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Pre-hospital procedure in narcotic substance intoxication – case study

Postępowanie przedszpitalne w zatruciu środkami odurzającymi – studium przypadku

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Summary

According to research conducted by the World Health Organization (WHO) intoxications are one of the main causes of deaths in the world.

Medical Rescue Teams undertaking rescue procedures in patients with acute intoxications caused by narcotic substances should act in accordance with the current guidelines of the European Resuscitation Council.

Every condition of a person who is potentially intoxicated should be treated as a life threatening condition. The symptoms of acute intoxication with a narcotic substance or a different chemical substance may occur immediately or with a few hours of delay related to the absorption from the digestive tract.

Streszczenie

Według badań prowadzonych przez Światową Organizację Zdrowia (WHO) zatrucia należą do jednych z czołowych przyczyn zgonów na świecie.

Zespoły ratownictwa medycznego podejmujące działania u pacjentów z ostrymi zatruciami substancjami odurzającymi powinny działać według aktualnych wytycznych Europejskiej Rady Resuscytacji.

Każdy stan osoby potencjalnie zatrutej należy traktować jako stan zagrożenia życia. Objawy ostrego zatrucia środkiem odurzającym lub inną substancją chemiczną mogą występować natychmiast lub z kilkugodzinnym opóźnieniem, związanym z absorpcją z przewodu pokarmowego.

INTRODUCTION

Every year from 7000 to 8000 people die only in the European Union as a result of narcotic substance intoxications. In Poland there are from 100 000 to 120 000 people addicted to narcotics, however these data refer only to people who officially admit it. The Chief Sanitary Inspectorate presents quite disturbing data in which it is possible to notice that at the turn of 2014 and 2015 the number of designer drug intoxications increased from 6.29 per 100 000 inhabitants in 2014 to 18.92 cases per 100 000 persons in 2015 (1). This is nearly a threefold increase of such cases recorded by the Chief Sanitary Inspectorate. The WHO has considered acute intoxications the fourth leading

cause of death in the world (2). The data demonstrate the great size of the problem which stimulants have become nowadays as people have started considering them a good escape from everyday stress related to work, school and family life.

Increased demand for various types of narcotic substances as well as the development of pharmaceutical technology make stimulants so popular.

One of the main routes of drug trafficking to western Europe is the "Balkan Trail" which starts in Afghanistan and the neighboring countries and goes to Poland through Turkey and the Balkan countries. This trail is mainly used for trafficking opioids which are responsible for 41% of all drug addictions in the countries of the European Union.

There is over a million registered people aged 15-64 who regularly take opioids and, what is interesting, ca. 4% of all the deaths of the inhabitants of Europe aged 15-39 are caused by the abuse of this drug (3).

According to the Polish law narcotic substances are substances of synthetic or natural origin affecting the central nervous system, the list of which has been published in annexes to the Act on counteracting drug addiction (4).

Despite of the constant extending of the list of narcotic substances every month new substances emerge; they are most often derivatives of the chemical substances present hitherto. The annexes to the act on counteracting drug addiction include several hundred psychoactive agents. Table 1 presents the latest changes to the list of narcotic substances included in the act on counteracting drug addiction dated 1st July 2015.

Since 2010 a medical and social problem of growing significance are chemical substances called "designer drugs". "Designer drugs" are products containing psychoactive substances which haven't been included in the list of controlled substances annexed to the act on counteracting drug addiction. The sales of these substances has significantly increased in the last years thanks to distribution taking place via online shops. Changes to the above mentioned act have extended the list of controlled substances by another 114 substances which have previously been considered as "designer drugs" (4).

A very popular division of narcotic substances is the classification which has been presented by the WHO (5):

I. opium group,
II. alcohol and barbiturates, barbiturate-like substances group,
III. amphetamine, amphetamine-like stimulant drugs group,
IV. cocaine group,
V. cannabis group,
VI. hallucinogen group,
VII. khat group,
VIII. volatile solvents group.

The opium group includes ca. 20 substances which are divided into two types: phenanthrene alkaloids and isoquinoline alkaloids. The most popular substances in this group are: heroin, methadone, morphine, buprenorphine, tramadol, fentanyl as well as hydromorphone which is not available in Polish drug stores (6). The substance from this group most often applied by Medical Rescue Teams in Poland is morphine which is present in the following medications: Morphini sulfas WZF, MST Continus, Sevredol, Vendal, Doltard oraz M-Eslon (7). Morphine (MF) is a phenanthrene alkaloid constituting one tenth of opium. It is an agonist of

Tab. 1. The classification of narcotic and psychotropic substances based on the act on counteracting drug addiction (4)

Group	List of narcotic substances
I-N	The group I-N narcotic substances are strongly addictive gents which may be used for industrial, medical and scientific purposes. The group includes cannabis and poppy products, coca leaves, cocaine, ecgonine, synthetic cannabinoids – 183 substances in total.
II-N	Narcotic substances from group II-N are moderately addictive substances which may be applied for industrial, medical and scientific purposes – in total 10 substances such as codeine, propiram, ethylmorphine and others.
III-N	Medicinal substances of groups I-N and II-N subject to mitigated control. The narcotic substances of group III-N are more rarely addictive agents which are subject to mitigated control. Drugs containing agents from this group in specified doses and concentrations may be distributed in pharmacies without prescription, the group includes: nicodicodeine, ethylmorphine, dihydrocodeine, acetyldihydrocodeine – 8 substances in total.
IV-N	Subset I-N subject to more restricted control. The narcotic substances of group IV-N are agents subject to more restricted control which may be applied only in the treatment of animals and for research purposes. This group includes: heroin, cannabis seeds other than fibrous, cannabis resins – 14 substances in total.
Group	**List of psychotropic substances**
I-P	The psychotropic agents of group I-P are substances of high possibilities of abuse which have been removed from the pharmaceutical market and are used only for research purposes. Group I-P includes 93 substances – i.a. agents obtained from hallucinogenic fungi such as psilocin and psilocybin.
II-P	The psychotropic agents of group II-P are substances of negligible medical application with high possibilities of abuse which may be used for industrial, medical and scientific purposes. This group includes: amphetamine, fenethylline, ketamine and 36 other substances.
III-P	The psychotropic agents of group III-P are substances of significant medical applications and moderate possibilities of abuse which may be applied for industrial, medical and scientific purposes. Group III-P includes a total of 8 substances, i.e. cathine, buprenorphine, flunitrazepam.
IV-P	The psychotropic agents of group IV-P are substances of significant medical applications and moderate possibilities of abuse which may be applied for industrial, medical and scientific purposes. This group includes: diazepam, clonazepam and 70 other substances.

opioid receptors, strongly acting on μ receptors, significantly less strongly on δ and κ. The primary effects of morphine are the analgesic, antitussive and anti-diarrheal effect. It is applied as a medicine of choice in patients with severe and very severe pain (8).

The next group are alcohols and barbiturates. The derivatives of barbituric acid have got a sedative, soporific, anxiolytic, anticonvulsant and amnestic effect. Their mechanism of action consists in activating the chlorine channel by binding to the GABAa receptor and blocking the conductance of the sodium and calcium channels. Due to the fact that these substances are strongly addictive, they exhibit high toxicity, they disrupt sleeping phases and they negatively affect the patients' behavior, currently they're applied only in anesthesiology and in the treatment of epilepsy. These medications include: phenobarbital, benzobarbital, methylphenobarbital (7-10).

The group of amphetamine and amphetamine-like stimulant drugs includes derivatives of phenylethylamine: amphetamine, methamphetamine, dexamphetamine, methylphenidate, dexmethylphenidate, ephedrine, fenfluramine, pheniprazine, phentermine, tranylcypromine. These are the so-called psychostimulants. Their mechanism of action is based on the intensification of dopaminergic and noradrenergic transmission and on weaker serotoninergic transmission. They cause increased releasing of catecholamines from presynaptic terminals and inhibit their neuronal re-uptake. Psychostimulants reduce the feeling of fatigue and sleepiness, they improve concentration and induce euphoria. Prolonged abuse leads to a serious mental addiction. Amphetamines are the cause of a number of side effects related to the stimulation of the sympathetic system such as arterial hypertension, coronary pain, arrhythmia or collapse. These substances proved to be effective in the treatment of obesity, however due to the risk of addiction and of the occurrence of side effects their usage is negligible. It should be added that the medications from this group, such as methylphenidate and dexmethylphenidate are used in the therapy of the attention deficit hyperactivity disorder in children (ADHD). In sport the derivatives of amphetamine are also illegally used as doping agents (7, 10).

Cocaine (benzoylmethylecgonine) which belongs to group IV according to the WHO classification, is produced mainly from the leaves of the cocaine bush (*Erythroxylon coca*). It is easily absorbed through the mucous membranes, it is considered a natural agent of local anesthesia and it strongly stimulates the sympathetic system and the central nervous system. The afflictions caused by this substance include tachycardia, hyperthermia, hypertensive crisis and myocardial ischemia with the symptom of angina pectoris. It belongs to strongly narcotic and addictive substances causing strong changes in the brain (7, 9, 10). Drug addicts abusing cocaine demonstrate atrophy of the nasal mucous membrane and mental changes: sexual and psychomotor agitation (characteristic symptoms are euphoria and the abolition of the feeling of fatigue) and visual and auditory hallucinations (7).

Cannabis (*Cannabis sativa indica*) is used for the production of hashish (a mixture of resin covering the tops of flowers), marijuana (dried leaves and inflorescences) and hashish oil. The most strongly acting substance is the hashish oil and the weakest one is marijuana. The derivatives of cannabis mainly contain cannabinols the most active of which is tetrahydrocannabinol. Cannabinols belong to psychodysleptic drugs and they have an analgesic, antiemetic and hallucinogenic effect. If they are taken for a long time they lead to a strong mental dependence causing mild symptoms of physical abstinence (7, 11).

Hallucinogenic substances (psychotomimetic, psychodysleptic) constitute a group diversified in terms of their structure and origin. They cause perception and mood disorders usually in the form of visual hallucinations, detachment from reality, euphoria, disorders of coordination, concentration, hearing and speech. Hallucinogenic drugs are not used in medicine, they are abused with the intention of inducing a psychotic state. This leads to a strong mental addiction which consists in the occurrence of symptoms similar to those occurring after taking hallucinogens; such symptoms last even for a few years. Psychotomimetic substances intensify noradrenergic and dopaminergic or serotoninergic transmission. The substances possessing a structure similar to noradrenaline include i.a. mescaline (a derivative of phenylalkylamine extracted from the Mexican cactus), 5-methoxy-3,4-methylenedioxyamphetamine (MDMA), 2-amino-1-(2,5-dimethoxy-4-methylphenyl)propane (DOM), 3,4-methylenedioxyamphetamine (MDA, ecstasy). The serotonin analogs include: D-lysergic acid diethylamide (LSD), N-dimethyltryptamine (DMT), psilocybin (a derivative of tryptamine contained in Mexican mushrooms of the *Psilocybe* genus), psilocin. The most popular substance – LSD is the strongest hallucinogen (1 mcg of LSD corresponds to 5 mcg of mescaline and 200 mcg of psilocybin), it is obtained from ergot which is an endospore form of a parasitic fungus *Claviceps purpurea* which attacks crop (7, 11).

Psychoactive substances from the khat group are obtained from a small tree called *Catha edulis* which grows in the eastern part of Africa and in the Arabian Peninsula. *Catha edulis* is the source of a substance called cathinone which is a stimulating alkaloid, the structure of which is similar to that of ephedrine, cathine and amphetamines. The most dangerous substances are the synthetic derivatives of cathinone, which include i.a. methylmethcathinone, buphedrone, mephedrone and other substances. These substances block the re-uptake for neurotransmitters: noradrenaline, serotonin and dopamine which accelerates the heart rate and in a slight degree leads to hallucinations. In the market it is available in the form of powder, tablets, capsules and liquid (12).

The volatile solvents group comprises several dozen different substances which are often colloquially referred to as "glues". They include primarily inhaled substances which go into a gaseous state in normal conditions (e.g. gasoline) or after heating (e.g. glues containing i.a. acetone, toluene, methyl chloride) and inhaled anesthetics (e.g. halothane, ethyl chloride, nitrous oxide). Volatile solvents are easily absorbed through the mucous membranes during the passage through the airways and next they permeate through the blood-brain barrier. Euphoria, excitement and hallucinations occur quite quickly after the inhalation of a volatile agent.

Due to unusually strong toxicity even one-time abuse of inhaled solvents can cause serious complications. The observed symptoms of intoxication include headaches and dizziness, somnolence, coma, damage of important organs: the liver, the kidneys, the heart, the lungs and the hematopoietic system. These substances may cause arrhythmia, hypoxia, cardiac arrest and in consequence – death. Patients abusing volatile agents are treated symptomatically (13, 14).

THE TREATMENT OF INTOXICATIONS CAUSED BY NARCOTIC SUBSTANCES

Intoxications are often the reason of hospitalization and they are one of the main causes of non-traumatic coma in persons under the age of 40. The most frequent reason of admissions to the Accident & Emergency Department (A&E) resulting from medication and narcotic substance intoxications are errors in their dosage or drug interactions (15).

Table 2 presents selected substances which most frequently cause intoxications together with their specific antidotes (10).

A few algorithms are applied in the treatment of intoxications. The basic element is treatment based on the ABCDE examination scheme consisting in i.a. fighting hypotension, hypoxia, compensating the disorders of acid-base equilibrium as well as of the electrolyte levels. The procedure is based on the maximal limiting of the absorption of the consumed intoxicant, increasing its excretion from the organism or applying specific antidotes. In case of very severe intoxications or intoxications with very rare and complex substances such as "designer drugs" it is necessary to get a specialist opinion at the toxicological center in order to obtain the current therapeutic procedures.

In order to neutralize the taken intoxicant it is possible to apply activated carbon (medicinal, *Carbo medicinalis*), which is able to absorb large amounts of substances. However the benefits of applying it decrease together with the elapse of time from the moment of the consumption of a particular substance. The physician should take into consideration the administration of one portion within 60 minutes from the consumption of the toxic substance of which he/she knows that it is absorbed by activated carbon. Carbon may be applied only in patients with preserved airways patency. An effective procedure is also gastric lavage and the administration of medicinal carbon but only up to an hour from the consumption of the intoxicant. In the case of the consumption of potentially toxic extended release substances, medications in the form of coated tablets as well as packaging (e.g. Ziploc bags) containing toxic substances the applied procedure is intestine cleansing performed using a polyethylene glycol solution (16).

CASE DESCRIPTION

On 16 January 2016 at 3:30 a.m. the emergency medical dispatcher received a report from a person who was under the influence of alcohol. The report referred to a 25 year old man who was unconscious. A basic medical rescue team of three medical rescuers was sent to the place of the event.

In case of intoxications the history taking is a significant link facilitating diagnosing. Asking about the type of the consumed toxic substance already at the stage of receiving the report may explain the reason of the health problem. In the analyzed case this was not possible due to the difficulties in communicating with the reporting person.

After arriving at the indicated address of the place of the event the medical rescuers assessed the safety of that location. A lying unconscious man was found in the flat.

Tab. 2. The list of selected substances together with antidote doses in the first phase of treatment (7, 9, 10)

Substances	Antidote	Antidote dose for adults	Antidote dose for children
Opioids	Naloxone	400 mcg *i.v.*	10 mcg/kg body weight *i.v.*
Benzodiazepines	Flumazenil	200 mcg *i.v.*	5-10 mcg/kg body weight *i.v.*
Beta blockers and Ca channel blockers	Glucagon	1 mg *i.m.* or *i.v.*	10-20 mcg/kg body weight *i.m.*
Organophosphorus compounds	Atropine	1- 2 mg *i.v.*	20 mcg/kg body weight *i.v.* (minimal dose 100 mcg)
Carbon monoxide	Oxygen	15 l/min	15 l/min
Tricyclic antidepressants (TCAs)	Sodium bicarbonate	50 mmol – 50 ml 8.4% *i.v.*	1 ml/kg body weight *i.v.*
Methanol and ethylene glycol	Ethanol	According to the physician's recommendations	Lack of data
Paracetamol	N-acetylcysteine	150 mg/kg body weight	According to the recommendations of the manufacturerof the drug

Information significant for the history taking were obtained from the partner of the injured man who was present at the place of the event. According to her report she found the unconscious partner and an empty Sevredol box (30 tablets 10 mg each).

Due to the limitation of consciousness and the weakening of defense reflexes a frequent problem in these patients is the obstruction of the airways. The preliminary examination found fully patent airways, breath frequency 6 times per minute, symmetrical vesicular murmur on auscultation. The saturation indicated by the pulse oximeter was 80% SpO_2. Due to the developing respiratory failure caused by the depressive effect of Sevredol on the respiratory center ventilation performed using a self-inflating bag was applied with oxygen supplementation 12 l/min. After applying breathing assistance he saturation increased to 94% SpO_2.

The toxicity of narcotic substances also affects the circulatory system leading to its destabilization. That is why it is important to assess the basic parameters such as the heart rate, the blood pressure, the coloration, warmth and moisture of the skin as well as the capillary refill time (17).

The patient's heart rate was steady – 65 beats per minute and the skin parameters (temperature, color and moisture) were normal. During the first blood pressure (BP) measurement the result 90/70 mmHg was obtained. Constricted (pinpoint) pupils not reacting to light, patient reacting to pain stimulus. After installing a vascular access port a multi-electrolyte solution and 400 mcg of naloxone were administered to the patient. After a few seconds his condition improved markedly. The breath frequency in the examination increased to 18 per minute, breathing assistance was abandoned and passive oxygen therapy was applied using an oxygen mask with the flow 10 l/min. The saturation indicated by the pulse oximeter was 98%. During the second blood pressure measurement the obtained result was 105/88 mmHg. Pupils of correct width, symmetrical, slowly reacting to light.

The patient regained consciousness – 13 points in the Glasgow scale (GCS), next he was transferred to hospital for further treatment.

CONCLUSIONS

The treatment of intoxications performed by Medical Rescue Teams is mainly based on three basic principles: maintaining the intoxicated patient's life functions, decontamination and applying specific antidotes in accordance with the guidelines. Any condition of a potentially intoxicated person should not be disregarded and should be treated as a life threatening condition. The symptoms of acute intoxication with a narcotic substance or another chemical substance may occur immediately or with a few hours of delay related to the absorption from the digestive tract (2, 17).

The indispensable help for the Medical Rescue Team in case of any form of intoxications is the 24 h possibility to consult an Acute Intoxication Center where a toxicologist physician may help to identify the substance and suggest the method of treatment of the patient intoxicated with it (7, 10, 18).

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