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A Bibliometric Analysis Study on Bone Marrow Transplantation Research Originating from Turkey

Can ÖZLÜ [1], Sevil ALKAN [2]

ABSTRACT

Aim: Scientific publications serve as indicators of global interest and activity in research. The aim of this study was to describe the characteristics of the scientific literature on bone marrow transplantation in Turkey between 1990 and 2022.

Material and Methods: In this bibliometric study, we searched the Web of Science database for all biomedical articles published between 1990 and 2022. MESH terms related to "Bone marrow transplantation" were used as the search keyword. The search was then narrowed by selecting Turkey as the country of publication. All data were transferred from the relevant database to Vosviewer and biblioshiny programs and analyzed.

Results: A total of 121 countries contributed to the bone marrow transplant literature with 41,236 publications. Turkey ranked 13th with 913 publications (2.214%). and 402 articles by 2991 authors from Turkey. This corresponded to 0.305 publications per author. These publications received 6.183 citations per publication. After 2014, the number of publications increased. Most articles (n=123) were published in 2015. In 2016, the number of publications decreased by almost half after the first peak and did not fall below 50 publications/per year in the following years. Ankara University (n=207), Hacettepe University (n=166), Gazi University (n=95), Erciyes University (n=82), and Akdeniz University (n=79) were the institutions that published the most publications on bone marrow transplantation.

Conclusion: Bone marrow transplantation appears to be of interest to Turkish researchers; however, not to the expected level. Turkey continues to lag behind other countries in this field despite an increase in research activity pertaining to bone marrow transplants in recent years.

Keywords: Bibliometric analysis; bone marrow transplantation; publications; Turkey.

Türkiye'den Yayınlanan Kemik İliği Transplantasyonu Araştırmaları Üzerine Bir Bibliyometrik Analiz Çalışması

ÖZ

Amaç: Bilimsel yayınlar, araştırmaya yönelik küresel ilgi ve faaliyetin göstergesi olarak hizmet etmektedir. Bu çalışmanın amacı, 1990-2022 yılları arasında Türkiye'deki kemik iliği transplantasyonu konulu bilimsel literatürün özelliklerini tanımlamaktır.

Gereç ve Yöntemler: Bu bibliyometrik çalışmada, Web of science veri tabanında 1990 ve 2022 yılları arasında yayınlanan tüm biyomedikal makaleler taranmıştır. Arama anahtar kelimesi olarak "Kemik iliği transplantasyonu" ile ilgili MESH terimleri kullanılmıştır. Arama daha sonra yayın ülkesi olarak Türkiye seçilerek daraltılmıştır. Tüm veriler ilgili veri tabanından Vosviewer ve biblioshiny programlarına aktarılarak analiz edilmiştir.

Bulgular: Toplam 121 ülke 41.236 yayın ile kemik iliği nakli literatürüne katkıda bulunmuştur. Türkiye 913 yayın (%2.214) ve 2991 yazarın 402 makalesi ile 13. sırada yer aldı. Bu, yazar başına 0,305 yayına karşılık gelmektedir. Bu yayınlar, yayın başına 6.183 atıf almıştır. 2014 yılından sonra yayın sayısı artmıştır. En çok makale (n=123) 2015 yılında yayımlanmıştır. İlk zirvenin ardından 2016 yılında yayın sayısı neredeyse yarı yarıya azalmış ve sonraki yıllarda da yılda 50 yayının altına düşmemiştir. Ankara Üniversitesi (n=207), Hacettepe Üniversitesi (n=166), Gazi Üniversitesi (n=95), Erciyes Üniversitesi (n=82) ve Akdeniz Üniversitesi (n=79) kemik iliği transplantasyonu konusunda en çok yayın yapan kurumlar oldu.

Sonuç: Kemik iliği transplantasyonu Türk araştırmacıların ilgisini çekmektedir; ancak beklenen düzeyde değildir. Son yıllarda kemik iliği nakli ile ilgili araştırma faaliyetlerindeki artışa rağmen Türkiye bu alanda diğer ülkelerin gerisinde kalmaya devam etmektedir.

1 Kütahya Health Sciences University, Faculty of Medicine, Department of Hematology, Kütahya, Türkiye
2 Çanakkale Onsekiz Mart University, Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, Çanakkale, Türkiye

Sorumlu Yazar / Corresponding Author: Can ÖZLÜ, e-mail: cozlu20@gmail.com
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Anahtar Kelimeler: Bibliyometrik analiz; kemik iliği nakli, Türkiye; yayınlar.

INTRODUCTION

Bone marrow transplantation is a transplantation technique used to treat disorders including leukemia, lymph node cancer, and bone marrow failure. It is carried out by transferring bone marrow or bone marrow stem cells obtained from a healthy donor to the patient (1).

The first studies on bone marrow transplantation date back to 1939-1940s. The first registered human bone marrow transplantation was performed in a male patient with gold-induced aplasia from his brother in 1939. In this patient, transplantation was not successful and the patient died five days later (2). In 1957, the first clinical bone marrow transplants were performed, although at that time, relatively little was understood about hematopoietic stem cells, immunological reactions to transplants, or the nature of transplant antigens (3). Over the past 60 years, bone marrow transplantation has transformed from a cutting-edge therapy laden with unknown risks and problems to a commonly used standard of care that has helped countless people with both malignant and non-malignant illnesses live longer, healthier lives. Through cutting edge clinical and laboratory research at this time, transplant specialists in the United Kingdom (UK) have significantly advanced the profession internationally. Through meticulous and cutting-edge clinical trials that concentrate on enhancing outcomes by lowering transplant toxicity and the likelihood of disease relapse, bone marrow transplantation is currently progressing in the UK (4). The European Society for Blood and Marrow Transplantation was founded in 1974 to allow researchers and medical professionals working on clinical bone marrow transplants to exchange knowledge and conduct collaborative investigations (5).

Although official records indicate that the first bone marrow transplantation took place in Turkey in 1978, the procedure quickly gained popularity as a therapy option. Turkey became one of the leading transplant centers in the world because of the successful practices of Turkish doctors, who quickly brought transplantation techniques in Turkey up to par with global advancements. Beginning in 1978 at Hacettepe University with Prof. Dr. Korkut Özerkan, bone marrow transplantation practices were followed by Prof. Dr. Önder Berk and his team who performed the first autologous bone marrow transplantation at GATA in 1984 and then Ankara University with the first peripheral stem cell transplantation in 1992. Similar to the rest of the globe, children patients in Turkey were treated with bone marrow transplants later than adult patients. The first such procedure was carried out at Istanbul University Faculty of Medicine in the early 1990s (1).

In this study, we aimed to conduct a bibliometric analysis of bone marrow transplantation research in Turkey according to topics and characteristics. We aimed to examine the literature on a number of bibliometric parameters such as the distribution of publications over the years, the institutions where the study was conducted, trending topics, the distribution of citations over the years, the most cited articles, and collaborations between institutions. The findings may address research hotspots, publication trends, and areas where there are gaps in the evidence. This information will help researchers and funding organizations better understand the areas with the most potential for further research.

MATERIAL AND METHODS

Data collection

We conducted a literature search in the electronic database Web of Science Core Collection (WoSCC), including Science Citation Index Expanded, Social Science Citation Index, Conference Proceeding Citation Index-Science, Conference Proceeding Citation index-Social Science and Humanities, Index Chemicus, and Current Chemical Reactions, to find relevant studies published between 1990 and 2022. Title terms were used in this search. The keywords used in search strategy were as follows: '' Grafting, Bone Marrow (Title) OR Bone Marrow Grafting (Title) OR Transplantation, Bone Marrow (Title) OR Bone Marrow Cell Transplantation (Title) OR Transplantation, Bone Marrow Cell (Title) OR Hematopoietic Stem Cell Transplantation (Title) OR Bone Marrow Purging (Title) ''.

Data analysis and visualization

The analysis was methodically divided into three separate groups to enable a thorough assessment. The creation of a thorough database that had been painstakingly vetted in accordance with the standards established by the Web of Science (WoS) was the first step in making the complex analyses easier. To ensure a thorough dataset for the subsequent analyses, this required the extraction of entire records from the WoS Core Collection (WoSCC). In order to maintain transparency and accountability in the data collection process, the sources of the articles were also carefully cited.

The retrieved dataset was reviewed by the researchers for duplicate publications. General data analysis was performed using Microsoft Office Excel 2019 to look at the distribution of publications, top journals, top nations and regions, funding organizations and top research topics. To determine the linkages between various research hotspots and subjects, bibliometric analysis is used to find these topics and hotspots. Third, VOSviewer 1.6.18 (https://www.vosviewer.com/download) and biblioshiny (https://www.bibliometrix.org/home/index.php/layout/biblioshiny) were used to implement the results visualizations.

Inclusion and exclusion criteria

This study examined papers from the WOS database that were published between 1990 and 2022 and included at least one author from Turkey.

Keyword and author co-occurrence analysis

The WOS database was used to extract the data, and the VOS Viewer tool (VOSviewer 1.6.18) analyzed the co-occurrence of keywords and the co-authorships of publications about bone marrow transplants from Turkey. The program's complete counting approach was used to create a bibliographic map that shows the most prevalent terms. The map's elements are grouped into non-overlapping groups and connected by lines that have values. The stronger the relationship or co-occurrence between things, the higher the value. Additionally, co-

authorship analysis on VOS Viewer identified the most illustrious institutions and writers who contributed to articles on transplants, as well as the strength of such links, which denotes the degree of collaboration between publications.

RESULTS

A total of 121 countries contributed to the bone marrow transplant literature with 41,236 publications. Turkey ranked 13th with 913 publications (2.214%) (Table 1).

Table 1. Ranking of the top 20 countries in the bone marrow transplant literature

Ranking	Countries/Regions	n	% of 41.236
1	The USA	12855	31.174
2	JAPAN	3716	9.012
3	FRANCE	3358	8.143
4	ITALY	3046	7.387
5	GERMANY	2941	7.132
6	CHINA	2677	6.492
7	ENGLAND	2349	5.696
8	NETHERLANDS	1453	3.524
9	CANADA	1318	3.196
10	SPAIN	1261	3.058
11	SWITZERLAND	945	2.292
12	BRAZIL	935	2.267
13	TURKEY	913	2.214
14	SWEDEN	887	2.151
15	ISRAEL	882	2.139
16	SOUTH KOREA	823	1.996
17	AUSTRALIA	768	1.862
18	POLAND	642	1.557
19	BELGIUM	601	1.457
20	RUSSIA	536	1.300

After duplicate articles have been removed, we found that there were 913 publications (402 articles) by 2991 authors from Turkey, which were published in 223 different journals between 1990-2022 on bone marrow transplantation. This corresponded to 0.305 publications per author. These publications received 6.183 citations per publication (Table 2). The Annual growth rate of these publications was 3.61%.

The first publication was published in 1990. After 2014, the number of publications increased. 2015 was the year with the highest number of publications (n=123). In 2016, the number of publications decreased by almost half after the first peak and did not fall below 50 publications/year in the following years (Figure 1).

Ankara University (n=207), Hacettepe University (n=166), Gazi University (n=95), Erciyes University (n=82), and Akdeniz University (n=79) were the institutions that published the most publications on bone marrow transplantation. Institutional information is the institution of the first authors of the publications. This data was obtained from the WOS database.

Dr. Muhit Özcan (n=67), Akif Yesilipek (n=65) and Gürman Gürhan (n=62) were the mostly published authors.

The most common keywords found in the publications were ‘bone marrow transplantation (132 times occured), versus host disease transplantation (76 times occured), blood (48 times occured) and children (44 times occured)’ (Table 3).

Table 2. General characteristics of publications on bone marrow transplantation from Turkey between 1990-2022.

Description	Results
Documents	913
Sources (Journals, Books, etc.)	223
Keywords Plus (ID)	1189
Author's Keywords (DE)	881
Period	1990-2022
Average citations per documents	6.183
Authors	2991
Author Appearances	8337
Authors of single-authored documents	18
Authors of multi-authored documents	2973
Single-authored documents	20
Documents per Author	0.305
Authors per Document	3.28
Co-Authors per Documents	9.13
Collaboration Index	3.33
Document types	
ARTICLE	402
ARTICLE; BOOK CHAPTER	2
ARTICLE; EARLY ACCESS	2
ARTICLE; PROCEEDINGS PAPER	8
EDITORIAL MATERIAL	7
EDITORIAL MATERIAL; BOOK CHAPTER	1
LETTER	41
MEETING ABSTRACT	415
NOTE	1
PROCEEDINGS PAPER	2
REVIEW	31
REVIEW; EARLY ACCESS	1

These 913 publications have cited a total of 5645 times (average 6.18 per publication). The average H index was 37. The top 20 most cited articles are given in Table 4.

Most of the publications on bone marrow from Turkey between 1990 and 2022 were published in the journal ‘*Bone Marrow Transplantation*’. The impact indicators (H, G, and M indexes) of the journals that published the most of the articles on this subject and other numerical findings about these journals are summarized in Table 5.

Network visualisations created by VOSviewer

Figure 3 decipts the co-authorship analysis between affiliations and Figure 4 decipts the bibliographic coupling between affiliations. The node size refers to the institutions' occurrence times. 87 out of 1060 organizations met the threshold. The action panel's resolution is set to 0.85. The weight is set to "total link strength" in the options panel. The color of circles varies depending on their clusters.

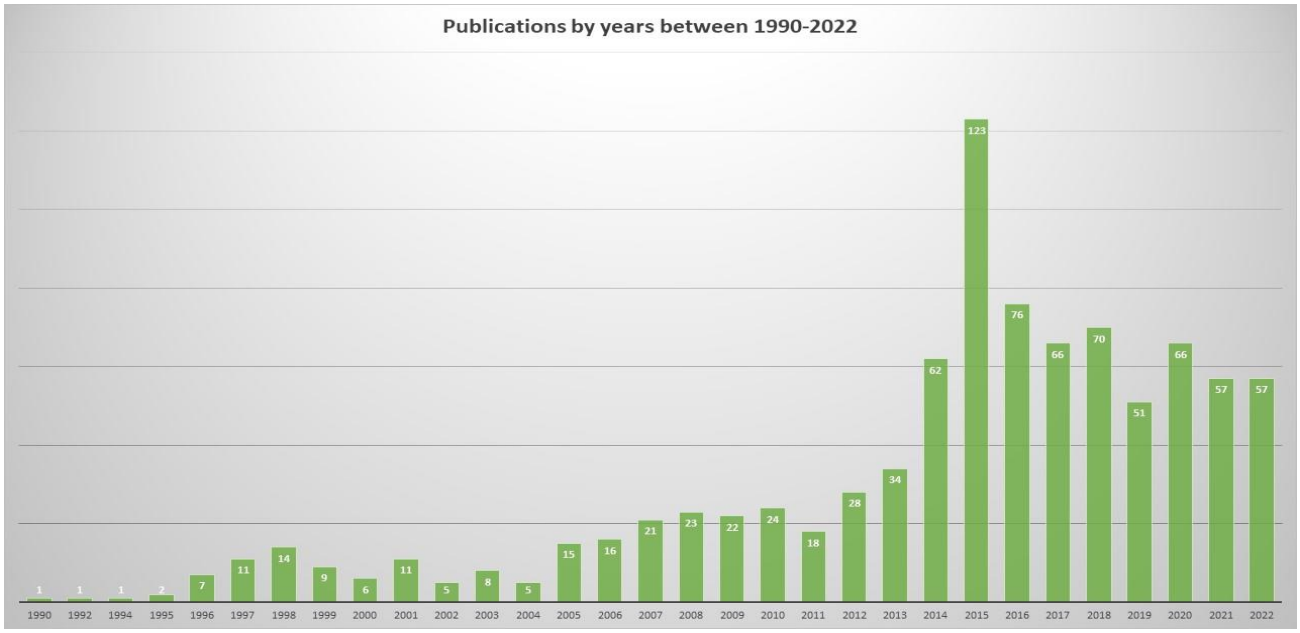

Figure 1. Annual Scientific Production

Table 3. Most commonly used keywords in publications

Words	**Occurrences**
bone marrow transplantation	132
versus host disease	76
blood	48
children	44
disease	39
recipients	37
therapy	34
risk factors	29
survival	27
chemotherapy	25
diagnosis	25
risk	25
impact	24
cancer	23
outcomes	23
complications	22
management	22
stem cell transplantation	20
high dose chemotherapy	19
leukemia	19
marrow transplantation	18
acute lymphoblastic leukemia	17
bone marrow	17
infection	16
quality of life	16

Table 4. Top 20 most cited papers from Turkey published between 1990-2022

Title	Authors	Source Title	Publication Year	Total Citations
Guideline for the Management of Fever and Neutropenia in Children With Cancer and/or Undergoing Hematopoietic Stem-Cell Transplantation	Lehrnbecher, et al.	JOURNAL OF CLINICAL ONCOLOGY	2012	236
Clinical outcome in IL-10-and IL-10 receptor-deficient patients with or without hematopoietic stem cell transplantation	Engelhardt, et al.	JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY	2013	170
Long-term outcome following hematopoietic stem-cell transplantation in Wiskott-Aldrich syndrome: collaborative study of the European Society for Immunodeficiencies and European Group for Blood and Marrow Transplantation	Ozsahin, et al.	BLOOD	2008	156
Treatment of amyotrophic lateral sclerosis patients by autologous bone marrow-derived hematopoietic stem cell transplantation: a 1-year follow-up	Deda, et al.	CYTOTHERAPY	2009	130
Transplantation of peripheral blood stem cells as compared with bone marrow from HLA-identical siblings in adult patients with acute myeloid leukemia and acute lymphoblastic leukemia	Ringden, et al.	JOURNAL OF CLINICAL ONCOLOGY	2002	116
Antimicrobial Resistance in Gram-Negative Rods Causing Bacteremia in Hematopoietic Stem Cell Transplant Recipients: Intercontinental Prospective Study of the Infectious Diseases Working Party of the European Bone Marrow Transplantation Group	Averbuch, et al.	CLINICAL INFECTIOUS DISEASES	2017	111
Hemopoietic stem cell transplantation in thalassemia: a report from the European Society for Blood and Bone Marrow Transplantation Hemoglobinopathy Registry, 2000-2010	Baronciani, et al.	BONE MARROW TRANSPLANTATION	2016	108
Impact of age on outcomes after bone marrow transplantation for acquired aplastic anemia using HLA-matched sibling donors	Gupta, et al.	HAEMATOLOGICA-THE HEMATOLOGY JOURNAL	2010	106
Late cardiovascular events after allogeneic hematopoietic stem cell transplantation: a retrospective multicenter study of the Late Effects Working Party of the European Group for Blood and Marrow Transplantation	Tichelli, et al.	HAEMATOLOGICA-THE HEMATOLOGY JOURNAL	2008	104
Treatment of chronic spinal cord injured patients with autologous bone marrow-derived hematopoietic stem cell transplantation: 1-year follow-up	Deda, et al.	CYTOTHERAPY	2008	101
An overview of infectious complications after allogeneic hematopoietic stem cell transplantation	Sahin, et al.	JOURNAL OF INFECTION AND CHEMOTHERAPY	2016	100
Allogeneic Hematopoietic Stem-Cell Transplantation for Acute Myeloid Leukemia in Remission: Comparison of Intravenous Busulfan Plus Cyclophosphamide (Cy) Versus Total-Body Irradiation Plus Cy As Conditioning Regimen-A Report From the Acute Leukemia Working Party of the European Group for Blood and Marrow Transplantation	Nagler, et al.	JOURNAL OF CLINICAL ONCOLOGY	2013	100
Tyrosine kinase inhibitors improve long-term outcome of allogeneic hematopoietic stem cell transplantation for adult patients with Philadelphia chromosome positive acute lymphoblastic leukemia	Brissot, et al.	HAEMATOLOGICA	2015	95
Multicenter experience in hematopoietic stem cell transplantation for serious complications of common variable immunodeficiency	Wehr, et al.	JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY	2015	88
Hematopoietic stem cell transplantation in patients with gain-of-function signal transducer and activator of transcription 1 mutations	Leiding, et al.	JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY	2018	87
Life-threatening neurological complications after bone marrow transplantation in children	Uckan, et al.	BONE MARROW TRANSPLANTATION	2005	70
Differences between graft product and donor side effects following bone marrow or stem cell donation	Favre, et al.	BONE MARROW TRANSPLANTATION	2003	69
Multicenter Analyses Demonstrate Significant Clinical Effects of Minor Histocompatibility Antigens on GvHD and GvL after HLA-Matched Related and Unrelated Hematopoietic Stem Cell Transplantation	Spierings, et al.	BIOLOGY OF BLOOD AND MARROW TRANSPLANTATION	2013	68
Transplantation of Nonhematopoietic Adult Bone Marrow Stem/Progenitor Cells Isolated by p75 Nerve Growth Factor Receptor Into the Penis Rescues Erectile Function in a Rat Model of Cavernous Nerve Injury	Kendirci, et al.	JOURNAL OF UROLOGY	2010	66
Transplantation of allogeneic hematopoietic stem cells: an emerging treatment modality for solid tumors	Demirer, et al.	NATURE CLINICAL PRACTICE ONCOLOGY	2008	66

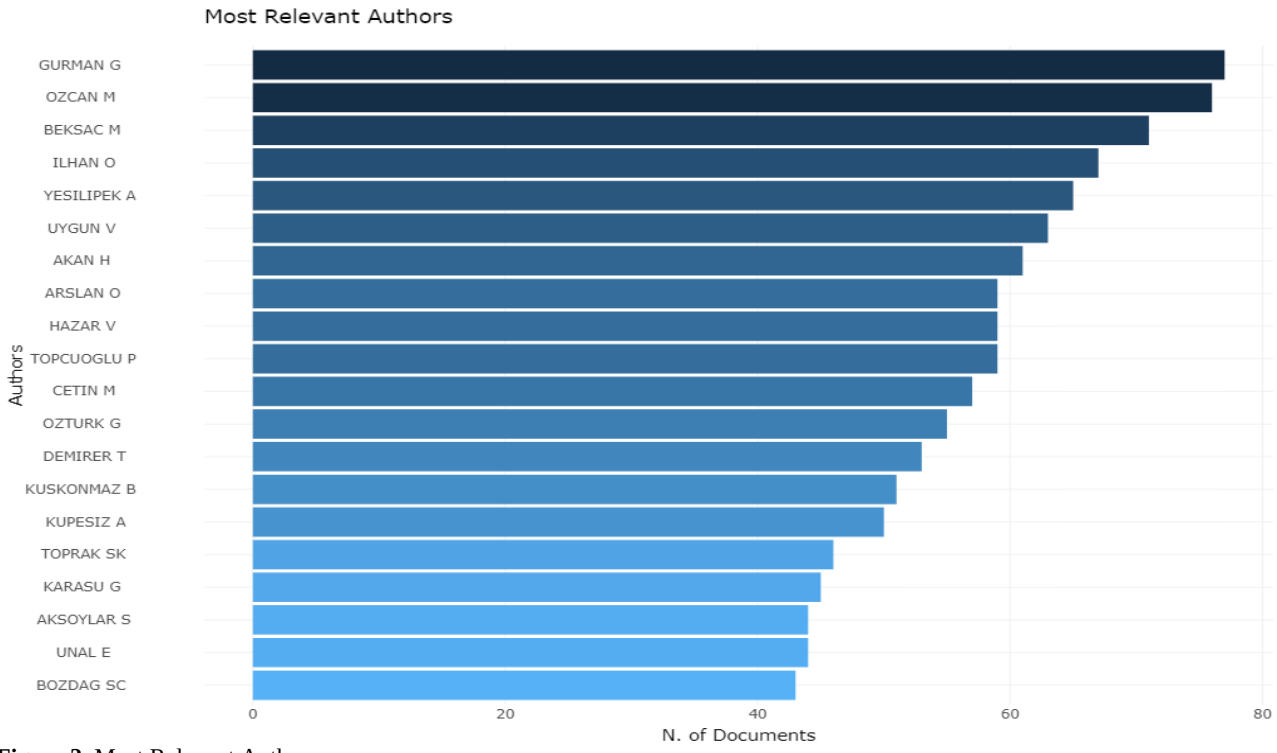

Figure 2. Most Relevant Authors

Table 5. Source Impact

Source	h_index	g_index	m_index	TC	NP	PY_start
BONE MARROW TRANSPLANTATION	16	27	0.571428571	779	260	1996
PEDIATRIC TRANSPLANTATION	10	16		360	53	2001
BIOLOGY OF BLOOD AND MARROW TRANSPLANTATION	8	14	0.421052632	223	26	2005
TRANSFUSION AND APHERESIS SCIENCE	7	10	0.5	132	21	2010
TRANSPLANTATION PROCEEDINGS	7	11	0.318181818	146	11	2002
BLOOD	5	17	0.147058824	307	50	1990
TURKISH JOURNAL OF HEMATOLOGY	5	9	0.333333333	106	27	2009
PEDIATRIC HEMATOLOGY AND ONCOLOGY	5	7	0.208333333	56	8	2000
JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY	5	5	0.454545455	413	5	2013
HAEMATOLOGICA	4	14	0.210526316	197	29	2005

***H: Hirsch index; m index:**m-quotient index; TC: total citations; NP: number of publication;PY:publication year.

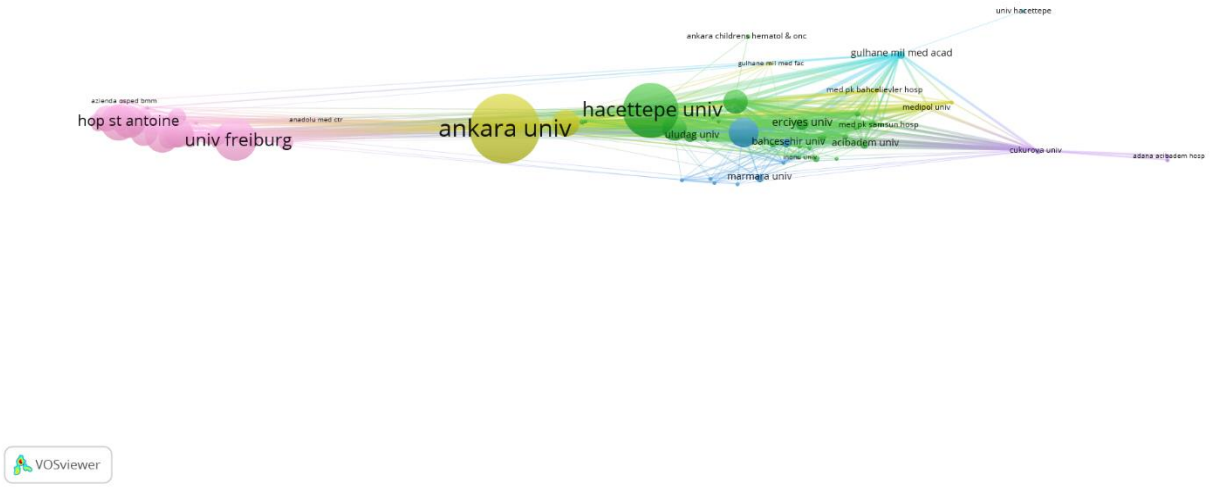

Figure 3. Co authorship analysis between affiliations

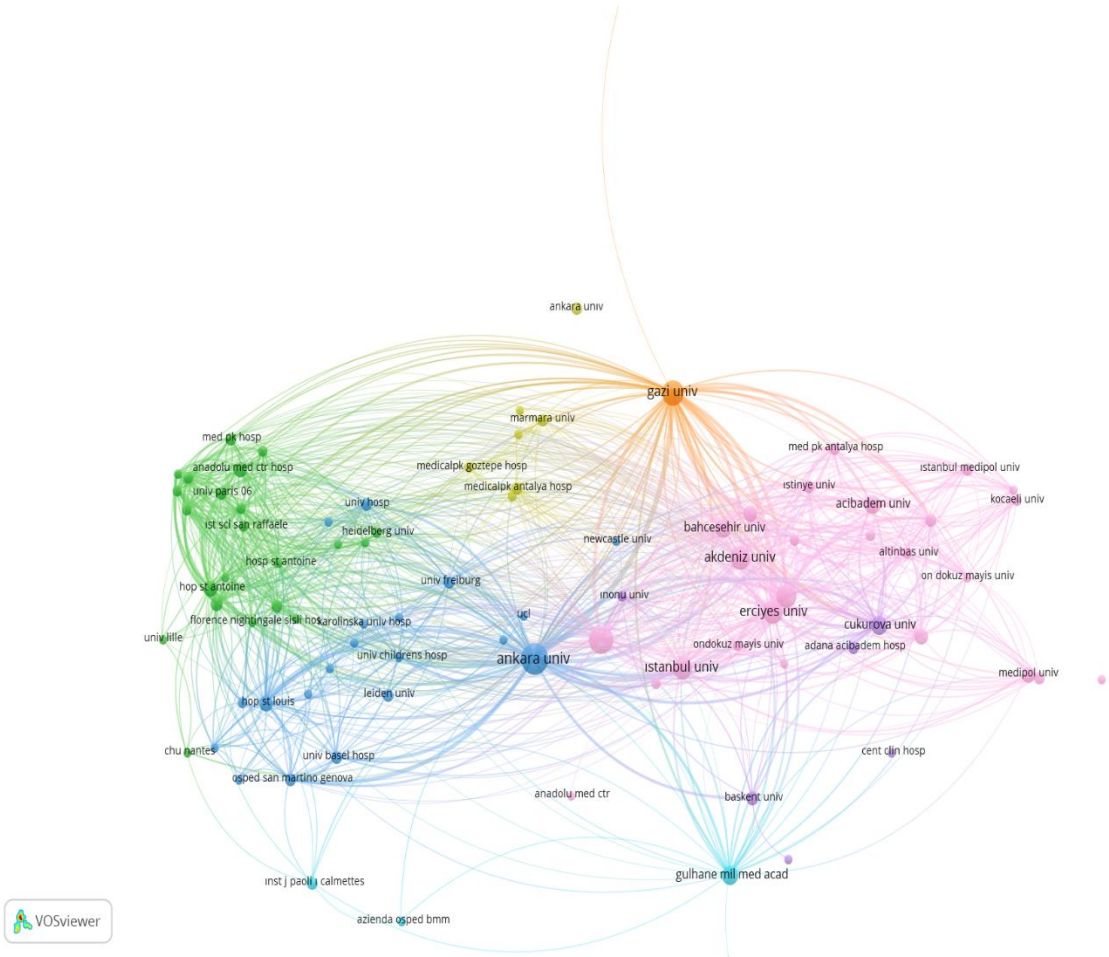

Figure 4. Bibliographic coupling between affiliations

DISCUSSION

Although there are bibliometric analyses on various organ transplants, no similar publication on bone marrow transplantation was found in the literature (6-10). Two similar bibliometric analyses analyzing publications on organ transplantation in Turkey on liver transplantation (11) and heart transplantation (12) were recently published. Also, bibliometric studies on bone marrow transplantation are very limited in the existing literature (13,14). This is the first study analyzing the scientific outputs of the literature on bone marrow transplantation in Turkey. This article's objective is to present a thorough bibliometric analysis of bone marrow transplantation research conducted in Turkey. Given the significance of bone marrow transplantation, it is essential to develop an overview of the state of publications and a clear picture of scientific exchanges in this area because doing so aids in the planning and decision-making processes for future research. This bibliometric analysis was carried out based on the examination of publication features. Bone marrow transplantation is still not a hot topic in Turkey, despite its importance in saving lives and enhancing quality of life. This theory is reinforced by the limited number of transplantation-related publications that have been published in the last 20 years, with the total amount of publications authored by Turkish authors not reaching 2.214 % of all publications on bone marrow transplantation in the world.

The Middle East Society for Organ Transplantation (MESOT) has members from more than 29 countries, and these countries have a total population of over 600 million. All of the Arab nations, Iran, Turkey, Pakistan, and the Central Asian nations are among them. Inadequate preventative medicine, uneven health infrastructure, low levels of public and medical awareness of the value of organ donation and transplantation, and inadequate government support for organ transplantation are all prevalent characteristics of organ transplantation in Middle Eastern nations. Additionally, there is a lack of planning for organ procurement and transplant centers, a lack of adequate health insurance, and a lack of teamwork among transplant doctors. Most frequently, patients seek out commercial transplantation (15). A similar situation may exist in Turkey, one of the MESOT countries. Therefore, the number of publications from Turkey in our study may also be related to the scarcity of organ transplantation.

Bone marrow transplantation has different procedures compared to other organ transplants. This type of transplant does not require the person to die or organ loss. This procedure does not harm the donor. However, people younger than 2 years and older than 60 years are not accepted as bone marrow donors. Before receiving the bone marrow, the person's blood count and blood values are checked. Tests are carried out on the liver, kidneys, and blood to make sure of general health. The stem cell transplant is performed in the operating room. Special needles are inserted just above the hip bone to remove all the blood cells from the bone marrow. This blood, which is about one unit, is taken to the laboratory to separate the stem cells. The stem cells are separated with an apheresis device. After counting and determining how many of them are alive, it is calculated whether they are the right number for the recipient. If they are suitable, preparations are made for transplantation. The donor's bone marrow starts to reproduce for itself. Donating bone marrow is a practice that has been around for more than 30 years and is well established. Although no medication is necessary, there is a hospital stay of 1-3 days and 7–10 days off of work. The anesthesia poses the biggest risk. According to the USA National Marrow Donor Program's experience with 1,193 donations, asthenia and pain in the aspiration area are thought to be the most common side effects. Only 1 fatal event (pulmonary embolism) and 12 serious adverse events were noted in the European Group for Blood and Marrow Transplantation analysis performed between 1993 and 2005 on 27,770 first HSCTs from bone marrow. Cardiovascular adverse events occurred most frequently (16). Another study reported that a small percentage of donors (6%–20%) may experience minor side effects like discomfort at the collection site, exhaustion, or discomfort when standing or sitting. Major and potentially fatal side effects from bone marrow donation, such as anesthesia-related events, mechanical damage to the bone, sacroiliac joint, and sciatic nerve, are thought to occur in 0.1% to 0.3% of cases (17). It is possible to collect hematopoietic stem cells from umbilical cord blood, peripheral blood stem cells that have been mobilized, or bone marrow. Peripheral blood hematopoietic cell transplantation has increased as a result of quicker engraftment and practicability in related, unrelated, or haploidentical settings (18).

In addition, since most stem cell transplants today are performed with stem cells collected by apheresis from peripheral blood, this method provides advantages such as not requiring general anesthesia, being less traumatic, less traumatic and painless (19).

The first publication of a survey by the European Society for Blood and Marrow Transplantation (EBMT) detailing the activities of hematopoietic stem cell transplant centers in Europe was published in 1990. The 2021 edition of the survey has now been published. Since then, the report has covered more than 800,000 transplants and more than 700,000 patients each year. In 1990, bone marrow transplants were reported in 20 countries; 30 years later, an estimated 51 countries and 715,000 people have reported bone marrow transplants (20). In recent years, there has been a significant increase in the number of bone marrow transplants performed all over the world. As of 2015, the number of bone marrow transplants in European countries reached 42,171. In line with the general trend, there has been a significant increase in bone marrow transplants in Turkey, especially in the last 15 years. According to the 2014 report published by the EBMT, Turkey ranks among the top 4 countries in Europe in terms of the increase in the number of transplants between 2004 and 2014. The total number of bone marrow transplants in Turkey reached 4052 in 2017 (21). According to the data of the Ministry of Health of Turkey, as of 2023, bone marrow transplantation is performed in 149 centers including private institutions, state universities, foundation universities, and Ministry of Health hospitals (22). The Turkish Stem Cell Coordination Center (TÜRKÖK) was established in 2015 to meet national and international allogeneic hematopoietic stem cell demands at world standards, to protect donor health, and to provide timely

quality healthcare services (23). Adult/pediatric hematopoietic stem cell transplantation center (bone marrow transplantation center) is a center that performs autologous, allogeneic intrafamilial, allogeneic unrelated stem cell transplantation. These centers act in accordance with the provisions of the 'Directive on Bone Marrow Transplant Centers and Bone Marrow Transplant Tissue Data Processing Centers' (24). Transplant centers are planned and licensed by the Ministry of Health (23). With the Turkish Stem Cell Coordination Center (TÜRKÖK) project carried out in cooperation with the Ministry of Health and the Türk Kızılay, stem cell transplants have been performed in a total of 3,900 patients, 320 of them from abroad (25). According to the TÜBA-National Stem Cell Policy Workshop Report, there were 20 Pediatric Stem Cell Transplantation Centers in Turkey in 2013. The first transplant center was established in 1989. The indications for transplantation in pediatric hematology and oncology are the indications published by the EBMT and adjusted for our country by the Pediatric Hematology Society Stem Cell Transplant Sub-Working Group. With the opening of public and private centers in the last two years, the number of beds has increased from 40 to 108 and the number of annual transplants from 180 to 500, and the number of patients waiting for transplantation has decreased to acceptable levels. In Turkey, 13% of pediatric transplants are autologous and 87% are allogeneic. The rate of unrelated transplants among allogeneic transplants is 12% (26). However, according to the current literature and official sources available, data on the number of transplants according to centers and current official numbers could not be reached. Despite the increase in the number of transplants and the prevalence of transplant centers, the number of publications on bone marrow transplantation in Turkey is below the expected level. There were 913 publications (402 articles) by 2991 authors from Turkey, which were published in 223 different journals between 1990-2022 on bone marrow transplantation. It was found that publications were made especially from institutions and state universities in large cities such as Ankara University (n=207), Hacettepe University (n=166), Gazi University (n=95), Erciyes University (n=82), and Akdeniz University (n=79). Centers in other cities should also participate in transplantation studies, especially in bone marrow transplantation, which can affect many people from many provinces. The institutions other than universities should also be supported scientifically.

In the study by Paulson et al. (13), abstracts at international meetings were analyzed. A similar study to ours has not been published on bone marrow transplantation. Also, there are published bibliometric analyses on the use of stem cell transplantation in non-hematology patients (27-29). However, a study similar to the subject of our study was not found in the available literature. WOS database was also utilized in these studies (26-28) and we obtained the study data from the WOS database in our study. And we used the Vosviewer tools (30) and biblioshiny applications (31) for visualizations and mapping.

In our study, other WOS core indexes other than SCIE were also included. This index includes indexes where publications on other sociological aspects of organ transplantation, educational aspects, etc. can be indexed. However, the number of scientific articles on this subject was quite low. In the keyword analysis, it was seen that topics related to treatment and disease management were included. This supported our hypothesis.

In our study, we could not make a comparison of our data since we could not access current transplantation data, and a similar study was not conducted. However, these data can provide an evaluation of the current situation in terms of the number of publications, the institutions that publish the most, and the leaders who have worked on this subject.

Limitations

The present study has certain limitations, which must be acknowledged. A typical limitation of research of this type was that the literature search was only conducted using the WOS collection's index of journals. Other medical science databases might be the subject of future bibliometric research, which would add to our understanding of this discipline. The WoSCC has fewer literature and journals than other databases like PubMed and Embase, which could lead to a bias in the selection of the literature. Second, all kinds of studies are used in the formation of hotspots. Although different study types do have distinct effects on the field, policies, and recommendations, the findings of these study types may be more significant.

CONCLUSIONS

It was determined that the number of publications on bone marrow transplantation from Turkey is quite low, only a few publications from a few centers have been published. Our study revealed that there is a lack of scientific publications on bone marrow transplantation applications that have been performed in our country for nearly 50 years. It is necessary to increase social awareness about bone marrow transplantation in our country. In addition, bone marrow transplantation, which is of critical vital importance for some diseases, should be increased and scientific productivity should be supported.

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