing or occupational activity. Mass fatality may occur in boat sinking, floods etc.

5. Suicidal drowning- In India, drowning occupies the first position of all the modes of committing suicide. Sometime a woman falls into water with her child, if she survives and the child dies, she is tried under sec 309 IPC for the offence of having committed an attempt at suicide and may be tried under sec 302 IPC for having committed the murder of her child or under sec 304-A IPC for causing the death of her child by negligence<sup>19</sup>.
6. Homicidal drowning is rare except infants and children<sup>20</sup>. Homicide by drowning is easier to conduct if the victim is rendered helpless by intoxication or drugs or by violence. Example- In the notorious insulin case, the husband (a male nurse) gave an injection of insulin to his pregnant wife, the wife taking it to be of ergonovine intended to induce abortion. Thereafter, when she lapsed into hypoglycaemic coma, the husband placed her in a bathtub to present the case as of death due to drowning (Bir Kinshaw et al., 1958).
7. Attachment of heavy weights to the body to keep it under water is consistent with both homicidal and suicidal drowning as well as disposal of a body of person who died of some other cause. The nature and manner of application of weights to the body and the presence /absence of attending injuries deserve consideration. Constrictions or marks, especially around neck, give strong evidence for homicide provided signs of drowning are wanting.
8. Position and floatation of a dead body in drowning<sup>23</sup> – When a person drowns, the body sinks, assuming a position of head down, buttocks up, and extremities dangling downward. Unless there are strong currents, the body will not move very far from its initial position. In relatively shallow water, the extremities or face may bump or drag against bottom of water column. Postmortem injuries to the face, back of the hands, knees, and toes may be present due to dragging along the bottom. The crown of the head and the buttocks may be at water level. In deeper water, the body stays below the surface until decomposition begins and gas formed, the body then gradually rises to the surface. Floatation of body in water may also help in crime investigation, especially in deciding time since death. Despite of several factors such as specific gravity of human body, body fat, age, sex, prior physical status etc. In India, floatation of the body occurs in summer by about 24 hours and in winter by 2- 3 days of drowning death.
9. Depending on how long the body was in the water, there may be evidence of animal activity, for example, fish, turtles, crabs, or shrimps. In very cold water, body may stay submerged for months before decomposition produces enough gas for it to rise to the surface.
10. Drowning in bath tubs [23]- relatively uncommon. Usually involves young children unattended by parents. Some are undoubtedly homicidal as well. If, while taking bath, one's feet are grasped and one is pulled underwater by them, there may be sudden flow of water into nasopharynx. This in combination with panic and being in smooth walled, wet, slippery container may result in inability to struggle effectively with rapid loss of consciousness and death. No injuries may be seen at autopsy. Overdose of drugs, seizure disorder, heart attack are some of the causes that can drown adults accidentally. There are well documented reports where victims slipped deliberately (homicidal) or accidentally in the bathtub, struck their head, and drowned.
11. Scuba Divers - Deaths can occur with use of scuba diving equipment, may be caused by natural disease, as a consequence of being under water at increased pressure. It could also result due to defective equipment. If a diver too rapidly does an ascent to surface it may cause air embolism, pneumothorax or interstitial emphysema. Divers may die also because of getting trapped in caves or under water debris. Contamination of air within the tank may also kill the diver. Hence it is suggested that in every scuba diving related death, the equipment used must be examined thoroughly by an expert with analysis of residual air in the tank<sup>23</sup>.

**Table 1:** Question may be raised whether drowning is antemortem or postmortem<sup>21</sup>. Differences are given in Table-

Characteristic features	Ante-mortem Drowning	Post-mortem Drowning
1. Definition	Drowning had occurred during life, usually accidental or suicidal.	Dead body thrown into water after killing, homicidal mode of death
2. Incidence	80%	20% of all drowning cases.
3. Evidence of struggle or injury on the body	Absent	Present
4. Fine, white, leathery persistent froth around the mouth and nostrils	Present	Absent
5. Cadaveric spasm	Present	Absent
6. Fine white froth in the air passage	Present	Absent
7. Lungs	Bulky and oedematous which exude copious, frothy blood- stained fluid on section.	May be bulky and oedematous but no escape of blood- stained fluid on section
8. Stomach and intestine	Shows presence of water, mud or weeds including diatoms	No such foreign objects ever present
9. Haemorrhage in the middle ear cavity	May be present	Never found
10. Diatom test	Positive ( diatoms < 20 um enters the circulation to reach other body organ.	Negative, except if a dead body is deposited in water or when the death in water is not due to drowning, then though the diatoms may be able to reach the lungs by passive percolation but not reach to the distant organs because of absence of circulation.

**Table 2:** Characteristic features Suicidal, homicidal and accidental drowning<sup>22</sup>

Features	Suicidal	Homicidal	Accidental
1. Incidence	Highest, being attempted by non swimmers	Rare, except in infants and kids	Common, mostly in non swimmers, at bathing places, common in alcoholics/ drug addicts in the bath tub
2. Marks of violence on the body	Not found	Present	Absent
3. Clothing on the body	Complete, the lower end of clothes folded flat not to expose nakedness after death (specially in female)	Present, body attached with heavy weight	Usually only a single piece of cloth or swimming costume present

## DISCUSSION AND CONCLUSION

Drowning is a form of asphyxial death where air entry into lungs is prevented due to submersion of mouth and nostrils into water or any fluid medium. Thus, drowning constitutes impairment of tissue oxygenation consequent to submersion in the fluid medium.

Complete submersion is not necessary because the process will be completed even if the nose and mouth are submerged. According to the WHO 7% of all deaths each year are due to unintentional drowning worldwide. In India and all over the world, it is common to throttle or kill a person by giving poison and

after that body is thrown into the water to avoid detection of crime. Suicide attempt through drowning is most common in India especially among women, sometimes woman takes her child. Accidental drowning is also seen commonly in children, bathers, fisherman, dock workers, intoxicated and epileptic persons. Large numbers of drowning deaths are associated with floods in worldwide. Alcohol is a risk factor for drowning among adolescents and adults. Hence, medico-legal aspect of drowning is very helpful for finding the cause of death and manner of death, whether the form of deaths were accidental, suicidal or homicidal in nature. Its medico-legal aspect is to confirm whether the drowning was antemortem in nature or to confirm whether any other associated cause of death was present or not. Diagnosis of death by drowning may be established from the following observations: (1) external signs of drowning, (2) internal signs of drowning, (3) biochemical and biophysical tests for drowning and (4) analysis of diatomaceous material, finding of diatoms from the distant body tissues, brain, bone marrow, liver, spleen, kidney etc also. The presence of similar type of diatoms from the water of drowning is considered to be the surest sign of antemortem drowning. Hence, knowledge about medico-legal importance of drowning death is needed to make a proper and accurate determination of the cause of death.

## REFERENCES

1. <https://www.who.int>
2. Gautam Biswas , Review of Forensic Medicine and Toxicology 2nd edition , Jaypee Brothers Medical Publisher(P) Ltd New Delhi-110002, page no-154.
3. K.S. Narayan Reddy, The Essentials of Forensic Medicine and Toxicology 34th edition -2017, jaypee Brothers Medical Publisher (P) Ltd New Delhi-110002, page no-341.
4. Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology 17th reprint edition -2017, CBS pulisher & Distributors P. Ltd New Delhi-110002, page no-188.
5. K.S. Narayan Reddy, The Essentials of Forensic Medicine and Toxicology 34th edition -2017, jaypee Brothers Medical Publisher (P) Ltd New Delhi-110002, page no-350.
6. Jaising P Modi, Modi A Textbook of Medical Jurisprudence and Toxicology 26th edition-2018, Lexis Nexis Publication Gurgaon-12202, Haryana, page no-291
7. Ajay Kumar, Text Book of Forensic medicine (Medical Jurisprudence and Toxicology) 2nd edition-2016, Avichal Publishing company (P) Ltd New Delhi-110002, page no-171
8. S.K.Singhal, Forensic medicine & jurisprudence 5<sup>th</sup> edition-2018, published by The National book depot Mumbai-400012, page no-139-140
9. Ajay Kumar, Text Book of Forensic medicine (Medical Jurisprudence and Toxicology) 2nd edition-2016, Avichal Publishing company (P) Ltd New Delhi-110002, page no-171.
10. S.K.Singhal, Forensic medicine & jurisprudence 5<sup>th</sup> edition-2018, published by The National book depot Mumbai-400012, page no-139-140
11. K.S. Narayan Reddy, The Essentials of Forensic Medicine and Toxicology 34th edition -2017, jaypee Brothers Medical Publisher (P) Ltd New Delhi-110002, page no-300.
12. Gautam Biswas , Review of Forensic Medicine and Toxicology 2nd edition, Jaypee Brothers Medical Publisher(P) Ltd New Delhi-110002, page no-157.
13. Rajesh Bardale, Principles of Forensic Medicine & Toxicology 2nd edition- 2017, Jaypee brothers Medical Publisher(P) Ltd New Delhi-110002, page no-308.
14. Prof. Rabindra Basu, Fundamentals of Forensic Medicine And Toxicology 2<sup>nd</sup> revised edition 2009, Books and allied (p) ltd Kolkata 700009, page no-252
15. Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology 17th reprint edition -2017, CBS pulisher & Distributors P. Ltd New Delhi-110002, page no-192-193.
16. Prof. Rabindra Basu, Fundamentals of Forensic Medicine And Toxicology 2<sup>nd</sup> revised edition 2009, Books and allied (p) ltd Kolkata 700009, page no-253
17. Ajay Kumar, Text Book of Forensic medicine (Medical Jurisprudence and Toxicology) 2nd edition-2016, Avichal Publishing company (P) Ltd New Delhi-110002, page no-174.
18. Rajesh Bardale, Principles of Forensic Medicine & Toxicology 2nd edition- 2017, Jaypee brothers Medical Publisher(P) Ltd New Delhi-110002, page no-312.
19. Jaising P Modi, Modi A Textbook of Medical Jurisprudence and Toxicology 26th edition-20, Lexis Nexis Publication Gurgaon-12202, Haryana, page no-290-291.

20. Krishan Vij textbook of forensic medicine and toxicology principles and practice, 5<sup>th</sup> edition 2011, Published by Elsevier, a division of Reed Elsevier India Private Limited, page no-145
  21. Ajay Kumar, Text Book of Forensic medicine (Medical Jurisprudence and Toxicology) 2nd edition-2016, Avichal Publishing company (P) Ltd New Delhi-110002, page no-175.
  22. Ajay Kumar, Text Book of Forensic medicine (Medical Jurisprudence and Toxicology) 2nd edition-2016, Avichal Publishing company (P) Ltd New Delhi-110002, page no-176.
  23. Nageshkumar G Rao, Textbook of Forensic Medicine and Toxicology 2nd edition 2010, Jaypee brothers Medical Publisher, page no-219
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