

# Bone marrow donation in Poland: 2021 update, and the impact of the coronavirus disease 2019 pandemic on haematopoietic stem cell transplantation

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Aleksandra Janowiak-Majeranowska<sup>1</sup>, Filip Lebedziński<sup>2</sup>  
and Alan Majeranowski<sup>3,4</sup> 

## Abstract

Haematopoietic stem cell transplantation is a treatment modality that saves the health and lives of a growing number of patients around the world. In the majority of cases, the procedure is conducted to treat haematologic neoplasms, although it can also be used as a therapy for some non-haematological diseases. The progress that has been taking place in the field of haematopoietic stem cell transplantation involves the need for recruiting more and more potential unrelated bone marrow donors for allotransplantation. In Poland, the number of people registering as potential bone marrow donors has been continuously growing and in order to maintain this trend, it is necessary, above all, to consistently spread the noble idea of bone marrow donation and to raise Poles' awareness and knowledge about haematopoietic stem cell transplantation. Unfortunately, the situation caused by the severe acute respiratory syndrome coronavirus 2 pandemic limited the opportunities to act in public space and, as a consequence, it has become more difficult to achieve the objectives associated with recruiting new potential donors. The article provides a presentation of ethical and practical aspects associated with bone marrow donations as well as an overview of the legal situation concerning bone marrow donating and transplantation in Poland. The purpose of the paper is to also present some of the changes in transplantation procedures that have emerged as a consequence of the current epidemiological situation. The authors would like to emphasize the importance and the rightfulness of taking action that enables further development of transplantology.

## Keywords

Clinical ethics, blood banking, donation and transfusion < clinical ethics, donation and procurement < organ and tissue transplantation < clinical ethics, legal aspects < organ and tissue transplantation < clinical ethics

## Introduction

Haematopoietic stem cell transplantation (HSCT) is a medical intervention that is used to treat multiple diseases.<sup>1</sup> The amount of conducted HSCT's has been systematically increasing around the world, including Poland.<sup>2</sup> Among the conditions treated with bone marrow transplant (BMT), the majority are haematological cancers, however, there is a number of non-haematological diseases that require performing of this procedure.

### Indications for HSCT

The spectrum of diseases that can be treated using HSCT has been successively extended. Currently, this spectrum involves haematological diseases (most of them being haematological), solid tumours, disorders resulting from genetic defects and autoimmune conditions. This method

of treatment can be applied to both adults and pediatric patients. Examples of diseases in which HSCT is used are given in Table 1.

<sup>1</sup>Department of Otolaryngology, Faculty of Medicine, Medical University of Gdańsk, Gdańsk, Poland

<sup>2</sup>Medical University of Gdańsk, Gdańsk, Poland

<sup>3</sup>Department of Hematology and Transplantology, Faculty of Medicine, Medical University of Gdańsk, Gdańsk, Poland

<sup>4</sup>Department of Cell Biology and Immunology, Intercollegiate Faculty of Biotechnology, University of Gdańsk and Medical University of Gdańsk, Gdańsk, Poland

### Corresponding author:

Alan Majeranowski, Department of Cell Biology and Immunology, Intercollegiate Faculty of Biotechnology, University of Gdańsk and Medical University of Gdańsk, ul.Smoluchowskiego 17, 80-214, Gdańsk, Poland.  
Email: a.majeranowski@gumed.edu.pl

**Table 1.** Examples of diseases treated with HSCT.

Blood cancers	AML
	ALL
	CML
	MDS
	T-cell non-Hodgkin lymphoma
	DLBCL
	Burkitt lymphoma
	Anaplastic large cell lymphoma
	MM
	MM
Solid tumours	Ewing's sarcoma
	Osteosarcoma
	Wilms' tumour, neuroblastoma
	Neuroblastoma
	GCT
Non-cancer diseases	• Aplastic anaemia
	• Congenital amegakaryocytic thrombocytopenia
	• Crohn's disease
	• Celiac disease, Al-toma et al. <sup>3</sup>

AML: acute myeloid leukaemia; ALL: acute lymphoblastic leukaemia; CML: chronic myeloid leukaemia; MDS: myelodysplastic syndromes; DLBCL: diffuse large B-cell lymphoma; MM: multiple myeloma; MB: medulloblastoma; GCT: germ cell tumour; HSCT: haematopoietic stem cell transplantation.

### *Bone marrow transplantation types by the origin of cellular material*

Three basic types of transplants are distinguished based on who the cells come from:

- Autologous stem cell transplant (ASCT) is a procedure in which a patient's healthy haematopoietic stem cells are extracted from the blood or the bone marrow before treatment, they are then stored for the time of the treatment and subsequently entered back into the patient's body once the treatment is completed.<sup>4</sup> Hence, no other histocompatible bone marrow donor is needed to be able to perform this procedure, which allows the entire process to be relatively simple as well as common (more than half of the stem cell transplants conducted in Europe is autologous).<sup>5</sup> ASCT is most often performed in order to treat haematological neoplasms, in order to replace patient's stem cells that have been destroyed during high-dose chemotherapy and radiotherapy treatments.
- Syngeneic transplant is a procedure in which a patient receives haematopoietic stem cells from a healthy donor who is patient's identical twin.<sup>6</sup>
- Allogenic transplant consists of administering stem cells to a patient from a donor who is not their identical twin. A donor can either be related to a patient or be an unrelated bone marrow donor.

Depending on the clinical situation, stem cells can be obtained from the peripheral blood or directly from the bone marrow.

### *Different sources of haematopoietic stem cells and practical aspects of the methods of obtaining those cells from particular sources*

- *Peripheral blood.* The procedure of extracting stem cells by peripheral blood apheresis is preceded by daily subcutaneous administration of the granulocyte colony stimulating factor (G-CSF) into donor's body for 10–14 days. The administration of this substance is done so with the aim of increasing the amount of stem cells in the peripheral blood. The procedure itself typically consists of inserting the intravenous line in both right and left arms, next, the blood is transfused from one arm, after that it goes to the cell separator that separates the stem cells and, eventually, the blood comes back to donor's circulation through the line in the other arm. If the amount of stem cells obtained is sufficient and there is no need for repeating the procedure, the whole process lasts about four hours.<sup>7</sup> According to the European Society for Blood and Marrow Transplantation (EBMT), the frequency of performing peripheral blood stem cell transplant (PBSCT) has been systematically growing and has been presenting with an increasing percentage in terms of the source of haematopoietic stem cells for transplantation.<sup>8</sup> As far as the allogenic transplantation is concerned, peripheral blood cells are used in >70% of cases, and in auto-HSCT, that percentage reaches 99%. This happens due to the advantages connected with choosing the method of obtaining cells from peripheral blood. First and foremost, that method is easier and causes a lot less discomfort to the person subjected to the procedure. Secondly, it was proven that haematopoietic reconstitution after PBSCT can be quicker compared to BMT.<sup>9,10</sup> However, allo-PBSCT does not show any advantage over allo-BMT in terms of the lifespan after the procedure.<sup>11</sup>
- *Bone marrow.* In some cases, it is indicated to extract the cellular material directly from bone marrow. This procedure requires hospitalization of the donor, who is typically admitted to the hospital the day before. The procedure itself is conducted under general anaesthesia. During the procedure, over a litre of the cellular mass is extracted from the wing of ilium (hip plate). Bone marrow constitutes around 5% of this mass. The donor is usually discharged from the hospital the day after the procedure. The advantage of choosing the bone marrow as a direct source of stem cells is due to the fact that BMT is characterized by a smaller risk of chronic graft versus host disease occurrence, compared to PBSCT.<sup>11</sup>
- *Umbilical cord blood.* Can be obtained when the mother donates the umbilical cord and the placenta of her newborn child. The cord blood has a higher concentration of stem cells than what can be found in the

peripheral blood of a regular adult. However, there is a very small volume of blood that can be obtained from the cord – only about 50 ml. With that being said, this blood is more often suitable for transplantation for small children than for adult patients. Nevertheless, there are methods that enable the *ex vivo* expansion of the cord blood units or using the cord blood from two different donors for the same transplant. Such techniques allow for the usage of this blood in the treatment of adult patients.<sup>12</sup>

## Becoming a bone marrow donor in Poland

In Poland, there are a number of facilities engaged in activities connected to bone marrow cells transplantation, including the recruitment of potential donors. The procedure of becoming a potential bone marrow donor is relatively simple and practically complimentary for people wanting to donate their bone marrow cells. Any person interested can retrieve additional information from their respective registry or foundation. Then, based on the sample from the buccal smear or extracted peripheral blood, human leukocyte antigen (HLA) is examined compatibility with the potential recipient. Throughout Poland, the registration is coordinated in such a way that the data and HLA testing results of all potential donors are forwarded to the Central Unrelated Potential Bone Marrow Donor and Cord Blood Registry (CBMDR Poltransplant); the data are also transferred to international registries. Such coordination enables to increase the chances of finding unrelated people whose histocompatibility makes the transplantation possible.

According to information presented by CBMDR, an increasing amount of people have been registering as potential bone marrow donors. The number of new people coming every month varies between several thousand and more than a dozen thousand and as of the end of 2019, this number rose to almost 17,80,000.<sup>13</sup> It is worth mentioning that, on a world scale, such a vast database is an enormous achievement – Poland ranks second in Europe and fourth in the World in terms of donor pool's volume, behind Brazil (over 4.4 million potential donors), Germany (8.3 million) and United States (9 million). This fact constitutes one of the reasons why the CBMDR Poltransplant is internationally considered to be a well-organized haematopoietic stem cell donor registry with a large, high-quality donor database, and also, more and more Poles eventually become actual donors for their compatriots as well as for patients from other countries.<sup>14,15</sup>

Increasing the number of people signing up as potential donors has critical meaning, mainly because of the fact that the chance of encountering an adequate donor for a particular patient is only 1 in 20,000. This indicates that the overwhelming majority of people that declared the willingness

**Table 2.** Examples of diseases that need to be evaluated in a potential donor and may potentially exclude from donation.

Gastrointestinal disorders	Celiac disease Crohn's disease Ulcerative colitis
Cardiovascular diseases	Pulmonary embolism Atrial fibrillation Recent myocardial infarction
Malignancies	History of any malignancy (there are exceptions)
Infectious diseases	HIV infection Hepatitis B or C
Autoimmune disorders	SLE Dermatomyositis Polymyositis Multiple sclerosis Scleroderma, Vasculitis syndromes
Liver diseases	Liver cirrhosis Sclerotic cholangitis
Psychiatric disorders	Schizophrenia Bipolar disorder
Nervous system diseases	Parkinson's disease Epilepsy

HIV: Human immunodeficiency virus; SLE: systemic lupus erythematosus.

to donate bone marrow cells and had their samples taken to create their genetic profile will never become a real donor.

## Who can and who cannot become a donor of haematopoietic stem cells

Generally speaking, practically every healthy person between 18 and 50 to 60 years of age (depending on the country and the registry) can become a donor. However, considering the safety of both donors and recipients, there are some medical contraindications to being a bone marrow donor. For that reason, the health status and medical history of every donor must be evaluated,<sup>16</sup> mainly in terms of pulmonary and cardiovascular diseases, gastrointestinal disorders, previous transplantations, malignancies, infectious diseases, liver dysfunction, allergies, autoimmune disorders and other conditions.<sup>17</sup> Certain drugs, addictions and mental disorders may also exclude a person from haematopoietic stem cell donation.<sup>18</sup> Examples of diseases that may exclude from the donation are given in Table 2.

## Promoting the idea of bone marrow donation in Poland and Poles' awareness and knowledge about bone marrow transplantation

Disseminating the idea of donation and spreading the knowledge about bone marrow cell transplantation among Poles is of particular importance for the recruitment of

new potential donors. An important role in this process is played by the website of the DKMS Poland foundation, which increases its reach through promotion in social media. The DKMS Poland Foundation also participates in the organization of the Bone Marrow Donor Days, i.e. events during which the medical staff and volunteers associated with the foundation, among other things, engage in promoting the idea of donating bone marrow cells, honouring bone marrow donors, or educating passersby about transplantation. Of course, all these activities are intended to convince as many people as possible to sign up as potential bone marrow donors. Education, and at the same time raising awareness to Poles about stem cell transplantation, seems to be a key factor, taking into account the results of research on Poles' knowledge regarding this issue. The surveys conducted among the students of Wrocław and Lublin universities show, inter alia, that 'many students cannot correctly state the elements of bone marrow procedures and their knowledge contains many stereotypes'.<sup>19,20</sup> Another study, this time conducted among potential unrelated bone marrow donors, led to the following conclusion: The level of knowledge of the surveyed persons registering as potential donors can be described as unsatisfactory.<sup>7</sup>

### **Ethical, practical and legal aspects regarding bone marrow cell transplantation in Poland**

The most important and comprehensive legal document defining the principles of the functioning of donor recruitment, registration, testing, collection and transplantation of haematopoietic stem cells, is the Act of 1 July 2005 on the collection, storage and transplantation of cells, tissues and organs.

#### ***Marrow cell transplant costs***

Section 3, paragraph 1, of the 2005 Act clearly prohibits demanding any payment for the donation of organs, tissues or cells: *No payment, other material benefit, or personal gain may be demanded or accepted for donated cells, tissues or organs.*<sup>21</sup> This means that bone marrow stem cells cannot be traded, which suggests that donating one's cells in every case is an act of altruism and will to help others.

According to the Act, the costs of collecting bone marrow haematopoietic cells include, among others, costs of the qualification of a potential donor, medical examinations, transport of a potential donor or an actual donor, stay in a health care facility, carrying out the collection and transplantation procedures, and the coordination of these procedures. However, neither real donors nor potential donors bear any costs related to transplantation. These costs are covered from public funds, and in the case of the operating costs of charity foundations engaged in bone marrow transplantation

(such as DKMS Poland), a large part of the funds are donations from private persons and institutions.

#### ***Bone marrow collection, transplantation centres and tissue and cell banks***

The function of bone marrow donor centres is legally regulated by the Regulation of the Minister of Health of 12 March 2010 on bone marrow donor centres.<sup>22</sup> Moreover, each centre that collects or collects and transplants bone marrow cells must obtain a permit from the Minister of Health to perform the given procedures. This permit is granted for a period of 5 years.

Bone marrow cells are stored in tissue and cell banks, which also needs a 5-year permit from the Minister of Health for their activities.

Both the list of bone marrow donor centres and the list of tissue and cell banks that have obtained permission to operate from the Minister of Health, are available on the website of the National Center for Tissue and Cell Banking.<sup>23</sup>

#### ***Obtaining consent for bone marrow donation***

The 2005 Act clearly sets out the conditions that must be met in order to legally collect and transplant cells, tissues or organs from a living donor. The fundamental issue is, of course, the donor's informed consent in writing. Informed consent of the candidate for a donor, in this case, means consent preceded by detailed information provided by doctors about the type of surgery, the risks associated with the procedure and possible negative effects on health. It is worth mentioning that consent to donate cells at the time of registration as a potential donor is not considered the final consent for the procedure of cell collection. This means that in a situation where a genetically compatible patient (potential recipient) is found, the potential donor will be asked again to consent to the donation of haematopoietic stem cells and, despite prior consent, may refuse to donate these cells without legal consequences. However, the law requires that the potential donor is informed of the possible health consequences for the recipient if the donor withdraws consent to donate cells.

Considering the fact that the chance of finding a genetically compatible donor for the potential recipient is really low, maintaining consent to donate your stem cells to a person in actual need of HSCT is extremely important. For this reason, the benefits of the transplant process should always be presented and emphasized – not only those related to improving the health of the recipient, but also the direct benefits for the donor. For example, in the process of preparing the patient for the procedure, the donor must undergo a panel of laboratory tests including basic blood chemistry, peripheral blood counts,<sup>24</sup> carbohydrate metabolism tests, iron metabolism tests, coagulograms, thyroid function assessment and

diagnosis of infectious diseases, including HIV, hepatitis and syphilis. Therefore, donating bone marrow may be a great opportunity for a donor to comprehensively check his or her health condition. It is also worth noting that according to the Polish Labour Code, the donor is entitled to a full-paid leave for the duration of the tests before the procedure and, of course, for the duration of the procedure itself.<sup>25</sup>

Additionally, more symbolic benefits, are the ‘Transplant Donor’ and ‘Meritorious Transplant Donor’ badges and cards, awarded to donors of regenerating cells and tissues, including donors of bone marrow cells, in accordance with the Regulation of the Minister of Health of 17 October 2018 on the badges ‘Donor of Transplant’ and ‘Meritorious Donor of Transplant’.<sup>26</sup>

### *Minor donor*

Most of the haematopoietic stem cell donors are, of course, adults. However, neither the Transplant Act nor the Code of Medical Ethics excluded the possibility of donating bone marrow cells by minors in exceptional cases, under certain conditions, e.g. immediate danger of loss of life of donor’s sibling. Naturally, informed consent for the procedure is needed,<sup>27</sup> both from child’s legal representative and from a minor themselves, if he or she is over the age of 13 years.<sup>28</sup>

## **Bone marrow cell transplantation in times of the COVID-19 pandemic**

### *Registration as a potential donor of bone marrow haematopoietic cells in Poland during the pandemic*

The outbreak of the COVID-19 pandemic resulted in changes in most aspects of people’s everyday lives, as well as on a larger scale—in the functioning of entire cities and countries. A sector that has been particularly affected by this situation is undoubtedly the health care system, which requires constant reorganization to adapt to the changing epidemiological situation. Disruptions also affected the functioning of transplantation, including the transplantation of haematopoietic stem cells and the registration as a potential donor of bone marrow cells. As the number of patients requiring treatment with the use of allotransplantation is not decreasing, and the demand for bone marrow haematopoietic cells is still high, organizations involved in the process of registering potential donors had to adapt this process according to the legal regulations introduced to inhibit the spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The DKMS Poland Foundation, which so far has been attracting potential donors mainly during the Marrow Donor Days, i.e. registration campaigns combined with the promotion of the idea of donation, has suspended all stationary registration campaigns throughout Poland. In order to further increase the base of potential donors, the Foundation decided

to organize Virtual Bone Marrow Donor Days,<sup>29</sup> as well as to introduce the possibility of online registration as a potential bone marrow haematopoietic cell donor. This registration includes an initial survey, ordering a registration pack (that contains sticks for the buccal swab collection, registration form and step-by-step registration instructions), self-sampling, filling in the form, and, finally, returning the registration pack.<sup>30</sup>

In order to minimize the risk of infection, people suspected of COVID-19, people quarantined after having contact with the virus, and those with confirmed SARS-CoV-2 infection are required to refrain from registering as potential donors. Additionally, as a security measure, people receiving the registration package are asked to send it back after a minimum of 3 days after the swab collection.<sup>30</sup>

### *How the COVID-19 pandemic impacted the amount of new registered potential donors*

CBMDR data on the number of people registered in Poland as potential donors of bone marrow cells seem to confirm the negative impact of the COVID-19 pandemic on the number of registrations. The CBMDR data shows that in the last 2.5 years, almost every month, about 15,000–25,000 new potential bone marrow donors had been signing up. However, from May 2020 until the end of the year, the number of monthly registered donors never exceeded 11,000. In the first half of 2020, a total of 94,111 new registrations were made, and in the second half – only 48,818<sup>31</sup> and that is as much as 48.1% less, which is a clear difference. It should be noted, however, that in the context of attempts to maintain the functioning of transplantations during a pandemic, caring for the real donor and recipient, ensuring their safety and protecting them from infection, is higher on the list of priorities than the number of new registrations.<sup>32</sup> The number of people who become new potential donors, however, is not without significance—the more people registered, the greater the chance of finding a compatible donor. The fact which gives hope for improvement is that an increase in the number of monthly registrations can be noticed at the beginning of 2021—the number of new potential donors amounted to 11,064 in January and 13,162 in February. These results are still significantly worse than those of previous years, but the presence of an upward trend shows the chances of bringing it to the high pre-pandemic level (Table 3).

### *The COVID-19 pandemic and the legal situation of facilities involved in bone marrow transplantation*

The situation related to the spread of the new SARS-CoV2 coronavirus forced changes to Polish law. The Act of 31 March 2020 amending certain acts in the field of the health care system related to preventing, counteracting and

**Table 3.** Number of registrations at Central Unrelated Potential Bone Marrow Donor and Cord Blood Registry (CBMDR) as potential haematopoietic stem cell donors.

Month	November 2019	December 2019	January 2020	February 2020	March 2020	April 2020	May 2020	June 2020	July 2020	August 2020	September 2020	October 2020	November 2020	December 2020	January 2021	February 2021
Number of registrations at CBMDR as potential haematopoietic stem cell donors	14,786	14,977	19,077	18,771	21,045	17,151	10,225	7842	7320	8981	10,154	7813	9089	5461	11,064	13,162

combating COVID-19, contains provisions that allow, inter alia, the possible extension of 5-year operating permits for bone marrow donor centres and tissue banks and cells, granted by the Minister of Health: *In the event of an epidemic threat, [...] permits to perform the activities referred to in the Act of 1 July 2005 on the collection, storage and transplantation of cells, tissues and organs (Journal U. of 2019, item 1405), the five-year period for which they were granted expires on December 31, 2020, will be extended by 6 months counted from the date of their expiry.*<sup>33</sup>

In addition, the possibility of postponing the inspection of these facilities has been introduced: *[...] the minister competent for health may postpone the date of the inspection referred to in Art. 35 sec. 3, once, not longer than for a period of 6 months from the date of lapse of 2 years from the date of the last inspection. In the event of persistent circumstances that constitute the basis for postponing the inspection, the minister competent for health may re-postpone the inspection for a period not longer than by 3 months.*<sup>34</sup> Considering that one of the most important challenges in bone marrow transplantation in the time of the COVID-19 pandemic is the continuation of transplantation for as many patients as possible, the introduction of the legal changes allowed to postpone formal issues in order to enable further patient care in entities involved in transplantation.

### *The difficult challenge of the care for recipients and donors of stem cells during the COVID-19 pandemic*

Caring for people involved in haematopoietic cell transplantations during the COVID-19 pandemic is a huge challenge for health care worldwide. Potential problems arise not only in terms of clinical practice, organization and logistics but also in ethical aspects related to the transplantation process.

Patients with haematooncological diseases are at a higher risk of developing complications of COVID-19.<sup>35</sup> In addition, patients with blood cancers, including bone marrow haematopoietic cell recipients who developed COVID-19, have poor overall survival.<sup>36</sup> One of the causes of this phenomenon may be the state of immunodeficiency, resulting from the conditioning process that recipients are subjected to before the transplantation. Conditioning is the administration of high-dose chemotherapy or radiation therapy to a patient with the aim to destroy cancer cells, create 'space' for new haematopoietic cells, and induce immunosuppression to reduce the risk of transplant rejection.<sup>37</sup>

The presence of the aforementioned risks related to COVID-19 in recipients has made the protection of these recipients one of the most important challenges for bone marrow transplantation.

With the unprecedented nature of the problem and the lack of experience in situations of such a massive epidemic threat, an urgent need arose to develop recommendations for the treatment of people undergoing bone marrow transplantation. Such recommendations have been developed by, inter alia, the World Marrow Donor Association<sup>38</sup> and the EBMT.<sup>39</sup> In Poland, based on the knowledge of experts and international guidelines, the Position of National Consultants and the Polish Society of Haematologists and Transfusionists on the care of recipients and donors of haematopoietic cells during the COVID-19 epidemic was published.<sup>40</sup>

The above-mentioned recommendations are based on scientific evidence<sup>41</sup> and relate to virtually every aspect of HSCT, such as:

- *Reducing the risk of infection in patients staying in transplant centres.* These recommendations include suspension of visits, limitation of staff rotation between hospitals, the introduction of a rotation system in the transplantation department, including providing employees with the possibility of remote work, excluding staff with symptoms of respiratory tract infection from working in the department and in the clinic; it is also recommended to call before the visit/admission and obtain information on the patient's symptoms and risk factors for SARS-CoV-2 infection.
- *Planning transplant procedures.* Including postponement of non-urgent transplants, carrying out an individual patient-specific risk assessment related to transplantation during the COVID-19 epidemic. In line with the EBMT recommendations, the differences in safety and logistics between alternative methods of haematopoietic cell collection were also noted: for epidemiological and logistic reasons, peripheral blood haematopoietic cell transplantation should be planned (donor hospitalization is not required, the collection is usually on an outpatient basis). BMTs should only be planned in situations where this type of transplant has an absolute advantage.
- *Patient care before transplantation of haematopoietic cells.* Patients before hospitalization should undergo two-week isolation at home, they should also be tested for SARS-CoV-2 with the molecular method on admission to the department. It is recommended to postpone treatment involving transplantation for 3 months in the case of confirmed SARS-CoV-2 infection, especially in low-risk patients.
- *Patient care after haematopoietic cells transplantation.* The following are recommended: avoiding travel (especially by public transport), avoiding contact with people with symptoms of infection, strict compliance with hygiene recommendations; in case of suspected infection, testing for SARS-CoV-2 is recommended. Attention is drawn to the possible occurrence of atypical symptoms

in post-transplant patients, and diagnostics for influenza and respiratory syncytial virus (RSV) is also recommended in the event of deterioration of the general condition. Patients after transplantation of haematopoietic cells infected with SARS-CoV-2 virus should be treated by an infectious disease physician in cooperation with a haematologist/transplantologist.

- *Handling the donor of haematopoietic cells.* First of all, absolute disqualification of the donor in the case of SARS-CoV-2 infection and suspension of donation for at least 28 days in the case of close contact of the donor with a person infected with SARS-CoV-2.

The existence of international and national recommendations undoubtedly facilitates actions aimed at protecting patients against infection. However, there are situations in which medical personnel, sometimes together with donors, recipients and their families, face ethical problems requiring difficult and often non-obvious decisions.

One of the restrictions that may adversely affect the patients' experiencing of HSCT is the suspension of visits to transplantation departments. Taking into consideration the danger associated with potential SARS-CoV-2 infection, these restrictions are necessary. However, they potentially raise concerns about the well-being of recipients who, while confronting their disease, have limited contact with their relatives during therapy. This problem most severely affects the population of pediatric patients, where parental support is particularly important due to the significant risk of anxiety, depression and post-traumatic stress disorder associated with disease and therapy.<sup>42</sup> The recommendations, therefore, allow parents to visit recipients but recommend repeated testing for SARS-CoV-2.<sup>39</sup> In case of a positive result, the inability of parents to stay with their children additionally complicates the already difficult situation faced by the families of minor, seriously ill patients.

Moreover, some recipients of haematopoietic cells, unfortunately, die during therapy or soon after HSCT.<sup>43,44</sup> It means that some patients who cannot be helped will pass away in transplantology departments without the possibility of spending their last moments with their family, without being able to hold their loved ones' hands. That situation can be associated with a potential trauma for the relatives of the deceased, especially for the child's parents, partly because the feeling of having a proper goodbye reduces the parents' grief.<sup>45</sup>

Difficult decisions also concern other aspects of transplantation, such as postponing donation in the event of a suspected contact of the donor with someone suffering from COVID-19 (especially if the patient urgently needs haematopoietic stem cells), or the potentially increased risk of infecting the donor associated with being inside a health care facility.

## Summary

Transplantation of bone marrow cells is a procedure that brings great benefits to an increasing number of patients; procedures and protocols related to transplantation are gradually improved to ensure the best possible results with the lowest risk of complications. However, it should be remembered that in cases requiring allogeneic transplantation of bone marrow cells, the most important element enabling this procedure is to find an appropriate donor – genetically compatible with the patient in need of transplantation. Therefore, the key factor for continuing the widespread use of this method of treatment is, firstly, the constant recruitment of new potential donors of bone marrow cells, and, secondly, obtaining, as frequently as possible, the consent to the procedure by potential donors whose cells have proved to be suitable for transplantation to a given patient. In order to achieve these goals, activities should be aimed primarily at disseminating the altruistic idea of donation, raising people's awareness about the methods of bone marrow stem cell transplantation and emphasizing the advantages and benefits of undergoing these procedures. In addition, every effort should be made to present and explain all the aspects (including legal ones) concerning bone marrow transplantation to every donor (actual and potential), as accurately as possible. The SARS-CoV-2 virus pandemic disrupted all components of the bone marrow transplantation process—from the registration of potential donors, through the management of patients in transplant departments, to patient care after transplantation. In order to maintain safety, health professionals face ethical dilemmas, as they are obliged to make difficult decisions, concerning, e.g. visitor restrictions or postponement of treatment. Each of the procedures required adaptation to the prevailing epidemiological situation. Finding a solution that will ensure the continued smooth functioning of bone marrow transplantation, while minimizing the risk of spreading the virus is an unprecedented challenge. For this reason, the effectiveness of the implemented solutions should be evaluated and, if necessary, updates should be made.

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## ORCID iD

Alan Majeranowski  <https://orcid.org/0000-0002-8801-4305>

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