ORGINAL RESEARCH ARTICLE

Evaluation of Methadone Poisoning, Clinical Manifestations, and Laboratory Findings in Hospitalized Children at Shahid Motahari Hospital, Urmia, During 2019–2024

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Abstract

Background Poisoning is one of the common causes of visits to emergency departments. Opioids and methadone are among the leading causes of unintentional poisoning, particularly in children, leading to a high burden of pediatric emergency admissions. This study was conducted to evaluate methadone poisoning, clinical manifestations, and laboratory findings.

Methods This descriptive cross-sectional study was performed using a census approach on the medical records of 107 children hospitalized due to methadone poisoning at Shahid Motahari Educational and Medical Center, Urmia, between 2019 and 2024. Data were collected using a checklist including demographic characteristics, clinical symptoms, and laboratory findings. Data analysis was conducted using SPSS version 26 through descriptive statistics and frequency distribution (absolute and percentage).

Results The mean age of the patients was 41 ± 52 months, with 62.6% falling within the age range of 13–59 months. A total of 59.8% were presented within less than 12 hours, 57% were boys, 81.3% of poisonings were accidental, and 64.5% were poisoned with methadone syrup. Clinical symptoms included miosis in 72.9%, decreased level of consciousness in 78.5%, seizures in 2.8%, respiratory arrest in 10.3%, intubation in 8.4%, and death in one case (0.9%). Laboratory findings showed metabolic acidosis in 35.5%, anemia in 59.8%, hyperglycemia in 43%, and positive urinary methadone in 71%. Naloxone was administered in 95.7% of patients.

Conclusion Parental education on preventing accidental methadone ingestion, timely referral to medical centers in case of poisoning symptoms, and training provided by addiction treatment centers on safe storage of methadone are effective strategies in reducing methadone poisoning among children.

Keywords Child, Clinical manifestations, Laboratory findings, Methadone, Poisoning

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1 Introduction

Currently, childhood injuries have become a significant global public health problem, imposing both direct and indirect economic burdens related to morbidity and premature mortality of children on all countries. The home is the primary environment where children spend most of their time, and many childhood-related injuries occur within this setting.[1] Both intentional and unintentional poisoning are among the common causes of emergency department visits. More than 60% of poisoning-related deaths are deliberate, while poisoning is the second leading cause of unintentional mortality in children after traffic accidents. In children, poisoning often occurs due to their tendency to imitate their parents.[2]

Substance abuse and its related poisonings are recognized as the most common types of poisoning worldwide. With the increase in population and the rising number of drug users, substance-related poisonings are also increasing. [3] Among the common and dangerous poisonings in children in Iran, opioid poisoning is significant. In recent years, there has been a shift in the pattern of opioid poisoning with a considerable rise in methadone poisoning. Unfortunately, appropriate measures have not always been taken in response to this type of poisoning. For instance, a study conducted in Tehran showed that in more than half of the children referred to a poisoning center from other medical facilities without being diagnosed with methadone poisoning, no effective intervention had been provided.[4]

Among the causes of poisoning in both children and adults in Iran, opioids remain one of the most significant, with methadone being the most frequent agent. Methadone poisoning, resulting from its use as a maintenance therapy for opioid addiction, is increasing. The growing use of methadone, on the one hand, and insufficient preventive measures, on the other, have turned this poisoning into a serious public health threat.[5] With the ongoing rise in substance abuse, the number of children admitted to pediatric hospitals due to drug poisoning has also increased. Narcotic substances account for half of all poisoning cases in children and, in some regions of Iran, are responsible for up to 91% of childhood deaths. [6] In pediatric departments of hospitals in the United Kingdom, methadone has been reported as the most common cause of fatal drug poisoning. Therefore, before and during methadone prescription, serious efforts are needed to ensure the drug is kept out of children's reach to prevent unintentional poisoning.[6]

In Iran, methadone syrup currently lacks dedicated childproof containers. Patients receiving methadone for addiction treatment usually obtain their daily or weekly dose in water bottles or other medicine containers, which they keep at home. This unsafe storage practice increases the risk of accidental ingestion either by children or due to mistaken administration by parents, leading to poisoning. [7] A study by Farnaghi et al., comparing unintentional methadone and buprenorphine poisoning in children, found that children exposed to buprenorphine had a higher rate of loss of consciousness at admission compared to methadone, but subsequently experienced fewer complications during hospitalization, likely due to the partial antagonist properties of buprenorphine. [8] These findings indicate that methadone exposure in children is more toxic than buprenorphine. A study by Hemmati et al. also demonstrated that the most common causes of poisoning in children were narcotics and medications, emphasizing the need for parents to improve their knowledge regarding the safe storage of these substances.[9]

Given the changing pattern of opioid poisoning and the remarkable increase in methadone use at home within addiction treatment and methadone maintenance programs in recent years, the issue of methadone poisoning in children has emerged as a serious and novel concern, accompanied by significant risks and complications. Therefore, this study was designed and conducted to determine the frequency of methadone poisoning in children, as well as to assess its clinical manifestations, laboratory findings, and outcomes. The findings of this research are expected to contribute to the development of strategies for preventing this type of poisoning in children.

2 Methods

The present research was a descriptive cross-sectional study. The study population consisted of children under 18 years of age who were admitted to the emergency department of Shahid Motahari Educational and Medical Hospital, Urmia, with a diagnosis of methadone poisoning between April 2019 and September 2024. Among 1,326 pediatric poisoning cases, 107 children with methadone poisoning were selected using a purposive census sampling method.

Inclusion criteria included medical records of all children under 18 years old with confirmed methadone poisoning based on clinical manifestations and laboratory findings. Exclusion criteria were incomplete records lacking clinical or laboratory data.

Data collection was performed using a checklist that included demographic information (child's age, sex, place of residence, family history of addiction, and birth order), as well as other relevant data such as number of hospital admissions, cause of poisoning, intent and amount of methadone ingested, time interval between ingestion and hospital admission, patient outcomes, length of hospital stay, respiratory, neuromuscular, ocular, gastrointestinal,

cardiovascular, and urinary symptoms, underlying diseases, pharmacological treatments, and intubation status. Information was gathered through interviews conducted by medical students and residents with the parents or caregivers, along with clinical examinations of poisoned children.

Laboratory evaluations included hematology, biochemistry, urine toxicology, electrocardiography, and other tests requested during hospitalization at the discretion of the attending physician, depending on the patient's clinical status. Data were entered and analyzed using SPSS version 26. Descriptive statistics such as mean, standard deviation, absolute frequency, and percentage were used to describe demographic characteristics. Inferential analyses, including correlation tests, were performed to assess associations between variables. A p-value of < 0.05 was considered statistically significant.

3 Results

In the present study, 67 children (62.6%) with poisoning were in the age group of 13–59 months, eight (7.5%) were in the age group of 0–12 months, 21 (19.6%) were in the age group of 60–120 months, 10 (9.3%) were in the age group of 121–168 months, and one child (0.9%) was in the age group of 169–216 months. Regarding their place of residence, 86 children (80.4%) lived in urban areas and 21 (19.6%) in rural areas. In terms of sex, 61 patients (57%) were boys and 46 (43%) were girls.

With respect to family history of addiction, 16 children (15%) had fathers with addiction, 18 (16.8%) had grandfathers with addiction, and only one child (0.9%) had a mother with addiction. In 15 cases (14%), addiction was present in other close relatives, while in 67 children (62.6%) the source of addiction in the family was not identifiable.

Regarding their birth order, 37 children (34.6%) were the first child in the family, 34 (31.8%) were the second child, 17 (15.9%) were the third child, four (3.7%) were the fourth child, and 15 (13%) were of fifth birth order or higher.

The time interval between ingestion and admission to the medical center was less than five hours in 41 children (38.3%), 6–12 hours in 23 (21.5%), 13–24 hours in 15 (14%), and 24–48 hours in three (2.8%). In 25 cases (23.4%), the time interval was either unknown or not recorded in the medical files.

The cause of poisoning was accidental in most cases (87 children, 81.3%). In five cases (4.7%), it was intentional by parents, in nine cases (8.4%), it was due to suicide attempts, and in six children (5.6%), the cause was unknown. With respect to the form of methadone, 69 children (64.5%) were poisoned by syrup, 26 (24.3%) by tablets, while in 12 cases (11.2%) the type of methadone was not documented.

The duration of hospitalization was 1–3 days in 49 children (45.8%), 4–7 days in 53 children (49.5%), and more than 7 days in five (4.7%). A previous history of poisoning was reported in nine children (8.4%), while the majority (98 children, 91.6%) had no such history. An underlying disease was present in 14 children (13.1%), whereas most children (93 cases, 86.9%) had no underlying medical condition (Table 1).

According to Table 2, which presents the laboratory findings, 64 children (59.8%) had abnormalities in hemoglobin and hematocrit levels, mainly in the form of anemia. Platelet abnormalities were observed in two cases (1.9%), while 41 cases (38.3%) had normal results.

In 103 children (96.3%), BUN and creatinine levels were normal, whereas four cases (3.7%) showed abnormalities. Serum sodium and potassium levels were normal in 105 patients (98.1%) and abnormal in two patients (1.9%).

Regarding coagulation tests (PT, PTT), 42 patients (39.3%) had normal results, five cases (4.7%) were abnormal, and in 60 cases (56.0%) these tests were not performed.

Arterial or venous blood gas (ABG/VBG) analysis showed normal results in nine patients (8.4%), metabolic acidosis in 38 (35.5%), respiratory acidosis in 17 (15.9%), metabolic alkalosis in six (5.6%), respiratory alkalosis in three (2.8%), and mixed acid–base disorders in five patients (4.7%). In 29 patients (27.1%), no sample was sent for blood gas analysis.

Blood glucose (BS) levels were normal in 45 patients (42.1%), elevated in 46 (43.0%), decreased in four (3.7%), and not reported in 12 cases (11.2%).

Urine toxicology screening revealed normal findings despite clinical symptoms and treatment response in nine cases (8.4%). Methadone was detected in 76 cases (71.0%), benzodiazepines in seven (6.5%), morphine in 11 (10.2%), methadone and benzodiazepines together in four (3.7%), barbiturates in six (5.6%), tramadol in one (0.9%), and methamphetamine in two cases (1.8%) (Table 2).

According to Table 3, which summarizes the clinical manifestations of the patients, respiratory symptoms were as follows: 28 children (26.9%) had normal findings, 10 children (9.4%) had tachypnea, 22 children (20.6%) had bradypnea, 31 children (28.9%) had cyanosis and oxygen desaturation, 11 children (10.3%) experienced respiratory arrest, and five children (4.7%) had aspiration.Regarding neuromuscular symptoms, 84 children (78.5%) exhibited decreased consciousness and drowsiness, 22 children (20.6%) had weakness and lethargy, three children (2.8%) experienced seizures, and 11 children (12.1%) were fully conscious. Ocular findings included 20 children (17.9%) with normal signs, 78 chil-

Table 1 Demographic characteristics of children with methadone poisoning

Variable	Category	Frequency (n)	Percentage (%)
Place of residence	Urban	86	87.4
	Rural	21	19.6
Family history of addiction	Father	16	15
	Mother	1	0.9
	Grandfather	8	7.5
	Close relatives	15	14.0
	Unknown source	67	62.6
Age group (months)	0–12	8	7.5
	13–59	67	62.6
	60–120	21	19.6
	121–168	10	9.3
	169–216	1	0.9
Sex	Male	61	57.0
	Female	46	43.0
Birth order	First	37	34.6
	Second	34	31.8
	Third	17	15.9
	Fourth	4	3.7
	Fifth or higher	15	13.0
Time to hospital admission	< 5 hours	41	38.3
	6–12 hours	23	21.5
	13–24 hours	15	14.0
	24–48 hours	3	2.8
	Unknown	25	23.4
Cause of poisoning	Accidental	87	81.3
	Intentional by parents	5	4.7
	Suicide	9	8.4
	Unknown	6	5.6
Type of methadone	Syrup	69	64.5
	Tablet	26	24.3
	Not specified	12	11.2
Length of hospitalization	1–3 days	49	45.8
	4–7 days	53	49.5
	> 7 days	5	4.7
Previous history of poisoning	Yes	9	8.4
	No	98	91.6
Underlying disease	Present	14	13.1
	Absent	93	86.9

dren (72.9%) with miosis, and nine children (8.4%) with mydriasis.

Gastrointestinal symptoms were normal in 26 children (24.3%), while 44 children (41.1%) had nausea and vomiting, and 37 children (34.6%) had diarrhea.

Cardiovascular signs were normal in 78 children (72.9%), 21 children (19.6%) had tachycardia, seven children (6.5%) had bradycardia, one child (0.9%) had hypotension, and one child (0.9%) exhibited mottling. Electrocardiograms (ECG) were not performed in 64 children (59.8%), were normal in 40 children (37.4%), and QT interval abnormalities were observed in three children (2.8%).

Urinary findings included positive glucose in 17 children (15.9%), positive ketones in five children (4.7%), hematuria in one child (0.9%), both ketones and glucose in

two children (1.8%), glucose and hematuria in one child (0.9%), and normal findings in 81 children (75.7%).
Regarding airway management, 98 children (91.6%) were not intubated, whereas nine children (8.4%) required intubation.

Table 2 Laboratory findings in children with methadone poisoning

Test/Variable	Category	Frequency	Percentage
CBC	Decreased Hb/Hct	64	59.8
	Platelet abnormality	2	1.9
	Normal	41	38.3
BUN/Cr	Normal	103	96.3
	Abnormal	4	3.7
Na/K	Normal	105	98.1
	Abnormal	2	1.9
PT/PTT	Normal	42	39.3
	Abnormal	5	4.7
	Not performed	60	56.0
ABG/VBG	Normal	9	8.4
	Metabolic acidosis	38	35.5
	Respiratory acidosis	17	15.9
	Metabolic alkalosis	6	5.6
	Respiratory alkalosis	3	2.8
	Mixed disorder	5	4.7
	Not performed	29	27.1
Blood Sugar (BS)	Normal	45	42.1
	Decreased	4	3.7
	Increased	46	43.0
	Not performed	12	11.2
Urine Toxicology	Methadone	76	71.0
	Benzodiazepines	7	6.5
	Morphine	11	10.2
	Methadone + Benzodiazepine	4	3.7
	Barbiturates	6	5.6
	Tramadol	1	0.9
	Methamphetamine	2	1.8
	Normal	9	8.4

Concerning pharmacological treatment, 102 children (95.2%) received naloxone, 34 children (31.8%) received sorbitol charcoal powder, 17 children (15.9%) received antibiotics, one child (0.9%) received ondansetron, 16 children (14.9%) received pantoprazole, and 12 children (11.2%) received other medications, including anticonvulsants.
The outcomes of methadone poisoning in this study showed that 90 children (84.1%) recovered, one child (0.9%) died, and 16 children (15.0%) were discharged with personal consent.

4 Discussion

According to the results of this study, the mean age of the participating children was 52 ± 41 months, with 62.6% of cases falling within the 13–59-month age range, representing the highest incidence of poisoning among children. This finding is consistent with the study by Ghaffourian et al.[10], in which 45.8% of poisoned children were aged 2 to 5 years. Additionally, 7.5% of cases occurred in the 0–12-month age group, with the youngest child being seven months old. In the study by Jabbehdari et al.[11], the youngest reported age was four months, while Hosseini-Nasab et al.[12] reported six months. Considering that infants under 12 months are not capable of ingesting methadone independently, these cases must have resulted from exposure by another individual, indicating the need for further investigation in this context.
According to the results of this study, 57% of the poisoned children were male, whereas some other studies did not report a predominance of boys.[13] Nevertheless, in the study by Besharat et al.[14], the frequency of poisoning with opium and its derivatives was higher among boys. Additionally, 87.4% of the poisoned children resided in urban areas, which is consistent with the findings of Masoudpour et al.'s study[15], in which 85.6% of the cases lived in cities. Although most studies have not examined the place of residence, a significant relationship between living environment and substance use can be interpreted as follows: residence in areas with higher exposure to delinquent behaviors or in socioeconomically disadvantaged neighborhoods may increase the likelihood of addiction, which explains the higher incidence in urban compared to rural areas.
Furthermore, 45.5% of the poisoned children had a first-degree family member or relative with a history of addiction. This result differs from the study by Hosseininasab et al.[12], in which 79% of poisoned children had family members with a history of addiction. This discrepancy may be because in 62.6% of the reviewed cases, the source of addiction was not documented; potential reasons include omission by healthcare personnel during history taking or intentional non-disclosure by the family or accompanying persons. In the present study, only one mother had a history of addiction, which contrasts with the study by Ahmadi et al.[16], titled "The Effect of Preventive Education on Mothers' Awareness of Methadone Poisoning in Children," in which group discussion-based education improved the awareness of mothers under methadone treatment.
Considering that 81.3% of methadone consumption in this study occurred accidentally, it can be concluded that proper education of mothers, as the primary caregivers, regarding safe methadone storage is critical and cannot be overlooked. In the current study, 66.4% of the poisoned

children were first- or second-born, while the incidence among later-born children was lower, and no significant association was found between parental addiction—particularly maternal addiction—and the child's birth order. In contrast, Masoudpour et al. [15] reported that 57.1% of poisoned children were fourth-born or later and had mothers with a history of addiction.

Methadone syrup accounted for 64.5% of poisoning

Table 3 Clinical manifestations, interventions, and outcomes in children with methadone poisoning

Variable	Category	Frequency (n)	Percentage (%)
Respiratory symptoms	Normal	28	26.9
	Tachypnea	10	9.4
	Bradypnea	22	20.6
	Cyanosis / Oxygen desaturation	31	28.9
	Respiratory arrest	11	10.3
	Aspiration	5	4.7
Neuromuscular symptoms	Decreased consciousness/ Drowsiness	84	78.5
	Weakness/Lethargy	22	20.6
	Seizure	3	2.8
	Fully conscious	11	12.1
Ocular symptoms	Normal	20	17.9
	Miosis	78	72.9
	Mydriasis	9	8.4
Gastrointestinal symptoms	Normal	26	24.3
	Nausea/Vomiting	44	41.1
	Diarrhea	37	34.6
Cardiovascular symptoms	Normal	78	72.9
	Tachycardia	21	19.6
	Bradycardia	7	6.5
	Hypotension	1	0.9
	Mottling	1	0.9
ECG findings	Normal	40	37.4
	QT abnormality	3	2.8
	Not performed	64	59.8
Urinary symptoms	Positive glucose	17	15.9
	Positive ketones	5	4.7
	Hematuria	1	0.9
	Positive ketones & glucose	2	1.8
	Positive glucose & hematuria	1	0.9
Intubation	Normal	81	75.7
	Intubated	9	8.4
	Not intubated	98	91.6
Medications administered	Naloxone	102	95.2
	Sorbitol charcoal	34	31.8
	Antibiotic	17	15.9
	Ondansetron	1	0.9
	Pantoprazole	16	14.9
	Other medications (e.g., anticonvulsants)	12	11.2
Outcome	Recovery	90	84.1
	Death	1	0.9
	Discharged with personal consent	16	15.0

cases in this study, which aligns with other studies.[10, 17] Given that methadone syrup is often stored in bottles resembling those of children's medications, children—or even their caregivers—may ingest it accidentally due to unawareness of its contents. Moreover, the observed increase in blood glucose in 43% of poisoned children and the presence of glucose in the urine of 15.9% of cases may indicate that methadone syrup contains sweeteners or flavoring agents that raise blood sugar levels. Although this aspect has not been examined in other studies, it is recommended that future research pay particular attention to changes in laboratory findings.

The results showed that 49.5% of the children were hospitalized for 4–7 days, while 45.8% were admitted for 1–3 days. These findings differ from those of Hosseininasab et al. [12], in which the average hospital stay for poisoned children was 43 hours. Clearly, the treatment and care of these children require time, medications, and other hospital-related expenses. Prolonged hospitalization can sometimes lead to nosocomial infections, increased complications, and even death. It is therefore recommended that future similar studies also examine the duration of hospitalization and associated costs so that, if similar results are observed, strategies to reduce hospital stay and establish standardized treatment protocols for methadone poisoning can be implemented.

The results also indicated that hemoglobin and hematocrit levels decreased in 59.8% of poisoned children. However, this reduction is unlikely to be caused by methadone poisoning, as anemia is not an acute feature of poisoning, and there is no clinically significant association between anemia and methadone toxicity. This finding reflects that anemia is one of the most common forms of childhood anemia.

One of the key diagnostic signs of methadone poisoning is miosis, which was observed in 72.9% of the poisoned children in this study, consistent with previous reports ranging from 64.6% to 75.9%.[17, 18] Thus, miosis can be considered a primary sign of methadone poisoning. Additionally, 78.5% of children presented to the emergency department with decreased consciousness and drowsiness, which aligns with other studies reporting impaired consciousness in 71.8–91.4% of cases.[12, 18] Arterial blood gas analysis showed that 35.5% of patients had metabolic acidosis, consistent with Maamouri et al. [4], who reported metabolic acidosis in 30.7% of cases.

In this study, 59.8% of poisoned children sought medical care within 12 hours and received prompt treatment ($p < 0.01$). These findings highlight the critical importance of early presentation and accurate recognition of methadone poisoning symptoms, as shorter intervals between exposure, diagnosis, and treatment are associated with better patient prognosis.

Electrocardiograms were obtained in this study, and only 2.8% of children showed QT interval abnormalities, consistent with Dadpour et al.[19], who reported no significant association between methadone poisoning and QT prolongation. However, these results are limited in generalizability because 59.8% of patients did not undergo ECG evaluation. Therefore, obtaining an ECG upon arrival at the emergency department should be considered an essential diagnostic step in methadone poisoning cases.

In this study, 2.8% of children presented with seizures, comparable to Ghaffourian[10], who reported seizures in 1.9% of cases, whereas Sharif and Nouri[18] reported a higher prevalence of 6.8%. Thus, methadone poisoning should be considered in children presenting with unexplained seizures.

Moreover, 41.1% of children experienced nausea and vomiting upon arrival at the emergency department or after regaining consciousness, consistent with other studies[5], indicating low-dose ingestion. Accordingly, 31.7% of patients received charcoal and sorbitol as part of their treatment. Respiratory arrest was reported in 3.1% of cases, and intubation was required in 4.8%. Naloxone injection was administered to 95.7% of poisoned children; however, this study did not assess the number of naloxone doses or the timing of administration, unlike other studies. Therefore, future research should address these aspects.

Mortality due to methadone poisoning was reported in one case (0.9%), compared to 0.1% in Ghaffourian [10], 1.1% in Kashani et al.[17], and two cases in Sharif and Nouri. [18] Given the high mortality associated with methadone poisoning, it is recommended that comprehensive and practical intervention protocols be provided to all healthcare centers, along with appropriate education for families on the safe storage and handling of methadone by methadone-maintenance centers.

5 Conclusion

In this study, age, gender, family history of addiction, time to presentation at the emergency department, method of methadone consumption—primarily in syrup form—and place of residence were identified as the most critical factors influencing the occurrence and severity of methadone poisoning. Therefore, educating individuals with addiction and their families on proper methadone storage, with a focus on the above variables, as well as implementing modifications in the color, taste, and packaging of methadone syrup—or replacing syrup with tablet forms—can be effective in reducing methadone exposure among children.

Methadone poisoning not only imposes irreversible health consequences on children but also significantly increases treatment costs and workload in pediatric

emergency departments. To mitigate these risks, it is recommended that authorized methadone-maintenance centers, as the only legal distributors of this medication, implement educational programs addressing the signs and complications of methadone poisoning and the importance of timely medical intervention. Additionally, a system should be established to monitor methadone recipients, preventing misuse, eliminating unauthorized distribution, and emphasizing the necessity of obtaining methadone from legitimate centers.

Furthermore, it is advised that the Ministry of Health disseminate comprehensive and practical guidelines to all healthcare facilities, ensuring that diagnostic and therapeutic protocols are followed in cases of methadone or other substance poisonings. This will prevent the shortcomings observed in this study, where laboratory tests and electrocardiograms were either missing or incompletely recorded in most cases.

Finally, given the significance of substance poisoning in both children and adults, future studies should include long-term follow-up to assess secondary and prolonged complications of poisoning. With proper and practical community-based education, it is hoped that incidents of methadone and other substance poisoning, as well as associated mortality, can be significantly reduced.

This study had several limitations. First, the clinical outcomes of patients after discharge from the hospital were not followed, which limits the understanding of the long-term consequences of methadone poisoning. Second, as data were collected retrospectively from medical records, some records contained incomplete information, leading to potential gaps in the dataset and limiting the comprehensiveness of the findings. These limitations should be taken into account when interpreting the results and planning future research.

Declarations

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Authors' Contributions

All authors contributed to the initial idea generation, study design, data collection, and manuscript drafting. All authors have read and approved the final version of the manuscript and declare no disagreement over its contents.

Availability of Data and Materials

The data and materials used in this study are available from the corresponding author upon reasonable request.

Conflict of Interest

The authors declare that this study was conducted independently and that there are no conflicts of interest with any organizations or individuals.

Consent for Publication

All authors have read and approved the final manuscript and provided their consent for publication.

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Ethical Considerations

This study was conducted as part of a research project approved by the Urmia Branch of Islamic Azad University, with the Project Code 21418 and the Code of Ethics IR.IAU.URMIA.REC.1403.215.

Artificial Intelligence Disclosure

No AI-assisted technologies were utilized in any part of this work.

References

1. Rahimi T, Faryabi R, Javadi A, Shojaei S. Attitudes of women from Jiroft city about prevention of home injuries in children under 5 years using protection motivation theory in 2015. J Rafsanjan Univ Med Sci. 2017;16(1):17-30.
2. Manouchehrifar M, Derakhshandeh N, Shojaee M, Sabzghabaei A, Farnaghi F. An epidemiologic study of pediatric poisoning; a six-month cross-sectional study. Emergency. 2016;4(1):21.
3. Chen C-Y, Lin K-M. Health consequences of illegal drug use. Curr Opin Psychiatry. 2009;22(3):287-92.
4. Maamouri G-A, Teimouri Bakharzi E, Banihashem A, Alizadeh Ghamsari A, ZakeriHamidi M, Boskabadi H. Methadone poisoning in children hospitalized in mashhad imam reza hospital, 2012-2013. J Mazandaran Univ Med Sci. 2018;27(157):247-51.
5. Alikhani B, Soleymanpour A, Sabzghabaee AM, Eizadi-Mood N. Demographic, clinical, and forensics findings in deceased cases of acute methadone poisoning. J Isfahan Med Sch. 2017;35(449):1343-51.
6. Anderson M, Hawkins L, Eddleston M, Thompson JP, Vale JA, Thomas SH. Severe and fatal pharmaceutical poisoning in young children in the UK. Arch Dis Child. 2016;101(7):653-6.

7. Allameh Y, Akrami FS, Mohammadi G, Molavi N, Babakhanian M. Methadone poisoning in children: a systematic review and meta-analysis in Iran. Journal of Pediatrics Review. 2017;5(2):1-8.

8. Fariba Farnaghi, Narjes Jafari, Fatemeh-Fereshteh Mehregan. Methadone Poisoning among Children Referred to Loghman-Hakim Hospital in 2009. Pajoohande. 2012;16(6):299-303.

9. Hemmati M, Tohidi MR, Mohammadi A, Jahanpour F, Andayeshgar B, Fallah S. Poisoning in children and adolescents in Kermanshah city, Iran. BMC Pediatr. 2024;24(1):135.

10. Ghaffourian T, Barati L, Khajavi A, Mehrjerdian M. Evaluation of Methadone Poisoning in Pediatric Emergency Department, Gorgan, North of Iran (2011-19). J Gorgan Univ Med Sci. 2021;23(4):95-8.

11. Jabbehdari S, Farnaghi F, Shariatmadari SF, Jafari N, Mehregan F-F, Karimzadeh P. Accidental children poisoning with methadone: an Iranian pediatric sectional study. Iran J Child Neurol. 2013;7(4):32.

12. Hosseininasab A, Vahidi A, Bagheri-Charouk F. Predisposing factors for methadone poisoning in children hospitalized at Kerman Afzalipour Hospital, Iran. Addict Health. 2016;8(1):61.

13. Zamani N, Sanaei-Zadeh H, Mostafazadeh B. Hallmarks of opium poisoning in infants and toddlers. Trop Doct. 2010;40(4):220-2.

14. Besharat M. Opium intoxication in children under 5 years old, Golestan-Iran (2006-07). J Gorgan Univ Med Sci. 2010;12(1):85-9.

15. Masoudpour N, Zare-Bidaki M, Sedighi E, Bakhtar M. Frequency and related factors of methadone poisoning in children aged under 15 years attending children emergency center of Rafsanjan Ali-Ebne-Abitaleb hospital in 2013. J Rafsanjan Univ Med Sci. 2015;14(7):561-74.

16. Ahmadi Forg F, Nasrabadi T, Alaee Karahroudy F. The effect of education on the prevention of children's poisoning with methadone on the awareness of mothers treated with methadone. Medical Science Journal of Islamic Azad Univesity-Tehran Medical Branch. 2022;32(3):328-36.

17. Kashani P, Safari S, Hatamabadi H, Dolatabadi AA, Manouchehrifar M, Tabrizi MD. Characteristics of methadone intoxicated children presenting to emergency department; a cross sectional study. Emergency. 2017;5(1):e80.

18. Sharif MR, Nouri S. Clinical signs and symptoms and laboratory findings of methadone poisoning in children. Iran J Pediatr. 2015;25(1):e176.

19. Dadpour B, Hatami Z, Liaghat A, Eshraghi A, Najari F, Najari D. Assessment of QT dispersion in electrocardiogram of patients with acute poisoning of methadone. Tehran University of Medical Sciences Journal. 2019;77(7):453-7.