Eur J Trauma Emerg Surg (2015) 41:683–688
DOI 10.1007/s00068-015-0493-0

ORIGINAL ARTICLE

Child drowning deaths in Aydin province, western Turkey, 2002–2012

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Received: 13 October 2014 / Accepted: 5 January 2015 / Published online: 10 January 2015

Abstract
Introduction Drowning, a major public health problem worldwide, occurs as an accident, suicide, or homicide. Deaths with an accidental origin are common in childhood in the 0–18 age group. In our study, pediatric drowning cases for whom a postmortem examination and an autopsy were conducted by Adnan Menderes University Department of Forensic Medicine were evaluated. The characteristics were determined and compared with domestic and foreign studies.
Materials and methods A total of 39 cases in the 0–18 age group in Aydın between 2002 and 2012 were analyzed regarding age, gender, cause of death, origin, the accident scene, and the month in which the death occurred.
Results Of the drowning cases, 33 (84.6 %) were male, and 6 (15.4 %) were female. The average age was 9.08 years, and drowning is most common in the 0–4 age group (33.3 %). The scene of the accident was an irrigation channel in 43.5 % of the cases, a river in 15.3 %, a sea in 12.8 %, a pool in 10.2 %, and a lake or pond in 7.69 %.
Conclusion Drowning deaths are a serious and preventable public health problem worldwide. There are strong correlations among lack of adult supervision, lack of precautions, and neglect.

Keywords Children · Deaths · Drowning · Autopsy

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Introduction

According to the definition accepted within the last decade, drowning is a process resulting in a respiratory function disorder that occurs when sinking down under water [1–4]. Drowning constitutes 0.07 % of unintentional deaths [1]. This means about 500,000 drowning deaths occur per year all over the world [2, 4, 5]. Therefore, drowning is a major public health problem worldwide [3, 6, 7]. According to the 2008 United Nations Children's Fund (UNICEF) report, 22 % of children all over the world die in traffic accidents, and 17 % die from drowning [8]. According to some authors, drowning is the third most common cause of unintentional death among children and young people [3, 5, 9–11]. Drowning has been reported as the top-ranked accidental death category of the pediatric age group in Southeast Asia and the Western Pacific regions [1]. In addition, drowning is one of the major causes of death in childhood in countries such as Australia, the United States, and Japan [1]. There are also a large number of drowning cases in European countries. According to several publications, the reason for this high rate is that many immigrant families come from low-income countries [8, 12].

Age and gender are the most important risk factors in drowning cases [1, 3, 5–7, 9, 10, 13, 14]. Children under 5 years of age and the male gender were the most important risk factors in many studies [3, 5–7, 11, 15–18]. Drowning is more common in younger age groups because of the child's carelessness and negligent supervision, according to some studies [13, 17–20]. The increase in public pools and pools in residential areas has led to an increase in deaths in the pediatric age group [6, 10, 11, 17, 21–24]. There have also been reports of children dying while taking a bath [13, 17, 23]. Other risk factors include the improper use of locations such as seas, lakes, ponds, or pools; low

socioeconomic status; low level of education; the presence of diseases, such as epilepsy; alcohol and drug abuse in older age groups; and swimming in unusual places [1]. The correlation between knowing how to swim and the risk of drowning is not clear [2].

Drowning originates as an accident, suicide, or murder. Deaths with an accidental origin are common in childhood in the 0–18 age group. Drowning deaths are important when researching deaths with an accidental origin [25–29]. Based on our experience, the origin is difficult to determine when an autopsy has not been performed in a drowning death. The autopsy must be done carefully and must be evaluated with the crime scene and legal investigations. A dead body removed from the water is different from a drowning case; a body in the water does not necessarily mean a drowning has occurred. Opinions on the cause of death and origin should be avoided when only an external examination of the dead, and not an autopsy, has been conducted.

In our study in Aydın between 2002 and 2012, we evaluated pediatric drowning cases for which our department conducted a postmortem examination and an autopsy. We determined the characteristics and compared them with domestic and foreign studies.

Materials and methods

In Aydın, Adnan Menderes University, Faculty of Medicine, Department of Forensic Medicine is the only authorized forensic unit that serves the entire city. All autopsies are performed by the department staff under the supervision of the district attorney.

In Aydın, autopsies are not performed at a headquarter facility. After the crime scene has been investigated by the gendarmerie and/or the police, the body is taken to the nearest hospital morgue, where the autopsy is performed. The first authorities to see the corpse and perform the examination are general practitioners. Forensic experts perform an autopsy at the hospital to which the body has been transported. An autopsy is performed by forensic experts in all cases if the cause of death was not successfully determined with an external examination.

This study used the deceased examination and autopsy reports from 2002 to 2012. In the 0–18 age group, 255 autopsies were performed by the Adnan Menderes University Department of Forensic Medicine. A total of 39 drowning cases in the 0–18 age group were analyzed regarding age, gender, cause of death, origin, accident scene, and the month in which the death occurred. Statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS) 14.0 for Windows. $p < 0.05$ was considered statistically significant.

Results

In Aydın, from 2002 to 2012, the cause of death was asphyxia in 66 (25.9 %) out of the 255 cases in the 0–18 age group for whom autopsies were performed at the University department. The 39 drowning cases constituted 15.3 % of all cases and 59 % of all *z* cases.

Of the drowning cases, 33 (84.6 %) were male, and 6 (15.4 %) were female. The female-to-male ratio was 5.5:1. The youngest was a 1-year old, and the oldest was 18-year old. The average age was 9.08 years. In the distribution of age groups, drowning was most common in the 0–4 age group (33.3 %), followed by the 10–14 age group (25.6 %), the 15–18 age group (25.6 %), and the 5–9 age group (15.3 %). The age groups and the distribution according to gender are given in Table 1.

In this study, drowning was most common during the summer (56.4 %) and spring (43. 5 %). The most common months were July (17.9 %) and May (15. 4 %). The scene of the accident was within the city limits in 28 cases (71.8 %), the district in 9 cases (23.1 %), and a village or town in 2 cases (5.1 %).

The crime scene investigations, autopsy findings, and judicial investigation showed all of the cases were accidents; none were murders or suicides. No abnormality was determined in the medical histories either; all 39 children were confirmed healthy.

No traumatic lesions were found according to the autopsy findings. Traumatic findings such as abrasions and ecchymosis were observed on the external examination; however, these lesions did not affect the death of the subjects, and were caused by falls, friction, and drifting underwater. In the internal examinations, evidence drowning (white froth, fine froth, waterlogged lungs) was found in the trachea, bronchia, and lungs in all cases, and 31 cases (79.4 %) had water in the stomach and duodenum.

When we look at the distribution according to the scene of the accident, 43.5 % occurred in an irrigation channel, 15.3 % in a river, 12.8 % in the sea, 10.2 % in a pool, and 7.7 % in a lake or pond. In addition, 1 child drowned in a water barrel, 1 in a water hole in a pit, 1 in a barrage, 1 in a water hole in a basement, and 1 who had growth retardation and epilepsy drowned in the bathroom while bathing. There was no significant difference statistically between the age

Table 1 Age groups of cases and distribution according to gender

Age groups (years)	Female *n* (%)[a]	Male *n* (%)[a]	Total *n* (%)[a]
0–4	3 (23)	10 (76.9)	13 (100.0)
5–9	1 (16.6)	5 (83.3)	6 (100.0)
10–14	0 (0.0)	10 (100.0)	10 (100.0)
15–18	2 (20.0)	8 (80.0)	10

[a] Row percentages

Table 2 Scene of the accident in drowning cases according to the age range

Age group (years)	Scene of the accident in drowning cases						Total
	Sea	Lake	River	Irrigation channel	Pool	Other	
0–4	1	1	1	4	3	3	13
5–9	1	1	1	2	1	0	6
10–14	2	0	1	7	0	0	10
15–18	1	1	3	3	0	2	10
Total	5	3	6	16	4	5	39

groups of the cases and the scene of the accident ($p > 0.05$), as shown in Table 2.

Irrigation canals are used to irrigate cultivated areas. The canals vary in length, depth, and structure. There are no protective barriers around the canals, and most are very close to residential areas. Sometimes, canals sometimes even cross residential areas.

Our study revealed that 17 children (43.5 %) were with their friends, 18 (46.1 %) were alone, and 4 (10 %) were refugees who drowned when their boat sank. One child who drowned while alone had been left at home under his older brother's supervision, and another child drowned while his parents were working in the fields. In two cases in which an autopsy was not performed, the cause of death was determined with an external examination and crime scene and judicial investigations. In both cases, eyewitnesses were present during the drowning accident. In most of the cases (64.1 %, $n = 25$), the children drowned while they were swimming or cooling off in the water. Eight children (20.5 %) drowned in pools or barrels used to provide water for animals or irrigation. Two children drowned while playing in puddles and four children drowned when their refugee boat sank.

According to the autopsy findings, there were external traumatic findings such as ecchymosis, abrasions, and lacerations in 16 cases (41 %); however, no traumatic lesions in the viscera and vessels were found.

In 89.7 % of the cases, the victim died at the scene of the accident. An autopsy was performed in 37 of the cases (94.8 %), a histopathological examination was performed in 4 (10.2 %), a toxicological examination was performed in 15 (38.4 %), and alcohol, opiates, and narcotics agents were screened in 26 (66.6 %). All drowning cases were determined to be accidental.

Samples for histopathological, toxicological, and drug examinations are taken during the autopsy by the forensic expert, if the cause of death cannot be completely determined with an autopsy when there is a suspicious situation or an allegation of substance and/or alcohol use in the history of the event. In this study, the histopathological samples did not reveal any type of pathology. In addition, the toxicological and alcohol–drug tests were normal.

Discussion

Asphyxia was determined to be the cause of death for 35 % of the cases with an accidental origin. Drowning cases constituted the largest portion of the asphyxia cases with an accidental origin (82.9 %). In a study conducted by Tokdemir et al. [26] in Elazig that examined forensic death cases in the 0–18 age group, drowning ranked second among non-natural causes of death (19.1 %). Yüksel et al. [15] evaluated preschool childhood deaths in Ankara and found the cause of death in 30 cases (21.4 %) was drowning. Drowning ranked third at a rate of 10.7 % in a study performed by Canturk et al. [27] in Istanbul. Drowning in Konya constituted 2.6 % of all cases, respectively [28]. Blunt trauma was followed by drowning, in a study performed in Adana [29]. Drowning caused 20.1 % of childhood deaths with an accidental origin in Istanbul [30].

Drowning was suspected or claimed in 11 % of cases in a study that evaluated autopsies in Adana [31]. This ratio was 7.26 % in another study performed in a larger series in the same area. The rates were 5.5 % for Ankara, 3.2 and 3.3 % for Diyarbakir, and 7.1 % for Edirne in different studies [32–34]. Drowning was also present in two studies that examined external examinations and autopsy series performed in Sivas [35, 36].

It was reported that 13.03 % of the 7,551 drowning cases in Spain [37] and approximately 2.7 %, or 314 of the 11,655 cases, drowned in water in a study conducted in India [38] based on autopsies. It was reported that 168 of the 197 bodies found in the water had drowned in a study covering an 8-year period from 1997 to 2004 in Greece [39]. It was reported that out of all the 1,590 bodies taken out of the water, 1,499 (94.3 %) drowned in a large study that covered the 23-year period between 1976 and 1998 in Finland [40].

In our study, drowning was the most common cause of death (33.3 %) in the 0–4 age group. This was followed by the 10–14 (25.6 %) age group, the 15–18 (25.6 %) age group, and the 5–9 (15.3 %) age group. In studies in which forensic death cases in the 0–18 age group were examined, drowning was the most common cause in the 0–5 and 15–18 age groups in a study performed by Tokdemir et al. [26] in Elazig. Drowning was the most common

cause of death in the 15–18 and 10–14 age groups in a study performed by Yayci et al. [30] in Istanbul. In a study that evaluated drowning cases in the emergency department in Adana [25], 9.8 % of the cases were in the 0–4 age group, 46.3 % were in the 5–15 age group, and all the cases who died (9.7 %) were under the age of 15 years. It has been reported that 14.1 % of all drowning cases were under the age of 15 years in a study in the 2002–2006 period in Mazandaran, Iran [41]. In Matlab, Bangladesh [19], 21 % of the deaths of children aged 1–4 years were due to drowning. Children and young people under the age of 15 are considered at-risk groups worldwide. Our findings in terms of age distribution agree with the rates for developing countries in studies performed in Turkey and abroad. Drowning cases are observed at any age in Turkey but are more frequent under the age of 40. This finding supports the view that drowning ranks first among the causes of unnatural child deaths [19, 29, 31, 34, 38, 42–46].

Of all cases in our study, 33 (84.6 %) were male. The male-to-female ratio was 4:1 for the Çukurova region and 3:1 for Diyarbakir in studies conducted in Turkey [7, 34]; 85.6 % of the cases were male and 14.4 % were female in a large study [33]. Turgut et al. [3] observed that in Turkey, for all age groups, 84 % of all drowning cases were male. Although the male-to-female ratio varies according to the year, it was 2.3–8.7:1 in India [38], 2.7–11.3:1 in Singapore [42], 4.16:1 for the adults in the United States of America (Sacramento, CA) [46], 6.6:1 in New York [47], 2.31:1 in Denmark [48], 4.76:1 in South Africa (Cape Town) [49], and 6.5:1 in Iran [10]. In similar studies, 65 % of the drowning cases in Greece [39], 78.98 % in Spain [37], and two out of three in Sweden [12] were male. Our results support the findings that the probability of an unnatural death is lower for women, and the male gender is a risk factor in drowning [43, 44].

In our study, 17 of the cases (43.5 %) were in the spring, and 22 cases (56.4 %) were in the summer. Shetty et al. [37] reported that an increase in drowning occurs during the rainy season when the water is higher in rivers, lakes, and ponds. In many studies performed in Turkey and abroad, the frequency of drowning increased in the summer months, in line with our findings. The need to cool off due to the warm weather seems to be a natural cause underlying this relationship [5, 10, 34, 38, 43].

The scene of the accident in the drowning cases was an irrigation channel in 43.5 % of the cases, a river in 15.3 %, a sea in 12.8 %, a pool in 10.2 %, and a lake or pond in 7.69 %. There was also 1 drowning in a water barrel, 1 in a water hole in a pit, 1 in a barrage, 1 in a water hole in a basement, and 1 case who had growth retardation and epilepsy who drowned in the bathroom while bathing. A study in Alanya/Antalya examined the patients taken to the emergency department due to drowning: 65.62 % of the drowning cases took place at sea, 28.12 % in a pool, and 6.3 % in fresh water. Another study in Samsun (the Black Sea Region) reported that 74.5 % of the cases occurred in saltwater [4, 43]. A study that examined asphyxiating death cases in Edirne reported that the scene of the accident was a river in 73.1 % of the 40 cases who drowned in water [50].

In studies performed in different countries, different distributions are observed in terms of the scene of the accident. In a study in Greece [39], all 197 cases drowned in the sea. The sea ranked first in Singapore [42], rivers are ranked first in Nigeria [51], ponds were the highest in Iran [10], wells, ponds, and rivers were ranked first in India [38], and swimming pools were ranked the highest in the United States [46], especially for children. Turkey is an agricultural region, and there is no seacoast inland; this is why irrigation channels are ranked first, unlike other regions.

An autopsy was performed in 37 of the cases (94.8 %). Autopsies are not performed in the cases of the presence of reliable witnesses and/or the person rescued from the water was alive when taken to the hospital. Many studies performed in Turkey reported that an autopsy does not need to be performed in drowning cases that are considered accidental; only an external examination is performed, which happens in other accidental deaths [31, 35, 36]. Most studies are based only on autopsy reports; external examinations are not covered; thus, the rates do not reflect the real numbers [31]. An autopsy was performed for only 13 % of those who drowned, while an external examination was performed for 87 %. In a study performed by the public prosecutor of Diyarbakır, death certificates were studied [34]. The higher autopsy rate we found reflects the positive effect of the active participation of experts at the Adnan Menderes University Department of Forensic Medicine.

Conclusion

In Turkey, Lifesaving Regulations of the Turkish Underwater Sports Federation have been published to prevent drowning [52]. These regulations are mainly about providing first aid in the event of drowning and appeal to the tourist regions [52]. Unfortunately, there is no other written program. As a team, we agree on the need for these precautions; however, the same level of seriousness and discipline is also required when it comes to applying them.

When we look at the precautions regarding drowning in Aydın, unfortunately, the necessary importance has not been given, the necessary work has not been performed to apply the existing rules, and sectors have not collaborated to prevent the deaths caused by drowning. As of December 2014, irrigation canals are still open, the necessary

precautions in places such as wells or small pools in houses have not been taken, and no sanctions are applied to people who swim in dangerous locations and disregard the warning signs that state the danger of swimming there. In addition, the opinions of forensic experts who have autopsy data have not been solicited regarding drowning in Aydın. Our study revealed that 25 % of the children could have been saved, if only the necessary precautions had been taken around open water areas (buckets, barrels, pools used for irrigation or to provide water for the animals, wells) in private residences. In the short term, children should be taught in schools about the danger of irrigation channels and imams should inform the public about irrigation channels during the Friday sermon.

Drowning is a preventable cause of death. Precautions such as teaching children how to swim; monitoring them while they swim; increasing the number of public pools; preventing swimming in open canals and puddles; placing warning signs near places such as seas, dams, and dam reservoirs; educating families; inspecting vehicles used for transportation in places such as seas and lakes; using life jackets; building protective structures such as barriers around pools; organizing education programs in the printed and visual media; and prohibiting the use of alcohol during swimming and water sports have been recommended in studies. The same level of seriousness and discipline is also required when it comes to applying these precautions. Everybody, especially authorities, should reconsider drowning prevention programs, and they should have different strategies for different age groups and cultures.

Acknowledgments We are grateful to Dr. Pınar Okyay for her assistance with the revision of this manuscript.

Conflict of interest M.Dirlik and B.Bostancıoğlu declare that there are no conflicts of interest.

Ethical standards In Aydın, Adnan Menderes University, Faculty of Medicine, Department of Forensic Medicine is the only authorized forensic unit that serves the entire city. All autopsies are performed by the staff of the Department of Forensic Medicine under the observation of the district attorney. All of our cases were forensic cases so ethical approval is not needed.

References

1. WHO (World Health Organization). 2014. http://www.who.int/mediacentre/factsheets/fs347/en.
2. Richards DB. Drowning. Afr J Emerg Med. 2001;1:33–8.
3. Turgut A, Turgut T. A population-based study on deaths by drowning incidents in Turkey. Int J Inj Contr Saf Promot. 2014;21(1):61–7.
4. Güzel A, Duran A, Paksu Ş, Akdemir HU, Paksu MŞ, Katı C, et al. Drowning and near-drowning: experience of a university hospital in the Black Sea region. Turk J Pediatr. 2013;55(6):620–7.
5. Fang Y, Dai L, Jaung MS, Chen X, Yu S, Xiang H. Child drowning deaths in Xiamen city and suburbs, People's Republic of China, 2001–5. Inj Prev. 2007;13(5):339–43.
6. Mosayebi Z, Movahedian AH, Mousavi GA. Drowning in children in Iran: outcomes and prognostic factors. Med J Malaysia. 2011;66(3):187–90.
7. Meel BL. Drowning deaths in Mthatha area of South Africa. Med Sci Law. 2008;48(4):329–32.
8. Bierens J, Scapigliatti A. Drowning in swimming pools. Microchem J. 2014;113:53–8.
9. Dai D, Zhang Y, Lynch CA, Miller T, Shakir M. Childhood drowning in Georgia: a geographic information system analysis. Appl Geogr. 2013;37:11–22.
10. Sheikhazadi A, Ghadyani MH. Epidemiology of drowning in Isfahan province, center of Iran. J Res Med Sci. 2009;14(2):79–87.
11. Centers of Disease Control and Prevention (CDC). Drowning-United States, 2005–2009. MMWR Morb Mortal Wkly Rep. 2012;61(19):344–7.
12. Schyllander J, Janson S, Nyberg C, Eriksson UB, Stark Ekman D. Case analyses of all children's drowning deaths occurring in Sweden 1998–2007. Scand J Public Health. 2013;41(2):174–9.
13. Jensen LR, Williams SD, Thurman DJ, Keller PA. Submersion injuries in children younger than 5 years in urban Utah. West J Med. 1992;157(6):641–4.
14. Quan L, Cummings P. Characteristics of drowning by different age groups. Inj Prev. 2003;9(2):163–8.
15. Yüksel F, Türkkan D, Ünal BM, Dinç AH. Medico-legal autopsy results of preschool childhood deaths. Med J Trak Univ. 2010;27(1):65–7.
16. Hss AS, Tan PS, Hasbim L. Childhood drowning in Malaysia. Int J Inj Contr Saf Promot. 2014;21(1):75–80.
17. Bamber AR, Pryce JW, Ashworth MT, Sebire NJ. Immersion-related deaths in infants and children: autopsy experience from a specialist center. Forensic Sci Med Pathol. 2014;10(3):363–70.
18. Al-Fifi SH, Shabana MA, Zayed M, Al-Binali AM, Al-Shehri MA. Drowning in children: Aseer Central Hospital experience, Southwestern Saudi Arabia. J Family Communıty Med. 2011;18(1):13–6.
19. Ahmed MK, Rahman M, Van Ginneken J. Epidemiology of child deaths due to drowning in Matlab, Bangladesh. Int J Epidemiol. 1999;28(2):306–11.
20. Kemp A, Sibert JR. Drowning and near drowning in children in the United Kingdom; lessons for prevention. BMJ. 1992;304(6835):1143–6.
21. Ferretti E, De Angelis S, Donati G, Torre M. Fatal and non-fatal unintentional drownings in swimming pools in Italy: epidemiological data derived from the public pres in 2008-2012. Microchem J. 2014;113:64–8.
22. Brünning C, Siekmeyer W, Siekmeyer M, Merkenschiager A, Kiess W. Retrospective analysis of 44 childhood drowning accidents. Wien Klin Wochenschr. 2010;122(13–14):405–12.
23. Lin CY, Wang YF, Lu TH, Kawach I. Unintentional drowning mortality, by age and body of water: an analysis of 60 countries. Inj Prev. 2014.
24. Guevara JP, Franklin RC, Basilio JA, Orbillo LL, Go JJ. Child drowning prevention in the Philippines: the beginning of a conversation. Int J Inj Saf Promot. 2014;11:1–11.
25. Şimşek Y, Satar S. Drowning and emergency department. Turk J Emerg Med. 2013;13(2):81–5.
26. Tokdemir M, Kafadar H, Düzer S. Evaluating the 0–18 years old cases autopsied between 2001–2007 in Elazığ. Fırat Med J. 2009;14(2):111–4.
27. Cantürk N, Eşiyok B, Özkara E, Cantürk G, Özata B, Yavuz F. Medicolegal child deaths in Istanbul: data from morgue department. Pediatr Int. 2007;49(1):88–93.

28. Demirci Ş, Doğan KH, Erkol Z, Deniz I. Deaths occurred in the age group of 0–18 years in Konya between 2001 and 2006. Turkiye Klinikleri J Foren Med. 2007;4(3):121–6.
29. Çekin N, Hilal A, Gülman MK, Kar H, Aslan M. Medicolegal childhood deaths in Adana Turkey. Tohoku Exp Med. 2005;206:73–80.
30. Yaycı N, Pakis I, Karapirli M, Celik S, Uysal C, Polat O. The review of autopsy cases of accidental childhood deaths in Istanbul. J Forensic Leg Med. 2011;18(6):253–6.
31. Salaçin S, Çekin N, Gülmen MK, Hilal A, Savran B. Retrospective analysis of the medicolegal deaths in Adana City, Turkey, vol. 17. Dublin: Congress of the International Academy of Legal Medicine; 1997.
32. Demirel B, Balseven A, Özdemir Ç, Bilge Y, Işık AF. Forensic autopsy cases in Ankara between 1996–2000, 10th National Forensic Medicine Meeting Poster Presentations Book. Antalya: Instıtute of Forensic Medicine Publications; 2003.
33. Yılmaz A, Azmak D. Evaluation of 197 forensic autopsies performed in Trakya Medical Faculty between 1984–1993. Balkan Med J. 1994;11:117–24.
34. Tıraşcı Y, Gören S. Evaluation of drowning cases in Diyarbakır. Dicle Med J. 2000;27(1):139–44.
35. Özkök MS, Katkıcı U, Özkara E. Retrospective analysis of forensic autopsies and death examinations in Sivas between 1984–1993, 1st Congress of Forensic Sciences Book. Adana: Çukurova University Publications; 1994.
36. Katkıcı U. Medicolegal autopsy cases in Sivas (1990–1995): demography and properties of forensic medical experts. Bull Leg Med. 1997;2(1):3–7.
37. Joaquin G, Jose-Luis R, Maria-Isabel A, Miguel-Angel V, Elena B. A study among the population of death due to submersion. Am J Forensic Med Pathol. 1997;18(1):70–4.
38. Shetty BSK, Shetty M. Epidemiology of drowning in Mangalore, a coastal of South India. J Forensic Leg Med. 2007;14:410–5.
39. Papadodima SA, Sakelliadis EI, Kotretsos PS, Athanaselis SA, Spiliopoulou CA. Cardiovascular disease and drowning: autopsy and laboratory findings. Hellenic J Cardiol. 2007;48:198–205.
40. Lunetta P, Pentilla A, Sajantila A. Circumtances and macropathologic findings in 1590 consecutive cases of bodies found in water. Am J Forensic Med Pathol. 2002;23:371–6.
41. Anary S, Hossein S, Ardeshir S, Ghadyani MH. Epidemiology of drowning in Mazandaran province, north of Iran. Am J Forensic Med Pathol. 2010;31(3):236–42.
42. Tan RMK. The epidemiology and prevention of drowning in Singapore. Singap Med J. 2004;45(7):324–9.
43. Lakadamyalı H, Doğan T. Türkiye'de Bir Turizm Bölgesinde Suda Boğulma Olgularının İrdelenmesi. Türkiye Klinikleri J Med Sci. 2008;28:143–8.
44. Peden MM, McGee K. The epidemiology of drowning worldwide. Inj Control Saf Promot. 2003;10(4):195–9.
45. Wintemute GJ, Kraus JF, Teret SP, Wright M. Drowning in childhood and adolescence: a population-based study. Am J Public Health. 1987;77:830–2.
46. Wintemute GJ, Kraus JF, Teret SP, Wright MA. The epidemiology of drowning in adulthood: implications for prevention. Am J Prev Med. 1988;4(6):343–8.
47. Browne ML, Lewıs-Mıchl EL, Stark AD. Unintentional drownings among New York State residents, 1988–1994. Public Health Rep. 2003;118:448–58.
48. Kringsholm B, Filskov A, Kock K. Autopsied cases of drowning in Denmark 1987–1989. Forensic Sci Int. 1991;52(1):85–92.
49. Davis S, Smith LS. The epidemiology of drowning in Cape Town 1980–1983. S Afr Med J. 1985;68(10):739–42.
50. Azmak D. Asphyxial deaths: a retrospective study and review of the literature. Am J Forensic Med Pathol. 2006;27:134–44.
51. Seleye-Fubara D, Nicholas EE, Esse I. Drowning in the Niger Delta region of Nigeria: an autopsy study of 85 cases. Niger Postgrad Med J. 2012;19(2):111–4.
52. Turkish Underwater Sports Federation. 2013. http://www.tssf.gov.tr/TR/yonetmelik-talimat.