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Clinical use of the poisoning severity score in acute pediatric poisoning

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Abstract

To make an accurate diagnosis of poisoning and determine the severity of poisoning quickly without losing time are critical for managing the patient's medical treatment and predicting the prognosis. This study aimed to investigate PSS and Glasgow Coma Scale Score (GCS) effectiveness in predicting outcomes in acute pediatric poisoning. We retrospectively reviewed the data of intoxicated patients aged under 18 years who were admitted to the pediatric emergency service of Ondokuz Mayıs University Faculty of Medicine Clinical Research and Practice Hospital between January 1, 2018, and December 31, 2018. Two hundred twenty-two patients were admitted to our pediatric emergency department (ED) after drug ingestions. Of the patients enrolled in the study, 148 (66.7 %) were female, and 74 (33.3%) were male. The mean age was 105.8±75.3 months, and the median age was 65 (12-213) months. 96 (43.3%) poisoning cases were in the age range of 12-18 years. According to Poisoning Severity Score, it was found that 84 cases (37.4%) were asymptomatic (PSS score=0), 86 cases (38.7%) were minor (PSS score=1), 48 cases (21.6%) were moderate (score=2) and four cases (1.8%) were severe (PSS score=3). Combined using the Poisoning Severity Score with the patient's biochemical and physiological values may help improve an accurate diagnosis of poisoning and determine the severity of poisoning more accurately.

Keywords: intoxication, pediatric, poisoning severity score, prognosis

1. Introduction

Poisoning, especially in the pediatric population, remains to be an essential public health issue. While it is commonly seen in the first year of life due to the parents' dose errors, it is later caused by accidental ingestion of household cleaning materials and easily accessible chemical agents. At an older age, poisoning cases can be observed in these groups with excessive intake of medications kept in medicine cabinets or left open.

Although the management of poisoned patients is challenging for every emergency physician, this can be more difficult, especially in the pediatric population. Difficulties in taking an anamnesis and defining the hiding symptoms due to physiological differences in pediatric age subgroups or determining the association between symptoms and relevant toxidromes suggest that the approach to the pediatric poisoned patient will be more difficult than adults.

Therefore, to make an accurate diagnosis of poisoning and determine the severity of poisoning quickly without losing time are critical for managing the patient's medical treatment and predicting the prognosis. For this purpose, Poisoning Severity Score (PSS) has been used successfully in many poisoning types such as hydrocarbons, organophosphates, antipsychotics, and envenomations in adults (1-3).

The Poisoning Severity Score, a simple grading scale proposed by the European Association of Poison Centres and Clinical Toxicologists, uses a collection of clinical signs and symptoms to give a 0 to 4 (4). The score is applied according to the patient's most severe clinical effects, regardless of the timing of those effects. It is not meant to provide prognostic information. A score of zero (0) equates to being asymptomatic, one (1) is minor, two (2) is moderate, three (3) is severe, and four (4) is given if the patient dies. As such, all patients that die should only receive a score of 4 (5).

This study aimed to investigate the effectiveness of PSS and Glasgow Coma Scale Score (GCS) in predicting outcomes in acute pediatric poisoning. We also aimed to describe the detailed characteristics of acute pediatric poisoning cases admitted to our pediatric emergency department.

2. Materials and methods

2.1. Ethical statement

The Clinical Research Ethics Committee approved this study of Ondokuz Mayıs University (Ondokuz Mayıs University CREC protocol no: 2019/506).

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2.2. Study design and population

We retrospectively reviewed the data of patients aged under 18 years who were admitted to the pediatric emergency service of Ondokuz Mayıs University Faculty of Medicine Clinical Research and Practice Hospital between January 1, 2018, and December 31, 2018, after drug ingestion. The patients who had a history of ingestion related to recreational drugs (heroin, synthetic cannabinoids), alcohol, rodenticides, insecticide (organophosphate), and perfume were excluded from the study. After exclusion, 222 patients who met the inclusion criteria were identified.

The relevant information for each of the patients was recorded into the study form about demographic information (age, gender), the admission time (hour and month) and type (direct, referral), school degree, type of ingestion (intentional or nonintentional) the presence of multidrug ingestion, main complaints and symptoms at initial admission, the ingested drugs and their amounts (in grams), vital signs, treatment (hydration, activated charcoal, gastric irrigation), the name of a specific antidote, Glasgow Coma Scale score, Poisoning Severity Scores, the properties of electrocardiography, QTC time, hospitalization status, duration of hospitalization (hour) and type of discharge and prognosis. Clinical staging was performed using Poisoning Severity Score (PSS). While making a statistical analysis using PSS, those with a <2 PSS were described as a minor group, and the remainder with a PSS of 2-3 were described as a moderate group. No patient had a PSS of four points (severe). Understanding the statistical analysis was simplified by dividing the patient group into two subgroups according to PSS. We evaluated the hospitalization and discharge status using PSS and GCS scores.

2.3. Statistical analysis

Data were analyzed using IBM SPSS 21.0 for Windows. The descriptive statistics were presented as mean (±) standard deviation (S.D); median (minimum (min) – maximum (max)), and frequency distribution was presented as percentage (%). The variables' suitability to normal distribution was analyzed using analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk Tests). Mann-Whitney U test was used to compare differences between two independent groups. Spearman's rho correlation test was used to investigate the relationship between different variables. Fisher's Exact test was used to examine the qualitative data. The significance level was accepted as $p < 0.05$.

3. Results

Two hundred twenty-two patients were admitted to our pediatric emergency department (ED) after drug ingestions. The poisoned patients represented 1.01% (222/21900) of overall pediatric emergency unit visits during 2018. Of the patients enrolled in the study, 148 (66.7%) were female, and 74 (33.3%) were male. The mean age was 105.8±75.3 months, and the median age was 65 (12-213) months. 96 (43.3%) poisoning cases were in the age range of 12-18 years (Table 1). There was a significant statistical difference between age groups and gender ($p \leq 0.001$), but there was no statistical difference between age groups and poisoning severity score ($p > 0.05$).

It was found that 56 admissions to our ED were in winter (25.2%), 34 in summer (15.3%), 74 in spring (33.3%), and 58 cases in autumn (26%), respectively. There was no statistical difference between admission month and gender as well poisoning severity score ($p > 0.05$). It was determined that the number of admissions between the hours of 00.00-08.00 were 55 cases (24.8%), 81 cases between 08.00-16.00 (36.5%), and 86 cases between 16.00-00.00 (38.7%) respectively. There was no statistical difference in admission hour according to gender and poisoning severity score ($p > 0.05$). When type of ingestion was compared according to gender, school status, admission month and hour, multiple drug ingestion and poisoning severity score; there was a significant statistical difference in gender ($p = 0.02$), school status ($p \leq 0.001$), admission hour ($p = 0.04$), and multiple drug ingestion ($p \leq 0.001$). Still, there was no statistical difference at admission month ($p > 0.05$) and poisoning severity score ($p = 0.217$), respectively.

Analgesic-antipyretics (49 patients (22.1%)) were the most ingested drugs among our pediatric poisoned group, which was consisted of 30 patients who ingested nonsteroidal anti-inflammatory drugs and 19 patients ingested paracetamol. There was no statistical difference between the PSS score and drug groups ($p > 0.05$). It was determined that four patients with high PSS score (PSS = 3) received antidepressants, antipsychotics, centrally acting muscle relaxants and antiepileptic drugs, respectively. A specific antidote was given to 11 (5%) of 222 patients. There was no statistical difference between the administration of specific antidote therapy and poisoning severity score ($p > 0.05$). According to data, 209 patients (94.1%) were hospitalized for treatment in the pediatric emergency observation unit, and 13 patients (5.9%) were hospitalized in pediatric intensive care unit. Of patients admitted to the pediatric intensive care unit, five patients had above 13 of Glasgow Coma Scale score (GCS score≥13), eight patients had 9-12 of GCS score. There was a statistical relation between PSS and GCS score ($p \leq 0.001$, $r = 0,35$). Of the 13 patients hospitalized in pediatric ICU, ten patients were poisoned by a single agent, and three of them were by multidrug intake. According to the data obtained from patients hospitalized in pediatric ICU, there was no statistical difference between multidrug intake and GCS and PSS ($p > 0.05$).

According to Poisoning Severity Score, it was found that 84 cases (37.4%) were asymptomatic (PSS score=0), 86 cases (38.7%) were minor (PSS score=1), 48 cases (21.6%) were moderate (score=2) and four cases (1.8%) were severe (PSS score=3). Of these patients with severe symptoms, three patients were female, and two patients were accidentally

intake and between the ages of 2-6 years. Contrarily, the remaining two patients were suicidal ingestion and between 12-18 years. Three patients with severe PSS have been poisoned by a single agent. Sixty-five cases (29.3%) refused the treatment left the hospital before the end of the observation period. The asymptomatic 156 patients (70.27%) were discharged after sufficient observation.

Table 1. Characteristics of acute pediatric poisoning

		Number of Patient n (%)
Gender	Female	148 (66,7)
	Male	74 (33,3)
Age (months)		105.8±75.3* 65 (12-213)**
Age Groups	0-2 years old	20 (9.0)
	2-6 years old	92 (41.4)
	6-12 years old	14 (6.3)
	12-18 years old	96 (43.2)
School Status	Out of School	121 (54.5)
	Nursery	23 (10.4)
	Preschool	3 (1.4)
	Primary school	11 (5.0)
	Middle school	21 (9.5)
	High School	43 (19.4)
Admission Time (Month)	Winter	56 (25.2)
	Spring	74 (33.3)
	Summer	34 (15.3)
	Autumn	58 (26.1)
Admission Time (Hour)	24.00 - 08.00	55 (24.8)
	08.00 - 16.00	81 (36.5)
	16.00 - 24.00	86 (38.7)
Type of Ingestion	Incidental	123 (55.4)
	Suicidal	99 (44.6)
Type of substance intake	Single drug	169 (76.1)
	Multiple drugs	53 (23.9)
Amount of substance intake	Antidepressants	36 (16.2)
	Nonsteroidal antiinflammatory drugs	30 (13.5)
	Antipsycotics	22 (9.9)
	Cardiovascular system drugs	21 (9.5)
	Paracetamol	19 (8.6)
	Antiepileptics	18 (8.1)
	GIS motility regulators	7 (3.2)
	Antibiotics	7 (3.2)
	Addictive substance	6 (2.7)
	Proton pump inhibitors	6 (2.7)
	Antihistaminics	4 (1.8)
	Antidiabetics	3 (1.4)
	Iron preperate	3 (1.4)
	Myorelaxants	3 (1.4)
	Acetylcysteine	3 (1.4)
	Alcohol	3 (1.4)
	Unknown	2 (1.4)
	Others	29 (13.1)
Complaints	Asymptomatic	91 (41.0
	Vomiting	55 (24.8)
	Altered mental status	35 (15.8)
	Syncope	13 (5.9)
	Seizure	5 (2.3)
	Dizziness	3 (1.4)
	Faint	2 (0.9)
	Abdominal pain	2 (0.9)
	Others	16 (7.0)
Decontamination	Activated charcoal – gastric lavage	184 (82.0)
	Activated charcoal	21 (9.5)
	Gastric lavage	5 (2.3)
	No application	12 (5.4)
ECG	Normal sinus rhythm	185 (83.3)
	Abnormal ECG finding	37 (16.7)
	Bradycardia	5 (2.3)

	Sinustachycardia	29 (13.1)
	PR elongation	1 (0.5)
	LongQTc	2 (0.9)
PSS	Asymptomatic -Minor (0-1)	170 (76.6)
	Moderate-Severe (2-3)	52 (23.4)
	Death (4)	0 (0)
GCS	Overall	15 (9-15)**
	Mild (≥13)	211 (95.0)
	Moderate (9-12)	11 (5.0)
Hospitalization	Pediatric Emergency / General service	211 (95.0)
	Pediatric intensive care unit	11 (5.0)
Duration of Hospital Stay (hours)		39.78±24.54* 35 (3-160)**
Antidote	Not used	211 (95.1)
	Specific antidote administered	11 (5.0)
	N-acetylcysteine	8 (3.6)
	Calcium and leucovorin	1 (0.45)
	Biperiden	1 (0.45)
	Deferoxamine	1 (0.45)
Final Status	Discharged with full recovery	155 (69.8)
	Treatment refusual	66 (29.7)
	Referred to Transplantation Center	1 (0.5)

*; The descriptive statistics were presented as mean (±) standard deviation (SD), **; The descriptive statistics were presented as median (minimum– maximum)

A 16-year-old girl who developed acute liver failure following massive paracetamol ingestion with the initial PSS score of two was referred to a transplantation center. The four patients who had severe symptoms at the admission (PSS score=3) were discharged from the hospital with complete recovery. The median (min-max) duration of hospitalization was 35 (3-160) hours. The median (min-max) duration of hospitalization in the single drug ingested patient and multiple drug intake were 35 (3-160) and 35 (6-120), respectively. The median (min-max) duration of hospitalization in the accidentally ingested group and suicidal group were 38 (6-96) and 32 (3-160), respectively. When patients were analyzed the type of ingestion (incidental, suicidal) according to admission time (month), there was no significant statistical difference at the seasonal variation (p=0.939). When we analyzed the patients' PSS and GCS scores according to hospitalization and discharge status, statistical differences were determined, respectively (Table 2 and 3).

Table 2. Evaluation of Poisoning Severity and Glasgow Coma Scale Scores according to hospitalization and discharge status

	Poisoning Severity Score (PSS)			
	Minor	Moderate	Total	p*
Hospitalization				
Pediatric Service	167 (98.2)	42 (80.8)	209 (94.1)	<0.001
IntensiveCareUnit	3 (1.8)	10 (19.2)	13 (5.9)	
Discharge				
Treatmentrefusual	57 (33.7)	8 (15.7)	65 (29.5)	<0.001
Dischargedwithfullrecovery	112 (66.3)	43 (84.3)	155 (70.5)	
	Glaskow Coma Scale Score (GCS)			
	Mild	Moderate	Total	
Hospitalization				
Pediatric Service	206 (97.6)	3 (27.3)	209 (94.1)	0.021
Intensive Care Unit	5 (2.4)	8 (72.7)	13 (5.9)	
Discharge				
Treatment refusual	65 (31.1)	0 (0)	65 (29.5)	0.036
Discharged with full recovery	144 (68.9)	11 (100)	155 (70.5)	

*Fisher's Exact test

Table 3. Evaluation of acute pediatric poisoning cases according to Poisoning Severity and Glasgow Coma Scale Scores

	N	Median	Minimum	Maximum	Mean	Std. Deviation	p*
PSS							
Minor	170	30.00	3.00	96.00	35.48	20.57	<0.001
Moderate	52	48.00	15.00	160.00	53.85	30.74	
GCS							
Mild	211	32.00	3.00	96.00	37.13	20.95	<0.001
Moderate	11	80.00	48.00	160.00	90.73	33.11	

*Mann Whitney U test

4. Discussion

In case of poisoning, determining the agent and administration of the specific antidote therapy without gratuitous delay is especially important, especially in the early ED admission period. Therefore, it is used in many clinical tools for early recognition of patients' prognosis. This retrospective study started with this idea. The poisoning severity score was used to determine the severity of acute pediatric poisoning cases admitted to a tertiary pediatric emergency department for one year.

The percentage of acute poisoning in our tertiary pediatric emergency department had a high level than the numbers of acute poisoning cases in western countries (0.28-0.66%) but also a similar ratio with the other pediatric emergency units in Turkey (0.21-2.31) (6). It supports that childhood poisoning is still an important issue; that is why it is a public health problem for Turkey and the other countries in the world. In our study, different from the others, acute poisoning was widespread in children between the ages of 12-18 years (7). In the various studies in the literature, the data that supports acute poisoning in children under five years of age are also available in our research. The female gender (66.7%) was dominant among all age groups in our study, like the other studies (8,9). Besides, there was no statistical difference between age groups and the poisoning severity score in our study. This result can be related to the small study size and duration because this study was planned as a pioneer study to determine the poisoning severity score as a valuable tool in pediatric aged, poisoned patients before a prospective study that will be conducted on the same field.

There was no statistical association between admission month and PSS. Still, in another study from Turkey, Sahin et al. (6) found that the highest numbers of pediatric poisoning cases have happened in the winter, contrary to our finding as spring. According to our data, antidepressant and anti-inflammatory drugs were the leading toxic agents, like the literature (7). While the younger patient group had more accidental single intakes, the older pediatric age group received higher rates of multiple suicide intake, like adults in our study.

Similarly, Mintegi et al. (7) emphasizes that the young pediatric patient group accidentally consumes a small number of drug-induced drugs at home, and the cases are benign. Although the symptoms or complaints are especially important for the clinician in the pediatric poisoning cases, it is noteworthy that most pediatric poisoning patients are asymptomatic in the studies conducted in the literature and our research. As the leading symptoms were vomiting (24.8%) and altered mental status (15.8%) in our research, neurologic symptoms, significantly altered mental status were often reported in the literature (7).

The fact that most patients are hospitalized due to the need for observation in pediatric poisoning cases appears with a high rate of hospitalization in our study. In contrast, the number of morbidities is deficient, and there was no mortality in the study group. We also think that it reduces the selectivity of scoring systems because most patients were mild or asymptomatic in our study. After all, a statistical difference was found between the admission to the intensive care unit and Glasgow Coma Scale score and Poisoning severity score. PSS and GCS's comparison is not exactly accurate, but it is noteworthy that both scores are in similar ratios in the pediatric poisoned group. When the PSS score was compared with gender, school status, admission hour, multidrug intake, hospitalization, and discharge status, significant statistical differences were detected. Then, it noticed that there were conflicting results about the poisoning severity score in specific poisonings in the literature. However, Akdur et al. (10) and Nauira et al. (11) did not find a relationship between pseudocholine esterase level and the PSS scores in two separate organophosphate poisoning studies like our study result. Tsao et al. (12) and Churi et al. (13) found contradictory results that there was a relationship between pseudocholine esterase level, clinical outcome, and PSS scores.

This retrospective study is a pilot study in a pediatric emergency department in a tertiary university hospital which contains only prescripted drug poisoning cases in a one-year limited time and reflects its data before the prospective research planned. Because of the low number of patients with severe symptoms and no mortality in our patient group, the PSS score was insufficient in the patient management in our study.

In conclusion, intoxication in childhood is a significant global public health problem causing mortality and morbidity that can be prevented. Even if the PSS score looks suitable for clinical and research uses, there is still no sufficient evidence in the literature. Also, the wrong usage of the PSS score was also emphasized in a few studies. Combined using the Poisoning Severity Score with patient's biochemical and physiological values may be helpful to improve an accurate diagnosis of poisoning and determine the severity of poisoning more accurately.

Conflict of interest

No conflict of interest was declared by the authors.

Acknowledgments

This study was approved by The Clinical Research Ethics Committee of Ondokuz Mayıs University Medicine Faculty (OMU CREC protocol no: 2019/506).

References

1. Abahussain EA, Ball DE. Pharmaceutical and chemical pediatric poisoning in Kuwait: a retrospective survey. Pharm Pract (Granada). 2010 Jan;8(1):43-9. doi: 10.4321/s1886-36552010000100005. Epub 2010 Mar 15. PMID: 25152792; PMCID: PMC4140576.

2. Davies JO, Eddleston M, Buckley NA. Predicting outcome in

acute organophosphorus poisoning with a poison severity score or the Glasgow coma scale. QJM. 2008 May;101(5):371-9. doi: 10.1093/qjmed/hcn014. Epub 2008 Mar 4. PMID: 18319295; PMCID: PMC2493062.

3. Adams RD, Gibson AL, Good AM, Bateman DN. Systematic differences between healthcare professionals and poison information staff in the severity scoring of pesticide exposures. Clin Toxicol (Phila). 2010 Jul;48(6):550-8. doi: 10.3109/15563650.2010.491484. PMID: 20615150.

4. Persson HE, Sjöberg GK, Haines JA, Pronczuk de Garbino J. Poisoning severity score. Grading of acute poisoning. J Toxicol Clin Toxicol. 1998;36(3):205-13. doi: 10.3109/15563659809028940. PMID: 9656975.

5. Schwarz ES, Kopec KT, Wiegand TJ, Wax PM, Brent J. Should We Be Using the Poisoning Severity Score? J Med Toxicol. 2017 Jun;13(2):135-145. doi: 10.1007/s13181-017-0609-5. Epub 2017 Mar 10. PMID: 28283941; PMCID: PMC5440322.

6. Sahin S, Carman KB, Dinleyici EC. Acute poisoning in children; data of a pediatric emergency unit. Iran J Pediatr. 2011 Dec;21(4):479-84. PMID: 23056835; PMCID: PMC3446134.

7. Mintegi S, Fernández A, Alustiza J, Canduela V, Mongil I, Caubet I, Clerigué N et al. Emergency visits for childhood poisoning: a 2-year prospective multicenter survey in Spain. Pediatr Emerg Care. 2006 May;22(5):334-8. doi: 10.1097/01.pec.0000215651.50008.1b. PMID: 16714960.

8. Chhetri UD, Ansari I, Shrestha S. Pattern of pediatric poisoning and accident in Patan Hospital. Kathmandu Univ Med J (KUMJ). 2012;10(39):39-43.

9. Alagözlü H, Sezer H, Candan F, Tabak E, Elaldı N. A survey of patients with acute poisoning in the Sivas region, Turkey, between 1994 and 1998. Turk J Med Sci. 2002;32(1):39-42.

10. Akdur O, Durukan P, Ozkan S, Avsarogullari L, Vardar A, Kavalci C, Ikizceli I. Poisoning severity score, Glasgow coma scale, corrected QT interval in acute organophosphate poisoning. Hum Exp Toxicol. 2010 May;29(5):419-25. doi: 10.1177/0960327110364640. Epub 2010 Mar 4. PMID: 20203133.

11. Nouira S, Abroug F, Elatrous S, Boujdaria R, Bouchoucha S. Prognostic value of serum cholinesterase in organophosphate poisoning. Chest. 1994;106(6):1811-1814.

12. Tsao TC-Y, Juang Y-C, Lan R-S, Shieh W-B, Lee C-H. Respiratory failure of acute organophosphate and carbamate poisoning. Chest. 1990;98(3):631-636.

13. Churi S, Bhakta K, Madhan R. Organophosphate poisoning: prediction of severity and outcome by Glasgow Coma Scale, poisoning severity score, Acute Physiology and Chronic Health Evaluation II score, and Simplified Acute Physiology Score II. J Emerg Nurs. 2012 Sep;38(5):493-5. doi: 10.1016/j.jen.2012.05.021. Epub 2012 Jul 21. PMID: 22819372.