Drowning and near-drowning: experience of a university hospital in the Black Sea region

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SUMMARY: Güzel A, Duran L, Paksu Ş, Akdemir HU, Paksu MŞ, Katı C, Başol N, Yılman M, Özsevik SN, Murat N. Drowning and near-drowning: experience of a university hospital in the Black Sea region. Turk J Pediatr 2013; 55: 620-627.

The aim of the study was to describe the characteristics of patients who applied to the Emergency Department (ED) due to submersion injury; to recognize the risk factors, complications, causes of death, and the educational needs of families and caregivers about unsafe environments for submersion; and to develop preventive strategies. All patients were analyzed retrospectively according to demographic features, clinical and laboratory findings, association between clinical variables and submersion injuries, and patient outcomes. Fifty-five patients with submersion injury were analyzed. The mean age of patients was 10.9±4.7 years. The most common Szpilman clinical scores were Grade 1 (24 patients, 43.8%), Grade 2 (15 patients, 27.3%), and Grade 5 (10 patients, 18.2%). The common location of the submersion injuries included the sea (74.5%), pool (18.4%), bathtub (7.3%), river (3.6%), and lake (3.6%). A limited swimming ability or exhaustion and suffocation (49.1%) due to unknown reasons were the most common causes of submersion injury among all patients. Most complications were due to aspiration pneumonia and hypoxic ischemic encephalopathy (HIE). Thirty-nine patients (70.9%) were followed in the ED, while 16 patients (29.1%) were admitted to the pediatric intensive care unit (PICU); 11 patients (20.0%) died. All of the risk factors of drowning should be taken into account when designing preventive measures and family education. In addition, all pediatricians should be trained periodically about the complications of submersion and the treatment strategies, particularly in coastal cities and areas where drownings occur frequently.

Key words: drowning, children, emergency department, intensive care, risk factors.

Drowning has been defined as "death by suffocation after submersion in water" and near-drowning as "survival by suffocation after submersion in water"[1]. According to the Global Burden of Disease 2000 data reported by the Department of Injuries and Violence Prevention of the World Health Organization (WHO), an estimated 409,000 people drowned worldwide (6.8 per 100,000 population). Of reported unintentional drowning deaths, 97% occurred in low- and middle-income countries. Africa had the highest drowning mortality rate (14.2 per 100,000 population)[2]. In 2008, approximately 3800 children in the United States (US) were brought to the Emergency Department due to near-drowning, and more than 60% of those patients were hospitalized[4]. One thousand and seventy-seven children in the US died from unintentional drowning, with a drowning death rate of 1.32-1.48 per 100,000 population[4,5]. The Emergency Department team approach to the management of drowning provides the highest level of expertise in reducing morbidity and preventing unintentional death. Thus, the team must understand the sociodemographic factors, temporal and geographic variations, underlying medical conditions, initial injury patterns, and complications from submersion injury in order to provide effective care[3,5,6].

Turkey is a country bounded by seas on three sides (Black Sea, Aegean Sea, and Mediterranean Sea). The Black Sea is an inland sea that lies

to the north of Turkey. Samsun is the second-largest city in the northern Black Sea region.

This study was proposed to describe the epidemiology of patients in our region who presented to the Pediatric Emergency Unit (PEU) with submersion injury; determine the etiological and demographic features; recognize the risk factors; determine complications and causes of death; identify the teaching needs of families about unsafe environments; and develop preventive strategies against drowning.

Material and Methods

Fifty-five patients with submersion injury who were admitted to the Emergency Department of Ondokuz Mayıs University Medical Faculty between 2005 and 2012 were retrospectively included in this study.

The findings that were evaluated included age, gender, seasonal distribution, place of occurrence, cause of drowning, admission times, duration of stay in the water, swimming time, Szpilman score[7], physical examination findings, radiological investigations, complications, laboratory findings, outcome of the submersion injury, and hospitalization rates after leaving the PEU.

Statistical Analysis

Analysis was performed using the Statistical Package for the Social Sciences (SPSS) 21.0. Raw data from the databases were pooled, and means, medians (min-max), standard deviations, and percentages were calculated. Differences between the two groups were analyzed using Mann-Whitney U test. The two-proportion Z test was used to compare the percentages of two groups. The analyses were performed by using Minitab® 15 statistical software. Statistical significance was defined as a p-value less than 0.05.

Results

Annually, the mean number of pediatric patients hospitalized with diagnosis of drowning or near-drowning in our hospital for the mentioned period was 7.9±3.1; the proportions of these patients among all patients admitted to the Emergency Department and Pediatric Intensive Care Unit (PICU) were 0.061% and 0.65%, respectively.

The median age of all patients was 11 years (1-17) (7 months - 17 years). The drowning rate was statistically higher in males (42 patients, 76.4%) than females (13 patients, 23.6%) ($p<0.001$). The overall male to female ratio was 3.2:1. The distribution of patients was split into three age groups for comparison as: 0–5 years, >5–10 years, and >10–18 years. The adolescent age group (>10–18 years) had the highest prevalence of submersion injuries (29 patients, 52.7%). There were more injuries on weekdays (54.5%) than weekend days (45.5%). Submersion injuries occurred throughout the year, but they were most common in the summer months (51 patients, 92.7% occurring in June through August), with the highest single monthly injury incidence occurring in July (65.4%). A total of 74.5% of cases occurred in salt water, while in fresh water, the rate was 25.5%.

The distribution of cases by place of occurrence is shown in Table I. The main cause of submersion, at 49.1%, was patients not knowing how to swim, while in decreasing order of frequency, other causes were suffocation due to unknown reasons, parental disinterest, and immersion and drowning secondary to trauma (Table I). The median stay in the water was 5 minutes (1–60). The median stay in the water among fatalities (10 hours, 5-60 hours) was significantly higher than that among discharged patients (4 hours, 1-25 hours; $p=0.017$), and the median temperature among fatalities (35°C, 35-37°C) was significantly lower than that among discharged patients (36.4°C, 35-38.8°C; $p<0.001$). The median entry time into the Emergency Department after the accident was 60 minutes (10–1440).

The patients' median Glasgow Coma Scale (GCS) (min-max) was 15 (3–15) on admission to the hospital. Fifteen of the patients (27.2%) had a GCS ≤8. Twenty-seven patients (49.0%) had a GCS of 15, followed by 11 patients (20.0%) with GCS 3. The median GCS (min-max) was as follows: 4 (3–15) in the 0–5 year age group, 13 (3–15) in the >5–10 year group, and 15 (3–15) in the >10–18 year group. All clinical signs and laboratory findings are represented in Table II. Forty of the patients (72.7%) had spontaneous breathing on admission to the Emergency Department; only 7 patients (12.1%) had no

spontaneous breathing, and 8 patients (14.5%) had cardiopulmonary arrest. Convulsion was observed in only 2 patients (3.6%). Thirteen of the patients (23.6%) had no pupillary reaction on admission. Twenty-nine of the patients (52.7%) had abnormal lung auscultation findings (rales and crackles), while 15 (27.3%) had abnormal chest roentgenograms. The cases were classified according to the clinical classification of Szpilman (Table I). The most common clinical Szpilman scores were Grade 1 (24 patients, 43.8%), Grade 2 (15 patients, 27.3%), and Grade 5 (10 patients, 18.2%).

Approximately half of the patients had complications. Clinical characteristics and outcomes of the patients who had complications are shown in Table III. Seventeen patients (30.9%) were intubated. All locations of intubation and cardiopulmonary resuscitation (CPR) are presented in Table I. The median time of CPR was 30 minutes (1-70). The median time of CPR in fatalities (30 minutes,

Table I. Distribution of Patients According to Demographic Data and Clinical Findings

	0-5 years n (%)	>5-10 years n (%)	>10-18 years n (%)	Total n (%)
Gender				
Male	5 (71.4)	13 (68.4)	24 (82.8)	42 (76.4)
Female	2 (28.6)	6 (31.6)	5 (17.2)	13 (23.6)
Season distribution				
Winter months	1 (16.4)	0	0	1 (1.8)
Spring months	1 (20.0)	0	1 (25.6)	2 (3.6)
Summer months	4 (38.2)	19 (100.0)	28 (39.4)	51 (92.8)
Autumn months	1 (25.4)	0	0	1 (1.8)
Place of occurrence				
Sea	1 (14.3)	16 (84.2)	24 (82.8)	41 (74.5)
Pool	1 (14.3)	3 (15.8)	2 (6.9)	6 (10.9)
River	0	0	2 (6.9)	2 (3.6)
Bathtub	4 (57.1)	0	0	4 (7.3)
Lake	1 (14.3)	0	1(3.4)	2 (3.6)
Cause of drowning				
Limited swimming ability or exhaustion	2 (28.6)	9 (47.4)	16 (55.2)	27 (49.1)
Suffocation due to unknown reasons	0	8 (42.1)	10 (34.5)	18 (32.7)
Parental disinterest	2 (28.6)	0	0	2 (3.6)
Immersion	0	2 (10.5)	2 (6.9)	4 (7.3)
Trauma due to traffic accident	3 (42.8)	0	1 (3.4)	4 (7.3)
Szpilman score				
Grade 1	1 (14.3)	7 (38.8)	16 (55.2)	24 (43.8)
Grade 2	1 (14.3)	5 (26.3)	9 (31.0)	15 (27.3)
Grade 3	0	1 (5.3)	0	1 (1.8)
Grade 4	0	0	0	0
Grade 5	5 (71.4)	3 (15.8)	2 (6.9)	10 (18.2)
Grade 6	0	3 (15.8)	2 (6.9)	5 (9.1)
Location of CPR and intubation				
At the scene of accident by 112	0	1 (5.3)	2 (6.9)	3 (5.5)
Pediatric emergency services	0	4 (21.1)	1 (3.4)	5 (9.1)
Other health centers	5 (71.4)	3 (15.8)	1 (3.4)	9 (16.4)
Unapplied	2 (28.6)	11 (57.9)	25 (86.2)	38 (68.1)
Patient follow-up clinics (n, %)				
Emergency Department	4 (57.1)	10 (52.6)	25 (86.2)	39 (70.9)
Pediatric Intensive Care Unit	3 (42.9)	9 (47.4)	4 (13.8)	16 (29.1)
Patient outcome (n, %)				
Discharged	4 (57.1)	15 (78.9)	25 (88.2)	44 (80.0)
Exitus	3 (42.9)	4 (21.1)	4 (13.8)	11 (20.0)
Total patients (n, %)	7 (12.7)	19 (34.6)	29 (52.7)	55 (100.0)

CPR: Cardiopulmonary resuscitation.

4-70 minutes) was statistically higher than that of discharged patients (5.5 minutes, 1-30 minutes; p=0.048). The mortality rate was 20% (11 patients), and all patients who died were male. Differences between fatal and non-fatal drowning cases are shown in Table IV. The median hospital stay of patients was 2 days (1-53). During the study period, 39 patients (70.9%) were treated and followed in the Emergency Department, while 16 patients (29.1%) were treated and followed in the PICU (Table I).

Discussion

The present study is the first study carried out in the north of Turkey about drowning and near-drowning, including intensive care patients in the pediatric population. Despite well-known prevention measures and treatment strategies, approximately 409,000 drowning deaths occur worldwide each year, and others suffer from devastating complications caused by this condition, especially those who are 1−4 years of age. The incidence rate of drowning per population of 100,000 varied from 1.32-1.48 in the US[2,5]. According to a study of autopsy cases in the southern coast of Turkey, the 10-year incidence of drowning cases was found to be 5.8%[8].

Table II. Clinical Signs and Laboratory Findings on Admission for All Patients

	n	%
Clinical signs		
No pupillary reaction	13	23.6
Cardiopulmonary arrest	7	12.1
Apnea	8	14.5
Convulsion	2	3.6
Arrhythmia	3	5.5
Rales or crackles	29	52.7
Hypothermia	10	18.1
Hyperthermia	4	7.3
Hypertension	3	5.5
Hypotension	12	21.8
Tachycardia	18	29.1
Bradycardia	1	1.8
Tachypnea	3	69.1
Laboratory findings		
Leukocytosis	30	54.5
Thrombocytopenia	3	5.5
Anemia	14	25.5
Hyponatremia	13	23.6
Hypokalemia	13	23.6
Hyperglycemia	34	61.8
Elevated liver enzymes	15	27.3
Metabolic acidosis	21	38.2
Coagulation disorders	6	10.9
Renal function impairment	7	12.7
Total	55	100

Previous studies report that among children, boys are much more likely to drown than girls. The reason given is that boys are more active and bold[9]. Drowning deaths expose the greatest seasonal variation, with two-thirds of deaths occurring from May to August in developed countries, and most occur on weekends[5]. Our study also had more boys than girls in all pediatric age groups, and the overall male to female ratio was 3.2:1. However, mortality rates of submersion were found to be much higher for males. Among our patients, 20% were fatal. In our study, drowning most commonly occurred in the summer months.

The most common location of submersion injuries occurred in the sea, swimming pools, storm drains, bathtubs, lakes, rivers, and streams[5,10]. Brenner et al.[11] examined the death certificates of drowning patients in pediatric age groups (1–19 years) in the US. They reported that infant (<1 year of age) drownings frequently occurred in bathtubs (55%), while children (1–4 years of age) frequently drowned in artificial pools (56%), and those over five years of age frequently drowned in natural areas of fresh water (63%)[11]. Similarly, in this study, we found that the bathtub was the most common place of submersion for children (<5 years of age). In contrast to the literature, we found that submersion injuries for children over five years of age frequently occurred in the sea. This result for the over-five-year age group may be due to the study taking place in a coastal city of our country. However, we also thought that age, geographic variation, socioeconomic status, and living conditions were significant determinants of the place of a submersion injury.

Detection of the factors contributing to drowning

Table III. Characteristics of All Patients with Complications

Age	Gender	Complication	CPR	MV / Duration (days)	Inotrop./ Duration (hours)	Duration of hospitalization (days)	Outcome
13.0	F	Aspiration pneumonia				4	Discharged
17.0	M	Aspiration pneumonia				2	Discharged
16.0	M	Aspiration pneumonia				3	Discharged
11.0	M	Aspiration pneumonia				3	Discharged
15.0	M	Aspiration pneumonia				3	Discharged
7.0	M	HIE, cerebral edema, hypertension	+	+/31		53	Discharged
4.0	M	HIE				2	Discharged
14.0	M	HIE, cerebral edema, MODS	+	+/1	+/8	1	Exitus
7.0	M	HIE	+			1	Exitus
10.0	M	HIE	+			1	Exitus
6.0	M	HIE, cerebral edema	+	+/5	+/48	30	Discharged
17.0	M	HIE, pulmonary edema, cerebral edema, MODS	+	+/12	+/144	12	Exitus
11.0	M	HIE, ARDS	+			1	Exitus
14.0	M	HIE, MODS				14	Discharged
3.0	M	ARDS, MODS	+	+/2	+/7	2	Exitus
5.0	M	Cerebral edema, MODS, convulsion, ventricular tachycardia	+	+/4	+/96	4	Exitus
6.0	M	HIE	+			1	Exitus
16.0	M	MODS	+	+/2	+/36	2	Exitus
17.0	M	Cervical vertebra fracture				30	Discharged
9.0	M	Aspiration pneumonia, MODS	+	+/2	+/9	2	Exitus
8.0	F	Aspiration pneumonia				1	Discharged
16.0	F	Aspiration pneumonia				4	Discharged
1.0	M	HIE, cerebral edema, ARDS, pneumothorax	+			5	Exitus
15.0	M	ARDS, cardiac failure		+/1	+/12	2	Discharged
9.0	F	Aspiration pneumonia				4	Discharged
3.0	M	Pulmonary atelectasia		+/1		2	Discharged

ARDS: Acute respiratory distress syndrome. CPR: Cardiopulmonary resuscitation. HIE: Hypoxic ischemic encephalopathy. MODS: Multiple organ dysfunction syndrome. MV: Mechanical ventilation.

in pediatric age groups is very important for preventive measures. Different risk factors for drowning-related mortality have been reported in the literature, such as trauma, myocardial infarction, cerebrovascular accident, use of alcohol, drug abuse, association with certain diseases (e.g., seizure, syncope, arrhythmia, long QT syndrome), limited swimming ability or exhaustion, risky behavior in the water, foul play (child abuse, suicide), and deliberate prolonged drowning[5,10]. Somers et al.[12] found a strong association between the lack of adequate adult supervision and drowning. They reported that other associated risk factors with bathtub drowning included co-bathing (39%), the use of an infant bath seat (17%), and certain coexistent disease (17%). In our study, a limited swimming ability or exhaustion and suffocation (49.1%) due to unknown reasons were the most common causes of submersion in all patients.

Tablo IV. Association between Clinical Variables and Fatal Drownings

Parameters	Fatal n=11, %	Non-fatal n=44, %	p
Mean age (year)	9 (1-17)	12.5 (1-17)	0.177
Male	11 (100.0)	33 (70.5)	<0.001
GCS ≤ 8	11 (100.0)	4 (9.1)	<0.001
Laboratory findings			
Leukocytosis	4 (36.4)	26 (59.1)	0.163
Thrombocytopenia	1 (9.1)	2 (4.5)	0.622
Anemia	2 (18.2)	12 (27.3)	0.498
Hyponatremia	3 (27.3)	10 (22.7)	0.759
Hypokalemia	0	13 (29.5)	
Hyperglycemia	8 (72.7)	28 (83.8)	0.551
Elevated liver enzymes	7 (63.6)	8 (18.2)	0.004
Metabolic acidosis	7 (63.6)	14 (31.8)	0.048
Respiratory acidosis	0	15 (34.1)	
Coagulation disorders	5 (45.5)	1 (2.3)	0.004
Renal function impairment	4 (36.4)	3 (6.8)	0.049
Clinical signs			
No pupillary reaction	11 (100.0)	2 (4.5)	<0.001
Cardiopulmonary arrest	5 (45.5)	0	
Apnea	10 (90.9)	3 (6.8)	<0.001
Convulsion	1 (9.1)	2 (4.5)	0.622
Arrhythmia	2 (18.2)	1 (2.3)	0.179
Rales or crackles	8 (72.7)	21 (47.7)	0.104
Hypothermia	8 (72.7)	2 (4.5)	<0.001
Hyperthermia	0	4 (9.1)	
Hypertension	1 (9.1)	2 (4.5)	0.622
Hypotension	8 (72.7)	4 (9.1)	<0.001
Tachycardia	1 (9.1)	15 (34.1)	0.026
Bradycardia	1 (9.1)	0	
Tachypnea	1 (9.1)	37 (84.1)	<0.001
Days of occurrence			
Week	3 (27.3)	22 (50.0)	0.140
Weekend	8 (72.7)	22 (50.0)	0.140
Place of occurrence			
Sea	7 (63.6)	34 (77.3)	0.389
Pool	0	6 (13.6)	
River	0	2 (4.5)	
Bathtub	2 (18.2)	2 (4.5)	0.258
Lake	2 (18.2)	0	
Cause of drowning			
Limited swimming ability or exhaustion	4 (36.4)	23 (52.3)	0.330
Suffocation due to unknown reasons	4 (36.4)	14 (31.6)	0.778
Parental disinterest	1 (9.1)	1 (2.3)	0.446
Immersion	0	4 (9.1)	
Trauma due to traffic accident	2 (18.1)	1 (2.3)	0.179
Szpilman score			
Grade 1	0	24(54.5)	
Grade 2	0	15 (34.1)	
Grade 3	0	1 (2.3)	
Grade 4	0	0	
Grade 5	5 (45.5)	4 (9.1)	0.020
Grade 6	6 (54.5)	0	
Location of CPR and intubation			
At the scene of accident by 112	2 (18.1)	1 (2.3)	0.179
Pediatric emergency services	4 (36.4)	1 (2.3)	0.020
Other health centers	5 (45.5)	4 (9.1)	0.020
Unapplied	0	38 (86.3)	

CPR: Cardiopulmonary resuscitation. GCS: Glasgow Coma Scale.

However, trauma due to traffic accident was the most common cause of submersion injuries in the five-year age group.

Even though lung injury is the principal complication in drowning patients, numerous additional pathologies can occur in the body after hypoxic ischemic damage because of drowning [6]. Hypoxic ischemic encephalopathy (HIE) is the most common cause of death due to drowning in hospitalized patients[13]. This condition may occur because of hypoxic episode or may result from ongoing lung injury, reperfusion injury, sustained acidosis, cerebral edema, hyperglycemia, release of excitatory neurotransmitters, seizures, hypotension, impaired cerebral autoregulation, or multiorgan dysfunction[14]. Saidel-Odes et al.[15] reported that some published literature put the death rate from 19% to 50%. Submersion injuries also result in patients at risk for aspiration pneumonia, HIE, cerebral edema, fluid overload, hypothermia, renal ischemic injury, pulmonary edema, adult respiratory distress syndrome (ARDS), arrhythmia, disseminated intravascular coagulation, sepsis attributable to nosocomial infection, and multiple organ dysfunction syndrome (MODS)[5,6,13,16-18]. In our study, 26 patients had developed complications, and approximately half of these patients died. The most frequent complications were aspiration pneumonia and HIE. The majority of patients with complications were male, and they usually died due to HIE and MODS.

Drowning is a preventable cause of death in children. Preventive measures against drowning noted in the literature include the provision of swimming lessons to young children, careful observation of children during swimming, increasing the number of swimming pools open to the public for training, avoidance of swimming in canals and nearby rivers, introduction of warning signs with international symbols in hazardous areas, prevention of alcohol intake prior to swimming, control of a vessel's maximum passenger capacity before travel, placement of barriers around swimming pools to protect young children and persons under the influence of alcohol against falls, greater care taken by families when children swim in inflatable or portable pools, the use of life jackets, and the organization of periodic training programs to educate families about all of these risk factors[4,5,9].

In conclusion, most of the reports in the literature generally focus on the risk factors for drowning. We believe that observation of young children around any body of water is the most important preventive method, because all other prevention strategies should necessarily be included with this. However, strategies for treating complications from submersion injuries in the PICU should also be included when discussing these risk factors in the literature, in order to reduce deaths due to drowning. In addition to educating all parents and caregivers about first aid for children with submersion injury, all pediatricians should be trained periodically about the complications from submersion injuries and especially about treatment strategies where cases of drowning are frequent.

REFERENCES

1. al-Talafieh A, al-Majali R, al-Dehayat G. Clinical, laboratory and X-ray findings of drowning and near-drowning in the Gulf of Aqaba. EMHJ 1999; 5: 706-709.
2. Facts about injuries. Drowning. World Health Organization. http://www.who.int/violence_injury_prevention/publications/other_injury/en/drowning_factsheet.pdf. Accessed 19 August 2013.
3. Wagner C. Pediatric submersion injuries. Air Med J 2009; 28: 116-119.
4. Weiss J. American Academy of Pediatrics Comittee on Injury, Violence, and Poison Prevention. Prevention of Drowning. Pediatrics 2010; 126: 253-262.
5. Salomez F, Vincent JL. Drowning: a review of epidemiology, pathophysiology, treatment and prevention. Resuscitation 2004; 63: 261-268.
6. Burford AE, Ryan LM, Stone BJ, Hirshon JM, Klein BL. Drowning and near-drowning in children and adolescents: a succinct review for emergency physicians and nurses. Pediatr Emerg Care 2005; 21: 610-616; quiz 7-9.
7. Szpilman D. Near-drowning and drowning classification: a proposal to stratify mortality based on the analysis of 1,831 cases. Chest 1997; 112: 660-665.
8. Arslan MM, Çekin N, Hilal A, Kar H. Investigation of drowning cases in Adana between years 1997-2006. Turkiye Klinikleri J Foren Med 2005; 5: 13-18.
9. Yang L, Nong QQ, Li CL, Feng QM, Lo SK. Risk factors for childhood drowning in rural regions of a developing country: a case-control study. Inj Prev 2007; 13: 178-182.
10. Warner DS, Bierens JJ, Beerman SB, Katz LM. Drowning: a cry for help. Anesthesiology 2009; 110: 1211-1213.

11. Brenner RA, Trumble AC, Smith GS, Kessler EP, Overpeck MD. Where children drown, United States, 1995. Pediatrics 2001; 108: 85-89.
12. Somers GR, Chiasson DA, Smith CR. Pediatric drowning: a 20-year review of autopsied cases: III. Bathtub drownings. Am J Forensic Med Pathol 2006; 27: 113-116.
13. Centers for Disease Control and Prevention. Nonfatal and fatal drownings in recreational water settings--United States, 2001-2002. MMWR Morb Mortal Wkly Rep 2004; 53: 447-452.
14. Oehmichen M, Hennig R, Meissner C. Near-drowning and clinical laboratory changes. Leg Med (Tokyo) 2008; 10: 1-5.
15. Saidel-Odes LR, Almog Y. Near-drowning in the Dead Sea: a retrospective observational analysis of 69 patients. IMAJ 2003; 5: 856-858.
16. Ballesteros MA, Gutierrez-Cuadra M, Munoz P, Minambres E. Prognostic factors and outcome after drowning in an adult population. Acta Anaesthesiol Scand 2009; 53: 935-940.
17. Swick D. Submersion injuries in children. Int J Trauma Nurs 1997; 3: 59-64.
18. Idris AH, Berg RA, Bierens J, et al. Recommended guidelines for uniform reporting of data from drowning: the "Utstein style". Circulation 2003; 108: 2565-2574.