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Medical waste including hazardous waste

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Abstract

Introduction and purpose of the work. Medical waste is a special type of waste generated as a result of conducting exceptional activities (related to, among others, saving human life) or related to a specific place (eg a hospital). They are a by-product of health care, arising at various levels of its activity. "Medical waste" means waste arising in connection with the provision of health services and the conduct of research and scientific experiments in the field of medicine.

Summary. The data show that the amount of medical waste generated (especially those hazardous, because they constitute the major part of this group), will increase year by year. It seems almost impossible to remedy this phenomenon in any way. That is why their proper management is so important.

Key words: medical waste, hazardous waste, hazard

Introduction

In the era of population aging, the number of patients served increases year by year [1]. The side effect of this phenomenon is the emergence of an increasing number of medical waste. The specificity of this type of waste does not allow to treat them equally with other wastes (eg municipal waste). Threats to the environment and to human life and health result primarily from their properties. The spreading of diseases as a result of poor handling of medical waste (especially those that are contagious) is a very real threat, it is enough to contact a drop of blood of a sick patient to contract a deadly infectious disease. The scale of danger that this kind of waste brings with it is so huge, although the problem is little known to the public [2,3].

Less than 30 years ago, legislation appeared in Polish legislation that directly related to waste management - the Act of 31 January 1980 on the protection and shaping of the environment [11]. After the period of political transformation, in 1997 the Act of 27 June 1997 on waste [12] entered into force. Currently, the Act of 14 December 2012 on waste [14] is in force. Under this Act, waste is considered to be "any substance or object belonging to one of the categories specified in the Annex to the Act, which the holder discards, intends to get rid of or is required to discard" [13].

In waste that generates the average citizen in your home, the amount of these particularly dangerous constitutes from 1% to 4% of the total waste [4]. Approx. 95% of hazardous waste goes to a normal waste bin [5]. As a consequence, these wastes go to landfills where they pose a threat to the environment and people. A good example is the discarded drugs (not necessarily expired), which amounts to around 5,000 per year. t [4]. Dr hab. Grzegorz Nałęcz-Jawecki from the Department of Environmental Research of the Pharmaceutical Faculty of the Medical University of Warsaw in one of his interviews quotes data on the amount of medicines given by the citizens. He stated that the downloadability of these unwanted medications is about 10-20% for the whole country, the rest goes to the garbage or to the sewage system [4]. The low awareness of citizens and the lack of proper government policy makes this data so less optimistic [8].

Medical waste is a special type of waste generated as a result of conducting exceptional activities (related to, among others, saving human life) or related to a specific

place (eg a hospital). They are a by-product of health care, arising at various levels of its activity. "Medical waste" means waste arising in connection with the provision of health services and the conduct of research and scientific experiments in the field of medicine "[6]. The most frequently used method of disposing of medical waste is to subject it to thermal transformation. In Poland, until 31 December 2008, 98 incinerators operated (including 38 for incineration of medical waste) [7]. The popularity of this form of disposal results first of all from the law, because some of the medical waste (especially dangerous ones) must be burnt. Other ways of neutralizing this type of waste are impossible.

Description of the state of knowledge

Regulation of the Minister of Health on the detailed way of dealing with medical waste. The first paragraph defines the area of legal regulation, and it concerns:
1) "classification of medical waste to determine the proper course of treatment [11,12];
2) collection of medical waste at the place where it was created;
3) storage of medical waste in healthcare facilities and other entities providing health services [13] and in entities conducting research and experience in the field of medicine before subjecting waste to a disposal process;

4) defining the conditions for transporting medical waste within the health care unit and the entity conducting research in the field of medicine [14] ".

Paragraph 3 of the Regulation imposes an obligation on health care units, in which waste of group 18 01 is formed, to collect these wastes selectively, that is, according to the previously accepted classification (infectious, special and other) [4,5]. In addition, infectious and special wastes must be collected taking into account their subsequent disposal or recovery. "Other" waste as a category of those that do not pose a threat to human life and health are treated similarly to municipal waste. All hazardous (ie infectious and special) waste, with the exception of those with sharp edges or ends, "is collected into single-use containers or bags made of polyethylene film, opaque, durable, resistant to moisture and chemicals, with the possibility of a single closure" [6,10]. The ordinance imposes the obligation that medical waste from particular categories be placed in bags of specific colors (§5 of the Regulation). Blue bags are intended for "other" waste (excluding those with sharp ends and edges). Infectious wastes are placed in red sacks (excluding, as in "other" ones, those with sharp ends and edges). Special waste is collected in yellow sacks. Waste bags should be placed in such a

way that their upper part is turned up to 20 cm wide, which will avoid contamination of this part of the bag [7]. Waste with sharp ends and edges is collected in disposable containers. Containers and bags of the health care unit must be replaced at least once a day, with maximum filling of sacks or containers not exceeding 2/3 of their volume. At least once every two days, waste containers with sharp edges or ends should be replaced. The allowed level of container filling is the same as in the previous case. Filled sacks and containers should have (§5 section 1):

1)"visible marking, indicating the type of waste stored in them;
2)visible signs showing the place of origin of the waste;
3)closingdate; information to identify the person closing the container or sack "[7,8].

Another aspect that found its regulations in this regulation is the storage of medical waste. Storage is an intermediate stage between the moment of their creation and disposal. The Minister of Health allows the storage of hazardous medical waste within the premises of a health care unit, in rooms suitably prepared. As for the time in which this waste may be in stock, it is conditioned by the temperature that prevails inside the room. The limit in this case is 10oC [2.8]. Below this temperature, storage is allowed for a period of 14 days, while above this temperature, the storage period is reduced to only 2 days. However, not all units, due to a small amount of generated waste, have the possibility to create such storage conditions (eg dental offices). The regulation on this matter is quite uncertain, because it allows for a small amount of medical waste to be stored in a separate, cool place in tightly closed containers. The Regulation no longer specifies how such a room should be prepared and when it is possible to talk about a "small amount" of medical waste that would be entitled to such storage (in these places some conflicts may arise with regard to the interpretation of regulations) [7,8]. The only thing that determines is the maximum storage time.

In large units, such as, for example, hospitals, waste is transported using specially designed means of transport (the so-called internal transport). The Regulation imposes an obligation that such vehicles and containers in which waste is transported are disinfected after each use. When transporting infectious wastes, the trolleys must be closed. Transportation of this type of vehicles takes place specially for this purpose [11]. Equally important is the fact that such vehicles must have a separate place in which they will be disinfected and stored, together with reusable containers. Such a place should meet similar conditions to those in which waste can

be stored. In addition, it should be adapted to allow free entry and exit from such a room [10]. The permitted ways to dispose of hazardous medical waste are presented below.

Tab. 1. Permitted methods of disposal of hazardous medical waste.

Code	Methods of disposal
18 01 02	thermal treatment of waste (parts of the body and organs exclusively in this method!); autoclaving; thermal disinfection; operation with microwaves;
18 01 03	thermal treatment of waste; autoclaving; thermal disinfection; operation with microwaves;
18 01 06	thermal treatment of waste; physico-chemical treatment other than auto-klawowanie; thermal disinfection; operation with microwaves;
18 01 08	thermal treatment of waste;
18 01 10	physico-chemical treatment other than autoclaving; thermal disinfection; operation with microwaves;
18 01 80	physico-chemical treatment other than autoclaving; thermal disinfection; operation with microwaves;
18 01 82	thermal treatment of waste; autoclaving; thermal disinfection; operation with microwaves;

Source: Own study based on the Regulation on acceptable methods and conditions for the disposal of medical and veterinary waste.

In the Regulation of the Minister of Health on the permissible ways and conditions for the disposal of medical and veterinary waste, we find a description along with detailed information on each of the above-mentioned ways of disposing of medical waste. And so, when it comes to:

- "a thermal waste treatment process, it is carried out in a way that ensures that the temperature of gases resulting from combustion, measured near the inner wall or other representative point of the combustion chamber or afterburning [...] even under the most unfavorable conditions, has been maintained for at least 2 seconds at a level not lower than 1100 ° C "[12,14],

- "autoclaving process is the disposal carried out in pressure chambers with saturated steam, while maintaining process parameters ensuring waste disposal of infectious properties"[13],
- chemical disinfection and microwave treatment are "processes carried out in specially adapted devices or installations, while maintaining the parameters of processes ensuring waste disposal of infectious properties" [14].

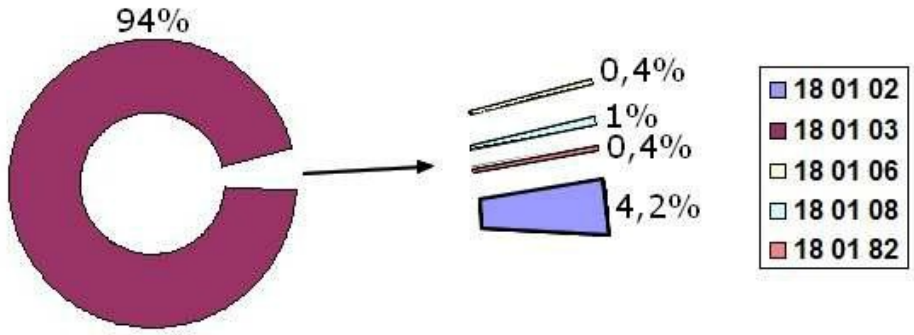
The regulations cited above set out the complete path to be followed by the waste holder. The procedures they must follow are established from the moment the waste is made and accompany them until they are disposed of.
The forecast of the amount of medical waste produced for Poland was prepared by engineers from the Faculty of Mechanical Engineering and Robotics of the AGH. It was created in 2000 on the basis of data from literature and statistical data (demographic forecast, GDP growth dynamics) [2.3]. The table below presents the results of the PZH research for 2006. The results of the research concern 795 Polish hospitals. The table shows what the structure of individual types of waste looked like in these facilities. As mentioned before, the largest percentage of waste is municipal waste (about 86%). Medical waste is about 16%, of which the hazardous is about 91% of all medical waste.

Tab. 3. Averaged results of PZH research on waste generated in hospitals in Poland in 2016

	National Institute of Hygiene
Total waste	203 796,9 kg/hospital
Municipal waste	175 898,8 kg/hospital
Medical waste	34 632,4 kg/hospital
Hazardous waste	31 826,1 kg/hospital
Waste is not dangerous	2 806,3 kg/hospital

Source: Own study based on materials received from dr n. Med. Krzysztof Kanclerski.

Chart 1. Percentage share of subgroups of hazardous medical waste (given in codes) in the total amount of hazardous medical waste in 2016.



Source: Own study based on data from the report on the state of hazardous waste management for 2016.

As much as 94% of all hazardous medical waste is waste that contains live pathogenic microorganisms or their toxins, and other forms capable of transferring genetic material of which there are known or for which there are reliable grounds for believing that they cause disease in humans and animals (e.g. infected nappy pants, sanitary towels, sleepers, bandages). The next largest subgroup is waste consisting of body parts and organs as well as containers for blood and preservatives used to store it, but their share is just over 4%. The remaining amount of wastes belonging to particular subgroups of medical waste being hazardous constitutes approx. 2%. These wastes (ie 18 01 02, 18 01 03, 18 01 06, 18 01 08, 18 01 80, 18 01 82) pose a threat to human life and health and they are covered by special procedures (referred to in the previous subchapter) related to their transport, storage and disposal. The amount of medical waste is only 0.014% of all waste produced in Poland. It may seem that this amount is insignificant and it is not necessary to attach importance to it, because it would be necessary to focus on those wastes that generate the most in our economy (eg industrial), however knowing the specificity of this type of waste and the fact that over 95% of them are hazardous waste [8,9], it is necessary to undertake all actions aimed at reducing or completely eliminating the risks that medical waste brings, in particular dangerous ones.

Summary

The data show that the amount of medical waste generated (especially those hazardous, because they constitute the major part of this group), will increase year by year. It seems almost impossible to remedy this phenomenon in any way. That is why their proper

management is so important.

The work of enterprises dealing in the disposal of medical waste is not completely environmentally friendly. On the one hand, we get rid of one problem, on the other hand, it costs us a lot of energy and consequently emission of pollution. With current technology, we are not able to carry out this process in a less harmful way to the environment.

It remains to be trusted that the responsibility of people dealing with the protection of this type of waste will be so large that the average citizen and the environment will not be exposed to the dangers posed by unsafe medical waste. Joint actions of central and local government institutions will allow to improve the entire system and to provide its citizens with the expected security.

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