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The specifics of dealing with an obese patient in the practice of emergency medical teams

Specyfika działania z otyłym pacjentem przez zespół ratownictwa medycznego

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Summary

One of the most serious health problems of the 21st century in the world is obesity. The occurrence of obesity has already reached the size of the global epidemic and is currently the most rapidly growing problem not only in the medical aspect, but also in epidemiological, social and economic.

Due to the constantly growing number of people struggling with excessive body mass, one should reckon with the fact that obese people, will be patients of emergency medical teams. You should be aware that this group of patients is specific, and caring for them is difficult and demanding. That is why you should prepare for this challenge technically and adapt emergency medical facilities and hospitals.

Obesity is currently one of the greatest challenges of modern medicine, including emergency medicine. Due to the constantly growing number of obese people, but also the constantly increasing number of people undergoing bariatric procedures, it should be analyzed how this trend translates into the work of medical emergency teams. It is important to properly and reliably care for an obese patient in order to avoid complications related directly to excessive body weight and inadequate equipment to the conditions in which an obese patient should be supplied.

Streszczenie

Jednym z najpoważniejszych problemów zdrowotnych XXI wieku na świecie jest otyłość. Występowanie otyłości osiągnęło już rozmiar światowej epidemii i aktualnie jest najszybciej narastającym problemem nie tylko w aspekcie medycznym, ale także epidemiologicznym, społecznym i ekonomicznym.

Z uwagi na stale rosnącą ilość osób borykających się z nadmierną masą ciała, należy liczyć się z tym, że osoby otyłe będą pacjentami zespołów ratownictwa medycznego. Należy mieć świadomość, że ta grupa pacjentów jest specyficzna, a opieka nad nimi jest trudna i wymagająca, dlatego należy przygotować się na to wyzwanie technicznie oraz przystosować placówki ratownictwa medycznego i szpitale.

Otyłość stanowi obecnie jedno z największych wyzwań współczesnej medycyny, w tym także medycyny ratunkowej. Ze względu na stale rosnącą liczbę osób otyłych, ale i co za tym idzie, stale rosnącą ilość osób poddanych zabiegom bariatrycznym, należy przeanalizować, w jaki sposób ten trend przekłada się na pracę zespołów ratownictwa medycznego. Istotna jest prawidłowa i rzetelna opieka nad pacjentem otyłym w celu uniknięcia powikłań związanych bezpośrednio z nadmierną masą ciała i niedostosowaniem sprzętu do warunków, w jakich powinien być zaopatrywany pacjent otyły.

Obesity has become one of the most serious health problems of the 21st century in the world. The occurrence of obesity has already reached the size of the global epidemic and is currently the most rapidly growing problem not only in the medical,

but also epidemiological, social and economic aspect (1). The most important reason for the rapid development of the obesity epidemic is the lifestyle characteristic for developed countries (1, 2). Interestingly, the number of obese people is growing

rapidly, despite the steadily increasing number of health awareness among the population and easier access to healthy food, diets, nutritionists and fitness instructors as well as people promoting healthy and active lifestyle (2).

Obesity is defined, according to the WHO, as a condition in which excessive fat accumulating in the form of adipose tissue adversely affects health (3). Obesity development occurs when there is an excess of energy consumption in relation to its expenditure (3).

The body mass index (BMI), which is expressed as the ratio of body mass in kilograms to the square of the height expressed in meters, serves for the clinical classification of body weight for adults and children over two years old (tab. 1) (4).

Tab. 1. BMI Classification. According to (4)

Classification	BMI (kg/m ²)
underweight	< 18.5
correct body mass	18.5-24.9
overweight	25-29.9
obesity	> 30
I degree	30-34.9
II degree	35-39.9
III degree	> 40

Among the causes of obesity, the most important are environmental factors, genetic predisposition, endocrine disorders and lifestyle.

Regarding to the causes of obesity associated with lifestyle, the most important is the lack of physical activity, the type of work undertaken (so-called sitting work), exposure to stress, food availability, the impact of culture, tradition and beliefs and the use of drugs and certain medications. Important factors contributing to the development of obesity include social factors such as low social class or poverty (5, 6).

The increase in the occurrence of obesity in the world is associated with the problem of increasing incidence of related diseases. The most important include type 2 diabetes, arterial hypertension, ischemic heart disease, increased risk of ischemic stroke, as well as osteoarthritis and sleep apnea syndrome. The huge importance is attached to the influence of obesity on the development of cancer (7, 8).

Obesity is strongly associated with high rates of cancer of the esophagus, large intestine, colon and rectum, gall bladder, pancreas, kidneys, and also increases the risk of death from stomach and prostate cancer in men and the nipple (after menopause), uterus, cervix and ovaries in women (7, 8). It should be remembered that obesity not only increases the risk of developing these

cancers, but also increases the proportion of deaths due to these diseases 8.

Excessive body weight contributes to the development of many chronic diseases of the gastrointestinal tract, such as gastro-esophageal reflux, additionally increasing the risk of its complications (Barret's esophagus, esophageal cancer), polyps and colorectal cancer and liver disease (non-alcoholic fatty liver, hepatic cirrhosis), hepatocellular carcinoma (9-11).

Extremely significant consequences obesity brings in female reproduction, starting with the problems of getting pregnant and maintaining it, ending with technical problems during surgery or even performing ultrasound examination, which is difficult due to excessive abdominal fat. The association of obesity with obstetric failure and the occurrence of polycystic ovary syndrome in women has been demonstrated (12). There is also a greater risk of complications during pregnancy in pregnant obese who are several times more likely to suffer miscarriage. In addition, the risk of pregnancy-induced hypertension and pre-eclampsia is significantly higher, which may be the reason for the intervention of emergency medicine teams (12).

Obesity is associated with an increased risk of death and a more severe course of chronic diseases – asthma, chronic obstructive pulmonary disease, psoriasis, rheumatoid arthritis. The treatment and healing process in obese people lasts longer and is associated with more complications and infections (9). Among the most serious metabolic complications of the obesity, the metabolic syndrome (10) should be mentioned.

Obesity is associated with a very negative impact on the quality of life as well as the frequent occurrence of depression and mood disorders, which may be related to excessive amount of leptin – a hormone of hunger, which is overproduced in obese people (13). Obesity is an important risk factor for developing venous thrombosis (14).

All diseases coexisting with obesity, or which develop more severely, due to the patient's weight, may be the reason for the intervention of emergency medicine teams, that is why it is extremely important to prepare paramedics and emergency medicine team to work with an obese patient. Unfortunately, there is no data on how many patients using the services provided by emergency medicine teams is obese, but it can be assumed that it is similar to society in general.

Among methods of obesity treatment, pharmacological, dietetic and psychological as well as operational methods are distinguished. Currently, bariatric surgery, or obesity surgery, is the gold standard of its treatment and at the same time one of the most significantly growing areas of surgery, due to the huge demand. Regarding the indications for bariatric surgery, it should be considered in adults whose BMI index is above 40 or 35 kg/m², along with co-morbidities

in which the loss of body weight due to surgical treatment will cause improvement or complete cure. In addition, the indication for surgical treatment is to achieve weight loss as a result of conservative therapy, and then to increase it again (10). Among the available methods of surgical treatment, the sleeve gastrectomy, the adjustable gastric banding and gastric bypass are mentioned.

The contraindications to surgical treatment of obesity include contraindications to general anesthesia, as well as important contraindications from the cardiovascular system, which excludes the possibility of surgery, as well as cancers, inflammatory bowel diseases, significant coagulopathies and mental disorders (10).

Obesity is currently one of the greatest challenges of modern medicine, including emergency medicine. Due to the constantly growing number of obese people, but also the constantly increasing number of people undergoing bariatric procedures, it should be analyzed how this trend regard the work of emergency medicine teams. It is important to properly and reliably treat an obese patient in order to avoid complications related directly to excessive body weight and inadequate equipment in which an obese patient should be supplied.

Over past two decades, the occurrence of obesity in Europe has tripled. There are already over 1.5 million obese people in Poland, and this problem affects men to a slightly greater extent. It is estimated that over half of Polish population suffer from overweight and obesity. This problem affects 49% of women and 64% of men. Extremely dangerous is the increase of occurrence of obesity and overweight in school and middle school children, where this problem affects every 5th child.

Due to the constantly growing number of people struggling with excessive body mass, it should be assumed that obese people will be patients of emergency medical teams. It should also be assumed that this group of patients is specific, difficult for treatment and demanding, that is why the personnel should be prepared for this challenge technically and emergency medicine facilities and hospitals should be adapted for the situation. Basing on questionnaires with health care workers, the most frequent problems concerning medical proceedings for obese people have been indicated: inability to measure blood pressure, difficulties in establishing a peripheral intravenous line, difficulty in maintaining the airways and intubation, necessity to engage additional personnel during transport and transfer of the patient and lack of adaptation of the size of the equipment to the size of the patient (15). According to the study, the majority of paramedics and medical personnel notice an increase in the average body weight of the patient, and virtually everyone has declared that they have to deal with an obese patient. About 25% of calls to emergency medicine teams from obese people are mainly

for help with transport and not to provide emergency medicine services. The most common reason for calling was breathlessness (16).

The transport of an obese patient appears to be particularly important and problematic. Many aspects have to be taken into consideration. One of them is the introduction to the practice two-person teams. Frequently, such a team includes a nurse or a female paramedic, which is associated with the need to call for assistance in the transport of an obese patient, another team of emergency medical services or fire department team. Usually, the help of witnesses of an event, family or nearby persons is insufficient or even impossible to obtain. During the transport of obese patients, members of emergency medicine teams are at risk of injury, in particular of the shoulder girdle, spine and upper limb joints, therefore, it seems important to identify risk factors and then to apply preventive measures (17). According to the results of the study in Australia published in 2011, the risk of injuries related to the transport of obese patients regards in particular paramedics and members of emergency medicine teams, nurses, firefighters and funeral homes workers. Interestingly, the latter introduced a whole range of necessary equipment to handle the oversize body of the deceased obese – larger body bags, transport trucks with increased load capacity, larger refrigerators, the dimensions of rooms and the width of the entrance door to larger sizes of bodies are also adapted (18). Employees and staff in the sector of forensic medicine as well as care for the deceased have applied many improvements to minimize lifting and manipulation of bodies.

Unfortunately, there are no standards and algorithms for dealing with obese patients in pre-hospital care in Poland. Another aspect is the technical capability of the equipment of an ambulance. It is intended that ambulance teams dispose the new, fully functional equipment, however, by definition, it is not a device adapted to transport a sick obese person. Due to the increasing number of obese patients, ambulances and emergency helicopters should be equipped with stretchers, chairs and lifts with increased load capacity. The stretcher on the ambulance's equipment has a load capacity of 150-270 kg, which in case of super obese patients may turn out to be insufficient, considering, for example, that during transport, on the stretcher next to the patient a cardio monitor should be present, as well as oxygen bottle and other equipment.

An attempt to improve the care of an obese patient has been made in the United Kingdom, including identification of the risk associated with handling, transport and care of an obese patient. In the study, questionnaires have been applied, supplemented, among others, by members of the emergency medicine teams. Five topics have been analyzed – factors directly related to the patient, space and design of

buildings and vehicles, equipment, communication as well as organizational and personnel issues. Almost 60% of the respondents admitted that there is no organization in the place of their work improving the care of a bariatric patient. Approximately 77% of respondents had access to specialistic equipment, but only 32% of them received specialistic training. In the study center, there were no formal communication systems between organizational units, which increased the need for manual transfer of obese patients. The study clearly showed that there is a need to design or adapt buildings, vehicles and equipment to reduce the risks associated with manual handling of bariatric patients (19).

In 2014, the only bariatric ambulance in Poland has a Krakow emergency department. However, it is a transport ambulance, which means that it does not serve the patients of the State Medical Rescue. In a bariatric ambulance, lifting a heavy patient by personnel has been replaced by a special lift. The patient is transported under the lift on a special stretcher, which can be widened, due to the fact that the obese patient has not only increased body mass, but also needs additional space. The load capacity of these stretchers is approximately 300 kilograms. In order to put the patient inside the ambulance, a special incline slides out of the vehicle. Then the stretcher attaches to the lift, which is in the ambulance. For each type of bariatric stretchers, there are special systems for loading the stretcher to the carriage, controlled by a remote control. Battery powered guarantee 77 up/down cycles at maximum stretcher load without the necessity to charge. Adapting the equipment to patients with excessive body mass reduces not only the risk of injury and overloading among medical personnel, but above all ensures greater safety and comfort for the patient.

There are also available stretchers for obese patients with the possibility of CPR (cardiopulmonary resuscitation), anti-shock position adjustment and additional equipment such as an oxygen bottle holder.

There is also the possibility of equipping ambulances with transport chairs adapted to transport patients with excessive body mass. They are equipped with a wider frame and reinforced structure, which gives the possibility of an acceptable load of 200-300 kilograms. In addition, the offer of rescue equipment producers includes a transport chair dedicated to going down the stairs, due to the installed traction system. The speed of sliding depends on the patient's weight – the heavier the patient, the slower sliding.

Adaptations to the care of an obese patient require orthopedic boards, lifts and devices for conducting automatic indirect heart massage, such as LUCAS or AutoPuls, which size can be adjusted to the patient's chest dimensions, however, in case of patients with morbid obesity, frequently, the perimeter of the device

is insufficient, which makes the chest compressions ineffective.

Particularly difficult in practice of emergency medicine teams is the lack of blood pressure cuffs, which sizes would be suitable for obese patients. For this measurement, the size of the cuff is important for its accuracy. This problem may be solved by attaching a pressure cuff to the forearm of the patient.

It has already been mentioned that it is difficult to obtain a reliable blood pressure result using the cuffs that are provided in an ambulance.

Huge difficulty in obtaining intravenous access in obese patients also occur, which is connected with the necessity of overcoming a thick layer of adipose tissue which occludes veins. In this case, equipping ambulances with devices that, by emitting infrared light, help locate blood vessels on the patient's body could be helpful. The device is dedicated, among others, to obese patients.

In case of a decision to perform central venous access, it is possible that the needles in the standard set may be insufficient.

Excessive accumulation of fat tissue in the buttocks makes intramuscular injections in the gluteal muscle difficult.

It is extremely important that in time of a increasing number of bariatric procedures, it is more and more common for emergency medicine teams to come across the situation of providing health services in case of post-operative complications. Therefore, during the course of education, members of emergency medicine teams should be familiarized with the possibility of postoperative complications, their symptoms and methods of conduct in case of their diagnosis.

The most serious complication after surgical treatment of obesity is pulmonary embolism. Almost half of all fatalities after bariatric surgery are caused by this disease. Patients during the stay in the hospital and in the postoperative period are provided with antithrombotic prophylaxis, but so far there are no unambiguous recommendations regarding the dosage of low molecular weight heparin in patients with morbid obesity and the duration of prophylaxis.

The most common complications after surgical treatment of obesity include separation of the anastomosis, stenosis of the anastomosis, bleeding into the peritoneal cavity, manifested by gastrointestinal obstruction, intraperitoneal abscess and thromboembolism. The most common symptoms of these complications include abdominal pain, emesis, fever, obstruction of gases and stools, dyspnea (tab. 2).

It seems to be important for the personnel of emergency medicine teams to be alert in cases when a fore-mentioned symptoms occur in the postoperative period in an obese patient. What is more, do not attempt pharmacological treatment at the patient's home, but recognize the possibility of complications and transport

the patient to the hospital, because treatment is possible only in hospital conditions.

Tab. 2. The most frequent complications after bariatric procedures and their symptoms

Complication	Symptoms
Pulmonary embolism	Dyspnoea, tachycardia, chest pain, dry cough
Separation of the anastomosis	Tachycardia, fever, abdominal pain, left arm pain, hiccup, sepsis
Bleeding to the peritoneal cavity	Hypotonia, weakness, tachycardia, pale skin
Anastomosis stenosis	Abdominal pain, inflation, obstruction of gases and stool, emesis
Venous thrombosis	Pain and edema of lower limb, redness

One of the emergency medicine proceedings, which cause the greatest difficulties in obese patients, is airway clearance. Endotracheal intubation is a special challenge. It is also very difficult to properly conduct respiratory therapy in patients with excessive body weight.

In obese patients, due to the significant amount of fatty tissue in the chest, lung ventilation is impaired, which means increased oxygen consumption and carbon dioxide production. Increased oxygen consumption causes a situation that apnea very rapidly lead to a decrease in oxygen saturation. As a consequence of obesity, sleep apnea syndromes may occur as well as difficulties in maintaining the airway obstruction during sleep, which results in snoring. Increased deposition of fat around the ribs, in peritoneal cavity and under the diaphragm, forces increased respiratory effort, and increased pressure inside the abdominal cavity exerts pressure on the diaphragm reducing its mobility. Increased capacity of the small circulation is responsible for the deterioration of lung compliance (20). Improvement of ventilation may be achieved by the correct placement of the patient. It turns out that the prone position is better, because in the supine position the cardiac output and pulmonary artery pressure are elevated. By laying the patient in a position with slightly lowered lower limbs, the pressure in the airways may be reduced because the diaphragm pressure from the abdominal cavity diminishes. Therefore, it is recommended to use pillows or sheets – reducing the angle between the chest level and the face which enables inserting a laryngoscope.

In case of obese patients, the anatomical conditions of the upper respiratory tract have the greatest impact on the possibility of effective ventilation. Usually, there is a thick, short neck, a significant excess of soft tissue around the palate and larynx that is advanced. In addition, there is a large tongue and thick cheeks, which reduces the possibility of opening the mouth and requires the use of more strength during intubation and significantly hinders the patient's ventilation with the mask. These ana-

tomic features increase the risk of aspiration to the digestive tract and make it more difficult to maintain airway patency, therefore, due to regurgitation of gastric contents, intubation with compression on the cricoid cartilage (Sellick maneuver) is recommended. It also happens that the neck has limited mobility. In combination with elevation of the chest level, this makes the intubation conditions very difficult. Due to these difficulties, in obese patients it is recommended to use laryngoscopes with short handles, McCoy laryngoscopes or alternative methods such as a mask or laryngeal tube. According to literature, the percentage of unsuccessful intubations in obese patients may reach up to 13% (21). Of course, the ideal of the procedure would be to equip ambulances with videolaryngoscopes, which are the method of choice for the intubation of obese patients.

The literature suggests that the standard breathing tests are less clinically useful in superobese patients, and that the best single predictor of difficult intubation in obese is neck circumference (22).

Obesity does not contribute to differences in the use of defibrillation, it does not affect the amount of energy used and the effectiveness of its use (23).

In case of indirect heart massage, it would seem that to assess the effectiveness of cardiopulmonary resuscitation in morbid obesity, the depth of the subcutaneous chest fat tissue should first be determined and its correlation with the body mass index (24). Such measurements have been made on the basis of computer tomography of the chest of obese patients, determining the average depth of adipose tissue. BMI has been shown to be consistent with the thickness of adipose tissue, both, on the front and on the posterior surface of the chest. It is likely that during the external heart massage, a large part of the force generated on the skin surface is absorbed by the adipose tissue, both, between the skin surface and the sternum and between the spine and the skin surface, therefore a correspondingly greater strength should be applied.

There is the data available in literature on the relationship between the BMI value and disaster survival. Reports may be found that people classified as obese were more harmed by disasters and accidents, precisely because of their weight or size. The most visible were problems associated with the evacuation of obese people from the place of the event. In several described cases of disasters it was emphasized that obese people were evacuated as the last from the place of an event. The case of the evacuation of a hospital in New Orleans was also described during which the obese patient has been rescued over 2 hours by 12 members of hospital personnel. The tragic case was the 263 kg patient whose evacuation from the accident scene has been ceased due to the fact that his size was too big to fit in emergency exit.

To emphasize the need to prepare for a disaster, including the problem of evacuation, transport and providing medical assistance to obese people, it should be added that the countries with the highest rates of obesity, i.e. the United States, Mexico, New Zealand, are also the countries most threatened by natural disasters. Therefore, it is necessary to prepare for securing the needs in the field of health care and psychosocial support for people with morbid obesity.

The literature also describes an increasing risk for obese people, in some public health situations such as influenza A (H1N1) pandemic, an increase in the frequency of hospitalization and an increase in mortality (25, 26).

The effect on the pharmacokinetics of drugs in obese people has not only the presence of excessive body fat, but reduced proportionally to body weight, the amount of water in the body. Biotransformation of drugs may also change due to diseases coexisting with obesity – liver disease (steatosis), diabetes or hypertension impairing renal filtration. An important aspect is hyperlipoproteinemia affecting the binding of drugs in plasma. It has not been proven that fat-soluble drugs have slower clearance or their elimination half-life is prolonged. However, it is necessary to make modifications when drug dosing, as it is usually given per kg body weight. Increased demand and slower elimination of fat-soluble relaxants are possible (tab. 3).

So far, obesity has not been proven to affect the absorption of drugs in humans, but it is possible that there are interactions between oral medicines and food ingredients typical for obese people. Food usually delays or reduces the absorption of drugs, but it is not a rule, and depends on the type of both medicine and food, and the form of the drug.

Due to the lower bowel motility than in people with regular body weight, the time of emptying the stomach and intestines is prolonged, which adversely affects the absorption of drugs and additionally intensifies the interaction between food components and the drug. On the other hand, a longer stay of a given drug in the gastrointestinal tract may cause the dissolution of a larger amount of drug substance, which increases its absorption. This phenomenon was observed, among others in the case of spironolactone or phenytoin.

Tab. 3. The influence of obesity on pharmacodynamics and dosage of chosen drugs

Drug	The influence on pharmacokinetics and dosage
Tiopental	Prolonged elimination
Opioids	Prolonged elimination
Paracetamol	Possibly shortened time of action
Sukcynylocholina	Time of action depends on plasma concentration of acetylcholinesterase and in case of obese patients it is elevated
Inhalatory anaesthetics	Dosage independent on body mass
Low molecular weight heparin	Dosage independent on body mass
Morphine	The time of action is prolonged
Fentanyl	Dosage depends on ideal body weight, dosage due to actual body weight may result in hypotonia and bradycardia
Atracurium	Necessity of higher dosage for obese patients in order to obtain proper level of myoneural blockage

CONCLUSIONS

Obesity is one of the greatest medical challenges of 21st century. The number of obese people is increasing, as well as people undergoing surgery to reduce the weight of their bodies. Due to this trend, paramedics as well as employees of the emergency medicine system will more and more often be in contact with patients with excessive body mass.

It is necessary to train the rescue team in terms of recognizing complications after bariatric procedures, but also in terms of presenting the specificity of providing assistance and performing emergency medicine proceedings for obese patients.

There is a necessity to adapt the equipment of emergency ambulances and emergency departments to provide assistance to obese patients.

In the profession of a paramedic, it is important to constantly improve qualifications and acquire the latest knowledge, which guarantees high quality of care and its effectiveness.

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