Pediatr Pol 2024; 99 (1): 15-22
DOI: https://doi.org/10.5114/polp.2024.135894
Submitted: 12.09.2023, Accepted: 25.11.2023, Published: 05.03.2024

PEDIATRIA Polska
Polish Journal of PAEDIATRICS

ORIGINAL PAPER

„Ми з Вами" (We Stand with You) – saving child war refugees from Ukraine by haematopoietic stem cell transplantation and chimeric antigen receptor T-cell therapy in Poland

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ABSTRACT

Introduction: The devastation of hospitals and the severing of international links has made paediatric haematopoietic stem cell transplantation (HSCT) in Ukraine impossible. The aim of our study was to present the activity of Polish paediatric bone marrow transplant units in saving the lives of child war refugees.
Material and methods: The data collected from 6 units on the treatment of child war refugees from Ukraine with HSCT were analysed.
Results: From 24 February 2022 up to the end of 2022, 18 children from Ukraine underwent HSCT and one received chimeric antigen receptor T-cell (CAR-T) therapy. This project was possible due to great organisational support from non-governmental organisations (NGOs), international cooperation ("SAFER Ukraine" enterprise), and financial coverage by the Polish national insurance system. Twelve patients were treated in Wrocław, 3 in Lublin, 2 in Bydgoszcz, one in Poznań, and one in Kraków. The group consisted of 10 boys and 9 girls, aged 1.3–17.9 years, 16 of whom suffered from haematological malignancy (acute lymphoblastic leukaemia $n = 9$, acute myeloblastic leukaemia $n = 5$, juvenile myelomonocytic leukaemia n = 2) and 3 from non-neoplastic disease (severe aplastic anaemia n = 2 and severe combined immunodeficiency syndrome $n = 1$). Despite poor preparation, numerous pre-existing comorbidities, a high rate of acute complications, and long hospital stays, the overall results were satisfactory. Only 2 patients (10%) died during the first 100 days after transplantation, both due to severe infection. The total number of allogeneic-HSCTs performed in Poland on Ukrainian children during wartime was not substantially lower than in previous years in their home country. Moreover, this specific war situation allowed the prescribing of CAR-T therapy to one of the first paediatric patients from this country.

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Conclusions: Saving the lives of seriously ill child war refugees with the use of HSCT and CAR-T therapy is effective provided that all entities responsible for it cooperate in a coordinated manner and support the activities of NGOs.

KEY WORDS:

Poland, Ukraine, children war refugees, haematopoietic stem cell transplantation, CAR-T cell therapy.

INTRODUCTION

Children are the first victims of all wars, and severely ill youngsters are even more likely to be affected by its harmful effects. The same happened in Ukraine after the invasion by Russian troops on 24 February 2022. By bombing hospitals, the invaders damaged medical infrastructure, making treatment of many adult and young patients impossible. It is clear that limiting access to medical care has become one of the methods of annihilation of Ukrainian society, despite the customary explanation that it was performed "by chance".

Before the war, there were several paediatric haemato-oncological units in Ukraine but only one paediatric bone marrow transplantation (BMT) centre, in Ohmadtyt National Specialised Children's Hospital in Kiev. Until 2020 only autologous and allogeneic haematopoietic stem cell transplantation (allo-HSCT) from related donors had been performed there, and the program of allo-HSCT from unrelated donors started in 2021 [1]. The Russian invasion not only devastated the hospitals but also cut the international links necessary to find donors and transport haematopoietic stem cells from donor centres to the only certified transplant unit in Kiev. Thus, all children qualified and waiting for HSCT were sentenced to death by the invaders. Very quickly the declarations of help were sent from Polish paediatric haemato-oncological centres, and coordinated action started. The first 4 children requiring an immediate transplant were transferred to Wrocław Medical University. In parallel, children in different phases of preparation for HSCT began to escape from Ukraine to Poland. In the beginning they reached transplantation centres by themselves and then were transferred *via* the Supporting Action for Emergency Response in Ukraine (SAFER Ukraine) initiated in cooperation with St. Jude Global program [2]. The aim of our study was to document the activity of Polish paediatric bone marrow transplant units in saving the lives of child war refugees. Herein we present data about child war refugees from Ukraine treated with HSCT or chimeric antigen receptor T-cell (CAR-T) in Poland during the first 10 months of the war.

MATERIAL AND METHODS

In January 2023 we summarised our Wrocław HSCT program for Ukrainian children transferred to Poland after 24 February 2022 and sent a survey on HSCT in Ukrainian child war refugees to the remaining 5 paediatric bone marrow transplant centres in Poland (Bydgoszcz, Poznań, Kraków, Lublin, and Warsaw). Epidemiological and clinical data of the patients were collected as well as information about their social situation and specific psycho-social problems. Responders from all departments returned completed data, and a total of 19 children were analysed.

There was no need for Bioethical Committee approval for this study because no study in patients was performed.

RESULTS

Among all children reported, 12 were treated in Wrocław (11 with HSCT and one with CAR-T), 3 in Lublin, 2 in Bydgoszcz, one in Poznań, and one in Kraków. The group consisted of 10 boys and 9 girls with a mean age of 9.3 + 5.3 years (range 1.3–17.9 years). Most patients (n = 15) had haematological malignancy as an indication for HSCT including acute lymphoblastic leukaemia (ALL, n = 8 patients), acute myeloblastic leukaemia (AML, n = 5 patients, among them 2 with secondary leukaemia), and juvenile myelomonocytic leukaemia (n = 2 patients). In the non-malignant group there were 2 patients with severe aplastic anaemia (SAA) and one with severe combined immunodeficiency syndrome (SCID). In Patient #7 with B-ALL relapse after HSCT performed in Ukraine, CAR-T therapy was ordered. Six patients had complete qualification with donor selection in Ukraine while 11 were qualified in Poland. Two patients started the procedure in Ukraine and completed it in Poland. Fourteen children were transplanted from matched unrelated donors and 4 from matched or mismatched related donors (Patient #13 from sister, Patient #15 from father, Patients #16 and #18 from brothers). Human leukocyte antigen matching was 10/10 in 14 patients, 9/10 in 3, and 4/6 in a patient transplanted from a parent. The most common conditioning was Treo-Flu-Thiotepa-ATG (n = 7 patients) and protocols with total body irradiation injury as myeloablation (n = 6 patients). In Patient #17 ATG was replaced with alemtuzumab because of ATG-related anaphylaxis presented during the treatment of SAA (Table 1).

Patients came from 10 out of 24 provinces (oblasts) of Ukraine, mainly from the western part of the country (Figure 1, Table 2). Ten of them were treated at the Central Children's Hospital in Kiev, and 7 in local onco-haematological departments. Patients #17 and #19 crossed the border as "healthy" children and were diagnosed as suffering from SAA and AML, respectively, in Poland. The first 3 children (patients #1, #2, and #3) reached a BMT unit in Poland directly from Ukraine with the help of the Tabletochki Foundation (on Ukrainian side, www.

TABLE 1. Patients and treatment characteristics

Patient	Sex	Age (years)	Primary disease	Qualification to HSCT or CAR-T, donor searching	Date of HSCT/CAR-T	Donor	HLA matching	Conditioning	BMT unit
1	F	11.2	B-ALL (relapse *post* HSCT)	Ukraine	22.03.23	MUD	10/10	Treo-Flu-TT-ATG	Wro
2	M	12.3	AML	Ukraine	24.03.23	MUD	9/10	Treo-Flu-TT-ATG	Wro
3	F	16.3	B-ALL	Ukraine	4.05.23	MUD	10/10	Treo-Flu-TT-ATG	Wro
4	M	1.7	MDS-AML	Ukraine	13.05.23	MUD	10/10	Bu-Cy-Mel-ATG	Wro
5	M	3.8	B-ALL	Poland	31.05.23	MUD	10/10	TBI-VP	Lub
6	M	13.4	sAML	Poland	6.06.23	MUD	10/10	Treo-Flu-TT-ATG	Cra
7[c]	M	7.1	B-ALL (relapse *post* HSCT)	Poland	9.06.23	–	–	Flu-Cy	Wro
8	F	1.3	SCID	Ukraine	8.07.23	MUD	10/10	Treo-Flu-TT-ATG	Byd
9	F	5.4	JMML	Ukraine/ Poland*	13.07.23	MUD	10/10	Bu-Cy-Mel-ATG	Wro
10	M	9.8	T-ALL	Ukraine/Poland**	4.08.23	MUD	9/10	TBI-VP-ATG	Wro
11	F	5.1	B-ALL	Poland	11.08.23	MUD	9/10	TBI-VP	Lub
12	M	12.4	B-ALL	Poland	18.08.23	MUD	10/10	TBI-VP-ATG	Wro
13	F	7.6	JMML	Poland	26.08.23	MRD	10/10	Bu-Cy-Mel	Poz
14	F	14.8	sAML (L-FS)	Poland	8.09.23	MUD	10/10	Treo-Flu-TT-ATG	Wro
15	M	1.3	SAA	Poland	22.09.23	MRD	4/6	Flu-Cy-ATG-*post* Cy	Wro
16	M	8.9	B-ALL	Poland	6.10.23	MRD	10/10	TBI-VP	Wro
17	F	9.8	SAA	Poland	7.10.23	MUD	10/10	Flu-Cy-Alem	Wro
18	M	17.9	B-ALL	Ukraine	7.10.23	MRD	10/10	TBI-VP	Lub
19	F	16.5	AML	Poland	8.12.23	MUD	10/10	Treo-Flu-TT-ATG	Byd

Alem – alemtuzumab, AML – acute myeloblastic leukaemia, ATG – anti-thymocyte globulin, B-ALL – B-cell acute lymphoblastic leukaemia, Bu – busulfan, Byd – Bydgoszcz, [c] – CAR-T therapy, Cra – Kraków, Cy – cyclophosphamide, F – female, Flu – fludarabine, JMML – juvenile myelomonocytic leukaemia, L-FS – Li-Fraumeni syndrome, M – male, MDS – myelodysplastic syndrome, Mel – melphalan, MUD – matched unrelated donor, MRD – matched related donor, Lub – Lublin, post Cy – post transplantation cyclophosphamide, Poz – Poznań, SAA – severe aplastic anaemia, sAML – secondary AML, SCID – severe combined immunodeficiency syndrome, T-ALL – T cell acute lymphoblastic leukaemia, TBI – total body irradiation, Treo – treosulfan, TT – thiotepa, VP – etoposide, Wro – Wrocław
** Last control in Ukraine 23.02.2023, patient sent for HSCT to Turkey, stopped in Poland because of severe bleeding*
*** Started the qualification in Ukraine, no donor found*

tabletochki.org) and University Hospital Wrocław (on Polish side), and the others were referred from local oncological departments in the same hospital (6 patients), *via* oncological departments in other hospitals (7 patients) and facilitated by the SAFER Ukraine initiative (3 patients). Children came to Poland with their mother (9 patients), both parents (6 patients), grandmother (3 patients), and aunt (one patient), while most of the male members of the families stayed in Ukraine to fight against the Russians. The communication skills of patients and their families were widely differentiated. One patient and his caregiver knew not a word in Polish, and 6 families needed continuous translatory support. Two families used fluent Polish from the very beginning. Their better language skills had been acquired due to contact with Polish people in Ukraine and prior work experience in Poland.

Only 3 patients had no pre-existing comorbidities with possible influence on transplantation, while the rest presented with several medical conditions listed in Table 2. These included dental decay (n = 5 patients) or active COVID-19 infection (n = 4 patients), they tended to delay HSCT. Three patients (#1, #6, and #15) had hepatitis. Two patients with SAA and agranulocytosis received a rescue-transplant during severe infections: sepsis with positive blood culture (Patient #15) and fungal pneumonia (Patient #17).

The mean time of hospitalisation of all children discharged from the hospital before 31 December 2022, was 69 + 37 days (mean + standard deviation, range 28–156), and for children after HSCT it was 73 + 36 days (range 39–156) (Table 3). All patients presented acute complications during hospitalisation. Fourteen out of 18 patients treated with HSCT had acute graft vs. host disease (GvHD) and 13 patients presented at least one infection (8 – cytomegalovirus infection, 4 – Epstein-Barr virus infection, 4 – sepsis, 2 – BK virus-related haemorrhagic cystitis, 2 – BKV

FIGURE 1. Patients' origins

viraemia). Moreover, 9 patients had a fever of unknown origin, 2 – veno-occlusive disease, and single cases of seizures, CNI-nephrotoxicity, and depression were found. Two patients died during the first 100 days after HSCT, both from infectious complications. A 14-year-old boy with AML had a multi-organ failure with stroke caused by sepsis and a 9-year-old girl with SAA transplanted during severe pulmonary mycosis presented progression of the disease, encephalopathy, and sudden death.

The time of follow-up in an outpatient clinic ranged from 18 to 200 days. Two children went abroad for family reunion, their records were sent to the local BMT centres in the Czech Republic and Germany where they are receiving further care. Eight patients presented clinically relevant complications during follow-up, and GvHD diagnosed in 5 of them was the most frequent.

Almost all children received organisational and financial support from Polish non-governmental organisations (NGOs), and they provided 12 families with accommodation in Poland. Only 2 families were independent in this regard. All patients were surrounded by psychological and pedagogical assistance. The largest group of refugees was supported by the Save Kids with Cancer Foundation located in Wrocław [3].

DISCUSSION

From the beginning of the war until the end of the year 2022 about 8 million people left Ukraine and 1 million of them fled to Poland [4]. Women and children constitute a large proportion of refugees. Humanitarians estimate that "a child from Ukraine becomes a refugee every single second of the war" [5]. Many of them suffered from severe diseases, and their parents or caregivers decided to leave their homeland for medical reasons. Typically, only the mother or the grandparent escaped with the child when the father fought the invaders. This stream of medical refugees was growing during the first year of the war because healthcare institutions were among the critical infrastructure, which is a target for Russian troops. According to the research of Kowtoniuk (former Deputy Health Minister of Ukraine) and his analytic group, 259 medical centres in Ukraine were totally or partially destroyed during first months of the war [6]. In a one-year period this number had grown to more than 900 [7]. It was obviously done in violation of article 12 of Additional Protocol I to the Fourth Geneva Convention, which forbids the attack of medical units [8].

Haematopoietic stem cell transplantation and CAR-T therapy are life-saving procedures used in cancer (CAR-T exclusively in B-ALL), bone marrow failures, and primary immunodeficiencies. The procedures are logistically complicated and expensive, and they need special hospital conditions and a skilled multidisciplinary team. All this makes it impossible to perform such therapies in a country encompassed with warfare. Because the time when the effective treatment should be introduced is very short, the only chance for the patients is to get the therapy abroad. A large group of foreign patients applying for this kind of treatment is aggravating for the national system and difficult to manage. In a country like Poland, where the predominant part of health care is financed by national insurance coming from the budget, it is problematic to rapidly find resources to cover these unexpected expenses. However, the ethical commitment to save a life

TABLE 2. Social and medical history

Patient	Place of origin	Place of treatment in Ukraine	Transfer to BMT unit	Caregiver in Poland	Communication skills*	Complications before HSCT/CAR-T
1	Sokyrnytsya (Zakarpattia Oblast)	Kiev	Direct	Mother	2	Tooth decay, chronic hepatitis G, herpes labialis
2	Kiev	Kiev	Direct	Grandmother	3	COVID-19
3	Dubove (Zakarpattia Oblast)	Kiev	Direct	Grandmother	2	Tooth decay with periodontitis and dental abscesses
4	Ternopil	Kiev	*Via* oncology**	Mother	5	COVID-19, phimosis, autism
5	Sambir (Lviv Oblast)	Kiev	*Via* Unicorn Clinic	Parents	4	Tooth decay
6	Kramatorsk (Donetsk Oblast)	Kiev	*Via* oncology	Parents	3	Active hepatitis B
7	Warasz (Rivne Oblast)	Kiev	*Via* oncology Katowice	Mother	5	Anaphylactic shock after platelets transfusion
8	Kiev	Kiev	*Via* oncology	Parents	3	Chronic RSV infection, BCG-itis
9	Kryzhopil (Vinnytsia Oblast)	Vinnytsia	*Via* oncology Warsaw	Parents	4	–
10	Lviv	Odessa	*Via* oncology Rzeszów	Mother	4	Left atrium thrombosis, motor disability
11	Borszczahivka (Kiev Oblast)	Kiev	*Via* Unicorn Clinic	Mother	4	Tooth decay, COVID-19
12	Lugi (Ivano-Frankivsk Oblast)	Ivano-Frankivsk	*Via* Unicorn Clinic	Grandmother	1	No remission of ALL (blinatumomab bridging treatment)
13	Pechyhvosty (Lviv Oblast)	Lviv	*Via* oncology	Parents	2	Tooth decay, COVID-19
14	Kherson	Kherson	*Via* oncology	Aunt	4	–
15	Sambir (Lviv Oblast)	Lviv	*Via* oncology	Parents	3	*Acinetobacter baumannii* sepsis, possible invasive aspergillosis, giant cell hepatitis
16	Lviv	Lviv	*Via* oncology Katowice	Mother	2	PRES, catheter-related sepsis
17	Lviv Oblast	–	*Via* oncology Kielce	Mother	2	Pseudomonas putida sepsis, fungal pneumonia (Aspergillus), anaphylaxis to ATG
18	Poltava	Poltava, Kiev	*Via* oncology Rzeszów	Mother	3	–
19	Kherson	–	*Via* oncology Olsztyn	Mother	2	Staphylococcus aureus sepsis, fungal pneumonia (Candida krusei)

BMT – bone marrow transplantation, CAR-T – chimeric antigen receptor T-cell, HSCT – haematopoietic stem cell transplantation
** Scale of assessment of communication skills: 1 – neither speak nor understand Polish at all, 2 – understand some words, and simple phrases, need continuous interpreter support in social and medical communication, 3 – understand and speak simple words and phrases, need interpreter support in medical communication, 4 – understand and speak Polish, need temporal interpreter support in medical communication; 5 – understand and speak Polish, full social and medical communication without interpreter*
*** "Via oncology" means oncological department in the same hospital than BMT unit*

TABLE 3. Follow-up after haematopoietic stem cell transplantation/chimeric antigen receptor T-cell

Patient	Time of hospitalisation (days)	Acute complications	Ambulatory follow-up (days)	Centre	Outcome, *post* hospital complications	Place of living	Social support in Poland
1	51	FUO, CMV, GvHD	17	Wro*	Hypogammaglobulinemia	Wro/Prague	SKwCF (accommodation, financial support)
2	120	FUO, GvHD, BKV-HC, EBV	74	Wro*	GvHD, BKV-HC, cath-sepsis	Wro/Germany	SKwCF (accommodation, financial support)
3	156	Facial cellulitis, Pseudomonas aeruginosa sepsis, seizures, BKV-HC, GvHD, CMV, FUO, CNI nephrotoxicity, depression	141	Wro	CMV, refractory thrombocytopaenia, depression	Wro	SKwCF (accommodation, financial support)
4	43	FUO, ADV, GvHD	200	Wro	No complications	Wro	SKwCF (accommodation)
5	61	VOD, cath-sepsis, GvHD	165	Lub	No complications	Lub	Local foundation
6	120	GvHD, CMV, EBV-PTLD, BKV-HC, depression Pseudomonas aeruginosa sepsis, stroke, MOF with AKI, death on day + 64	–	–	Death	–	"Coliber" Association
7	28	CRS1	187	Kat	No complications	Dąbrowa Górnicza	"Spark" Foundation (accommodation)
8	39	GvHD	148	Byd	GvHD, mixed chimerism, BCG-it is	Byd	Local foundation (accommodation)
9	65	FUO, VOD	115	Wro	GvHD, hypogammaglobulinaemia	Wro	SKwCF (accommodation, financial support)
10	75	FUO, GvHD, CMV, EBV, Klebsiella pneumoniae NDM diarrhoea	82	Wro	No complications	Rzeszów	No support needed
11	125	GvHD, EBV, BKV	37	Lub	GvHD, weight loss	Lub	Family in Poland
12	54	FUO, VOD, CMV, GvHD	94	Wro	GvHD	Wro	SKwCF (accommodation, financial support) family in Poland
13	127	VOD, GvHD, CMV, Kocuria kristinae sepsis, tuberculosis	–	–	Still in hospital 31.12.22	Poz	Local foundation
14	71	FUO, BKV, CMV, ADV	53	Wro	No complications	Wro	SKwCF (organising support) family in Poland
15	76	*Acinetobacter baumanii* sepsis, upper limb cellulitis, GvHD, CMV, EBV, GI bleeding	31	Wro	No complications	Katowice	"Spark" Foundation (accommodation)
16	40	FUO, GvHD, mixed chimerism	56	Wro	Mixed chimerism, UTI, CMV	Katowice	Local foundation (accommodation), "Spark" Foundation (organizing support)
17	43	Fungal pneumonia, encephalopathy, sudden death on day + 27	–	–	Death	–	Local foundation, SKwCF (organizing support)
18	43	CNI-TMA	10	Lub	No complications	Lub	Local foundation (accommodation)
19	34	GvHD, CMV	–	–	Still in hospital 31.12.22	–	"Future for Children" Foundation (accommodation, organising support, financial support)

ADV – adenovirus infection, AKI – acute kidney injury, BKV-HC – BK virus-related haemorrhagic cystitis, Byd – Bydgoszcz, cath-sepsis – catheter-related sepsis, CMV – cytomegalovirus infection, CNI-TMA – calcineurin inhibitor-related thrombotic microangiopathy, Cra – Kraków, CRS1 – cytokine release syndrome stage 1, EBV – Epstein-Barr virus infection, EBV-PTLD – EBV-related posttransplant lymphoproliferative disorder, FUO – fever of unknown origin, GI – gastrointestinal, GvHD – graft versus host disease, Lub – Lublin, MOF – multiorgan failure, NDM – New Delhi metallo-beta-lactamase, Poz – Poznań, SKwCF – Saving Kids with Cancer Foundation, VOD – veno-occlusive diseases, Wro – Wrocław

** Transferred abroad*

with any available methods obliges medical professionals to take action with no respect to restrictions and troubles. For this reason, the society of Polish paediatric haemato-oncologists and BM transplanters supported Ukrainian child refugees from the very beginning of the war. Initially, it was spontaneous and uncoordinated. Thanks to a statement of the government about transferring money for medical services for Ukrainian people on the same conditions as for Polish citizens, paediatric oncological centres had no economic obstacles to admit every child requiring special care. Subsequently, the Polish Society of Paediatric Oncology and Haematology in cooperation with St. Jude Children's Research Hospital and many national and international organisations formed the SAFER Ukraine project and coordinated the transfer of patients by organising a temporary hospital (Unicorn Clinic) and informational network described elsewhere [2]. It is worth mentioning that similar efforts dedicated to patients with end-stage kidney disease were undertaken by the Polish Society for Paediatric Nephrology [9].

All children requiring HSCT were qualified in Poland or re-qualified after the primary decision in Ukraine according to global criteria [10]. Thanks to international cooperation, foreign donors matched from Ukraine were identified and utilised in Poland. One patient reached a unique possibility to be treated with novel CAR-T therapy, which had not yet been available in Ukraine.

Among the population of Ukrainian child war refugees treated in Polish BMT units, there were 2 groups of problems: medical and social. The first was related to bad conditions in Ukrainian hospitals during the war, not adapted to the treatment of such patients, and long-lasting transport in poor epidemiological conditions. The latter results from wartime family disorders (including *post* traumatic stress disorder) and language difficulties. It can be said that specific medical factors did not change the effectiveness of the treatment and overall survival. Social problems were gradually solved with help from NGOs and Polish society. Ukrainian doctors working in Poland and some Ukrainians who previously knew the Polish language played an irreplaceable role as interpreters. It should be remembered that even before the war many Ukrainian families came to Poland for oncological treatment of their children, and sometimes those patients were subjected to HSCT, so "the trail was blazed" [11].

The length of hospital stay in the refugee group appeared to be longer than that of standard patients, and the complication rate was slightly higher, but this population was too small and heterogeneous to draw firmer conclusions. There is only one report of HSCT in child war refugees. Comparing 166 children who escaped to Turkey from Syria, the Middle East, and Africa with a control group of 76 Turkish patients, the authors found the same rate of early HSCT complications, with the exception of neutropaenic sepsis, which was more common among refugees [12]. Self-assessed quality of life was similar in both groups. In our study several patients underwent HSCT complicated by active infections, which affected the outcome. However, none of them could wait to recover from the infection due to the high risk of dying from the underlying disease.

The total number of allo-HSCTs performed in Poland on Ukrainian children during wartime was not substantially lower than in previous years in their home country [1]. Given that all patients would die without treatment, an early mortality rate of 10% seems to be acceptable, and in Ukrainian patients *post* HSCT it was only a little higher than in Polish patients during that time (11% vs. 5%). It is worth emphasising that the total number of allo-HSCTs performed in 2022 on Polish children in 5 centres also treating Ukrainian child war refugees was similar to the number of allo-HSCTs carried out there in 2021 (131 and 133, respectively). This data indicates that treatment of additional patients from Ukraine did not influence the availability of HSCT for Polish children, and it abolishes the concerns of a certain part of the Polish public about limiting access to treatment for our young citizens caused by providing therapy for Ukrainian children. Thanks to the special organising efforts of our medical community, all Polish patients were transplanted without any waiting period. At the same time, by saving the lives of young Ukrainian war refugees, we presented the strength and solidarity of the medical world against war and barbarity.

CONCLUSIONS

Saving the lives of seriously ill child war refugees with the use of HSCT and CAR-T therapies is effective provided that all entities responsible for it cooperate in a coordinated manner and support the activities of NGOs.

ACKNOWLEDGMENTS

We would like to thank all NGOs listed in the text for help in organising the lives and treatment of our patients and Mrs Svitlana Ostrowska for language support.

DISCLOSURE

The authors declare no conflict of interest.

REFERENCES

1. Czyżewski K, Sedláček P, Štěrba J, et al. Progress and trends in pediatric hematopoietic cell transplantation in Central-East European countries. Acta Haematol Pol 2020; 51: 142-150.
2. Agulnik A, Kizyma R, Salek M, et al. Global effort to evacuate Ukrainian children with cancer and blood disorders affected with war. Lancet Haematology 2022; 9: e645-e647.
3. Available from: https://www.naratunek.org (accessed: 03.02.2023).
4. Available from: https://www.gov.pl/web/udsc/obywatele-ukrainy-w-polsce--aktualne-dane-migracyjne (accessed: 24.02.2023).

5. Available from: https://www.savethechildren.org (accessed: 23.01.2023).
6. Pieniążek P. What will you do, when it is finished? Tygodnik Powsz 2023; 1-2: 67-70.
7. Mazur A. Personal communication; data from the conference "Health and medicine in the face of armed conflict". Rzeszów, 12–13.06.2023.
8. Available from: https://www.icrc.org (accessed: 13.02.2023).
9. Maternik M, Andrunevych R, Drożdż D, et al. Transition, and management of Ukrainian war refugee children on kidney replacement therapy. Pediatr Nephrol 2023; 38: 311-314.
10. Wachowiak J, Chybicka A, Kowalczyk JR, et al. Development and current use of hematopoietic stem cell transplantation in children and adolescents in Poland: report of the Polish pediatric study group for hematopoietic stem cell transplantation of the Polish society for pediatric oncology and hematology. Transfus Apher Sci 2018; 57: 316-322.
11. Styczyński J, Dębski R, Czyżewski K, et al. Transborder program of allogeneic hematopoietic cell transplantations from unrelated donors for Ukrainian children between 2015–2020 in Bydgoszcz. Acta Haematol Pol 2022; 53: 407-415.
12. Gokcebay DG, Küpeli S, Gursel O, et al. Hematopoietic stem cell transplantation activities and HRQOL of refugee or asylum seeker children in Turkey: a multicenter study. Pediatr Transplant 2022; 26: e14397.