Bibliometric analysis of primary central nervous system lymphoma

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Abstract

Aim: Primary central nervous system lymphoma (PCNSL) is an important topic in hematology due to its rare, aggressive course, difficult diagnosis and special treatment requirements. This bibliometric analysis study aimed to examine PCNSL-related publications published since the last 2000 and to identify potential points of future research.

Materials and Methods: Web of Science Core Collection documents published between 2000 and 2022 were analyzed using selected keywords. The obtained data were visualized with bibliometric tools. Publishing countries, organizations, journals, authors, references, and keywords were all examined comprehensively.

Results: 1,160 articles on PCNSL published since 2000 were retrieved. These publications tend to focus on research in oncology (n=456, 39.310%), clinical neurology (n=354, 30.517%), and hematology (n=173, 14.914%). Search criteria revealed that 6,458 authors from 65 different countries and 1,570 organizations worldwide contributed to PCNSL articles.

Conclusion: Studying research on PCNSL is crucial to improve our knowledge of this disease and to create new treatment strategies. It is very important to keep in mind that the characteristics and trends in PCNSL research may change over time as new findings and developments in the field are discovered. The results of this study may provide guidance for researchers working in this area.

Introduction

Primary central nervous system lymphoma (PCNSL) is a infrequent form of non-Hodgkin's lymphoma (NHL) and this aggressive disease specifically affects the central nervous system [1]. It originates from extranodal locations and primarily settles down in the brain parenchyma, meninges, the spinal cord, and intraocular structures (including the corpus vitreum and/or retina), and leptomeninges. PCNSL differs from systemic lymphoma in that it does not occur simultaneously or previously outside the central nervous system [1,2]. In addition, cases of PCNSL associated with immunodeficiencies such as acquired immunodeficiency syndrome (AIDS) or immunosuppression are not considered under this definition [1]. The diffuse large B-cell lymphoma (DLBCL) subtype is the predominant form of PCNSL and has been reported to represent more than 95% of all PCNSL cases. Other types of PCNSL are less common, including T-cell lymphomas, Burkitt lymphomas, and low-grade lymphomas. These alternative subtypes are relatively rare compared to DLBCL [3]. The activated B-cell-like (ABC) subtype, the main PCNSL, accounts for more than 90% of DLBCL cases. Frequently recurrent mutations, mostly in the MYD88, CD79B and less commonly in the CARD11 and TNFAIP3 cohorts, have an impact on the B-cell receptor (BCR) signaling axis and its downstream target, NF-B. Outside of the CNS, ABC PCNSLs are more likely to include MYD88 and CD79B alterations than ABC DLBCL. Since MYD88 and MYD88 + CD79B mutations are present in more than 70% of samples from lymphomas discovered in other immune-privileged locations like the testes, PCNSL is, therefore, more resemblance to these lymphomas [4].

This disease's annual incidence is 0.4 per 100 000 in all new cases [5,6], although the prevalence increases with age, reaching up to 4 per 100,000 in people over the age of 70 [5]. According to the findings of some studies in the literature, PCNSL makes up around 2% of all primary central nervous system tumors, and the reported median age of onset is 65

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[7,8]. Since 2000, there have been reports of an increase in PCNSL cases worldwide, especially among the elderly [9].

A gadolinium-enhanced brain magnetic resonance imaging (MRI) scan is the most reliable radiographic technique to detect PCNSL. The majority of PCNSL patients showed up with an isolated brain mass. Stereotactic brain biopsy, cerebrospinal fluid (CSF) analysis, or studies of vitreous aspirate in patients with ocular involvement are frequently used to make the diagnosis of PCNSL. Urgent stereotactic biopsy is indicated in almost all surgically accessible cases due to potential delay in diagnosis and treatment. 15% to 20% of PCNSL patients and 5% to 20% of patients with ocular involvement had secondary CSF involvement, respectively [10].

Therapeutic optimization, such as high-dose methotrexate-based chemotherapy followed by consolidation therapy in the form of whole-brain radiation or autologous stem cell transplantation, results in better survival rates. However, some individuals do not benefit from initial treatment and relapse may occur. Delayed neurotoxicity may develop, especially in elderly patients. As a result of recent molecular discoveries supporting the pathogenesis of PCNSL, clinical trials involving targeted therapies and immunotherapies for rescue have been developed [11]. Bruton's tyrosine kinase inhibitors, immunomodulatory imide drugs, mammalian target of rapamycin, phosphoinositide 3-kinase, immune checkpoint inhibitors, and CD19-directed chimeric antigen receptor T cells are among the novel therapeutics currently under investigation [4]. Furthermore, recent data support the importance of activating the B-cell receptor/Toll-like receptor/nuclear factor kappa B signaling pathway and the use of consolidation radiotherapy, autologous stem cell transplantation, and intensive chemotherapy after high-dose methotrexate (MTX)-based polychemotherapy [12].

The development of high-throughput genome sequence technology in recent years has improved our understanding of the etiology of this disease, and a large number of scientific studies on disease classification, prognostic markers, and therapeutic targets have been produced. Despite these noteworthy developments, a thorough bibliometric analysis that captures the changing scientific landscape in this field is noticeably lacking. Therefore, the main goal of this study is to carefully review the body of knowledge already available on PCNSL research, providing a thorough overview to enable the scientific community to grasp this complex topic in a nuanced and comprehensive manner.

Materials and Methods

Study design

Bibliometric approach was applied in the present retrospective study. Does not require ethics committee approval as there are no animal and human data. The study is a literature review study and consists of articles published on the subject of PCNSL. A research method known as "bibliometric methodology" analyzes and rates the qualitative and quantitative components of bibliographic data using mathematical and statistical techniques. The distribution, structure, quantity, and evolution of the content of publications in a field can be investigated through this methodology [13]. Bibliometrics, derived from the field of library and information science, has found a wide range of uses in various disciplines, including medicine [14-17].

Power of study

By offering thorough quantitative evaluations of scholarly publications, bibliometric studies have significant influence in the field of scientific research. These studies provide invaluable insights into the development of scientific knowledge, developing research fields, and the influence of research outputs through the systematic investigation of citation patterns, publishing trends, and collaboration networks. They are essential tools for academics, organizations, and policymakers, enabling resource allocation, partnership opportunities identification, and informed decision-making. They also allow for historical reflection and the assessment of research effect. In essence, bibliometric studies are crucial in determining the focus and influence of scientific research [13-17].

Data collection

Firstly, 2,743 publications were retrieved from the Web of Science database by keyword ('Primary Central Nervous System Lymphoma'). Although there were 61 articles published in 2023, the year 2023 was excluded to avoid bias due to the ongoing addition of this year's data and the continuous updating of the database. Since the aim was to analyze publications after 2000, the time range was narrowed to 2000-2022. According to the search methodology, a total of 2310 publications were found. Then, the term 'article' was entered into the database search engine to evaluate only research articles. In this way, 1,160 research articles were found. During the search process, no selection was made regarding the language of publication.

After a total of 1,160 research publications were found, the data were downloaded to the computer for analysis and visualization.

Quantitative statistics

The online version of the "WOS Literature Analysis Report" was used to review the characteristics of publications, including article types, categories, author names, country/region distribution, number of publications per year, number of citations, and H-index. To perform visual analyses, all data were imported into Microsoft Excel 2019 or VOSviewer 1.6.19 (Leiden University, Leiden, The Netherlands) [18]. The VOSviewer tool is software for bibliometric mapping. In particular, VOSviewer enables comprehensive bibliometric maps to be presented in an interpretable way [18]. Furthermore, for additional analysis, the dataset was uploaded to the Literature Metrology Online Analysis Platform available at https://bibliometric.com/app.

## Results

General informations of the articles

The PCNSL articles were written by 6,458 authors from 65 different countries and affiliated with 1,570 organizations globally. Since 2000, 1,160 articles on PCNSL have

**Table 1.** Keyword occurences and total link strength of the most preferred keywords.

Keyword	Occurrences	Total link strength
Primary central nervous system lymphoma	370	363
Lymphoma	170	295
Central nervous system	102	177
Primary cns lymphoma	97	103
Pcnsl	85	88
Methotrexate	79	161
Chemotherapy	75	177
Prognosis	67	109
Diffuse large b-cell lymphoma	41	56
Radiotherapy	41	110
Magnetic resonance imaging	38	66
Survival	36	79
High-dose methotrexate	35	63
Rituximab	34	76
Glioblastoma	30	44
Primary central nervous system lymphoma (pcnsl)	29	22
Cns lymphoma	26	23
Central nervous system lymphoma	24	22
Epstein-barr virus	24	32
Mrı	23	29
Cns	21	36
Cerebrospinal fluid	18	25
Brain tumor	17	35
Non-hodgkin lymphoma	17	21
Brain	16	35
Elderly	16	37
Neurotoxicity	16	48
Radiation therapy	16	38
Temozolomide	15	36
Case report	14	24
Incidence	13	25
Non-hodgkin's lymphoma	13	19
Relapse	13	23
Treatment	13	29
Diagnosis	12	22
Overall survival	12	19
Pd-l1	11	15
Primary central nervous system lymphomas	11	4
Aids	10	15
Brain neoplasm	10	29
Oncology	10	20
Radiation	10	20
Whole brain radiotherapy	10	16

Table 2. Number of documents, Number of citations and total link strength of the most publishing countries.

Country	Number of documents	Number of citations	Total link strength
The USA	296	9.434	220.910
China	198	1.735	95.110
Japan	196	2.868	103.622
Germany	124	5.261	89.861
South Korea	75	1.194	58.080
France	66	2.460	71.724
Italy	44	1.508	46.651
Canada	39	1.381	46.388
England	32	1.002	38.421
India	30	228	26.455
Switzerland	29	1.068	36.037
Australia	25	514	23.591
Spain	24	344	20.380
Netherlands	22	736	25.466
Turkey	18	133	9.080
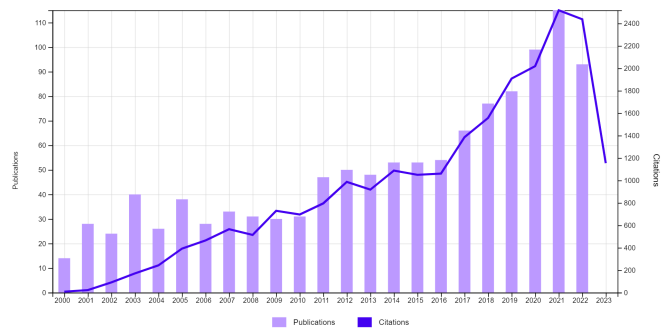
**Figure 1.** Times cited and publications over time.
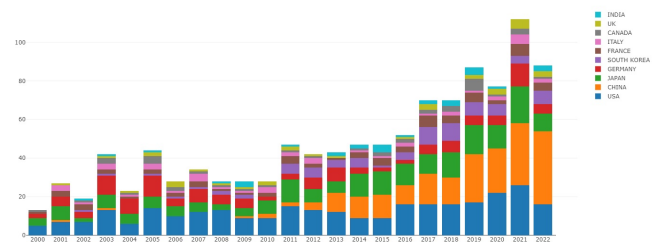
Figure 2. Publications by countries.

been published, the majority of them in Oncology (n=456, 39.310%), Clinical Neurology (n=354, 30.517%), Hematology (n=173, 14.914%), Pathology (n=115, 9.914%), Neurosciences (n=112, 9. 655%), Radiology Nuclear Medicine Medical Imaging (n=107, 9. 224%), Surgery (n=97, 8.362%), General Internal Medicine (n=84, 7.241%), Immunology (n=29, 2.500%) and Experimental Medicine Research (n=28, 2.414%). The distribution of these articles according to Web of Science indexes is as follows; Science Citation Index Expanded (n=1. 020, 87.931%), Emerg-

ing Sources Citation Index (n=119, 10.259%), Conference Proceedings Citation Index Science (n=23, 1.983%), Book Citation Index Science (n=21, 1.810%) and Social Sciences Citation Index (n=6, 0.517%). In terms of publication languages, the majority of articles were published in English (n=1,118, 96.379%). There are also articles published in other languages such as Spanish (n=18), French (n=9), German (n=7), Japanese (n=3), Turkish (n=3), Portuguese (n=1), and Russian (n=1). When the articles were analyzed in the following different access categories; all open access (n=553, 47.672%), gold (n=296, 25.517%), gold-hybrid (n=44, 3.793%), free

Table 3. Highly cited journals.

Journal name	Number of articles	Number of citations	Category Quartile
Journal of Clinical Oncology	5	3.489	Q1
Blood	16	1.909	Q1
The Journal of Neuro-Oncology	64	1.373	Q2
Neurology	7	1.098	Q1
Cancer	20	810	Q1
Neuro-oncology	20	770	Q1
Annals of Oncology	6	613	Q1
Journal of Neurosurgery	7	585	Q1
International Journal of Radiation Oncology - Biology - Physics	7	582	Q1
American Journal of Neuroradiology	12	572	Q2
Clinical Cancer Research	6	534	Q1
Leukemıa Lymphoma	27	473	Q3
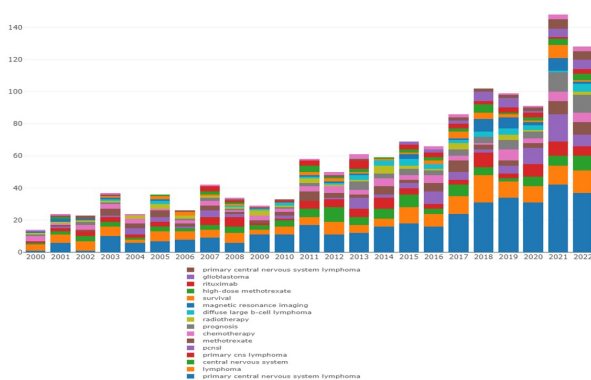
Figure 3. Keywords by years.

reading (n=145, 12.500%), green publication (n=377, 32.500%), green acceptance (n=38, 3.276%) and green submission (n=106, 9.138%).

Publication and citation numbers over years

The analysis of the numerical distribution of PNSL articles and the corresponding number of citations from 2000 to 2022 had shown that 2021 was the year with the highest level of interest in the field of PCNSL. A total of 115 papers and 2,517 citations were recorded in that year, indicating a significant focus on PCNSL research. Figure 1 represents a visualization of the number of publications and citations over the years. This graph was downloaded from the Web of Science database. The metrics "Times Cited" and "Publications Over Time" are both important indicators of the general development of research in a certain field.

The geographic distribution of articles

This study showed that researchers from around the world are actively engaged in this topic. The collective efforts of authors from a total of 65 countries have collectively enriched the body of knowledge on PCNSL.

This study examines the geographical distribution of articles, focusing on the United States of America (USA), China, Japan, Germany, South Korea, France, Italy,

Canada, the United Kingdom (UK), and India. The dataset consists of a total of 1,161 articles, with each country contributing a different number of articles. The majority of the articles originate from the USA, with 297 articles representing approximately 25.603% of the total dataset. Following the USA, China contributed 198 articles, representing 17.069% of the dataset. Japan followed closely with 196 articles, representing 16.897% of the total. Germany contributed 10,690% of the dataset with 124 articles. South Korea accounted for 6.466% of the total with 75 articles. France and Italy contributed 5.690% and 3.793% of the dataset with 66 and 44 articles respectively. Canada contributed 3.448% of the dataset with 40 articles. The UK contributed 33 articles, representing 2.845% of the dataset. Finally, India contributed 30 articles, representing 2.586% of the total dataset.

These findings highlight the prominent contribution of the USA, China, Japan, Germany, South Korea, France, Italy, Canada, England, and India to the articles included in this study. A comprehensive analysis of the distribution of publications by country reveals several noteworthy trends. Firstly, it is observed that the USA consistently produced publications each year from 2000 to 2022. This sustained publication output underscores the active research landscape and scholarly contributions from the USA in the field under study.

In contrast, the emergence of publications from China began in 2009, marking a significant development in research output from this country. Over the past decade, the number of Chinese publications has shown a steady increase, reflecting the growing research capacity and scholarly contributions from Chinese institutions. Notably, the highest number of Chinese publications was recorded in 2022, signifying a culmination of efforts and a robust research output in that particular year. To visually represent the distribution of publications from different countries, Figure 2 provides a graphical depiction of the countries with the highest number of publications. This visualization aids in understanding the relative contributions of each country, highlighting the prominent role played by the USA and the increasing presence of China in the scholarly landscape.

The top publishing institutions

The PCNSL literature has benefitted from the contributions of authors affiliated with a diverse range of institutions, totaling 1,571 distinct affiliations including universities, hospitals, research centers, and other academic and medical organizations.

The preponderance of articles within the analyzed dataset primarily originated from Harvard University (the USA) (n=77), Memorial Sloan Kettering Cancer Center (the USA) (n=48), Udice French Research Universities (France) (n=38), Mayo Clinic (USA) (n=37), Unicancer (France) (n=37), Assistance Publique–Hôpitaux de Paris (France) (n=34), the University of Cologne (Germany) (n=33), Fudan University (China) (n=32), and Sorbonne University (France) (n=32).

Harvard University, situated in the USA, holds the distinction of being the most prolific contributor with 77 articles. Following closely, Memorial Sloan Kettering Cancer Center, also located in the USA, contributed 48 articles, signifying their substantial research output in the field.

Udice French Research Universities, representing academic institutions in France, collectively contributed 38 articles, further exemplifying their significant involvement in advancing the knowledge base of the subject.

Mayo Clinic in the USA and Unicancer in France both made notable contributions, each accounting for 37 articles, highlighting their dedication to the research and understanding of the topic at hand.

Additionally, Assistance Publique–Hôpitaux de Paris in France, the University of Cologne in Germany, Fudan University in China, and Sorbonne University in France each played a significant role, publishing 34, 33, 32, and 32 articles respectively. These findings underscore the influential contributions from Harvard University, Memorial Sloan Kettering Cancer Center, Udice French Research Universities, Mayo Clinic, Unicancer, Assistance Publique–Hôpitaux de Paris, University of Cologne, Fudan University, and Sorbonne University, highlighting their dedicated research efforts in advancing our understanding of the subject matter. The top publishing authors Martina Deckert from the Department of Neuropathology at the University of Cologne in Cologne, Germany, has made notable contributions to the research on PCNSL. She has published extensively (n=31) in this field. Lisa Marie DeAngelis, an American neuro-oncologist, holds the positions of Physician-in-Chief and Chief Medical Officer at Memorial Sloan Kettering Cancer Center in the USA. She has made significant contributions to the field of PCNSL research and has published a substantial number of articles (n=26) in this area. Lauren E. Abrey from Roche Holding (with 24 articles), Khe Hoang-Xuan from Hopital Universitaire Pitie-Salpetriere (with 24 articles), and Manuel Montesinos-Rongen from the University of Cologne, Germany (with 23 articles) are also among the top publishing authors in the field of PCNSL. Their contributions through their published works have significantly contributed to the advancement of knowledge in PCNSL research.

The top publishing authors

Martina Deckert from the Department of Neuropathology at the University of Cologne in Cologne, Germany, has made notable contributions to the research on PCNSL. She has published extensively (n=31) in this field. Lisa Marie DeAngelis, an American neuro-oncologist, holds the positions of Physician-in-Chief and Chief Medical Officer at Memorial Sloan Kettering Cancer Center in the USA. She has made significant contributions to the field of PCNSL research and has published a substantial number of articles (n=26) in this area. Lauren E. Abrey from Roche Holding (with 24 articles), Khe Hoang-Xuan from Hopital Universitaire Pitie-Salpetriere (with 24 articles), and Manuel Montesinos-Rongen from the University of Cologne, Germany (with 23 articles) are also among the top publishing authors in the field of PCNSL. Their contributions through their published works have significantly contributed to the advancement of knowledge in PCNSL research.

Keywords analysis

Figure 3 displays the results of the keyword analysis conducted over the years. In recent years, several keywords have gained significant importance. Apart from keywords associated with PCNSL, treatment-related terms such as rituximab, methotrexate, radiotherapy, chemotherapy, and survival have emerged as prominent themes. In this study, authors used a total of 1815 different keywords in their publications. We also utilized the Vosviewer tool for keyword analysis. As a result we found 43 keywords that occurred at least 10 times. Among these 43 keywords, a keyword analysis conducted using the Vosviewer revealed that the most frequently identified keywords primarily consisted of the disease name itself, demonstrating their prominent occurrence within the dataset. Table 1 presents a comprehensive overview of the keyword occurrences and the total link strength (TLS) associated with the most preferred keywords. The TLS indicates the degree of association or co-occurrence between keywords, providing insights into their interconnectedness and relevance within the body of literature.

International collaborations

Table 2 provides a comprehensive overview of the number of documents, number of citations, and TLS of most publishing countries. This table was generated using Vosviewer analysis. The analysis revealed that the USA had the highest number of citations, with a total of 9434 citations. China emerged as the second most cited and publishing country, receiving a significant number of citations (1735 citations).

The TLS represents the level of international collaborations established by each country. According to the analysis, the USA had the highest level of international collaborations, indicating its strong connections and collaborations with researchers from other countries. Japan secured the second position in terms of total link strength, highlighting its active engagement and collaborations with researchers globally (TLS: 103622).

The co-authorship analysis was done to depict the connections between countries. The color groups in the figure represent the linkages among the countries, while the thickness of the lines indicates the level of connection (TLS) between countries. The size of the bubbles reflects the num-

ber of publications associated with each country, symbolizing their publication output. This visualization provides insights into the collaborative relationships and publication patterns among different countries, shedding light on the extent of research collaboration and the productivity of each country in the analyzed dataset.

Journals

The analyzed publications were published in a total of 436 different journals. The Journal of Neuro-Oncology emerged as the leading journal in terms of publishing articles related to PCNSL, with a total of 64 publications dedicated to this subject. The list of journals that published the highest number of articles on PCNSL is summarized in Table 3. This summary provides a valuable overview of the key journals contributing to the PCNSL literature, highlighting the significance of specific outlets in disseminating research findings and fostering scholarly discussions within the field.

Discussion

Bibliometric studies are quantitative research methods that have become quite popular in the field of hematology in recent years [19-26]. However, a comprehensive literature search did not yield any similar studies published on the topic of PCNSL. This study included 1,160 articles on PCNSL published since 2000.

The present study showed that there were contributions of authors from 65 different countries. The study's emphasis on global participation highlights the value of PCNSL topic. A sizeable fraction of the articles in the overall dataset, namely 297 articles were written in the USA. China also contributed significantly with 198 articles. Following closely after with 196 articles was Japan. Germany was another noteworthy contributor, contributing 124 papers. Throughout the whole study period (from 2000 to 2022), the USA continually published articles. The first publications from China, on the other hand, appeared in 2009. But the number of publications coming from China increased significantly in the ensuing ten years. This shows a rising level of participation and research production among Chinese scientists, which reflects an increased attention to this field. The maximum number of articles published in China was recorded in 2022.

This point to a possible increase in research output and activity, highlighting the growing importance and contribution of Chinese scholars to the subject. The observed patterns in the distribution of publications amongst nations shed light on how the global research landscape is changing and how various countries have contributed to the advancement of the topic under study.

According to this research, Memorial Sloan Kettering Cancer Center (the USA) came in second with 48 papers, closely trailing Harvard University (the USA) with 77 articles. With 38 articles, Udice French Research University (France) also provided a significant role. 37 publications were contributed by The Mayo Clinic (USA) and Unicancer (France), demonstrating the two organizations' commitment to this area of study. With 34, 33, 32, and 32 publications, respectively, Assistance Publique-Hôpitaux

de Paris (France), University of Cologne (Germany), Fudan University (China), and Sorbonne University (France) were also notable contributors.

Collaboration among authors connected to a variety of institutions has produced the substantial amount of literature on PCNSL. An extensive examination demonstrates that writers from a total of 1,571 different affiliations have contributed to the PCNSL literature, highlighting the broad and multidisciplinary nature of this field's research. The large number of institutions, including universities, hospitals, research institutes, and other academic and medical organizations, actively interested in increasing our understanding of this disease is reflected in the affiliations engaging in PCNSL research.

In scientific literature, keywords serve as vital indicators that encapsulate the fundamental concepts and research domains. Employing keyword co-occurrence analysis enables researchers to gain insights into the progression and dissemination of various research hotspots within a specific subject matter. By examining the patterns of keyword associations, one can discern the expansion and distribution of significant areas of investigation in a given field. This approach offers a valuable methodological tool for understanding the evolving landscape of scholarly discourse and identifying prominent research trends [19-26]. The outcome of this study states that treatment interventions and survival results are becoming more and more important in PCNSL research. The predominance of these keywords demonstrates the importance given in recent studies to examining therapy options and comprehending the elements that affect patient survival. By analyzing keywords, researchers can gain important insights about the field's changing trends and hot topics, as well as the topics that are most important to them when doing PCNSL-related research. The importance of numerous keywords in the field of PCNSL research has noticeably increased in recent years. There has been a noticeable predominance of words relating to treatment, such as rituximab, MTX, radiation, chemotherapy, and survival, in addition to the keywords directly relevant to PCNSL. The word "survival" itself serves as a further indication of the increased interest in evaluating PCNSL's long-term results and prognostic variables. PCNSL research must take into account patient survival rates as well as factors that affect patient outcomes. The use of Vosviewer and the ensuing keyword analysis provide insightful information about the most frequent and pertinent keywords within the dataset, improving our comprehension of the important concepts and theories in the subject. This study helps to pinpoint the essential ideas and lingo that academics frequently use to discuss the subject at issue. MTX and rituximab were among the frequently used keywords on treatment.

In the analyzed dataset, the publications were distributed across 436 different journals. *The Journal of Neuro-Oncology* stood out as the top journal, publishing 64 articles specifically focused on PCNSL. *The Journal of Neuro-Oncology*, established in 1983 and currently published by Springer Science and Business Media, is a respected peer-reviewed medical journal specializing in central nervous system cancer. With 15 annual publications, it serves as a vital platform for the dissemination of research in the field

of neuro-oncology. The journal's transition from its initial publisher, Martinus Nijhoff Publishers, to Springer in 2005 signifies its enduring presence and evolution. Through its regular publication frequency, the journal demonstrates its dedication to fostering scientific discourse and progress in neuro-oncology. Its extensive history and association with the esteemed publisher Springer contribute to its standing as a credible and influential resource within the scientific community.

Limitations

This study used particular keywords to conduct an analysis of publications that were indexed in the Web of Science Core Collection and published between 2000 and 2022. Therefore, it should be acknowledged that articles from older years or those not included in this specific dataset may not have been taken into account. However, evaluating the 23-year period under investigation is the analysis' main goal. In this study, the lack of content analysis was mostly ascribed to the bibliometric tools used. However, it is important to note that by using different and more specialized bibliometric tools, content analysis might be incorporated into future research projects. A more thorough comprehension of the subject matter and a more comprehensive evaluation of research trends and discoveries within the area may be achieved with such an approach, which would delve into the substantive substance of scholarly publications.

Conclusion

Our bibliometric study provides a thorough review of the PCNSL documents released since 2000. This analysis can be used as a reference for attracting the attention of researchers all over the world to recognize and participate in the growing body of scientific work. Due to its propensity for malignancy and poor prognosis, PCNSL has been able to garner some financial and technological support throughout the years, albeit not enough. This analysis helps highlight the necessity of developing therapeutic regimens by employing a multidisciplinary approach, despite the fact that active research is still mostly restricted to a few nations. Due to PCNSL's aggressive course, it is essential that new opportunities for increasing funding and collaboration among scientists be explored.

Ethical approval

This study does not require ethics committee approval as there are no animal and human data.

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