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RESEARCH ARTICLE

DEATHS DUE TO DROWNING

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ABSTRACT

Background: in india drowning is one of the most common cause of death and it is mostly related to plenty of water resources from rivers, ponds, wells and extensive sea coast. **Aim:** to study death related to drowning. **Materials and methods:** this is a retrospective study of death due to drowning which underwent postmortem from 2008-2018 in department of Forensic medicine, Al Ameen medical college Bijapur, Karnataka. **Results:** Drowning deaths were predominantly seen in males (70%) followed by females (30%)with male to female ratio 2.33:1. Most common age group involved is 21-30 years(30%) followed by 31-40 years (20%). Most of the victims are married (48%) followed by unmarried(30%). Maximum number of deaths due to drowning has occurred in rural area (58%) followed by urban area (42%). Most of the victims are students (16%). Most of the victims belong to Hindu community(62%) followed by muslim community(20%). Most of the victims belong to upper lower class (36%) followed by lower calss (22%). Familial and Financial problem (22%) is the most common cause followed by Chronic alcoholism (20%). Lake (42%) is the most common place of occurrence. Most of the cases (92%) are showing positive result for some diatoms in bone marrow and sample water. In 6% cases, sample water only and 2% cases showing no diatoms in bone marrow and sample water. **Conclusion:** Deaths due to drowning is commonly observed in males in younger age group, married people, students followed by farmers and mostly people from rural population having familial and financial problems were commonly observed victims.

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INTRODUCTION

In death due to mechanical asphyxia, drowning occupies the first place in the competition with hanging (Ranga Rao, 2014) WHO had adopted the new definition in the year 2002 as, "drowning is the process of experiencing respiratory impairment from submersion or immersion in liquid (Laxman Gangadhar, 2018). The term drowning should be used to denote the process resulting from submersion in water in which, there is loss of consciousness and a threat of life (Reddy, 1998; Franklin, 1988). Drowning occurs when an individual is unable to remain float in water. Complete submersion is not necessary. Submersion of nose and mouth alone for a sufficient period can cause death from drowning (Ranga Rao, 2014). According to WHO it is one of the top five causes of death in children aged between 1 and 14 years and one of the ten leading causes of death in children and young people aged between 1 and 24 years. Rate of drowning is 82 cases per day in india. According to NCRB data 2014(National crime records Bureau), this was 2nd most common cause of unnatural death after RTA (Laxman Gangadhar, 2018). The autopsy diagnosis of death by drowning can be one of the most difficult problems in forensic pathology because in our Indian set up the time required to complete the inquest formalities and transport of the body to the mortuary is enough to cause the decomposition which masks the most of the postmortem evidences of cause of death (Ranga Rao, 2014). Here we are presenting our experiences regarding autopsies of death due to drowning.

MATERIALS AND METHODS

This is a Retrospective study of 100 cases of death due to drowning which underwent postmortem from 2008-2018 in Department of Forensic Medicine, Al Ameen Medical College, Bijapur, Karnataka.

Detailed history and relevant information was collected from police inquest and requisition(panchnama) regarding the age, sex, address, Marital status, mental status, occupation, education, religion, supposed cause of and eye witness of incidence, etc., and if the relatives were present at the time of postmortem examination, necessary information was collected regarding the personal, mental and behavioural aspect.

RESULTS

Table 1. Distribution of cases according to Gender of victims

Gender	Number	Percentage
Male	35	70%
Female	15	30%
Total	50	100%

In our study the drowning death was most predominantly seen in male i.e., 35 cases(70%) followed by the females 15 cases (30%) with male to female ratio 2.33:1

Table 2. Distribution of cases according to Age group

Age	Number	Percentage
0-10	3	6%
11-20	5	10%
21-30	15	30%
31-40	10	20%
41-50	9	18%
51-60	4	8%
61-70	3	6%
>70	1	2%
Total	50	100%

In the present study drowning deaths were commonly seen in the age groups of 21-30 years(30%) 15 cases were seen, followed by 10 cases in 31-40 (20%), then 9 cases in 41-50(18%).

Table 3. Distribution according to Marital status of victims

Marital status	Number	Percentage
Married	24	48%
Unmarried	15	30%
Widowed	3	6%
Not known	8	16%
Total	50	100%

As per the marital status 24 cases(48%) victims are married and 15 cases(30%) are unmarried, 3 cases(6%) are widowed and 8 cases(16%) the marital status is not known.

Table 4. Distribution of cases according to Region of occurrence of death due to drowning

Region	Number	Percentage
Rural	29	58%
Urban	21	42%
Total	50	100%

Maximum number of deaths due to drowning has occured in the rural area i.e., 29 cases (58%) followed by urban area i.e., 21 cases (42%).

Table 5. Distribution of cases according to Occupation of victims

Occupation	Number	Percentage
Student	10	20%
Farmer	8	16%
Labourer	5	10%
Service	4	8%
Housewife	4	8%
Business	3	6%
Not working	9	18%
Not known	7	14%
Total	50	100%

In our study most of the victims of drowning are students i.e., 10 cases (20%) followed by the non-working victims i.e., 9 cases (18%), farmers in 8 cases(16%), labourer in 5 cases(10%) and 7 cases(14%) of victims occupation is not known.

Table 6. Distribution of cases according to Religion of victims

Religion	Number	Percentage
Hindu	31	62%
Muslim	10	20%
Christian	3	6%
Buddhism	2	4%
Not known	4	8%
Total	50	100%

In our study most of the victims are belonging to the hindu community i.e., 31 cases(62%) followed by muslims community i.e., 10 cases(20%) and 8% of victims i.e., 4 cases the religion is not known.

Table 7. Distribution of cases according to Socioeconomic status

Socioeconomic status	Number	Percentage
Upper class	3	6%
Upper middle class	5	10%
Lower middle class	7	14%
Upper lower class	18	36%
Lower class	11	22%
Not known	6	12%
Total	50	100%

Depending on socioeconomic status most of the victims of drowning deaths belong to upper lower class i.e., 18 cases (36%), followed by lower class i.e., 11 cases(22%) and 6% of the victims of drowning death belong to upper class i.e., 3 cases.

Table 8. Distribution according to Personal history

Personal history	Number	Percentage
Financial and familial problem	11	22%
Depression	10	20%
Chronic alcoholism	9	18%
Chronic illness	8	16%
Psychiatric illness	4	8%
Failure in love	2	4%
Epilepsy	1	2%
Not known	5	10%
Total	50	100%

In our study 22% of victims i.e., 11 cases had a familial and financial problem. The second most commonest history associated with drowning death was depression seen in 10 cases i.e., 20%, followed by chronic alcoholism in 18% i.e. 9 cases and chronic illness in 16% i.e. 8 cases and 10%(5cases) family history was not known.

Table 9. Distribution according to Place of occurrence

Place	Number	Percentage
Lake	21	42%
Well	18	36%
River	4	8%
Pond	3	6%
Swimming pool	1	2%
Canal/gutter	1	2%
Water tank	1	2%
Water tub	1	2%
Total	50	100%

Most of the drowned victims were retrieved from lakes(42%) followed by well(36%), then river(8%) and pond(6%). Rarely the body was found in swimming pool, canal/gutter, water tank and water tub.

Table 10. Cases of drowning in respect to medium of immersion

Diatoms	Number	Percentage
Present in sample and bone marrow	46	92%
Present only in water samples	3	6%
Absent in sample and bone marrow	1	2%
Total	50	100%

In our study, out of 50 cases, 46 cases (92%) are showing positive result for some diatoms in bone marrow and sample water. In 3 cases (6%) sample water only showing positive results and 1 case (2%) showing no diatoms in bone marrow and sample water.

DISCUSSION

Among the drowning cases, most of the cases were seen in males i.e. 70% and 30% were seen in females, with male to female ratio 2.33:1. Study conducted by Ranga rao *et al* showed that among males most of the deaths were due to accidental while in females the cause was suicide. Amongst female victims the percentage of married are more. In the males no much difference between married and unmarried (Ranga Rao, 2014). Laxman *et al* observed 71.02% were females, 28.98% were females and male to female ratio was 2.45:1 (Laxman Gangadhar, 2018). In the present study, drowning deaths were commonly seen in the age groups of 21-30 years (30%) 15 cases were seen, followed by 10 cases in 31-40 (20%) then 9 cases in 41-50 (18%) (Laxman Gangadhar, 2018). These findings are consistent with that of Auer *et al*. (1990), Suresh *et al*. (2007), Quon *et al*. (2003). The probable reason behind preponderance of 21-30 years age group in drowning is carelessness and adventurous nature usually seen in youngsters while swimming or doing recreational activities in or around water source leading to accidental deaths. This is followed by the age group of 31-40 years, it may be due to familial and financial problems arising in life and their inability to deal with them (Laxman Gangadhar, 2018). Study conducted by ranga rao *et al* showed as the age advances the number of suicide cases goes up. Suicide and accident cases are almost equal in third decade (Ranga Rao, 2014). As per the marital status 24 cases(48%) victims are married and 15 cases(30%) are unmarried, 3 cases(6%) are widowed and 8 cases(16%) the marital status is not known. In a study conducted by Laxman *et al* 46.59% were married and 32.95% were unmarried (Franklin, 1988). It may be due to over exposure of married and working people in and around water sources leading to accidental deaths. Also they prefer to commit suicide by drowning due to inability to handle familial and financial problems. Maximum number of deaths due to drowning has occurred in the rural area i.e. 29 cases(58%) followed by urban areas i.e. 21 cases (42%). Similar observations were made by Delmonte and capelozzi *et al* (8) and murky *et al*. (2008). In our study most of the victims of drowning are students i.e. 20% followed by the non working victims i.e. 18%, farmers 16%, labourers 10% and 14%of victims occupation is not known. In a study conducted by Laxman *et al*, the most common victims of drowning deaths were the student, it may be due to carelessness and adventurous nature usually seen in youngsters while swimming or doing recreational activities in or around water source. This is followed by non working victims, then farmers the labourers. It is probably due to financial and familial problems. In our study most of the victims are belonging to the hindu community i.e. 62% followed by muslim community i.e. 20% and in 8% of victims, the religion is not known. Study conducted by Pathak and Mongalshowed that 90.69% of the victims of drowning deaths belong to Hindu community, followed by muslim community in 6.98% cases and sikh community in 2.33% cases. (Pathak, 2009). In our study most of the victims of drowning deaths belong to upper lower class i.e. 36% followed by lower class i.e. 22% and 6% of the victims of drowning death belong to upper class. Similar observation is made by Laxman *et al*. (2018). In our study, 22% victims had familial and financial problem. The second most commonest history associated with drowning death was depression seen in 20% cases followed by chronic alcoholism in 18%, chronic illness in 16% and 10% family history was not known. Our study is consistent with Dietz and Boker (Dietz, 1974). In a study conducted by Laxman *et al*, 21.02% of victims of drowning death had familial and financial problems. The second most common history associated with drowning death was depression seen in 20.45% cases. This is followed by chronic alcoholism in 18.18% cases and chronic illness in 17.61% cases. Male predominance was seen in almost all the associated history except psychiatric illness (7.38%) in which female (15.68%) outnumbered male (4%) in drowning death. (Laxman Gangadhar, 2018)

In our study, most of the victims were retrieved from lakes (42%), followed by well (36%), then river(8%) and pond(6%). Rarely the body was found in the swimming pool, canal/gutter, water tank and water tubs. In a study conducted by Laxman*et al*, shows that most of the drowned victims were retrieved from lake in 44.32% cases. This is followed by well in 34.66% cases, river in 8.52% cases, and pond in 5.68% cases (Laxman Gangadhar, 2018). In our study, 92% are showing positive result for some diatoms in bone marrow and sample water. In 6% cases sample water only showing positive results and 2% showing no diatoms in bone marrow and sample water. In cases of unknown and in advanced stage of decomposition, early signs of drowning on postmortem examination are marked and diatom test becomes the only means of knowing whether death was due to antemortem drowning or postmortem disposal. Study conducted by Ranga rao shows that 57.77% cases were found to be positive for diatoms in diatom analysis. Two water samples were negative for diatoms. These were found to be P.M disposals (Ranga Rao, 2014).

Summary and Conclusion

In above study we concluded that, male predominance seen in drowning deaths with highest incidence seen in third and fourth decades. Drowning deaths are most common in married people as compared to unmarried people. Drowning deaths are most common in rural region followed by urban region. Students are the most common victims of drowning deaths followed by non-working, farmers and labourers. Drowning deaths are most commonly found in the hindu community followed by muslims and Sikhs. Drowning deaths are most commonly found in upper lower class followed by lower class and upper class. Familial and financial problems is the most common history seen in drowning deaths followed by depression, chronic alcoholism and chronic illness. Lake is the most common place from where the bodies were retrieved

followed by well, river and pond. Most of the drowning deaths are showing positive results for some diatoms in bone marrow and sample water followed by sample water only and least cases showing no diatoms in bone marrow and sample water.

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