

Impact of Drowning on Liver Weight: A Forensic Analysis

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ABSTRACT

Introduction: Drowning is a form of asphyxial death where air enters the lungs due to submersion of the mouth and nostrils into water or other fluid medium. The study aims to determine the prevalence of drowning deaths in a specific region in relation to epidemiological factors such as age, sex, seasonal variation, and site of drowning.

Objectives: To determine effect of drowning on weight of liver.

Methods: All cases of alleged drowning deaths were included, excluding cases with damage or pathological condition of vital organs or cases with any other co-morbid causes. Liver was removed during postmortem and findings were analysed and compared with other studies on normal organ weights. Data was collected from drowning cases of adult population, from 1 Jan 2021 to 30 June 2022. Total number of cases are 54.

Results: The average mean weight of liver in the study was 1435.52 gm in males and 1263.70 gm in females.

Conclusion: No significant change in the weight of liver in drowning was found in the study.

Keywords: Autopsy; drowning; socio-demographic profile; organ weights.

1. INTRODUCTION

Drowning is a form of asphyxial death where air entering into the lungs is prevented due to submersion of the mouth and nostrils into water or any other fluid medium. The process of submersion does not require the whole body to be underwater. Submersion of nose and mouth is sufficient.[1]

The present study was undertaken to find out the prevalence of death due to drowning in this part of the country in relation to epidemiological factors such as age, sex, seasonal variation, and site of drowning and also to find out the importance of organ weights of lungs, liver, spleen and kidneys during post-mortem examination and for manner of death of such cases.

In physiology of drowning there can be two different events; immersion (when person's upper airways are above level of water) and submersion (when person's upper airways are below water level). In immersion there is involvement of integrated cardio respiratory response to deep body temperature and skin temperature which include physical incapacitation, cold shock and also hypovolemia and can be precursors of collapse and submersion. In physiology of submersion mechanisms involved are; fear of drowning, diving response, autonomic conflict, upper airway reflexes, water aspiration and emesis, swallowing and disturbances of electrolytes.[2]

Medico-legal requests for investigation of bodies recovered out of water comprise an important proportion and sometimes it becomes very difficult to ascertain the manner of death because though the diagnosis of drowning can appear straightforward

but reality is, that it is one of the most difficult diagnosis in forensic pathology. There is no universal agreement on what we can say is a case of drowning surely. Moreover with the increase in post mortem intervals there are associated art factual modifications from putrefaction and also from aquatic animal predation. So such condition creates and disguises injuries. Now sometimes because there are no path gnomonic pathological features at autopsy and potentially life threatening underlying organic illnesses presence can complicate determination of both the manner and cause of death. There can even be no autopsy findings to say that immersion had occurred. Signs of immersion will only demonstrate that the body was submerged for a period of time but these cannot be the perfect signs of drowning. Although we can say that froth around mouth and nostrils and lung distension are somewhat reliable. Even the diatom test has poor sensitivity and debate about its usefulness can be long because of the contamination issue and a negative diatom test also cannot rule out drowning.[1]

So the diagnosis is basically one of the exclusion because it is based largely on the history and investigative reports of the case. When the findings are negative during post-mortem examination of the body then the cause of death is given as “consistent with drowning” or even sometimes it is admitted that the cause of death “cannot be determined.”[1]

2. MATERIALS AND METHODS

All cases of alleged drowning deaths were included excluding cases with damage or pathological condition of vital organs or cases with any other co morbid causes. All cases were of fresh water antemortem drowning in in Patiala district of state of Punjab in north west India.

Liver was removed during postmortem and findings were analysed and compared with other studies on normal organ weights.

3. RESULTS& DISCUSSION

Table1: Liver weight in Grams of combined male and female deaths.

Liver weight(grams.)	Mean	SD	Median	Range
Liver	1403.70	206.93	1395.50	930-1871

Table showing the combined organ weights in both males and females; liver is 1403.70 with SD of 206.93, median of 1395.50 and range of 930-1871;

Table 2: Liver weight in comparison with Gender

Liver weight(gms)	Gender	N	Mean	Std. Deviation	Std. Error Mean	Lower 95% CI	Upper 95% CI	t-test	p value
Liver	Female	10	1263.700	243.044	76.857	-310.683	-32.962	2.483	0.016
	Male	44	1435.523	186.606	28.132				

Table showing mean weight of liver mean weight in males was 1435.523 gm and in females was 1263.7 gm.

ORGAN WEIGHTS

In order to compare the normal weights as a control the following normal organ weights at autopsy of 4 different studies were considered.

Table 3: Age with Gender wise distribution of drowning deaths.

Age Group (Years)	Patients	Percentage
18-27 Years	21	38.89%
28-37 Years	12	22.22%
38-47 Years	13	24.07%
48-57 Years	6	11.11%
58-67 Years	2	3.70%

Total	54	100%
Mean±SD	34.19±12.08	
Median	32.00	
Range	18-66	

Table 4: Comparison of Liver weight of average weight in Males in other similar studies

Liver Weight (grams.)	UTK [3] (25-55 yrs)	PGI [4] (21-50 yrs)	SouthKerala[5] (18-98 yrs)	Molina &DiMaio[6] (16-35 yrs)
Liver	1490.34 (860-2990)	1543.31 (835-2032)	1356.99 (116-2822)	1561 (838-2584)

Table 5: Comparison of Liver weight of average weight in Females in other similar studies

Liver Weight (grams.)	UTK[3] (25-45 yrs)	PGI[4] (21-50 yrs)	South Kerala[5] (18-95 yrs)	Molina &DiMaio[7] (18-25 yrs)
Liver	1295 (800-1920)	1341.94 (801-1720)	1171.78 (550-2880)	1288 (775-2395)

Comparison of Liver weight of average weight of 4 studies with organ weights found in this study.

Table 6: Comparison of Liver weight of average weight in Males in other similar studies of antemortem drowning and present study

Liver Weight (grams.)	Avg. Weight of liver in four similar Studies	Avg. Weight of liver in Present Study
Liver	1487.91	1435.52

Table 7. Comparison of Liver weight of average weight in Females in other similar studies of antemortem drowning and present study

Liver Weight (grams.)	Avg. Weight of liver in four similar Studies	Avg. Weight of liver in present Study
Liver	1274.18	1263.70

Average weight of four studies combined were compared with average Liver weightof my study in males as well as females. Liver weight- in our study average mean weight of liver is 1435.52 gm in males with standard deviation of 186.6 and 1263.70 gm in females with standard deviation of 243.044.

In study conducted in Uttarakhand(UTK) of India in 2022[3] on organ weights found average Liver weightof liver at autopsy to be 1490.34gm(3.7%↑) in males and 1295 gm(2.44%↑)in females.

In study conducted in Kerala in 2021[5] on organ weights shows average Liver weightof liver at autopsy to be 1356.99 (5.6%↓) in males and 1171.78 gm(7.5%↓) in females.

In study of organ weights at autopsy in PGI (post graduate institute) Chandigarh in 2004[4] between age 21 to 50 years found mean weight of liver to be 1543.31gm(7.2%↑) in males and1341.94 gm (6%↑)in females.

In study of normal organ weights at autopsy conducted in USA in 2012[6] and 2015[7]found mean weight of liver to be 1561 gm(8.31%↑)in males and1288 gm(1.9%↑) in females.

Average mean weight of these four studies comes out to be 1487.91gm (↓3.5%) in males and 1274.18gm(↓0.8%) in females. So it was seen that there was no significant change in the weight of liver in drowning. Similar results were seen in studies conducted at Germany 1994 [8] and USA in 2003 [9].

4. CONCLUSION

There was no significant change in Liver weight of liver due to drowning.

CONFLICT OF INTEREST: None to declare

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