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Analysis of Forensic Cases Prepared a Report Due to Poisoning: Retrospective Original Research

Zehirlenme Nedeniyle Rapor Düzenlenen Adli Olguların Analizi: Retrospektif Özgün Araştırma

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ABSTRACT Objective: Poisoning may occur as a result of accident, suicide and homicide and has an important place in forensic medicine. This study aimed to analyse the characteristics of the cases in which forensic reports were prepared due to poisoning and discuss them in light of the literature. **Material and Methods:** The files of the cases whose forensic reports were issued due to poisoning at Bolu Abant İzzet Baysal University Department of Forensic Medicine between January 01, 2019 and June 30, 2024 were retrospectively analysed. **Results:** A total of 233 patients were included in the study. More than half of the cases (n=125, 53.6%) were female. The mean age of the cases was 29.65±17.05 years and 33.5% (n=78) were under 18 years old. The most common cause of poisoning was food (n=105, 45%). Accidental poisoning was in 85.8% of cases (n=200). Two-thirds of the cases (n=140, 60.1%) were treated as outpatients. In the forensic reports, 26 cases (11.2%) were diagnosed as life-threatening. A total of 6 cases (2.6%) were found to have impaired function of one of the organs, all of these cases were poisoned by mains water and all of them were under 18 years old. **Conclusion:** We found that the most common causes of poisoning in Bolu province were food and mains-water poisoning. For this reason, we think both food and tap water inspections should be carried out more strictly in Bolu province.

Keywords: Poisoning; food; mains water; forensic medicine

ÖZET Amaç: Zehirlenmeler; kaza, intihar ve cinayet sonucu gerçekleşebilmektedir ve adli tıpta önemli bir yere sahiptir. Bu çalışmada, zehirlenme sonucu adli rapor düzenlenen olguların niteliklerinin incelenmesi ve literatür ışığında tartışılması amaçlanmıştır. **Gereç ve Yöntemler:** Bolu Abant İzzet Baysal Üniversite Adli Tıp Ana Bilim Dalı'nda 1 Ocak 2019-30 Haziran 2024 tarihleri arasında zehirlenme nedeniyle adli rapor düzenlenen olguların dosyaları retrospektif olarak incelenmiştir. **Bulgular:** Toplam 233 olgu çalışmaya dâhil edilmiştir. Olguların yarısından fazlası (n=125, %53,6) kadındı. Olguların yaş ortalaması 29,65±17,05 olup, %33,5'i (n=78) 18 yaş altıydı. En sık zehirlenme neden gıda zehirlenmesiydi (n=105, %45). Olguların %85,8'i (n=200) kaza sonucu zehirlenmiştir. Olguların 2/3'üne (n=140, %60,1) ayaktan tedavi verilmiştir. Düzenlenen adli raporlarda sonuç olarak 26 olguya (%11,2) hayati tehlike verilmiştir. Toplam 6 olguya (%2,6) duyu veya organlardan birinin işlevinde zayıflama verildiği, bu olguların hepsinin şebeke suyundan zehirlendiği ve hepsinin 18 yaş altı olduğu belirlenmiştir. **Sonuç:** Bolu ilinde en sık zehirlenme nedenlerinin gıda zehirlenmesi ve şebeke suyu zehirlenmesi olduğunu bulduk. Bu nedenle Bolu ilinde hem gıda denetimlerinin hem de şebeke suyu denetimlerinin daha sıkı yapılması gerektiğini düşünüyoruz.

Anahtar Kelimeler: Zehirlenme; gıda; şebeke suyu; adli tıp

Poisoning is the introduction of a toxic substance into the body or the disruption of the body's normal organ functions by ingesting a higher-than-normal dose of a substance.[1] Acute poisoning may cause serious injuries and even death.[2] Acute poisoning may be due to various chemical substances or may develop due to spoiled food and contaminated water.[3] Poisoning is mostly caused by accidents and suicide, but rarely by homicide.[1-4] Factors that cause poisoning may differ between countries and even between regions within the same country.[5] It is very crucial to reveal the poisoning cases in a region to take the necessary measures for faster diagnosis, effective treatment and prevention of injuries and deaths due to poisoning.[6]

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Developing countries are linked to high rates of poisoning because of the unconscious and extensive use of pesticides in agriculture to boost yields and insufficient safe storage and disposal facilities.[7] The most common agents of acute poisoning in Türkiye include drugs (such as analgesics and antidepressants), pesticides and insecticides (particularly organophosphates), household chemicals (like bleach, detergent, sink cleaner, and descaler), toxic gases (notably carbon monoxide), various other chemicals, plants and foods (such as mushrooms, andromedotoxin, and apricot kernels), as well as bites and stings from venomous animals (including scorpions, bees, spiders, and snakes).[8] In the United States, more than 2 million people were looked to poison control centres in 2020 due to toxic exposures.[9] According to data from the National Poison Advisory Centre, 187,528 individuals presented to the emergency department due to poisoning in Türkiye in 2020.[10]

In our country, most of the studies on poisoning consist of emergency service studies and studies from forensic medicine clinics are very few. This study aims to evaluate the cases for which forensic reports were issued due to poisoning in Bolu Abant İzzet Baysal University Faculty of Medicine, Department of Forensic Medicine between 2019-2024.

MATERIAL AND METHODS

STUDY DESIGN

The study was performed in Bolu Abant İzzet Baysal University. All cases in which a forensic report was issued due to poisoning were evaluated. The reports prepared between January 1, 2019-June 30, 2024 at Bolu Abant İzzet Baysal University Faculty of Medicine Department of Forensic Medicine were retrospectively analyzed.

SAMPLING

All cases in which a forensic report was issued due to poisoning were included in the study.

DATA COLLECTION

Permission was obtained from Bolu Abant İzzet Baysal University Management of Medical Faculty Hospital for the study. The study was conducted in accordance with the principles of the Declaration of Helsinki. The files and reports of these cases were then retrospectively analyzed. A total of 233 cases that forensic reports were issued due to poisoning were evaluated in terms of "age, age group, gender, season, origin, cause of poisoning, degree of forensic injury, treatment" parameters.

STATISTICAL ANALYSIS

SPSS 21.0 (IBM, Armonk, NY) statistics program was used for data analysis of the study. Descriptive statistics are presented with frequency, percentage, mean, standard deviation, minimum, maximum values. The relationship between categorical variables was analyzed using Pearson's exact chi-square test and $p<0.05$ was considered statistically significant.

ETHICS APPROVAL

This study was designed retrospectively and does not include any identification data or human/animal subjects. Therefore, it was not necessary to prepare an informed consent form. Ethics committee scientific approval was obtained from the Clinical Research Ethics Committee of Bolu Abant Izzet Baysal University, dated August 8, 2024 and numbered 2024/192.

RESULTS

More than half of the cases (n=125, 53.6%) were female (Table 1). The mean age of the patients was 29.65±17.05 years and 33.5% (n=78) were under 18 years old (Table 1). More than one third of the poisonings (n=85, 36.5%) occurred in autumn (Table 1). The most common cause of poisoning was food (n=105, 45%), followed by mains water (n=60, 25.8%) and drug (n=34, 14.6%) (Table 1). The most common cause of food poisoning was aubergine puree (n=42, 40%) (Table 2). The reason for this was mass poisoning, as the food served in a large hotel contained *Escherichia coli*, which was found in aubergine puree in the examinations. These poisoning cases were identified as a result of toxicological and microbiological examinations of the food in the hotel. It was determined that 60 cases were poisoned due to the lack of chlorination in the mains water contaminated with *Escherichia coli* coming from the plateau.

TABLE 1: Distribution of gender, age group, season and cause of poisoning

	n	%
Gender		
Female	125	53.6
Male	108	46.4
Age Group		
0-17 years	78	33.5
18-64 years	148	63.5
≥ 65 years	7	3.0
Season		
Spring	40	17.2
Summer	82	35.2
Autumn	85	36.5
Winter	26	11.2
Cause of poisoning		
Food	105	45
Mains water	60	25.8
Medicine	34	14.6
Carbon monoxide	9	3.9
Cleaning material	8	3.4
Ammonia gas	4	1.7
Ethyl alcohol	4	1.7
Mushroom	2	0.9
Rat poison	2	0.9
Others*	5	2.1
Total	233	100

*Disinfectant, pesticide, chlorine gas, battery, gel cream

TABLE 2: Distribution of food poisoning

	n	%
Food poisoning		
Aubergine puree	42	40.0
Meat products and meals containing meat	41	39.0
Chicken products and meals containing chicken	15	14.3
Milk and dairy products	7	6.7
Total	105	100

It was determined that 85.8% (n=200) of the cases were accidents and 14.2% (n=33) were suicides (Table 3). Two-thirds of the patients (n=140, 60.1%) were treated as outpatients (Table 3). In the forensic reports, 12 cases (5.2%) were diagnosed as not being able to be resolved by a simple medical intervention and 26 cases (11.2%) were diagnosed as life-threatening (Table 3). Of the 26 life-threatening cases, 22 were poisoned by mains water, 2 by drugs and 2 by

TABLE 3: Distribution of origin, treatment and degree of forensic injuries

	n	%
Origin		
Accident	200	85.8
Suicide	33	14.2
Treatment		
Outpatient	140	60.1
Referral	36	15.4
Service hospitalization	33	14.2
Intensive care admission	24	10.3
Degree of forensic injuries		
Cured by simple medical intervention	195	93.1
Not cured by simple medical intervention	12	5.2
Life-threatening	26	11.2
Total	233	100

carbon monoxide. Haemolytic uremic syndrome and acute renal failure developed in all 22 cases poisoned by municipal water. In 2 patients with carbon monoxide poisoning, HgCO value was above 20 and hyperbaric oxygen treatment was required. One of the 2 patients suffering from drug intoxication was in a life-threatening condition due to a Glasgow Coma Scale score of 7 and required intubation in the intensive care unit. In the other patient, life-threatening was given because the Glasgow coma score was 5, the pH value was 7.13, intubated in the intensive care unit and cardiopulmonary resuscitation was performed after cardiac arrest. A total of 6 cases (2.6%) were found to have impaired function of one of the organs, all of these cases were poisoned by mains water and all of them were under 18 years old. All 6 patients developed hypertension after haemolytic uremic syndrome 24 months after the event and received antihypertensive treatment.

DISCUSSION

In a study conducted in Egypt, more than half of the poisoning cases (55.9%) were women.[11] Pradhananga et al. also reported that 58.6% of poisoning cases were women.[12] In studies conducted in Türkiye, women (56.5-67.3%) constituted the majority of general poisoning cases.[5,6,11-20] In this study, more than half of the patients (n=125, 53.6%) were female, in accordance with the literature.

The mean age of the patients admitted to the adult emergency department for poisoning ranged between 25.63 and 38.6 years.[14-16,18,21,22] In a study conducted in Uşak, 27.9% of poisoning cases were under 18 years of age.[13] In another study conducted in Artvin, 15.1% of poisoning cases were children under 15 years old.[23] In this study, the mean age was 29.65±17.05 years and 33.5% (n=78) were under 18 years old.

In studies on poisoning, there may be increases in frequency in different seasons, possibly depending on the cause of poisoning and age group.[6,13,16,17,20,21,24] In Türkiye, food poisoning occurs most frequently (29.2%) in autumn months.[25] Urazel et al. reported that food poisoning occurred most frequently in autumn (39%) in Eskisehir and the reason for this was the high number of students coming to the city in this season.[24] In this study, more than 1/3rd of the poisonings (n=85, 36.5%) occurred in autumn. In this study, the fact that food poisoning was the most common cause of poisoning and the month of autumn was the most common month of poisoning suggests that it may be related to the increasing student population at this time.

The most common cause of poisoning in the majority of studies related to poisoning in emergency departments (22.4-86.5%) is drug intoxication.[5,13-16,20-23,26] In a study conducted in the emergency department in Bolu province, it was reported that 66.5% (n=250) of the cases admitted due to poisoning were food-related poisoning.[27] In this study, the most common cause of poisoning was food (n=105, 45%), which is different from the general literature but consistent with the previous study conducted in Bolu. In addition, it is quite remarkable that the 2nd most common cause of poisoning was water mains poisoning (n=60, 25.8%).

Urazel et al. reported that the most common food poisoning in Eskişehir was due to chicken products.[24] In a study conducted in Sivas province, the most common cause of food poisoning was rice pilaf, soup, and tas kebab (58.2%) and this was due to mass poisoning in a male dormitory.[28] In this study, the most common cause of food poisoning was aubergine puree (n=42, 40%). The reason for this was mass poisoning, as the food served in a large hotel contained *Escherichia coli*, which was found in aubergine puree in the examinations. However, it should be noted that 43.8% of the cases in our study occurred as a result of mass poisoning (hotel and city water). Nonetheless, even when these cases are excluded, food poisoning is still the most common poisoning.

In a Chinese study, suicides accounted for more than half (56.7%) of poisonings.[29] In another study conducted in Nepal, suicides accounted for 80.47% of poisoning cases.[12] In Egypt, intentional poisonings (58.6%) were also more common than accidental poisonings.[11] In studies conducted in our country, there are studies reporting that poisonings are most frequently caused by suicide (43-86.5%), as well as studies in which accidental poisonings are reported more frequently (57-89.2%).[5,13,15,17,19-23,30] This situation is closely related to the city, department and age group in which the study was conducted. Furthermore, 43.11% (n=80,852) of the cases admitted to the National Poison Information Centre in 2020 were poisoned by suicide and 37.78% were poisoned by accident.[10] In this study, the majority of the cases were accidentally injured (n=200, 85%). Such a high accident rate is due to the high number of poisonings from food and mains water. Therefore, we think that both food inspections and tap water inspections should be carried out more strictly in terms of Bolu province.

Regarding the treatment of poisoning cases in Türkiye, the proportion of cases discharged after outpatient treatment varies between 51-79.5%.[13,15,20,22,28] In this study, 2/3rd of the patients (n=140, 60.1%) received outpatient treatment following the literature.

Dal et al. reported that 8.5% of poisoning cases admitted to the emergency department were life-threatening.[15] Yürürdurmaz et al. reported that 13.3% of accidental poisonings were life-threatening.[6] In studies on food poisoning, Urazel et al. reported that 1.3% of the cases were life-threatening, while Bütün et al. reported that none of the cases with food poisoning were life-threatening.[24,28] In this study, 26 cases (11.2%) were diagnosed as life-threatening. Of the 26 life-threatening cases, 22 were poisoned by mains water, 2 by drugs and 2 by carbon monoxide. Haemolytic uremic syndrome and acute renal failure

developed in all 22 cases poisoned by municipal water. In 2 patients with carbon monoxide poisoning, HgCO value was above 20 and hyperbaric oxygen treatment was required. One of the 2 patients suffering from drug intoxication was in a life-threatening condition due to a Glasgow Coma Scale score of 7 and required intubation in the intensive care unit. In the other patient, life-threatening was given because the Glasgow coma score was 5, the PH value was 7.13, intubated in the intensive care unit and cardiopulmonary resuscitation was performed after cardiac arrest.

A total of 6 cases (2.6%) were found to have impaired function of one of the organs, all of these cases were poisoned by mains water and all of them were under 18 years old. This situation shows how dangerous mains water poisoning can be, especially in individuals under the age of 18, and therefore, inspections in this regard should be much stricter and more serious. It was understood that all of the patients with sensory organ impairment developed hypertension after haemolytic uremic syndrome and received antihypertensive treatment accordingly. According to the 2019 updated Guidelines for the Evaluation of Injury Offences Defined in the Turkish Criminal Code in Terms of Forensic Medicine, the loss of 10-50% of the function of an organ or extremity is considered as "functional impairment", and the loss of more than 50% is considered as "functional impairment".[31] However, the guideline updated in 2019 specifies only certain situations related to sensory organ loss. Still, it does not fully clarify how to proceed in rare cases or which disability regulation should be applied. For this reason, we think that the guideline, which was last updated in 2019, should be updated again and a broader explanation should be made, especially in the evaluation of sensory and organ impairment.

CONCLUSION

In our study conducted in Bolu province, we found that poisonings occurred most frequently as a result of accidents and the most common causes of poisoning were food and mains water. It is noteworthy that all the patients who were reported to have impaired function of one of the organs were under 18 years old and all of them were poisoned by mains water. We strongly advocate for more rigorous inspections of both food and mains water in Bolu province. It's crucial to ensure the safety and quality of these essentials for the well-being of our community.

Source of Finance

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Erdem Hösükler, Zehra Zerrin Erkol, Ebru Şen Yavaş;* ***Design:*** *Erdem Hösükler, Zehra Zerrin Erkol, Ebru Şen Yavaş;* ***Control/Supervision:*** *Erdem Hösükler, Zehra Zerrin Erkol;* ***Data Collection and/or Processing:*** *Erdem Hösükler, Zehra Zerrin Erkol, Ebru Şen Yavaş;* ***Analysis and/or Interpretation:*** *Erdem Hösükler, Zehra Zerrin Erkol;* ***Literature Review:*** *Erdem Hösükler, Zehra Zerrin Erkol, Ebru Şen Yavaş;* ***Writing the Article:*** *Erdem Hösükler, Zehra Zerrin Erkol, Ebru Şen Yavaş;* ***Critical Review:*** *Erdem Hösükler, Zehra Zerrin Erkol;* ***References and Fundings:*** *Erdem Hösükler, Zehra Zerrin Erkol;* ***Materials:*** *Erdem Hösükler, Zehra Zerrin Erkol.*

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