

Drowning and Near-Drowning in Children in the Southeast of Turkey

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Abstract

Aim: This study aimed to analyze and describe the epidemiology, risk factors, and prognosis of pediatric drowning and near-drowning incidents.

Materials and Methods: Forty-four children were included in to the study. Data on social demographics, the location of drowning, clinical and laboratory results, and progress as well as outcome of patients were retrospectively investigated.

Results: The median age of patients was 4.2 ± 2.9 years. Most of drownings (65.9%) occurred during the summer, in swimming pools (47.7%), and mostly on weekends (70.4%). Sixteen patients (47%) were not supervised by their caregivers. None of the children had received resuscitation before arriving at the emergency department. Clinical outcomes included 10 (22.7%) deaths, 7 (15.9%) discharges with neurologic sequelae, and 27 (61.3%) successful discharges.

Conclusion: Public education, safety regulations, lifeguards at swimming pools, restrictions on access to swimming in ponds, canals, and rivers, supervision of children, and increased awareness of this problem are necessary to reduce the rate of pediatric drowning. (*JAEM 2015; 14: 16-8*)

Key words: Drowning, near-drowning, prevention, children

Introduction

Drowning or near-drowning is an unexpected catastrophic injury, which may affect all age groups at all geographical regions, in which cerebral hypoxia may lead to death or survival with severe cerebral injury. Drowning is the second leading cause of accidental death in children (1, 2). World Health Organization (WHO) statistics reported 388.000 deaths by drowning around the world in 2004, and almost half of the victims were under the age of 20 years (3). To our knowledge, there are no reports concerning drowning and near-drowning in children in the southeast of Turkey, and there is limited information on the subject in the rest of the country in literature. The present study aimed to investigate the clinical characteristics and outcomes of drowning and near-drowning in the southeast of Turkey in children aged 0-15 years, to assess the risk factors and to develop appropriate preventive measures.

Materials and Methods

A total of 44 children under the age of 15 years with drowning or near-drowning applied to the Pediatric Department of the Dicle University Hospital between 2008 and 2013 and were included in this study. Retrospective analysis of clinical data records was conducted

in all children with a primary discharge diagnosis of near-drowning or drowning. Demographic characteristics, including age, gender, along with the time and location of drowning, were collected. Clinical data regarding the length of hospitalization, laboratory findings, and the outcome were also collected. The outcome was stratified as survival without sequelae, survival with neurologic sequelae, and death.

Statistical analysis

Continuous variables that are normally distributed were expressed as mean \pm standard deviation; continuous variables that are not normally distributed were expressed as median (minimum-maximum); ordinal variables were expressed as median and mode, and nominal variables were expressed with number and percent values.

Results

The Dicle University Hospital is a referral hospital, to which most of complicated patients are transported from other hospitals in the region. The study included a total of 44 patients, aged 0-15 years, admitted with the diagnosis of near-drowning or drowning. The age (years) ranged from 0 to 4 years in 28 (63.6%), from 5 to 9 years in 11 (25%), and from 10 to 15 years in 5 (11.3%) patients. Their mean age was recorded as 4.2 ± 2.9 years. Twenty-six of them (59%) were boys and 18 (41%) were girls. The supervision of children at the time



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of the incidents was most frequently by their parents. Sixteen (47%) patients were not supervised by their caregivers. There were absolutely no safety regulations at the location of the incidents, such as lifeguards, flotation devices, and a swimming instructor or warning signboards in swimming pools (Table 1). It was found that the most of drownings or near-drownings occurred during the summer days with 29 cases (65.9%), and the majority of them (70.4%) took place on weekends (Table 1). Swimming pools were the most frequently reported sites of near-drownings, accounting for 21 (47.7%) cases, as shown in Figure 1.

On admission, the following clinical evaluations were recorded in the first physical examinations of patients: hypothermia in 10 (22.7%), hypotension in 11 (25%), hypervolemia and dilutional hyponatremia in 10 (22.7%), pulmonary edema in 8 (18.1%), and Glasgow Coma Scale was 3 in 7 (15.9%) patients. Cardiopulmonary resuscitation (CPR) was applied to 9 patients (20.4%) in the emergency department, and none of the children received CPR before arriving at the emergency department of the hospitals in the region. The laboratory findings were as follows: leukocyte count was increased ($>11,000/\text{mm}^3$) in 21 (47.7%), and metabolic acidosis (arterial pH ≤ 7.1) was detected in 15 (34%) patients. The hemoglobin levels and platelet counts were within normal limits. The mean duration of hospitalization and mechanical ventilation were 5.4 ± 5.9 and 8.4 ± 8.2 days, respectively. Twenty-nine (65.9%) children required intensive care. Clinical and radiological evidence of infectious or chemical pneumonitis was observed in 27 (61.3%) children within 48-72 hours.

Clinical outcomes were classified as follows: 10 patients (22.7%) as death, 7 patients (15.9%) as survival with neurologic sequelae, and 27 patients (61.3%) as survival without any sequelae (Table 1). Neurological damage was "mild" in 2 children (seizure) and "severe" in 5 children (seizure, spasticity, spastic quadriplegia).

Swimming pools were the most reported site for near-drowning in all children with neurological sequelae. No detailed information was available on the long-term outcome, including neurological status, of these children.

Discussion

Injuries, poisonings, falls, pedestrian-motor vehicle crashes, and drownings are the important causes of accidental death in the pediatric population. Drowning is one of the most common causes of noninflicted traumatic pediatric death and remains as a significant problem in young children under the age of 5 years (4). In our study, the mean age of children was 4.2 ± 2.9 years, and the majority of them (63.6%) were aged 0-4 years.

The majority of drowning and near-drowning incidents occurs among boys and girls aged 0-4 years (5). In younger children aged 4 years and below, ponds, buckets, bathtubs, and jacuzzis are the most reported sites of drowning and near-drowning; but in children aged greater than 4 years of age, swimming pools are the most reported sites of drowning and near-drowning (6, 7). Swimming pools are the most reported sites of near-drownings and pose the highest risk in all age groups. Infants are most at risk from near-drowning in the bath, while toddlers are most at risk from near-drowning in swimming pools (8). Baths are particularly dangerous places for unsupervised infants, as it is easy for an infant to fall over in a slippery bath with smooth sides and very difficult for an infant to regain a sitting posture. Children have drowned in bathtubs in as little as 5 cm of

Table 1. Clinical characteristics of patients with drowning and near-drowning

Characteristics		n (%)	
		Near-drowning/ drowning (n=34)	Drowning deaths (n=10)
Age (years)	0-4	23 (67.6)	8 (80)
	5-9	8 (23.5)	2 (20)
	10-13	3 (8.9)	0
Gender	Male	18 (52.9)	4 (40)
	Female	16 (47.1)	6 (60)
Time of drowning	Summer	22 (64.7)	7 (70)
	Spring	6 (17.6)	2 (20)
	Autumn	5 (14.7)	1 (10)
	Winter	1 (2.9)	0
Lifeguard present	Swimming pool	0	0
Supervision	Mother	13 (38.2)	0
	Father	3 (8.8)	0
	Other	2 (5.8)	0
	Not supervised	16 (47)	0

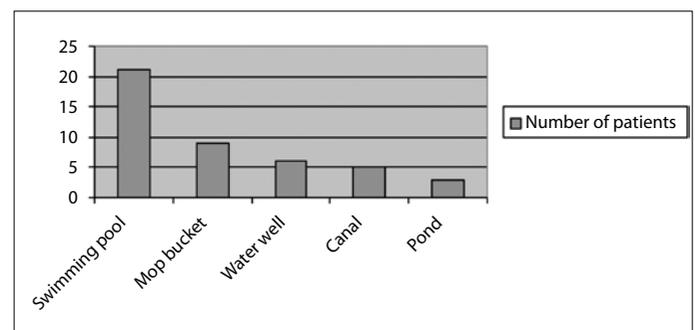


Figure 1. Pediatric near-drowning and drowning injuries according to sites of incident

water (9, 10). The most common site of drownings and near-drownings are swimming pools (48.3%), mop buckets (22.6%), and water well (12.9%), and swimming pools were the most frequent sites of near-drownings in our study. The most frequent sites of drowning, leading to death, were swimming pools in children above the age of 5 years and mop buckets in those under the age of 4 years in our study.

Fresh water, which is hypotonic relative to plasma, transverses the alveolar membrane and causes hypervolemia and dilutional hyponatremia. In contrast, salt water, which is $3\frac{1}{2}$ to 4 times more hypertonic than plasma, draws fluid into the alveolar space, resulting in hypovolemia and increased electrolyte concentrations instead (5). Our region is far away from the seaside.

Drownings and near-drownings in recreational settings occur most commonly on weekends (Friday-Sunday), and most of them occur in the summer days (Jun-August) (11). Tyebally et al. (6) reported that the most of drownings or near-drownings occurred between 14:00 and 19:00 hours on weekends. Similarly our results showed

that drownings and near-drownings were most likely to occur on summer days (65.9%), with occurrence largely on weekends (70.4%).

Drowning and near-drowning accidents may occur in children despite the supervision of their parents. However, a significant association between the lack of child supervision and drowning incidents was reported in previous studies, where baths were particularly recorded as dangerous places for unsupervised infants (12, 13). Our study indicated that most of patients (47%) were not supervised during the time of drowning or near-drowning incidents. It also showed that mop buckets in baths are the main cause of drowning, leading to death in children under the age of 4 years. A significant outcome from our data was the high incidence of death in girls compared with that in boys.

Permanent brain damage is not uncommon in near-drowning victims. Approximately 10% of survivors suffer severe neurologic sequelae (14). The clinical outcome depends on the early initiation of resuscitation. None of patients in the present study received early resuscitation before arriving at the emergency department. As a consequence, neurological deficit was detected in 7 patients (15.9%) and "mild" in 2 and "severe" in 5 children.

Study limitations

Small sample size and records from a single center may be the limitations of the present study. However, data are still valuable and may be used by other centers for further investigations.

Conclusion

This retrospective study shows that drowning and near-drowning continue to be an important public health problem in our region, and measures to prevent their mortality and morbidity are essential. Regular controls and restrictions on access to swimming in rivers, canals, and ponds are other preventive measures that can be taken by authorities to reduce the causes of drowning-related problems. We believe that most of drowning deaths can be prevented by education and rehabilitation of individuals in their early ages.

Ethics Committee Approval: Ethics committee approval was not received due to the retrospective nature of this study.

Informed Consent: Written informed consent was not obtained due to the retrospective nature of this study.

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