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Variations In Lung Weight as An Indicator in Drowning Deaths

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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 fluid medium. It is a leading cause of unintentional deaths, particularly in rivers and canals. The chances of drowning increase with time spent near water bodies and the distance of water bodies from the person's residence.

Objectives: To determine effect of drowning on the weight of lungs.

Methods: Data was collected from drowning cases of adult population which met our inclusion criteria from 1 Jan 2021 to 30 June 2022. Total number of cases are 54.

Result: Average weight of four studies on normal organ weight at autopsy it was found that there was a increase of 4.78% and 10.8% in weight of right and left lung respectively in males. In females there was increase of 11.5% in weight of right lung and 18.72% increase in weight of left lung.

Conclusion: Weight of lungs increased in cases of drowning.

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]

Drowning is one of the leading causes of unintentional deaths, and rivers and canals are common location for drowning in this region.There is very little knowledge about preventing river drowning deaths, unlike specific prevention efforts given in other locations (home, swimming pools, ponds).[2]

It is seen that more the person spends time near water bodies, more are the chances of drowning.[3]Also it is seen that the chances of drowning are directly related to the distance of water bodies from residence of the person.[4]

It is seen from various different studies in the past that a large number of drowning deaths are of suicidal or accidentalin nature but a smaller but still significant number is also homicidal drowning or the post mortem drowning after homicide.

Lungs-

In fresh water:Lungs are ballooned up, oedematous, doughy, heavy, spongy and voluminous completely covering the pericardial sac. This is known as ballooning of lungs.In case of dry drowning, such changes are not seen and usually non-specific signs of asphyxia are present.

2. MATERIALS AND METHODS

All cases of alleged drowning deaths were included excluding **c**ases 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 Patiala district of state of Punjab in north west India.

Lungs were removed during postmortem and findings were analyzed and compared with other studies on normal organ weights.

3. RESULTS& DISCUSSION

Table 1: Age distribution of drowning cases brought for autopsy.

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 2: Lungs Weight in Grams of combined male and female deaths.

Lungs Weight (grams.)	**Mean**	**SD**	**Median**	**Range**
Lung (Rt)	518.06	84.63	511.50	290-702
Lung (Lt)	496.70	83.23	500.50	295-690

Table showing the combined organ weights in both males and females; right lung is having mean weight of 518.06 gm with SD of 84.63, median of 511.50 and range of 290-702, of left lung is 496.70 with SD of 83.23, median of 500.50 and range of 295-690;

Table 3: Lungs Weight comparison with Gender

Lungs Weight (gms)	**Gender**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**Lower 95% CI**	**Upper 95% CI**	**t-test**	**p value**
Lung (Rt)	Female	10	438.100	88.514	27.991	-151.626	-44.629	3.681	0.001
	Male	44	536.227	73.239	11.041				
Lung (Lt)	Female	10	425.100	85.021	26.886	-141.649	-34.106	3.279	0.002
	Male	44	512.977	74.583	11.244				

Table showing mean weight of right lung in males was 536.227 gm with SD of 73.239and std. error mean of 11.041 and in females was 438.1 gm, weight of left lung in males was 512.977 gm while in females was 425.1 gm

Lungs Weight

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

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

Lungs Weight (grams.)	**UTK** [6] **(25-55 yrs)**	**PGI** [7] **(21-50 yrs)**	**South Kerala**[8] **(18-98 yrs)**	**Molina &DiMaio**[9] **(16-35 yrs)**
Lung (Rt)	511.14 (120-1270)	603.34 (210-835)	484.41 (110-1400)	445 (185-967)
Lung (Lt)	476.6 (120-1080)	545 (180-810)	425.09 (83-1426)	395 (186-885)

Table 5: Comparison of average weight of lungs in Female in other similar studies

Lungs Weight (grams.)	**UTK**[6] **(25-45 yrs)**	**PGI**[7] **(21-50 yrs)**	**South Kerala**[8] **(18-95 yrs)**	**Molina &DiMaio**[10] **(18-25 yrs)**
Lung (Rt)	423.5 (160-650)	451.91 (210-890)	346.05 (98-992)	340 (142-835)
Lung (Lft)	386.9 (100-730)	419.92 (200-860)	303.43 (22-760)	299 (108-736)

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

Table 6: Comparison of organ weight of average weight of lungs in Males in other similar studies and present study

Lungs Weight (grams.)	**Avg. Weight of lung in four similar Studies**	**Avg. Weight of lung in Present Study**
Lung (Rt)	510.97	536.23
Lung (Lt)	460.42	512.98

Table 7. Comparison of average weight of lungs in Females in other similar studies and present study

Lungs Weight (grams.)	**Avg. Weight of lung in four similar lung Studies**	**Avg. Weight of lung in Present Study**
Lung (Rt)	390.37	438.10
Lung (Lt)	352.31	425.10

Average weight of four studies combined were compared with average organ weight of my study in males as well as females.

Weight of Lungs;

Right- in this study average mean weight of right lung is 536.227gm in males with standard deviation of 73.279 and 438.1gm in females with standard deviation of 88.514.

In study conducted in Uttarakhand(UTK) of India in 2022[6] on normal organ weights showed average organ weight of right lung at autopsy to be 499.4 gm(4.68%↓) in males with standard deviation of 207.5 and 459.6 gm(4.79%↓) in females with standard deviation of179.19.

In study conducted in Kerala in 2021[8] on organ weights showed average organ weight of right lung at autopsy to be 484.41gm(6.66%↓) in males and 346.05 gm(15.07%↓) in females.

In study of organ weights at autopsy in PGI (post graduate institute) Chandigarh in 2004[7] between age 21 to 50 years found mean weight of right lung to be↑603.34 gm(11.77%↑) in males with standard deviation of 114.1 and 451.91gm(3.1%↓) in females with standard deviation of 76.3gm.

In study of normal organ weights at autopsy in USA in 2012[9] and 2015[10] found mean weight of right lung to be 445gm(18.59%↓) in males 340gm(25.1%↓) in females.

Left lung- in our study average mean weight of left lung is 512.77 in males with standard deviation of 74.5 and 425.1 in females with standard deviation of 85.02.

In study conducted in Uttarakhand of Indiain 2022[6] on organ weights showed average organ weight of left lung at autopsy to be 476.6gm(7.31%↓) in males and 386.9gm(9.4%↓) in females.

In study conducted in Keralain 2021[8] on organ weights showed average organ weight of left lung at autopsy to be 425.09 gm(18.6%↓) in males and 303.43(33.4%↓) gm in females.

In study of organ weights at autopsy in PGI Chandigarh in 2004[7] between age 21 to 50 years found mean weight of left lung to be 545gm(6%↑) in males and 419.92gm(1.2%↓) in females.

In study of organ weights at autopsy in USA in 2012[9] and 2015[10]found mean weight of left lung to be 395gm(25.9%↓) in males and 299 gm(34.8%↓) in females.

After taking the average weight of these four studies on normal organ weight at autopsy it comes out to be 510.97 for right lung which is lower than 536 gm(↑4.78%) found in our study and 460.42 for left lung against 512.98gm(↑10.8%) found in our study in males and in females there was increase of 11.5% in weight of right lung and 18.72% increase in weight of left lung in my study.

Weight of lungs of males in our study was found to be less than the study conducted at Chandigarh in 2004[7] but was significantly more than other three studies. Possible reason behind this can be that organ weight on autopsy also depends on race, age and socioeconomic factors. As most of the people in our study are from poor backgrounds and a significant portion are also suffering from mental or physical conditions like depression or alcoholism so it can be the reason behind low organ weight seen in our study from study done at Chandigarh. Also Chandigarh is covering a large part of northern India including Punjab, Haryana, Rajasthan and union territories of Jammu and Kashmir. So people from different regions are coming here which can be the possible reason behind increased weight lungs found in their study.

Study conducted in USA in 1985 [11], Denmark in 1991 [12], USA in 1995 [13],USA in 2003 [14], in Tokyo 2009 [15], India in 2015 [16], Spain in 2014[17] and USA in 2018[18] all reported higher lung weight in drowning than other causes of death.

4. CONCLUSION

After the completion of this study it was evident that, Weight of lungs increased in cases of drowning. Average weight of other four similar studies on normal weight of lung at autopsy was found to have a increase of 4.78% and 10.8% in right and left lung respectively, in males. In females, there was increase of 11.5% in weight of right lung and 18.72% increase in weight of left lung in this study.

CONFLICT OF INTEREST: None to declare

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REFERENCES

[1] Armstrong EJ, Erskine KL. Investigation of Drowning Deaths: A Practical Review. Acad Forensic Pathol. 2018 Mar;8(1):8–43.

[2] Peden AE, Franklin RC, Leggat PA. Fatal river drowning: the identification of research gaps through a systematic literature review. Inj Prev J Int Soc Child Adolesc Inj Prev. 2016 Jun;22(3):202–9.

[3] Handley AJ. Drowning. BMJ. 2014 Apr 16;348:1734–40.

[4] Gorea R. Prevention of Drowning and its Societal Implications. J Indian Acad Forensic Med 2005 274 240 ISSN 0971. 2005 Jan 1;27:240–5.

[5] Bierens JJLM, Lunetta P, Tipton M, Warner DS. Physiology Of Drowning: A Review. Physiol Bethesda Md. 2016 Mar;31(2):147–66.

[6] Vaibhav V, Meshram R, Shukla P, Kalonia T, Bhute A. A Preliminary Study of Organ Weight After Histological Exclusion of Abnormality During Autopsy in the Adult Population of Uttarakhand, India. Cureus.

2022 Jul 19;14:245–51.

[7] Singh D, Bansal Y, Sreenivas M, Pandey AN, Tyagi S. Weights of human organs at autopsy in chandigarh zone of north-west india. J Indian Acad Forensic Med. 2004 Jul 1;26(3):97–9.

[8] Autopsy Study of Organ Weights in a Tertiary Care Centre in Kerala. Indian J Forensic Med Toxicol. 2021 Apr 13;1123–30.

[9] Molina DK, DiMaio VJM. Normal organ weights in men: part II-the brain, lungs, liver, spleen, and kidneys. Am J Forensic Med Pathol. 2012 Dec;33(4):368–72.

[10] Molina DK, DiMaio VJM. Normal Organ Weights in Women: Part II-The Brain, Lungs, Liver, Spleen, and Kidneys. Am J Forensic Med Pathol. 2015 Sep;36(3):182–7.

[11] An assessment of lung weights in drowning cases. The Metro Dade County experience from 1978 to 1982. Am J Forensic Med Pathol. 1985 Dec;6(4):301–4.

[12] Kringsholm B, Filskov A, Kock K. Autopsied cases of drowning in Denmark 1987-1989. Forensic Sci Int. 1991 Dec;52(1):85–92.

[13] Morild I. Pleural effusion in drowning. Am J Forensic Med Pathol. 1995 Sep;16(3):253–6.

[14] Hadley JA, Fowler DR. Organ weight effects of drowning and asphyxiation on the lungs, liver, brain, heart, kidneys, and spleen. Forensic Sci Int. 2003 Nov 26;137(2–3):239–46.

[15] Chen JH, Quan L, Ishikawa T, Michiue T, Wang Q, Zhu BL, et al. Postmortem lung weight with regard to survival time. Leg Med Tokyo Jpn. 2009 Apr;11 Suppl 1:238–40.

[16] Chidanand C, Satish K. Study of Incidence of Middle Ear Hemorrhage in Drowning. J Evid Based Med Healthc. 2015 Feb 1;2(6):621–8.

[17] Rubio L, Cazorla F, Gaitán M, Ramos V, Santos I. Influence of postmortem findings on lung weight of drowning victims. Romanian J Leg Med. 2014 Jun 2;22:89–96.

[18] Tse R, Garland J, Kesha K, Morrow P, Lam L, Elstub H, et al. The Potential Diagnostic Accuracy of Autopsy Lung Weights, Lung-Heart Ratio, and Lung-Body Ratio in Drowning Deaths. Am J Forensic Med Pathol. 2018 Sep;39(3):223–8.