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A STUDY ON THE PATTERNS OF INJURY IN DROWNING CASES BROUGHT FOR MEDICO-LEGAL AUTOPSY

Forensic Medicine

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ABSTRACT

Drowning is a form of asphyxia due to aspiration of fluid into air passages caused by submersion in water or other fluid. Drowning is classified as Wet, Typical, Primary drowning, Dry drowning, Secondary drowning and Immersion syndrome [1] or Fresh water and Sea water drowning [2] Death may occur due to cerebral hypoxia and circulatory failure in fresh water drowning, hyperkalaemia and hypervolaemia leading to ventricular fibrillation in sea water drowning, vagal inhibition in dry drowning etc. [3] However fatal injuries may also be sustained at the time of drowning depending on the place of drowning, struggle to survive, medium of drowning, circumstances preceding fall in the fluid medium etc and accordingly various patterns of injuries may be encountered which may consequently lead to death. [2,4]. With a view to investigate these masked fatal injuries a study was conducted in the Deptt. of Forensic Medicine, Gauhati Medical College for a period of 1 year. In our study we found that 125 cases were deaths due to drowning and out of 81 selected cases, in 21 cases (25.93%), injuries were detected. In the 30-39 age group there were highest 8(9.87%) injury cases. Out of the 21 injury cases, most occurred in running water and were typical drowning. Head injuries were most common. A meticulous procedure should be undertaken to unearth these associated injuries which amplify the burden of fatalities and blur the actual cause of death.

KEYWORDS

Drowning, asphyxia, injury, prevention.

INTRODUCTION

India is a large country having plenty of water bodies both natural and artificial and an extensive seacoast line 7,517 km. Death due to drowning is a frequent event and on the rise every year, which require medico-legal expertise of the highest standard. Deaths due to drowning is a serious issue plaguing the modern society, but is often neglected. Asphyxia is the most common mode of death in drowning. According to World Health Organisation, drowning is the 3rd leading cause of unintentional injuries causing deaths worldwide, accounting for 7% of all injury-related deaths. There are an estimated 3,60,000 annual drowning deaths worldwide [1] In majority cases water gets into the lungs and is churned up with air and mucus producing a fine froth which blocks the air vesicles resulting in anoxia and consequent asphyxia. Visiting the crime scene and collection of sample has their own significance which reveals hidden facts. The mere finding a dead body in water does not meant that, death was caused by drowning. Drowning can be accidental, suicidal and homicidal and accordingly injuries may vary - simple or grievous, natural or artificial, ante-mortem as well as post-mortem. Floods, tsunami and uncovered sewage drains also play a significant role. Injuries sustained in drowning can be from traffic incidents, homicidal assaults, fall on underneath rocks, marine and solid objects. After immersion, body may be dragged along the bottom causing injuries. Accidental drowning in shallow water can occur in intoxicated, insane or epileptic individuals.[2]

According to National Crime Records Bureau (NCRB) 2014 India, the total number of accidental deaths by drowning in India was 29,903 and 498 in Assam. [4] The global burden and death from drowning is found in all countries, however 91% of unintentional drowning deaths occur in low and middle-income countries. According to WHO over half of the world's drowning deaths occur in South-East Asia. Both China and India have particularly high drowning mortality rates and together contribute 43% of all drowning deaths worldwide. Because of increasing incidence of drowning, it is therefore necessary to evaluate all possible aspects including cause of death following fatal injuries which may help in reducing the human death toll.

AIMS AND OBJECTIVES

1. To determine the types of injuries commonly encountered in deaths due to drowning.
2. To determine the sites on the body where injuries are commonly sustained.
3. To detect patterns of underlying injuries and formulate effective measures to prevent such occurrences.

MATERIALS AND METHODS

The cross-sectional study was conducted on 125 cases of death due to drowning out of a total of 3,136 cases brought for medico-legal autopsy to the Mortuary of Deptt. of Forensic Medicine, Gauhati Medical College and Hospital, within a span of one year (1st August 2016 to 31st July 2017). The data was collected in proforma from autopsies, interviews of accompanying attendants and police, which were subsequently analysed and represented in the form of tables, graphs and charts.

Inclusion criteria

Cases of typical fresh water drowning were included in the study.

Exclusion criteria

Decomposed cases and cases autopsied after 36 hours were excluded from the study.

Ethical clearance

Taken from institutional ethical committee

Source of funding

Self

Conflict of interest

Nil

RESULTS AND OBSERVATION

During the period of 1st August 2016 to 31st July 2017, a total of 3,136 autopsies were conducted in the Mortuary of the Department of Forensic Medicine, Gauhati Medical College and Hospital out of which 125 (3.98%) cases were deaths due to drowning and 81 were selected for study following inclusion and exclusion criteria. Most of the victims were male with a total of 61 cases (75.31%) and only 20 females (24.69%). Maximum 21 (25.92%) cases were in the age group between 10-19 years. Out of the total, in 21 cases (25.93%), injuries were detected - 20 males (24.69%) and 1 female (1.24%). In the 30-39 age group there were 8 (9.87%) injury cases followed by 50 years or above **(Table 1).** Out of the 21 injury cases, most occurred in running water and were typical drowning. **(Table 2).** Maximum number of deaths occurred during summer season 31 (38.27%), followed by spring – 21(25.93%) cases, however injuries were mostly detected in cases which occurred during winter. **(Fig 1)** Asphyxia was the most common mode of death in 79 cases. All injuries were related to running fresh water drowning. Anatomical breakup of injury site shows that most injuries occurred in head part in both running and stagnant waters **(Table 3).**

Table 1

Age group (yrs)	Numbers		Total No. (M+F)	Total % (M+F)	Cases of Injuries
	Male	Female			
0-9	6	5	11	13.57	1

10-19	14	7	21	25.92	2
20-29	10	1	11	13.59	3
30-39	14	3	17	20.98	8
40-49	3	2	5	6.18	1
>50	14	2	16	19.76	6
Total	61	20	81	100	21

Table 2

Injuries	Site		Type		Locality		
	Running water	Stagnant water	Typical	Atypical	Urban	Rural	Unknown
Present	15	6	21	0	2	17	2
Total	21		21		21		

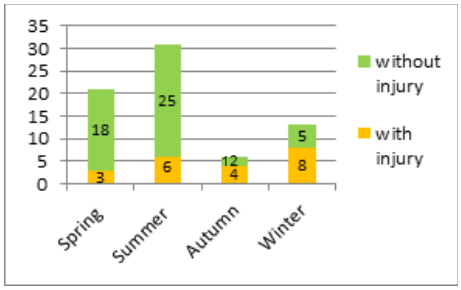

Fig 1

Table 3

Type of injuries	Running Water					Stagnant Water				
	Head	Face	Trunk	Upper limb	Lower limb	Head	Face	Trunk	Upper limb	Lower limb
Abrasion	3	2	2	2	3	1	0	1	3	1
Laceration	0	1	0	0	1	3	0	0	0	0
Contusion	4	0	0	0	0	0	0	0	0	1
Cerebral haemorrhage	1	0	0	0	0	0	0	0	0	0
Total	8	3	2	2	4	4	0	1	3	2
Grand total	19					10				

DISCUSSION

The present study has been compared with similar studies carried out by different authors in different parts of the world. The comparison has been done in order to bring out similarity and variation of findings of the observation. During study, a total of 3,136 medico-legal autopsies were performed, out of which, 125 (3.98%) cases were found to be death due to drowning.es, an increase in Assam compared to earlier study done by **Gupta VP (2014),** which shows only 64 cases of death sue to drowning [5], it is also similar to study done by **Chaurasia N et al [6].** But it differs from of **Rao G.S.R.K.G.R [7]** and **Bose et al [8]** The reason for variation in the incidence of drowning in different parts may be due to different availability and accessibility to water resources. Males were higher in number both in terms of injuries and deaths which are consistent with the findings of **Nayak G H [9]** and **Kanchan T [10].** Males are more prone to it because of work place related incidents like fishing. The p value is 0.0170; this is Fisher's exact score which shows sex distribution is significantly associated. Drowning cases was maximum in the age group between 10-19 years but most of the injuries were found in 30-39 age group similar with **Clemens T et al [11]** but varies from **Rao G.S.R.K.G.R [7]** This may be due to erratic , unsupervised and hyperactive nature to explore new avenues. Majority of the incidents and associated injuries occurred in running water followed by stagnant water. Fresh water drowning constituted most cases including injuries. The p value is 1 which is not significant. This finding is consistent with the finding of **Bose et al [8]** and **Kanchan T [10].** Easy access to fresh water streams and lakes and geographical distance from salt water bodies gave the resultant outcome. In our study we found that maximum cases occurred during summer season which corresponds to rainy season similar to the findings of **Pal S K et al [12]** and **Turgut A [13],** P value was 0.0130 and Degree of freedom 3 which are significantly associated, but most injuries occurred during winter season when the water levels go down significantly exposing the rock beds. The injuries described in our study were similar to the findings of **He S et al [14], Hwang V et al [15], Bich TH [16]** and **Reddy KSN et al [17].** Injuries may occur before falling or being thrown into the water (head injuries etc) and also while falling against objects above water like bridge, piers, walls or under water like rocks, broken objects etc. however in our study Asphyxia was the mode of death in 79 cases (97.53%) followed by cerebral oedema 2 cases similar to **Singh A et al [18]** and **Seleye-Fubara D et al [19].**

CONCLUSION

Drowning is a common form of death in Assam and systemic analysis reveals different injury pattern that may be encountered during drowning which at times may alter opinion regarding cause of death in drowning. The type and site of injury are necessary to correlate autopsy findings and mechanism of death in drowning. Any gross inconsistencies in this regard may create doubt or foul play or suspicious death. A well planned programme and counselling centres should be established to give proper guidance to victims and identify the suicidal factors hence preventing such death. Swimming should be made compulsory in schools, adult supervision should be mandatory in case of young swimmers, rescue equipments and teams should be on alert, emergency information numbers should be advertised regularly, signage and markings should be properly highlighted in prone areas, proper fencing should be installed and mock flood drills should be exercised by the local administration from time to time.

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