

Medicolegal Analysis of Fatal Drowning in Karachi: An Autopsy Based Study

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ABSTRACT

Background: Large numbers of people still drown even though swimming classes and safety measures are available in many countries. Morbidity and mortality associated with drowning is preventable, thereby an effort is made to develop awareness of risk factors in and around the water to prevent drowning. This autopsy based study is conducted to describe the frequency and socio-demographic factors of fatal drowning in Karachi, Pakistan.

Study Design: Autopsy-based descriptive cross-sectional study

Place and Duration of Study: Mortuaries of Jinnah Postgraduate Medical Center, Civil Hospital and AbbasiShaheed Hospital Karachi from 1st January 2013 to 31st December 2018

Methodology: A total of 13,864 autopsies were conducted during the autopsy period, out of which details of drowning death were collected. The demographic information like age, gender, year-wise distribution of cases, season of the year, time and day of the week were recorded. The police papers and crime scene reports were also collected to confirm the case as drowning.

Results: Prevalence rate of drowning was 0.76% as 106 cases out of 13, 864 autopsies were identified to be the victims of drowning. There were 88(83.01 %) males and 18(16.98%) females. Male's predominance was seen in all range of ages. Mean age was 30.08±15.81. Half of the victims belong to the age group 21 to 40 year of age. Most frequent day was Monday and summer was the season of peak incidents of drowning. Mostly the dead bodies were brought at night.

Conclusions: Young males are the main victims of fatal drowning which guides the government and policy makers to develop preventive countermeasures for the target population. Summer in Karachi is the time when people visit beaches requiring strict surveillance and employment of additional lifeguards.

Key Words: Drowning, Morbidity, Mortality, Summer season

INTRODUCTION

Although preventable and in spite of adopting a number of safety measures, large number of death results from drowning every year and ranks it among the top three causes of death resulting from the injuries in most of the countries. The global mortality rate of drowning is estimated to be 6.8/100,000, resulting in approximately 400,000 deaths annually.¹ Studies have reported variable pattern of mortality due to drowning across the population. Accidental drowning is inevitably preventable requiring data of circumstances of drowning for the various agencies to develop an effective preventive plan.² A number of factors including low-socioeconomic status, alcohol use, illiteracy, pre-existing illnesses and energetic children and youth without supervision are contributing factors of drowning.³

Pakistan with a population of 184 million has been ranked sixth most populous country and a major contributor, in the South Asian region of death due to drowning, the rate being 6.54 deaths per 100,000 population⁴. Pakistan along with the Bangladesh is considered as country where the drowning is a major public health problem and leading cause of unintentional injuries among the children.^{5,6} Floods which frequently occur in both of these countries with the extreme weather and

changing climate are another major factor in Pakistan resulting in death toll due to drowning. Global estimate is an underestimation of unintentional drowning death because it excludes the flood related drowning deaths.⁷

Although the fatality associated with drowning is almost two thirds compared to deaths resulting from malnutrition and over half of that resulting from malaria, it is the most neglected public health challenge. For this catastrophe no effective and preventive measures or safety plans are developed yet now. Karachi, the populous city has emerged as one of the most significant geographical cities of Pakistan with the Arabian Sea beaches lining its coastline. Customarily citizens of Karachi use to go on beaches in summer season. This is the season when the heavy rains occur and sea is aggressive posing greater risk to the people visiting beaches to seek relief from heat resulting in drowning incidences.⁸ It must be remembered that there is no time of the day and weather fixed for the drowning to occur. It may take place year around and any time of day and night but peaks in summer season. One must realize that recovering the body from the water is not an indication that the victim died of drowning. The person may have died of natural cause or injury before falling into the water or within the water. The pathological diagnosis of

drowning is therefore not only difficult but impossible in all of these cases.⁹

To rule out all these possibilities a complete history, autopsy and circumstantial evidence is necessary. Development of water safety measures and training of life savers and lifeguards is one aspect where improvement may reduce the drowning incidences in situations particularly of accidental cases. This study is therefore aimed to find out the magnitude and some epidemiological aspect of drowning deaths in Karachi by analyzing the medicolegal autopsy reports of six years. The study mainly emphasize to develop prevention program which might include public awareness campaign for risk factors of drowning and educating people about safety measures for swimming at sea beside training of lifeguards and life savers.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted on 106 cases of drowning deaths autopsied in three major public sector hospitals i.e. Jinnah Postgraduate Medical Center, Civil Hospital and Abbasi Shaheed Hospital of Karachi during the period from 1st January 2013 to 31st December 2018. The autopsy reports of the said duration were scrutinized and data was collected for the autopsies conducted on death due to drowning. Information of variables like time, day, season, year and location of drowning, year-wise distribution of cases and reported police station besides age and gender from autopsy reports were recorded. We included those cases in which death was attributed due to mechanical interference of process of respiration leading to asphyxia as a result of drowning. The cases of death due to drowning were diagnosed by the history of accompanying personals and police papers and confirmed by performing complete autopsy. All medical and those medico legal cases in which death was due to causes other than drowning or in which the autopsy was refused or dead body returned to relatives or attendant without performing full and proper autopsy were excluded. The data was entered and analyzed through SPSS-20. Chi square and independent sample t test was used to compare categorical and continuous variables across the two groups respectively. A p-value less than 0.05 were considered statistically significant.

RESULTS

One hundred and six cases were identified to be due to drowning, making the prevalence rate 0.76%. A step wise reduction in unnatural deaths with comparative increase in the prevalence rate of drowning death has been noted from 2013 through 2018(Table 1).There were 88(83.01%) males and 18(16.98%) females, with a male to female ratio of 4.9:1. Mean age was 30.08±15.81. Nearly half of the victims of drowning belong to the young age group ranging from 21 to 40 years of age. Females of age range 31 to 40 years contributed significantly but did not exceed males in any of the age group (Table 2).

Most of the victims were brought to the mortuary at night followed by evening and afternoon mostly on week days compared to weekends and public holidays Monday was the most frequent day of drowning. Among the seasons summer was the most favored when the peak

incidences of drowning took place (Table 3).An initial rise of fatalities due to drowning was observed in the year 2014 and then in 2017. In the year 2014 it was due to the overall increase in number of unnatural deaths while in 2017 in spite of decrease in number of unnatural deaths brought for autopsy a comparative increase in drowning deaths was observed which is better understood by the progressive increase in prevalence rate (Fig 1).

Table 1: Year-wise frequency of deaths due to drowning

Year	Total No. of autopsies	Deaths due to drowning	%
2013	3411	13	0.38
2014	3185	26	0.81
2015	2459	17	0.69
2016	1794	16	0.89
2017	1654	20	1.20
2018	1361	14	1.02
Total	13,864	106	0.76

Table 2: Age and gender distribution among the drowning victims (n =106)

Age (years)	Male		Female		Total
	No.	%	No.	%	
<5	5	4.72	2	1.88	7 (6.6%)
5-10	3	2.83	-	-	3 (2.83%)
11-20	17	16.04	1	0.94	18 (16.98%)
21-30	33	31.13	4	3.77	37(34.91%)
31-40	10	9.43	8	7.54	18 (16.98%)
41-50	7	6.6	2	1.88	9 (8.49%)
51-60	7	6.6	1	0.94	8 (7.54%)
61-70	6	5.66	-	-	6 (5.66%)
Total	88	83.01	18	16.98	106 (100%)

Table 3: Frequency distribution of time, day and season of drowning (n=106)

Variable	No.	%
Time of drowning		
Morning	14	13.2
Afternoon	29	27.4
Evening	29	27.4
Night	34	32.0
Day of drowning		
Monday	21	19.8
Tuesday	8	7.5
Wednesday	15	14.2
Thursday	20	18.9
Friday	17	16.0
Saturday	13	12.3
Sunday	12	11.3
Season of drowning		
Spring	26	24.5
Summer	41	38.7
Fall or Autumn	20	18.9
Winter	19	17.9

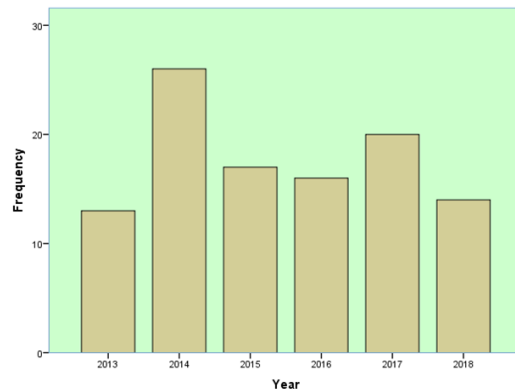


Fig.1: Year-wise distribution of drowning victims

DISCUSSION

Understanding the epidemiological profile and scenario of drowning is essential to develop strategies for the prevention of drowning. This study has reported a

progressive increase in the prevalence rate of death as a result of drowning in spite of reduction in unnatural death indicating lack of preventive measures, safety barriers and training of lifeguards and supervision at the beaches. Study from Isfahan and Mazandaran, Iran during the period from 2002 to 2006 and 2007 to 2011, has reported drowning rate 1.6 and 0.95% per 100,000 populations respectively.^{2,10} A lower prevalence rate in our study may be due to under reporting of cases or bodies not recovered after drowning. In addition children died accidentally due to drowning at home are not brought to mortuary to avoid police confrontation in our culture. A relative increase in drowning deaths compared to overall unnatural deaths might be due to failure of effective safety policies and training of lifeguards.

Males have obvious predominance and show approximately five times more tendency of being drowned than females in our study. This is in accordance with most of the national and international studies.^{11,12} This might be due to males risk taking behavior and cultural differences of gender. Females in Pakistan restrict themselves at homes and do not expose in public thereby avoid swimming and bathing at beaches.

Risk of drowning in our study has been observed in age group ranging from 11 to 40 years. Nearly two third of the cases were drowned of the age group 11 to 40 years. Children below ten years are least likely to be affected in the present study. Similar trend has been reported in studies from Iran which show higher rate of drowning in age group ranging from 15–24 and 15–34 years respectively.^{2,10} In a systemic review on research articles of drowning has observed that several studies identified teenager and young adult males due to their risk taking behavior as risk factors of drowning.¹³ However our findings are in contrast to the studies done in developed countries where higher risk of drowning is seen in children below five year of age.^{14,15}

In our society children visit beaches or swimming pools with their elders who keep a strict watch over the children thereby the incidence of drowning in children is less in our study. Another reason might be the visits of parents to the private hospital to get immediate and better treatment of the child and if the child is dead then buried without any notification to the law enforcement authority. The highest percentage of cases in our study belongs to age group ranging from 21 to 30 year particularly involving males. This group which consists mainly of males is independent and self decision making and do not follow the instruction of their elders. Boys use to go on beaches with their friends and have a tendency to go into the area of deep water and unfortunately if trapped in water the likely chance of drowning is increased when they do not know swimming.

Most of the drowning deaths were reported at night in the present study followed by evening and afternoon and Monday was the most frequent day and summer was the most favored season when the peak incidences of drowning took place. The association of these deaths to the day of the week, time of the day and seasons is somehow related to the beach recreational activities. Season and climatic factors along with the time of vacation urge people to spend time at beaches and increase the risk of

accidental drowning. Reports from the Western Cap, South Africa has reported 42% of fatal drowning in summer season and two thirds of cases of drowning occurred between 12:00 and 19:59 disproportionately on weekend and public holidays.¹⁶ Considering the day in our study Monday (19.8%) and Thursday (18.9%) have been observed as favorable days of the week. Comparing the week days (Monday to Friday) to public holidays (Saturday and Sunday), we find, most of the drowning deaths took place during week days in contrast to the study done in Western Cape South Africa which reports two third of drowning cases occur on weekends and public holidays.¹⁶

Our data depends upon the cases which are brought for autopsy in three public sector hospital and it is likely that the drowning took place on weekends and public holidays and bodies recovered later on week days. Reports from other parts of the world have also shown that the risk of drowning increases in summer and monsoon or rainy seasons.¹⁷⁻¹⁹ Study on child deaths due to drowning from Matlab, Bangladesh has reported majority of deaths before noon when mother leave their children and become busy in household or other work and pay less attention towards their children.²⁰ This is in contrast to our study where deaths occur mostly in night followed by evening and afternoon. A difference in sample may be the reason, as our study has included all ages ranging from one year through seventy and above. Difference in time of drowning may be due to delay in recovery of the body from the water. A person may be drowned earlier in the morning or evening but his or her body is recovered late on the same day or next day. In some cases body may even not be recovered. This may also explain the reason of low rate of drowning deaths in our study.

In our study two peaks of drowning deaths are observed, one in 2014 and 2017 which do not reflect the true picture of actual trend of drowning deaths. If we consider it with the total number of unnatural deaths brought for autopsy in three public sector hospitals of Karachi then it would be clear that there is a progressive increase in drowning deaths relative to total number of unnatural deaths. Another study from the Karachi conducted during the period from 2012 to 2014 based on data from Karachi Municipal Corporation's Emergency Response Center at Hawks Bay has shown a substantial increase in the drowning incidents during the study period.¹² WHO mortality database for the period from 2004–2005 and 2014–2015 indicated a decline in mortality rate in most (51/60) countries during the past decade while half (34/61) of the countries showed improvement in reporting information on death certificates.²¹ It has indicated that either the better law and order situation in the city has reduced the total number of unnatural deaths from causes other than the drowning but fail to improve the preventive measures at beaches of Karachi or our reporting system has improved.

CONCLUSION

A low prevalence with overall reduction of unnatural deaths indicates either improvement in law and order situation in Karachi or underreporting of cases during the study period. Higher rate of drowning deaths with over all male dominance was seen in third and fourth decade of life.

Dead bodies were brought to the mortuary at night followed by evening and afternoon mostly on weekdays indicating late recovery of bodies out of water. Summer in Karachi is the time when people visit beaches requiring strict surveillance and employment of additional lifeguards.

REFERENCES

1. WHO, World Health Organization. Facts about injuries: drowning. Geneva, Switzerland: WHO, Injuries and Violence Prevention. 2004.
2. Sheikhzadi A, Ghadyani MH. Epidemiology of drowning in Isfahan province, center of Iran. *JRMS* 2009;14(2): 79-87.
3. Kumar AGV, Shivaramu MG, Kumar. Pattern of drowning cases in rural areas: A retrospective autopsy study. *JMSH* 2015;1(3):18-20.
4. He S, Lunnen JC, Zia N, Khan U, Shamim K, Hyder AA. Pattern of presenting complaints recorded as near-drowning events in emergency departments: a national surveillance study from Pakistan. *BMC Emerg Med* 2015;15 Suppl 2:S4
5. Razzak JA, Khan UR, Zia N, Azam I. A child an hour burden of injury deaths among children under 5 in Pakistan. *Arch Dis Child* 2013;98:867-71.
6. Chowdhury SM, Rahman A, Mashreky SR, Giashuddin SM, Svanstrom L, Horte LG, et al. The horizon of unintentional injuries among children in low-income setting: an overview from Bangladesh Health and Injury Survey. *J Environ Public Health* 2009;2009:435403.
7. Centre for Research on the Epidemiology of Disasters (CRED); United Nations Office for Disaster Risk Reduction (UNISDR). 2018 Review of Disaster Events. 2019.
8. Shaikh MA. Epidemiology of drowning and near drowning at Karachi beaches from 2012 to 2014. *J Pak Med Assoc* 2016;66(5):602-5.
9. Saukko P, Knight B. Immersion Deaths. In: Knight's Forensic Pathology. 4th Edition. CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300 Boca Raton FL 33487-2742; 201.p.399.
10. Zolala F, Nasehi MM, Moosazadeh M, et al. Epidemiology of drowning in Mazendaran, Iran: apopulation based study. *Middle-East JSciRes* 2012;11(7):969-973.
11. Death registration, statistics published by Legal Medicine Organization of Iran. Tehran, Iran. LMO Press Annual Report 2002;206.
12. Shaikh MA. Epidemiology of drowning and near drowning at Karachi beaches from 2012 to 2014. *J Pak Med Assoc* 2016; 66: 602-5.
13. Peden AE, Franklin RC, Leggat PA. Fatal river drowning: the identification of research gaps through a systematic literature review. *InjPrev* 2016;22(3):202-9.
14. Kallas HJ. Drowning and submersion injury. In: Behrman RE, Kliegman RM, Jenson HB, eds. *Nelson Text book of Pediatrics*. 18th ed. Philadelphia: Saunder's 2008; 438-49.
15. Ross FI, Elliott EJ, Lam LT, Cass DT. Children under 5 years presenting to paediatricians with near-drowning. *J. Paediatr Child Health* 2003; 39: 446-50.
16. Saunders CJ, et al. Fatal drowning in Western Cape, South Africa: a 7 year retrospective, epidemiological study. *InjPrev* 2019;25:529-34.
17. Linnan AMR, Scarr J, Reinten-Renolds T, Linnan H, et al. Child drowning: Evidence for a newly recognized cause of child mortality in low and middle income countries in Asia. Working paper 2012 -07, special series on child injury No. 2. Florence, Italy. 2012
18. Hss AS, Tan PS, Hashim L. Childhood drowning in Malaysia. *International journal of injury control and safety promotion* 2013;21(1):75-80.
19. Chen Y, Mo F, Yi QL, Jiang Y, Mao Y. unintentional injury mortality and external causes in Canada from 2001 to 2007. *Chronic diseases and injuries in Canada* 2013;33:95-102.
20. Ahmed MK, Rehman M, Ginneken JV. Epidemiology of child deaths due to drowning in Matlab, Bangladesh. *IntJEpidemiol* 1999;28:306-11.
21. Lin C, Wang L, Lu T. Changes in drowning mortality rates and quality of reporting from 2004-2005 to 2014-2015: a comparative study of 61 countries. *BMC Public Health* 2019; 19:1391.