Review

Eurasian Journal of Toxicology

General Approach to Patients Admitted to The Emergency Department with Poisoning

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Abstract

Poisonings are a group of patients that can cause serious mortality and morbidity and are frequently referred to Emergency Departments. Providing an approach to the poisoning phenomenon with predetermined diagnosis and treatment will increase the success rates in treatment. Diagnosing and evaluating poisoned cases in the emergency department at the earliest stage, early decontamination, elimination, and appropriate antidote treatment are life-saving. In this article, it is aimed to compile the general management of poisoning cases admitted to the Emergency Department in line with the current literature.

Keywords: Poisoning, emergency, drug, toxicology

Özet

Zehirlenmeler ciddi mortalite ve morbiditeye neden olabilen ve Acil Servislere sık başvuran hasta grubudur. Zehirlenme olgusuna yaklaşımın önceden belirlenmiş tanı ve tedavi akışları ile sağlanması tedavideki başarı oranlarını artıracaktır. Zehirlenmiş olguların acil serviste en erken dönemde tanınıp değerlendirilmesi, erken dekontaminasyon ve eliminasyonunun yapılması, varsa uygun antidot tedavisinin verilmesi hayat kurtarıcıdır. Bu makalede Acil Servise başvuran zehirlenme vakalarının genel yönetiminin güncel literatür bilgileri doğrultusunda derlenmesi amaçlandı.

Anahtar Kelimeler: Zehirlenme, acil, ilaç, toksikoloji

Introduction

Intoxication is a public health problem that can cause serious morbidity and death[1]. One of the causes that is increasing the cost of public health worldwide is drug overdose, whether intentional or not[2]. When the poisoned patients seen in the emergency department were examined, it was determined that the majority of them were adults who took an overdose of drugs intentionally. Abuse of illegal drugs, unconscious excessive intake of drugs used for chronic diseases, chronic poisoning, exposure to environmental, industrial and agricultural chemicals and drug interactions are other common causes[3]. When the exposed drugs were examined, the most common were antidepressants (15.2%) and opioids (10.9%)[2]. These constitute the majority of the records created by the calls made to the regional poison control centers of the countries[3].

In our country, the National Poison Information Center (NPIC) is an institution that has been providing 24-hour uninterrupted service since 1988[4]. NPIC records all the information, it collects and contributes to the development of protective measures by publishing a regular report every year. It shares all this evidence-based information with the public and all health personnel free of charge, and contributes to the health economy of our country by preventing ineffective and unnecessary treatment and hospitalizations[5]. It is not possible to give an exact number of poisoning cases in Turkey due to both sociocultural structure and ethnic problems. According to NPIC data, the number of case reports, which was around 15,000 in 2005, was found to be 97,087 in 2009 as a result of new studies. It was determined that the substance or substances that cause poisoning were frequently taken orally (93%) by the patients[4]. Although toxic substances causing poisoning are most commonly by ingestion, inhalation, skin and mucous membranes, and injection[1]. It is important to detect poisoning cases presenting to the emergency department immediately, to recognize and evaluate early, to initiate decontamination, to increase drug elimination, and to plan antidote treatment within indications[3].

In this article, it was aimed to compile the general management of poisoning cases admitted to the Emergency Department in line with the current literature.

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Received: 31.03.2022 • **Revision:** 06.04.2022 • **Accepted:** 06.04.2022
Cite this article as: Ecevit Kaya A. Risk General Approach to Patients Admitted to The Emergency Department with Poisoning. Eurasian J Tox. 2022;4(1): 11-16

Clinical Features

Toxicological Story and Physical Examination

Since poisoning cases can admitted to the emergency department with a wide variety of complaints and clinical findings, it is very important for physicians to have a systematic and regular approach in the evaluation of these cases and in the management of the emergency department[6].

Generally, patients with poisoning may have altered consciousness or may not be able to adapt during the examination. For this reason, the history may be limited to the information that can be obtained from relatives, family members or witnesses, as well as the information that can be obtained by physical examination in cases where the patient does not cooperate. In poisoned cases, a history should be obtained from all available sources. Substance records, pharmacy records, and medical records checked by authorities are among other sources of reliable and useful information[3]. In the emergency service evaluations, the occupation of the patient, the place where the poisoning occurred, the empty drug boxes around, whether there is a different smell at the crime scene and suicide should be investigated[6]. In case of inhalation poisoning, exposure and poisoning of other persons present at the scene at home or at work should be avoided. In cases of poisoning, it is important to determine the exposed substance correctly, to start treatment and to obtain reliable product information registered about the exposed substance[3].

In general, physical examination of poisoning cases can not be done according to their current clinical features. Therefore, the findings obtained in the physical examination are based on observational findings that do not require patient compliance[3].

In the management of the poisoned patient, airway, respiration, circulation (ABC) should be evaluated in the first evaluation stage in the emergency department, and patient resuscitation and stabilization should be provided when necessary. Vital signs (blood pressure, pulse, fever, saturation), mental status, pupil diameter, skin moisture should be evaluated. Follow-up with pulse oximetry and cardiac monitoring should be provided. Intravenous vascular access should be provided. Fingertip blood sugar should be checked. electrocardiogram (ECG) should be taken. Vital signs monitoring should be repeated at appropriate intervals[6].

Toxidromes

A collection of signs and symptoms that suggest a poisoning is caused by a particular poison are called toxidromas or toxicological syndromes[4].

Sympatomymetic Syndrome

It occurs with toxins (with the release of epinephrine and norepinephrine) that increase sympathetic stimulation. Examples of substances that cause sympathomimetic toxidroma are cocaine and amphetamine[4]. These patients with hypertension, tachycardia, and tachypnea typically have increased vital signs[3]. In patients who are often agitated, dilated pupils are typical. Bowel sounds are active and there is sweating[4]. Seizures may occur[1]. Caused by exposure to amphetamines, cocaine, and cations[3].

Anticholinergic Syndrome

Anticholinergic toxidroma is caused by ingestion of agents that reduce acetylcholine release or inhibit acetylcholine binding at muscarinic and nicotinic receptors[4]. Atropine, antihistamine, antipsychotic drugs cause this group of poisonings[3]. Anticholinergic toxidromas characterized by hypertension, tachycardia and hyperthermia are common in patients with impaired consciousness and delirium. Pupils are mydriatic. There is urinary retention and hypoactivity detected in bowel sounds. Dryness of the skin and mucous membranes is an important finding in differentiating it from sympathomimetic toxidromas[4]. There is no diaphoresis. The definition of "mad like a clown, hot like a rabbit, blind like a bat, red like a beet, dry like a bone" can be used to recall the typical signs and symptoms of anticholinergic toxidromas[3].

Cholinergic Syndrome

Organophosphate and carbamate pesticides, chemical warfare agents (such as sarin gas) cause this intoxication picture[3]. It may be accompanied by fasciculations, seizures, somnolence, fatigue[1]. Caused by exposure to toxic substances such as pesticides. Saliva, tears, urinary incontinence, diarrhea and vomiting are typical findings. Deaths usually occur due to bradycardia, increased bronchial secretion, and bronchospam[4].

Sedative and Hypnotic Syndrome

It is the clinical picture that occurs in patients taking sedative-hypnotic agents (such as ethanol, benzodiazepine, barbiturate group drugs). Hypotension, bradycardia and bradypnea are more common findings. The pupils are isochoric and the patient's state of consciousness tends to sleep[4]. There is a predisposition to hypothermia[1]. Benzodiazepine can have effects such as delirium, psychosis, and transient global amnesia. Barbiturates, on the other hand, can cause hypothermia and skin blisters in high doses[7].

Opioid Syndrome

Opioid toxicity is typically characterized by hypertension, bradycardia, hypothermia, and hypoventilation[4]. Examples are codeine, heroin, morphine poisoning[3].

Serotonin Syndrom

It is a toxidrome defined as a serotonergic excess table due to selective serotonin reuptake inhibitor (SSRI), monoaminoxidase inhibitors (MAO) for examples. In addition, tricyclic antidepressants, amphetamines, fentanyl,

St. John's Wort are examples of this type of poisoning. Altered consciousness, hyperthermia, and agitation, as well as hyperreflexia, clonus, and sweating are common findings[3].

Neuroleptic Malign Syndrome

Alteration of consciousness, hyperthermia, and agitation are common. It differs from the serotonin syndrome in that it tends to rigidity and decreased reflexes rather than clonus and hyperreflexia by peripheral muscle effects. Occurs when exposed to antipsychotic agents[3].

Differential Diagnosis

In a patient presenting to the emergency department due to poisoning, other correctable causes that impair consciousness, such as hypoglycemia, should be excluded. When evaluating the patient, it is important to look at a wide variety of toxicological and non-toxicological causes for differential diagnosis[3].

Diagnostic Tests

In case of undetected overdose or exposure, the use of extensive laboratory testing assists the clinician in identifying possible clinical signs and abnormalities. Routinely requested blood tests are complete blood count, kidney functions, liver function tests, pregnancy test (if patient is female), urinalysis, urine toxicology screening, serum alcohol concentration, serum lactate and fingertip glucose measurement[3]. Blood gas analysis is a very useful test as it can be used in many different differential diagnoses. Determines the type and depth of patient's acidosis or alkalosis, carboxyhemoglobin level and oxygen saturation[4].

Urine toxicological screening tests are not routinely used except for forensic cases. Although urine toxicological screening tests are especially for illicit substance use, false positive and false negative rates are extremely high[4].

If the ingested substance is definitively identified, other tests such as specific serum concentration measurement may be used[3].

ECG should be taken. If the patient is determined to be tachycardic or bradycardic in vital signs, or if there is a history of ingestion of cardiotoxic substances that can prolong the QRS or QT interval, such as cyclic antidepressants and antipsychotic substances, an ECG should be performed, and a control ECG should be performed if necessary[3].

Radiological Imaging

In cases of poisoning, radiological imaging is used to detect some radiopaque substances, lead, heavy metals, enteric-coated tablets and packages containing oral cocaine/heroin. They can be seen radiologically on plain X-ray[4]. However, although it is not seen as a very common clinical picture, radiological imaging may be requested for the evaluation of some rare signs of poisoning (acute lung injury due to salicylate poisoning, pneumomediastinum due to cocaine use, aortic dissection, brain infarction, etc.). Imaging methods such as computed tomography (CT), ultrasonography (USG), transesophageal echocardiography (TEE), magnetic resonance imaging (MRI), positron emulsion tomography (PET) and single photon emission computed tomography (SPECT) should be performed in the appropriate clinic. Conditions in patients exposed to toxins. It can also be used for service evaluation[6].

Poisoned Patient Management

The clinician should have a systematic and consistent assessment management in the management of the poisoned patient[2]. Resuscitation is the first priority in the emergency service evaluation of a poisoned patient. Structured risk assessments are used to determine which of the appropriate antidotes, decontamination, and advanced elimination techniques would benefit the patient stabilized after resuscitation. Airway, respiratory and circulatory stabilization are priority[1]. After the maintenance of the airway and ventilation, which is the basic 'ABC' of resuscitation, the main purpose is to provide the patient's circulation with fluid resuscitation and, if necessary, vasopressor support. Intubation is often the preferred route in patients who are unable to maintain an airway or have insufficient respiratory effort to maintain adequate ventilation. Peripheral and central venous catheters may be preferred for vascular access. There is no suitable antidote for every toxin and therefore supportive care is the mainstay of treatment for the poisoned patient[3].

Treatment

Decontamination

The decontamination process is used to clean the skin surface exposed to the toxic substance. Decontamination should be done in a separate area close to the emergency service, but in a way that does not contaminate the emergency service and other environments. The decontamination process is carried out by the healthcare personnel using appropriate equipment (bone, gloves, eye protection) in international standards, by undressing the patient and washing with plenty of water. Clothing exposed to the toxin is properly packaged and disposed of properly[1].

In addition to contact with the skin, in case of eye contamination, it is provided by washing with plenty of water[3]. Abundant irrigation with crystalloid solutions can be done for eye contamination. Local anesthetic application and valve retractors may be required to facilitate the procedure[1].

Ipecac Syrup

It is not appropriate to use ipecac syrup in patients who apply to the emergency department with a history of poisoning for purpose of vomiting[3].

Gastric Lavage

Gastric lavage is the direct removal of material from the stomach using a 30 Fr or larger orogastric tube, and few data have been found to demonstrate the effectiveness of this treatment[3]. In patients with toxic doses, gastric lavage therapy is recommended within the first hour after ingestion of the substance. However, it is inconvenient to apply if the patient's airway safety cannot be ensured in cases of poisoning, if there is caustic substance intake, if the risk of aspiration is increased, if there is a risk of gastrointestinal bleeding and perforation[6]. Because of the risk of aspiration and esophageal trauma, the American Central Poison Association recommends gastric lavage within the first hour after ingestion of a potentially life-threatening venom that is not absorbed with activated charcoal or has no antidote[3].

Vomiting

In the past, vomiting was used to extract the toxic substance to which it was exposed. However, it is not recommended to induce vomiting in the emergency management of oral toxic substances[1].

Antidote

The correct use of antidotes is important. Required for patient stabilization after exposure to toxic substances[1]. However, there is no suitable antidote for every toxic picture[3].

Activated Carbon

Activated charcoal, which has the ability to bind to many toxins; It binds to these toxins and prevents toxin absorption[6]. Activated charcoal is most effective in the first one to two hours after ingestion of the toxin. It has been reported that a single dose of activated charcoal is not routinely required in every case of poisoning. Activated charcoal may be considered if a potentially toxic amount of poison is present and less than 1 hour has passed[4]. Activated charcoal is not recommended if the ingested poison or drug has low toxicity (eg, ibuprofen, diazepam) or if an effective known and available antidote is available (eg N-acetylcysteine for acetaminophen, digoxin immune-fab for digoxin)[3]. Activated charcoal can be given by giving an oragastic or nasogastric tube in intubated patients. The dose of activated charcoal is 1 gram/kg in children and 50 grams PO in adults. Repeated doses of activated charcoal are usually recommended for overdose. The recommended dose is 50 grams PO followed by 25 grams PO every 2 hours[1].

Repeated Activated Coal Application

A single dose of activated charcoal aims to prevent the absorption of a drug. Repeated dosing of activated charcoal aims to eliminate an absorbed toxin[3]. Repeated doses of activated charcoal increase the elimination of toxins from the enteroenteric, enterohepatic, or enterogastric circulation[1]. However, it accelerates the elimination of toxins with its low volume of distribution, low binding affinity and long elimination half-life. It has been found to be beneficial in poisoning due to exposure to carbamazepine, phenobarbital, theophylline, quinine, aspirin, dapsone[6]. Repeated doses of activated charcoal should not be given if bowel sounds are hypoactive or absent[1]. For toxins whose serum level can be monitored, repeated doses of activated charcoal are discontinued if the serum level is not in the toxic range[3].

The Entire Bowel Lavage

The entire bowel lavage procedure is the administration of an osmotically stable polyethylene glycol solution through a nasogastric tube[6]. Entire bowel irrigation is indicated if extended-release drugs, illicit drug packages, or oral metals (eg, iron and lead) are present. However, it is contraindicated in patients with impaired general condition, intestinal hypoperfusion or intestinal obstruction. Because it has been reported to increase morbidity and mortality in such clinical conditions[3].

Hemodialysis

Toxins are metabolized by hepatic and renal pathways after ingestion and absorption. In overdose exposures, it is appropriate to eliminate some toxins by extracellular mechanisms (eg hemodialysis) and some toxins by mechanisms that increase intracellular elimination (eg urine alkalization and repeated dose activated charcoal). Hemodialysis and similar treatments are the most suitable methods to remove low molecular weight, low protein binding and high water soluble toxins[3]. Hemodialysis can be applied in lactic acidosis triggered by exposure to lithium, phenobarbital, salicylate, valproic acid, methanol/ethylene glycol, potassium salts and theophylline, and in metformin, which is life-threatening poisoning. As complications of hemodialysis, hypotension, infection at the catheter site, and bleeding can be seen[1].

Hemoperfusion

It is a method that allows the absorption of the toxin by passing the whole blood through a cartridge covered with activated charcoal or a non-ionic resin[8,9]. It is a suitable treatment for toxins with high molecular weight and protein binding[2,9]. A higher rate of anticoagulation is required in hemoperfusion[9,10]. It can be applied in theophylline, carbamazepine, thallium, procainamide poisonings[11]. Thrombocytopenia, leukopenia and hypocalcemia are complications different from hemodialysis. As in hemodialysis, hypotension, infection at the catheter site, and bleeding may also occur[1].

Contınuous Hemofiltration and Hemodiafiltration

Hemofiltration and hemodiafiltration can be applied for toxins that can be applied hemodialysis. Unlike hemodialysis, it is also effective in toxins with higher

molecules (approximately 25000 Da)[8,12,13]. Due to the increasing technical need and transportation difficulties, its use in poisoning cases is limited[8,14].

Exchange Transfusion and Plasmapheres

In both methods, it is effective on digoxin, thyroxine, antidigoxin antibodies and high molecular weight immunoglobulins by removing plasma proteins[11]. It is suitable for methemoglobinemia, which occurs with toxins such as xenobiotics, sodium nitrate, dapsone, which are not suitable for hemodialysis[8,15,16]. It is easy to apply in the newborn patient group[11].

Serum Alkalization

Water-soluble substances (such as salicylates, methotrexate, and phenobarbital) can be eliminated by alkalizing the serum by an ion-scavenging mechanism. This is crucial for salicylate poisoning. Because alkalinization prevents salicylates from entering the central nervous system by crossing the blood-brain barrier and ensuring their elimination[3]. In salicylate poisoning, it can reach medium and high concentration values such as 0.3-0.5 lt/kg[17]. The primary indication is medium and high dose salicylate poisoning in which hemodialysis cannot be applied. Serum pH and bicarbonate levels and urine pH values should be monitored in patients undergoing alkalization. Serum pH value should be around 7.5, urine pH value should be around 8.0. Serum potassium value should be closely monitored. One of the reasons that reduce the effectiveness of urine alkalization is hypokalemia[1]. 150 milliequivalents of sodium bicarbonate can be added to 1 liter of 5% dextrose in the alkalization process, and it can be applied at a rate not exceeding 250cc per hour. Potassium (20-40 milliequivalent I.V. in total) can be added to the prepared liquid and given[3].

Intravenous Lipide Emulsion

It was first applied in the treatment of local anesthetics[3]. Intravenous lipid emulsion therapy may be considered in cases where all interventions fail to respond[6]. An exact indication for the application has not been reported. It has been shown that successful resuscitation results are obtained in cases of beta-blocker overdose, calcium channel blockers, cyclic antidepressants, bupropion and cocaine toxicity, except for anesthetic agents treated with intravenous lipid emulsion therapy[3]. The most common complications are pancreatitis, electrolyte disturbance, acute respiratory distress syndrome[6].

Follow-up, Discharge and Admission

In most cases, an observation period of 6 hours is sufficient to exclude serious toxicity to schedule patient discharge from the emergency room[1]. Patients with severe toxicity should be admitted to the intensive care unit. Patients who are asymptomatic on admission to the emergency department, but who have dangerous toxin intake that may cause deterioration in their clinical status, or who use extended-release drugs are suitable for hospitalization and follow-up. Discharge of patients hospitalized or observed in the emergency department should be planned after the first 24 hours after ingestion or after the effect of the poisoning has disappeared[3]. It is appropriate for patients with deliberate overdose to be evaluated by a psychiatrist after their treatment is completed[4].

Conclusion

It is important to develop a systematic and consistent approach in cases of poisoning presenting to the emergency department with very different signs and symptoms for early diagnosis and planning of appropriate treatment. A detailed history should be taken from the patient, patient's relatives and the staff at the scene. Providing information about the case to the national poison information center is a suitable option both to contribute to the national poisoning registry and to determine the treatment management. It can be used for direct toxicity detection for toxins whose serum level can be measured, although it is recommended to schedule a large blood test to reveal the effects of the toxin. There is no suitable antidote for every toxin exposure. But some specific antidote applications can be lifesaving. In case of poisoning, decontamination, gastric lavage, administration of activated charcoal, serum alkalization, whole bowel irrigation, extracorporeal methods, IV. lipid emulsion methods can be preferred according to the toxic substance. Determining systematic and consistent diagnosis and treatment management strategies in emergency service evaluations of poisoning cases will increase the success of patient resuscitation.

Table 1: Toxidromes and differential diagnosis

TOXIDROME	Heart Rate	Respiratory Rate	Fever	Pupil Diameter	Bowel Sounds	Diaphoresis
Anticholinergic	increases	not affected	increases	increases	decreases	decreases
Cholinergic	not affected	not affected	not affected	decreases	increases	increases
Opioids	decreases	decreases	decreases	decreases	decreases	decreases
Sympathomimetic	increases	increases	increases	increases	increases	increases
Sedative and Hypnotic	decreases	decreases	decreases	decreases	decreases	decreases

Table 2: Antidotes and indications[3]

ANTIDOTE	INDICATION
N-Acetylcysteine	Acetaminophen
Fomepizole	Methanol / Ethylene Glycol
Oxygen / Hyperbaric	Carbon Monoxide
Alaxon	Opioids
Physostigmine	Anticholinergic
Atropine / Pralidoxime	Organophosphate
Methylene Blue	Methemoglobinemia
Nitrites / Hydroxycobalamin	Cyanide
Deferoxamine	Ferrous
Succimer	Lead, Mercury
Caedta	Lead
Fab Trailers	Digoxin, Crotalids
Glucagon	Beta Blockers
Sodium Bicarbonate	Salicylates, Tricyclic Antidepressants
Calcium, İnsulin/Glucose	Calcium Channel Antagonists
Dextrose, Glucagon Octreotide, Pyridoxine	Oral Hypoglycemic Agents, İsoniazid
Intravenous Fat Emulsion	Local Anesthetic Systemic Toxicity, Base Oil Soluble Drugs
Dimercaprol (BAL)	Arsenic, Lead

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