ACUTE POISONING IN CHILDREN AND ADOLESCENTS HOSPITALIZED AT THE INSTITUTE OF CHILD AND YOUTH HEALTH CARE OF VOJVODINA BETWEEN 2015–2017

Katarina KATIĆ1, Aleksandra STOJADINOVIĆ1-3, Vesna MIJATOVIĆ2, 4 and Marijana GRUJIĆ5

Summary
Introduction. Acute pediatric poisoning has become an increasingly important medical emergency. This study was aimed at determining characteristics of acute poisoning in children and adolescents hospitalized at the Institute of Child and Youth Health Care of Vojvodina from 2015 to 2017. Material and Methods. Data were collected from medical records of all patients hospitalized for suspected acute intoxication at the Institute of Child and Youth Health Care of Vojvodina during the observed time. Results. This study included 519 patients hospitalized for suspected exposure to toxic substances. There were 49% male and 51% female patients. The intoxications had no seasonal features. The toxic substances were commonly taken orally. Medications were the most frequent cause of all poisonings, among which the most commonly reported were drugs for central nervous system disorders. Medications were the most frequent cause of poisoning in children and adolescents, as well as in children up to 10 years of age. In adolescents, the most prevalent cause of intoxication was alcohol abuse. Poisoning with suicidal intent and intentional self-poisoning without suicidal attempt were considerably more frequent in girls than in boys. There were no fatalities. Conclusion. It is of great importance to be familiar with the characteristics and circumstances of acute poisoning to plan and implement adequate preventive measures.

Key words: Poisoning; Acute Disease; Child; Adolescent; Risk Factors; Hospitalization; Accident Prevention; Alcohol Drinking; Drug-Related Side Effects and Adverse Reactions

Introduction

Acute poisoning accounts for a significant proportion of morbidity and mortality in children and adolescents and it is one of the most common medical emergencies in pediatrics [1–5]. Poisoning in children is always an emergency, regardless of the clinical signs and symptoms. The diagnosis is based on anamnestic and heteroanamnestic data, physical examination of the patient, as well as various laboratory and toxicological test results [6].

Poisonings are either intentional or accidental. Unintentional poisoning is rather common in childhood, and it is mainly caused by the drugs used by parents or caregivers, as well as by household chemicals [7–11]. Infants are at risk of accidental overdose due to miscalculation of drug dosage or parental drug misuse [10]. Pediatric poisoning is most common between 1 and
5 years of age, when children are very active and curious, so they examine the world around them, and they can walk but their physical abilities are limited, and they are inexperienced [11]. The incidence of accidental poisonings decreases gradually with the age and cognitive development of the child, being considerably less frequent in adolescents [12]. Poisonings in adolescents are most commonly induced by substance abuse or as intentional self-poisonings (with or without suicidal intent), taken as a form of mechanism of overcoming a problem the adolescents face during the process of maturation [13]. Cases of intentional self-poisoning are usually non-fatal; however, those who survive the suicidal attempt may encounter severe health consequences which require long-term medical help and psycho-social support [14, 15].

This study was aimed at determining the age and gender distribution of patients, mode of poisonous substance intake, circumstances under which poisoning occurred, as well as groups of poisonous substances causing acute poisoning in children and adolescents hospitalized at the Institute of Child and Youth Health Care of Vojvodina.

Material and Methods

This retrospective study included data from medical records of all patients hospitalized for suspected acute substance-induced intoxication at the Institute of Child and Youth Health Care of Vojvodina in the period from January 1, 2015, to December 31, 2017. The study data were taken from the medical records of the study sample, including the doctors’ reports, medical histories, laboratory test results and other examinations. The following data were analyzed: number of patients exposed to toxic substances hospitalized in the study period, gender and age of patients, symptoms of poisoning on admission, month or period of the year when the patients were hospitalized, medical data on the type of consumed poisonous substance/s, mode and circumstances of intake, and treatment outcome. If a patient was admitted several times for suspected acute poisoning, each admission was considered as an individual case.

Microsoft Office Excel 2010 program was used to process the collected data statistically as mean values, standard deviations and percentage relations among groups. Statistical significance was determined by $\chi^2$-test and $p \leq 0.05$ was considered statistically significant. The results are shown in graphs and tables.

Results

There were 540 patients (100%) hospitalized at the Institute of Child and Youth Health Care of Vojvodina for exposure to toxic substances in the period from 2015 to 2017. The highest number of poisoning cases was recorded in 2015 (199 cases), and then in 2016 (194), whereas in 2017 it was statistically significantly lower (147 cases of poisoning) ($\chi^2$, $p \leq 0.05$). Out of 540 patients, 21 were hospitalized for suspected gas poisoning, what turned out to be a mass psychogenic reaction, so they were left out of the analysis and 519 patients were analyzed.

There were 259 male patients (49.90%) and 260 female patients (50.10%) during the observed time.

Gender and age distribution of patients is represented in Graph 1. The highest number of patients was between 14 and 16 years of age – 183 (33.33%). Chi-square test was performed to determine gender differences, and the difference was found to be statistically significant in the age group from 4 – 6 ($p \leq 0.01$), the boys having been affected by poisoning much more frequently, whereas the girls outnumbered the boys in the age group from 14 – 16 ($p \leq 0.05$). During the observed period, no cases of poisoning were found in the newborns.

On admission, 323 patients (62.23%) had symptoms of poisoning and 196 patients (37.77%) were without symptoms, so the discharge diagnosis was non-toxic exposure. There were no available data regarding the period between the toxic substance exposure and hospital admission for all patients. Therefore, we cannot determine with certainty the patients who had non-toxic exposure in regard to those who received appropriate aid before and on admission.

The number of children and adolescents hospitalized for suspected acute poisoning was found to be similar when analyzed by months.

The majority of patients ingested toxic substances (483 - 93.96%), 20 patients (3.85%) inhaled them, while 11 (2.12%) patients combined oral and inhalation. In 4 patients (0.77%) the route of toxic substance intake was ingestion and skin absorption, and 1 patient (0.19%) subcutaneously injected the substance (Graph 2).

Medications were the most common cause of poisoning, of which the following groups were most frequent: medications for the treatment of central nervous, cardiovascular, and musculoskeletal systems (Graph 3).

Medications and household chemicals were the dominant etiological agents for poisoning during the first ten years of life, which were all accidental (Table 1).
In adolescents, poisoning was most frequently caused by abuse of toxic substances including psychoactive substances (60.38%). Intentional self-poisoning was the second most frequent type of poisoning, in 32.91% of cases, whereas in 6.71% of cases poisoning was unintentional.

Circumstances of poisoning in adolescents, gender distribution, and causes were very specific and therefore they were analyzed separately (Table 2).

Due to acute poisoning by abuse of psychoactive substances, 110 male adolescents (58.1%) and 79 female adolescents (41.8%) were admitted, and the gender distribution was statistically significant ($\chi^2$, $p \leq 0.05$). Intentional self-poisoning was the reason for admission of 87 female adolescents (84.47%) and 16 male adolescents (15.53%), the difference being statistically significant ($\chi^2$, $p \leq 0.01$). There was no difference between genders in cases of accidental poisoning – 10 male adolescents (47.62%) and 11 female adolescents (52.38%).

The most frequent causative agents of poisoning in adolescents were alcohol (168 cases, i.e. 53.67%) and medications (99 cases, i.e. 31.63%), and drug abuse was recorded in 21 patients (6.71%). Of all psychoactive substances, alcohol abuse was most frequent (168 cases, i.e. 88.89%), while medications were most common in intentional self-poisoning (89 cases, i.e. 86.41%).

Acute alcohol intoxication was the reason for admission of 96 male (57.14%) and 72 female adolescents (42.86%), and the gender difference was statistically insignificant ($\chi^2$, $p = 0.06$). Acute poisoning caused by medications was recorded in 81 female adolescents (81.82%) and 18 male adolescents (18.18%), and the gender difference was statistically significant ($\chi^2$, $p \leq 0.01$). Fifteen male and six female adolescents were hospitalized because of drug abuse, and the difference between male and female adolescents was statistically significant ($\chi^2$, $p \leq 0.05$).

Out of 103 adolescents (100%) who reported that the reason of poisoning was their intent to commit

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**Table 1. Age distribution of patients and etiological agents reported in medical history data**

| Age (yrs)/Uzrast (god.) | 0 - 1 | 1 - 3 | 4 - 6 | 7 - 10 | 11 - 13 | 14 - 16 | 17 - 19 | Total/Ukupno |
|--------------------------|-------|-------|-------|--------|---------|---------|---------|-------------|
| Medications/Lekovi       | 14 (40) | 67 (59.82) | 26 (50) | 2 (28.57) | 23 (44.23) | 69 (34.85) | 21 (20.59) | 222 (39.78) |
| Alcohol/Alkohol          | /     | /     | 1 (1.92) | 2 (28.57) | 13 (25) | 100 (50.50) | 71 (69.61) | 187 (33.51) |
| Households chemicals     | 12 (34.28) | 30 (26.78) | 13 (25) | 1 (14.29) | 2 (3.85) | 5 (2.52) | 1 (0.98) | 64 (11.47) |
| Toxic gases/Štetni gasovi| /     | 2 (1.79) | /     | 2 (28.57) | 13 (25) | 11 (5.56) | 2 (1.96) | 30 (5.38) |
| Pesticides/Pesticidi     | 7 (20) | 7 (6.25) | 3 (5.77) | /     | /     | /     | /     | 17 (3.05) |
| Psychoactive substances/Psihoaktivne sustancije | 1 / (0.89) | /     | /     | 13 (6.57) | 4 (3.92) | 18 (3.23) |
| Poisonous plants and mushrooms | 1 (2.86) | 3 (2.68) | 8 (15.39) | /     | 1 (1.92) | /     | 1 (0.98) | 14 (2.51) |
| Other/Ostalo             | 1 (2.86) | 2 (1.79) | 1 (1.92) | /     | /     | /     | 2 (1.96) | 6 (1.07) |
| Total/Ukupno             | 35 (100.00) | 112 (100.00) | 52 (100.00) | 7 (100.00) | 52 (100.00) | 198 (100.00) | 109 (100.00) | 558 (100.00) |

**Graph 2. Route of xenobiotic intake**

**Grafikon 2. Put unosa ksenobiotika**

**Graph 3. Medication groups reported as the most frequent causes of acute poisoning according to anamnestic data**

**Grafikon 3. Grupe lekova koji su najčešći uzročnici akutnih trovanja prema anamnestičkim podacima**
suicide or intentional self-poisoning, fifty-eight adolescents (56.31%) were referred to the Department of Psychiatry for further treatment. Regarding the treatment outcome, all poisoned patients were successfully treated and there were no fatalities.

Eight patients were admitted due to repeated acute poisoning, among which there were seven adolescents and one toddler.

A female toddler was hospitalized because she accidentally ingested a rodenticide, and a year later she had taken clonazepam, a drug used by her grandmother.

Among adolescents, there were five female and one male patients hospitalized due to repeated self-poisoning.

Four female adolescents were previously treated by a psychiatrist. Three of them had repeatedly taken a great amount of drugs they used in regular therapy, and one of them had taken a drug used by her mother for treatment of epilepsy. After receiving appropriate aid, these patients were referred to the Department of Psychiatry for further treatment. One female adolescent took a large amount of sedatives due to a family conflict. After detoxication she was discharged with an advice to visit a child psychiatrist. Two months later, this girl was admitted because of the same reason. After stabilization, she left the treatment and there is no further data about this case.

One of the two male adolescents took several medications (sedatives and analgesics) on two occasions, first due to a family conflict, and next time the intent of poisoning was unclear. After treatment, he was also referred to the Department of Psychiatry. Another male patient had symptoms of poisoning due to inadequate compliance of drugs used in the therapy of epilepsy. The next time he was hospitalized for alcohol abuse.

A group of 21 adolescents attending the same school were hospitalized for suspected exposure to a toxic gas on the same day. Toxicological test results showed no substance of any toxicological importance. Teachers, who were with the patients on
the same premises that day, did not have any symptoms. Therefore, it was concluded that it was a case of mass psychogenic reaction.

Discussion

The study included 519 patients with suspected acute poisoning who were admitted at the Institute of Child and Youth Health Care of Vojvodina in the period from 2015 to 2017.

Of the patients hospitalized for acute poisoning, 51% were females and 49% were males, so the difference between genders was not statistically significant. Similar results were obtained by studies performed throughout the world [3, 12, 16].

In this study, acute poisoning was most frequent in patients between 14 and 16 years of age, and then in those aged 1 to 3. These results are in accordance with those obtained by Even et al., who reported the majority of acute poisoning in patients below 3 and above 13 years of age [2], whereas Oliveira et al. showed that acute poisoning was most common in children up to 4 years of age [13], thus confirming that children at this age are at risk because of being more active and curious. As for the gender, females prevailed in the age group between 11 and 18 years, and males in the group up to 11 years of age that is in accordance with the research of Lee et al. [16].

Zakharov et al. have reported that the number of non-fatal self-poisoning attempts is highest in the spring (31.3%) [14, 15]. A similar study conducted in Turkey showed that the highest number of intoxications occurred in the autumn and summer [3]. Our study showed no seasonal differences in the frequency of poisoning, and monthly variations were random. For example, in February 2015, there was a rise in the number of patients hospitalized at the Institute of Child and Youth Health Care of Vojvodina for suspected accidental exposure to poisonous gas, which was later ruled out.

In our study, 62% of patients had symptoms of poisoning, while 38% were without symptoms and it is also in accordance with other researches [14 - 16]. If patients arrived within an hour after the exposure, adequate measures to prevent the absorption of poisonous substance were undertaken. As a result, patients did not develop symptoms of poisoning. Also, some of them had non-toxic exposure to harmful substances.

In our study, ingestion of toxic substances was most common (89%), as well as in many other similar studies [3, 17 – 21].

In this study, medications were the most frequent etiological agents in all age groups, which is in accordance with other previous researches [16, 19]. The second most common cause of poisoning was alcohol, followed by household chemicals which are somewhat less frequent, and it is in accordance with the results obtained in Croatia [20].

Medications used in the therapy of central nervous system disorders were the most frequent causes of intoxication, which is in accordance with other authors’ findings [16, 19, 22 – 24]. The second and third place in our study was taken by medications used in the therapy of cardiovascular and musculoskeletal system diseases, which is in agreement with the most frequently consumed medications in general population of the Republic of Serbia [25].

Regarding the circumstances of poisoning, accidental poisonings were the most common in this study, as well as in other studies [2, 26]. In children up to 10 years of age, all poisonings were accidental, whereas in adolescents 6.7% of poisonings were unintentional. Due to acute poisoning by abuse of psychoactive substances, 60.38% of adolescents were hospitalized. The percentage of intentional self-poisonings in adolescents was 32.9% of cases in our study, and it was similar to the study done by Liisanantti et al. [22].

The most common etiological agent of poisoning in adolescents in this study was alcohol (50.3%) followed by medications (29.64%). Almost identical results were obtained in Croatia (alcohol – 55.7%, medications – 28.89%) [17]. Alcohol was also the most frequent agent of poisoning followed by medications, according to a Finnish study [18]. In this study, 6.29% of adolescents consumed psychoactive substances (sometimes combined with alcohol) and 2.6% of adolescents combined medications with alcohol, that is in accordance with several researches [14, 15, 21].

Alcohol abuse is the most common cause of acute poisoning in individuals aged between 10 and 18 years in the most developed European countries as well [27 – 29]. Young people may consider consumption of alcohol a part of growing up and imitation of adult drinking habits [28]. In our study sample, there were more male patients hospitalized for acute alcohol intoxication, which complies with the results of other studies, but the gender difference was not significant, which implies that female adolescents use alcohol almost as often as male adolescents [17, 21, 30]. The most common etiological agents of intoxication in male and female adolescents were alcohol and medications, respectively. Intentional self-poisoning caused by medications was more frequent in female patients, and that is in accordance with other studies [17, 18, 21]. Araújo Veras et al. explained this phenomenon by the fact that male adolescents tend to express their aggressiveness towards their environment in circumstances causing frustration in young people, whereas girls are self-aggressive, they are prone to self-infliction [18].

Among the adolescents who were admitted due to intentional self-poisoning or intended suicide, 56.31% were referred to the Department of Psychiatry for further treatment. According to the literature data, the mortality rate due to acute intoxication ranges between 0.4% and 7.6% [19, 22, 29, 30]. The treatment outcome was good in all the patients included in our study and there were no fatalities.
A group of 25 adolescents attending the same school, who were hospitalized for suspected exposure to harmful gas on the same day, is interesting because it suggests a possibility of a phenomenon of mass panic disorder in adolescents, which is important to be recognized and managed at institutions dealing with treatment of poisoning in children and adolescents.

Conclusion

This study included 519 patients hospitalized at the Institute of Child and Youth Health Care of Vojvodina in Novi Sad in the period from January 1, 2015, to December 31, 2017. There were no gender differences in admitted patients. Intoxications were without a seasonal pattern. The poisonous substances were most commonly taken orally.

Medications were the most frequent cause of poisoning in children and adolescents. Medications and household chemicals were the most frequent causes of poisoning in children up to 10 years of age, whereas in adolescents (more often males than females) it was alcohol abuse. Poisoning with suicidal intent, and intentional self-poisonings without attempted suicide, were considerably more frequent in girls than in boys. Medications were the most common etiological agents in intentional self-poisoning.

Acute poisoning is a serious health problem and therefore it is of utmost importance to take necessary preventive measures against it.

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