Drowning in children: Aseer Central Hospital experience, Southwestern Saudi Arabia

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ABSTRACT

Aim: To study the reasons, magnitude and outcome of drowning following submersion in water of children admitted to the Pediatric Intensive Care Unit in Aseer Province, Saudi Arabia. Materials and Methods: A retrospective cohort study of all pediatric patients (0-13) years old who drowned and were admitted to the Pediatric Intensive Care Unit, Aseer Central Hospital, Southwestern Saudi Arabia, between January 1st 1999 and December 31st 2009. Results: A total of 19 cases were admitted following submersion in water. The mean age was 5.2 years ±3.8. Majority of victims (94.1%) were from the highland areas. Events most frequently occurred in the summer (46.7%), followed by spring and winter, 33.3% and 20%, respectively. Home events constituted 44.4% of submersion cases. Of these, 55.6% drowned in a washing container, while 53.4% submersed in swimming pools. Twenty-two percent of these accidents occurred in the sea and in wells while 11.1% occurred in a lake. The mean duration of submersion was 4.04 minutes ± 5.35. Cardiac arrest was reported upon arrival at hospital in 42.1% of the victims. There were seven deaths (36.8%) and in one patient (5.2%) there was severe brain injury. In all deceased cases, no adults were watching the children when the accidents occurred. Conclusion: Drowning is a significant risk factor facing our children and can claim lives. The media as well as the authority should play a major role in increasing the public awareness to minimize or prevent such a problem.

Key words: Aseer Province, children, drowning, Saudi Arabia

INTRODUCTION

Drowning is a significant cause of disability and death. It had been defined as death secondary to asphyxia while immersed in a liquid, usually water, which occurs within 24 hours of submersion. Owing to confusion over the number of terms and definitions used, the World Congress on drowning held in Amsterdam 2002 defined drowning as “a process resulting in primary respiratory impairment secondary to submersion in liquid medium”. Consequently, terms such as wet drowning, dry drowning, active or passive drowning, near drowning, secondary drowning and silent drowning have been discarded. After submersion in a liquid medium, suffocation and asphyxia may occur with or without pulmonary aspiration.

Over 400,000 people die annually from drowning worldwide. In the US, drowning claims nearly 3,600 lives annually and is the third leading cause of accidental death in the United States. It is the second leading cause of accidental death after road-traffic accidents in children of school-age and the number one cause of death for preschoolers.

Roughly 80% of children with a history of drowning are admitted to hospital for at least 1 day, and 40-50% of the cases die, and as many as 20% of the survivors suffer severe permanent disability.

Prediction of outcome in drowning victims is important in guiding triage decisions, counseling families, reducing unnecessary interventions and guiding to withdraw support.

There is little published data about drowning in Saudi
Arabia with few papers coming from Riyadh area.\[^8^,^9\] To the best of our knowledge, this issue has not been studied in this part of the Kingdom. Aseer region is located in the southwestern part of Saudi Arabia and has an area of 80,000 Km\(^2\) and a population of 2.1 million. It is bordered on the west by the Red Sea. Unlike the rest of Saudi Arabia, it has a high annual rainfall (15-57 cm) which does increase the risk of drowning in lake water. The area is divided into lowland and highland (3000 m above sea level). Aseer Central Hospital is located in Abha City and is the only referral hospital at the tertiary care level in Aseer Health Directorate. The hospital has 500 beds including a 10-bed pediatric intensive care unit (PICU). At the time of the study, this hospital was privileged to have the only PICU in the area, making it the only referral center for cases of drowning.

The aim of this work was to study circumstances surrounding the event, magnitude and outcome in children referred and admitted to PICU as a result of drowning.

**MATERIALS AND METHODS**

A retrospective cohort study between January 1\(^{st}\) 1999 to December 31\(^{st}\) 2009. All pediatric patients up to 13 years of age admitted to Aseer Central hospital PICU because of drowning were included in the study.

Data collected from patients’ charts aimed at studying the circumstances of the event, including the time of drowning, season, whether indoors or outdoors, age and gender of the child, nature of water in relation to the outcome, vital signs and Glasgow coma score (GCS), cardiopulmonary resuscitation, outcome and its correlation with the confounding factors.

**Statistical analysis**

Frequency, arithmetic mean, mode, median and standard deviations were used to present data. The “\(r\) test, \(\chi^2\), Mann-Whitney tests were used as tests of significance. The chosen level of significance was 5%.

**RESULTS**

During the study period, a total of 19 cases, nine boys (47.4%) and 10 girls (52.6%) were admitted following submersion in water. Their mean age was 5.2 years ± 3.8 with a median of 4 years. The majority of victims (94.1%) were from the highland areas. Most of the accidents took place in the summer (46.7%) followed by spring (33.3%) and winter (20%).

Accidents at home were the most frequent (44.4%). Of these, 55.6% sank in washing containers including washing machines and buckets, 53.4% in indoor swimming pools and in the backyard pools. An equal percentage (22.2%) of events occurred in the sea and in wells. Lake water was responsible for 11.1% of the submersion cases. Fresh water accounted for 78.8% of the cases and sea water in 22.2%.

An equal percentage of the events, 42.9%, occurred in the morning and evening, while 14.2% occurred at night.

The mean submersion time was 4.04 ± 5.35 minutes, with longest period of 15 minutes in two victims. In 62.1% of the events, there were no adults watching the children.

A majority of the victims (94.7%) were unconscious at the scene, but unfortunately GCS was not documented when victims were taken out of the water. In 57.9% of the cases, a lay rescuer did the resuscitation at the scene. As a consequence, 42.1% of the victims were reported to have had a cardiac arrest on arrival at the hospital.

As there were no medical facilities available at the scene, patients did not receive any professional medical help until arrival at the hospital in a mean time of 19±14 minutes. On arrival at hospital, 26.3% of patients were still unconscious, 5.3% were post-ictal, and 21% were stable on arrival. Of these, GCS was recorded only in seven patients. Five of them were recorded to have GCS of three, and all of them eventually died.

All of these patients were admitted to PICU, with a mean hospital stay of 4.53 ± 9.69 days.

Of the 19 reviewed cases, seven patients died, one patient remained in a vegetative state and 11 patients had full recovery (\(P=0.02\)). Survival was significantly better in the summer and spring than in winter and autumn. Worse outcome was significantly observed in those who drowned in washing containers in comparison to victims taken from pools (\(P=0.04\)). The outcome was inversely proportional to the median duration of submersion in minutes (\(P=0.001\)). All deceased victims in this series were not being watched by adults at the time of the event [Tables 1 and 2].

**DISCUSSION**

Most submersions (66%) in the present study were in or around the home (pools, wells, buckets) which is similar to reports from the USA and Riyadh.\[^8^,^9\] This may be explained by the fact that the majority of our cases occurred in the highland areas away from beach. In a study by Almofadda \textit{et al}, in the Riyadh area, 21 out of
28 cases drowned in swimming pools in contrast to four out of 19 in our study (21.1%). The difference may be the result of social and topographical difference between Aseer area and Riyadh.

Since home swimming pools were very common in the Aseer highland, they are source of hazard especially in the absence of strict safety precautions and adult supervision. Hence the significant number of events found in our study.

A significantly, higher percentage of events occurred in summer and autumn time when most children’s activities occur. This seasonal incidence is also similar to what was reported by Almofadda et al[8] in Riyadh in contrast to what has been observed in American and European communities.[9]

Reports from USA showed male to female ratio of 2:1, which is in agreement with the reports from Riyadh. Contrary to the reviewed literature, there was no sex difference in our study, which may be explained by the fact that outdoor activities are limited in preference for indoor activity for both sexes. The majority of deaths (71.4%) occurred in boys in comparison to 28.6% of the girls. However, the number is too small for any conclusions to be drawn.

The age distribution between our study is in accord with reports from the United States[5] and other areas of Saudi Arabia. Children of this age are active and difficult to supervise.

Similar to previous reports by Brenner et al 2001[10] and Mayo clinic staff 2007,[11] the majority of drowning cases in this study, occurred in fresh water, mainly washing containers. The worst outcome seen in our study was in washing containers, this could be attributed to associated trauma, trapped hair, chemicals and relatively big head size of younger children.

As expected, patients who were submersed for longer periods in water had significantly poor outcome.

**CONCLUSIONS**

Drowning is a significant risk factor facing our children and
can claim lives. The media as well as the authority should play a major role in increasing the public awareness to minimize or prevent such a problem. Similar emphasis is needed to raise awareness of basic life-support measures (first aid) and the support of emergency medical services.

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