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Research

Meningioma: A Bibliometric Analysis of the 50 Most Cited Articles

Menenjiyom: En Çok Atıf Alan 50 Makalenin Bibliyometrik Analizi

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ABSTRACT

Objective: It was aimed to contributing to contributing to the literature by making a bibliometric analysis of original scientific research on meningiomas.

Methods: We reviewed the literature using Thomson-Reuters Web of Science-Science Citation Index Expanded database. The 50 most cited articles containing the keyword meningioma were identified. The number of citations, the country and institute of submission, the name of the publishing journal, the year of publication, and the content of the articles were noted. The top-publishing journals were searched using the multidisciplinary database Scopus, through the free-access portal SCImago Country & Journal Rank (SJR). The documents they published, the citations they received, and the citation/document ratios for the last two years were collected.

Results: When the 50 most cited articles were examined, it was seen that they recorded a total of 17,432 and an average of 348.6 citations. While the most cited article received 1237 citations, the least cited one was cited 196 times. The most common field of study in these articles (22%) was a cytogenetic study. Other article types and topics were radiosurgery, classification score system, progression, epidemiology-etiology, review, surgical outcomes, and radiology. More than half (54%) of the articles consisted of the studies conducted in the US. Germany followed this country with 14%. These studies were conducted at 36 different institutes. The institute that conducted the highest number of studies is the Mayo Clinic. These articles have been published in 25 different journals. Eight journals published at least 2 articles. The Journal of Neurosurgery, which published 20% of the articles, outnumbered other journals. It is followed by the International Journal of Radiation Oncology Biology Physics and the Journal of Neurosurgery with five articles each. We identified 8 journals which published 2 or more of the 50 most cited articles on meningioma. Examining these journals using the data obtained from SJR, with Scopus data, we have seen that the average number of citations per document (cites/doc.) was 4.14, the average total documents were 949.7 in 2020, and the average total number of citations for those documents was 18307.1.

Conclusion: The findings of this study show that an article about meningioma is more likely to be cited highly if it was published in a subject-specific journal of an English-speaking institution in the US.

Keywords: Meningioma, bibliometric, analysis

ÖZ

Amaç: Çalışmamızda, menenjiyomlarla ilgili yayınlanmış özgün bilimsel araştırmaların bibliyometrik analizini yapmayı ve literatüre katkı sağlamayı amaçladık.

Gereç ve Yöntem: Literatür taraması Thomson Reuters Web of Science-Science Citation Index Expanded veri tabanı kullanılarak yapılmıştır. Meningioma anahtar kelimelerini içeren en çok atıf alan 50 makale tespit edildi. Makalelerin atıf sayısı, gönderildiği ülke ve enstitü, yayınlayan dergi, yayın yılı ve makalenin içeriği kayıt altına alındı. En çok yayın yapan dergiler multidisciplinary database Scopus, through the free-access portal SCImago Country & Journal Rank (SJR) kullanılarak tarandı ve yayınladıkları dokümanlar, aldıkları atıflar ve son iki yıllık atıf/doküman oranları toplandı.

Bulgular: En fazla atıf alan 50 makale incelendiğinde, en az atıf alan makalenin 196 ve en çok atıf alan makalenin 1237 atıf aldığı ve toplamda 17.432 ve ortalama 348,6 atıf aldığı görüldü. En sık makale türü (%22) sitogenetik çalışmalardı. Diğerleri radyocerrahi, sınıflandırma skor sistemi, progresyon, epidemiyoloji-etiyoloji, derleme, cerrahi sonuçlar ve radyoloji idi. Makalelerin yarıdan fazlası (%54) ABD'de yürütülmüş çalışmalardı. ABD'yi %14 ile Almanya takip ediyordu. Bu çalışmalar 36 farklı enstitüde yapılmış olup 5 araştırma ile en çok çalışma yapan enstitü Mayo Clinic idi. Makaleler 25 farklı dergide yayınlanmıştır. Sekiz dergide 2 ve 2'den çok makale yayınlanmıştır. En çok makale (%20) Journal of Neurosurgery'de

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ÖZ

yayınlanmıştır. Journal of Neurosurgery'i beşer makale ile International Journal of Radiation Oncology Biology Physics ve Neurosurgery dergileri takip etmektedir. SJR ile Scopus data ulaşılan verilerde en çok atıf alan menenjiyom çalışmalarının 2 ve daha fazla sayıda yayın yapan sekiz derginin doküman başına yapılan atıf sayısı (cites/doc.) ortalama 4,14, ortalama toplam dokümanları 2020 yılı içinde 949,7 ve bu dökümanlar için yapılan ortalama toplam atıf sayıları 18307,1 olarak saptanmıştır.

Sonuç: Menenjiyom hakkında bir makalenin yüksek oranda atıf alması için ABD'de İngilizce konuşulan bir kurumdan konuya özel bir dergide yayınlanmasının daha olası olduğu görülmektedir.

Anahtar Kelimeler: Menenjiyom, bibliyometrik, analiz

INTRODUCTION

Meningiomas are the most common (36.6%) primary intracranial tumors (1). The incidence of meningioma depends on age; while it occurs in 0.14 per 100,000 children aged 0-19, it is 37.75 per 100,000 in the 75-84 age group (1-2). They originate from arachnoidal cap cells and often adhere to the dura (3). They are mostly benign tumors, but there are also variants with malign features (4). The diagnosis of meningiomas has increased significantly with cross-sectional imaging techniques such as magnetic resonance imaging and multi-detector computed tomography (5).

In parallel with the overall increase in the number of publications recently, the number and variety of bibliometric studies have also increased (6). With many bibliometric studies conducted in this field, thousands or even tens of thousands of studies have been analyzed, thus creating a valuable source for new research. Bibliometric analysis reveals actively publishing authors, institutes, countries, journals, and their relations with each other (6). Examining the most cited publications is a frequently used method in bibliometric analysis (7,8). The number of citations of an article is an important objective indicator showing the extent of credit and interest it gets in the academic world (9). For this reason, in bibliometric studies, the 50 most cited publications are filtered and analyzed (7).

A review of the literature shows that many bibliometric studies have been conducted on various subjects in the field of neurosurgery (6,10-14). We also planned to review the 50 most cited publications on meningioma using the Thomson ISI Web of Science® Database.

METHODS

In March 2022, we searched the term "meningioma" in the "title" section and in Neurology and Neuroscience categories of the Thomson Reuters Web of Science-Science Citation Index Expanded database. The 50 most cited articles published in English since 1970 were examined.

The parameters we noted were the number of citations, the country and institute where they were submitted, the publishing journal, the year of publication, and the content of the articles. Eight journals that published two or more articles were searched using the multidisciplinary database Scopus, through the free-access portal SCImago Country & Journal Rank (SJR). The documents published by these eight journals, the citations they received, and the citation/document ratios for the last two years were noted.

The period from 1970 to present was divided into decades and grouped by the year articles were published. The content of the articles was categorized as cytogenetic studies, non-surgical or radiosurgery studies, studies on classification and scoring, progression, epidemiology-etiology studies, reviews, surgical outcome studies, and radiological studies.

Statistical Analysis

The IBM SPSS Statistics Co. 25.0 (IBM Co., Armonk, NY, USA) was used for statistical analysis. Qualitative data were defined as frequency distributions and quantitative data were presented as mean, minimum, and maximum values.

RESULTS

When the 50 most cited articles were examined, it was seen that they recorded a total of 17,432 and an average of 348.6 citations. While the most cited article received 1237 citations, the least cited one was cited 196 times (Table 1). The articles were found to be under eight different research titles. The most common article field was cytogenetic studies with 11 articles (Table 2). Others were radiosurgery, classification score system, progression, epidemiology-etiology, review, surgical outcomes, and radiology.

More than half (54%) of the articles were on studies conducted in the US, followed by Germany with 14%. The studies that led to the publication of 50 articles were conducted at 36 different institutes from 12 different countries (Figure 1). The institute that carried out the highest number of studies (5) is the Mayo Clinic (Table 3).

Table 1. The 50 most cited articles on meningioma

No	Article	Number of citations
1	Marosi C, Hassler M, Roessler K, Reni M, Sant M, Mazza E, et al. Meningioma. Crit Rev Oncol Hematol 2008;67:153-71.	394
2	Abdel-Rahman MH, Pilarski R, Cebulla CM, Massengill JB, Christopher BN, Boru G, et al. Germline BAP1 mutation predisposes to uveal melanoma, lung adenocarcinoma, meningioma, and other cancers. J Med Genet 2011;48:856-9.	430
3	Wiemels J, Wrensch M, Claus EB. Epidemiology and etiology of meningioma. J Neurooncol 2010;99:307-14.	1010
4	Rohringer M, Sutherland GR, Louw DF, Sima AA. Incidence and clinicopathological features of meningioma. J Neurosurg 1989;71:665-72.	493
5	Kalamarides M, Niwa-Kawakita M, Leblois H, Abramowski V, Perricaudet M, Janin A, et al. *Nf2* gene inactivation in arachnoidal cells is rate-limiting for meningioma development in the mouse. Genes Dev 2002;16:1060-5.	212
6	Claus EB, Bondy ML, Schildkraut JM, Wiemels JL, Wrensch M, Black PM. Epidemiology of intracranial meningioma. Neurosurgery 2005;57:1088-95.	618
7	Commins DL, Atkinson RD, Burnett ME. Review of meningioma histopathology. Neurosurg Focus 2007;23:E3.	205
8	Kollova A, Liščák R, Novotný J, Vladyka V, Šimonová G, Janoušková L. Gamma Knife surgery for benign meningioma. J Neurosurg 2007;107:325-36.	209
9	Perry A, Stafford SL, Scheithauer BW, Suman VJ, Lohse CM. Meningioma grading: an analysis of histologic parameters. Am J Surg Pathol 1997;21:1455-65.	719
10	Buetow MP, Buetow PC, Smirniotopoulos JG. Typical, atypical, and misleading features in meningioma. Radiographics 1991;11:1087-106.	375
11	Levy WJ, Bay J, Dohn D. Spinal cord meningioma. J Neurosurg 1982;57:804-12.	426
12	Clark VE, Erson-Omay EZ, Serin A, Yin J, Cotney J, Özduman K, et al. Genomic analysis of non-NF2 meningiomas reveals mutations in TRAF7, KLF4, AKT1, and SMO. Science 2013;339:1077-80.	627
13	Jääskeläinen J. Seemingly complete removal of histologically benign intracranial meningioma: late recurrence rate and factors predicting recurrence in 657 patients. A multivariate analysis. Surg Neurol 1986;26:461-9.	538
14	Lamszus K. Meningioma pathology, genetics, and biology. J Neuropathol Exp Neurol 2004;63:275-86.	238
15	Weber RG, Boström J, Wolter M, Baudis M, Collins VP, Reifenberger G, et al. Analysis of genomic alterations in benign, atypical, and anaplastic meningiomas: toward a genetic model of meningioma progression. Proc Natl Acad Sci U S A 1997;94:14719-24.	433
16	Longstreth Jr WT, Dennis LK, McGuire VM, Drangsholt MT, Koepsell TD. Epidemiology of intracranial meningioma. Cancer 1993;72:639-48.	386
17	Nauta HJ, Tucker WS, Horsey WJ, Bilbao JM, Gonsalves C. Xanthochromic cysts associated with meningioma. J Neurol Neurosurg Psychiatry 1979;42:529-35.	218
18	McCarthy BJ, Davis FG, Freels S, Surawicz TS, Damek DM, Grutsch J, et al. Factors associated with survival in patients with meningioma. J Neurosurg 1998;88:831-9.	238
19	Milker-Zabel S, Zabel A, Schulz-Ertner D, Schlegel W, Wannenmacher M, Debus J. Fractionated stereotactic radiotherapy in patients with benign or atypical intracranial meningioma: long-term experience and prognostic factors. Int J Radiat Oncol Biol Phys 2005;61:809-16.	204
20	Pasquier D, Bijmolt S, Veninga T, Rezvoy N, Villa S, Krengli M, et al. Atypical and malignant meningioma: outcome and prognostic factors in 119 irradiated patients. A multicenter, retrospective study of the Rare Cancer Network. Int J Radiat Oncol Biol Phys 2008;71:1388-93.	196
21	Taylor Jr BW, Marcus Jr RB, Friedman WA, Ballinger Jr WE, Million RR. The meningioma controversy: postoperative radiation therapy. Int J Radiat Oncol Biol Phys 1988;15:299-304.	334
22	Zorludemir S, Scheithauer BW, Hirose T, Van Houten C, Miller G, Meyer FB. Clear cell meningioma. A clinicopathologic study of a potentially aggressive variant of meningioma. Am J Surg Pathol 1995;19:493-505.	260
23	Sadetzki S, Flint-Richter P, Ben-Tal T, Nass D. Radiation-induced meningioma: a descriptive study of 253 cases. J Neurosurg 2002;97:1078-82.	257
24	Goyal LK, Suh JH, Mohan DS, Prayson RA, Lee J, Barnett GH. Local control and overall survival in atypical meningioma: a retrospective study. Int J Radiat Oncol Biol Phys 2000;46:57-61.	245

25	Mirimanoff RO, Dosoretz DE, Linggood RM, Ojemann RG, Martuza RL. Meningioma: analysis of recurrence and progression following neurosurgical resection. J Neurosurg 1985;62:18-24.	1237
26	Willis J, Smith C, Ironside JW, Erridge S, Whittle IR, Everington D. The accuracy of meningioma grading: a 10-year retrospective audit. Neuropathol Appl Neurobiol 2005;31:141-9.	228
27	Carella RJ, Ransohoff J, Newall J. Role of radiation therapy in the management of meningioma. Neurosurgery 1982;10:332-9.	264
28	Seizinger BR, De La Monte S, Atkins L, Gusella JF, Martuza RL. Molecular genetic approach to human meningioma: loss of genes on chromosome 22. Proc Natl Acad Sci U S A 1987;84:5419-23.	371
29	Zang KD. Cytological and cytogenetical studies on human meningioma. Cancer Genet Cytogenet 1982;6:249-74.	328
30	Couce ME, Aker FV, Scheithauer BW. Chordoid meningioma: a clinicopathologic study of 42 cases. Am J Surg Pathol 2000;24:899-905.	216
31	van Alkemade H, de Leau M, Dieleman EM, Kardaun JW, van Os R, Vandertop WP, et al. Impaired survival and long-term neurological problems in benign meningioma. Neuro Oncol 2012;14:658-66.	209
32	Claus EB, Calvocoressi L, Bondy ML, Schildkraut JM, Wiemels JL, Wrensch M. Dental x-rays and risk of meningioma. Cancer 2012;118:4530-7.	228
33	Dziuk TW, Woo S, Butler EB, Thornby J, Grossman R, Dennis WS, et al. Malignant meningioma: an indication for initial aggressive surgery and adjuvant radiotherapy. J Neurooncol 1998;37:177-88.	300
34	Milosevic MF, Frost PJ, Laperriere NJ, Wong CS, Simpson WJ. Radiotherapy for atypical or malignant intracranial meningioma. Int J Radiat Oncol Biol Phys 1996;34:817-22.	242
35	Al-Mefty O, Kadri PA, Pravdenkova S, Sawyer JR, Stangeby C, Husain M. Malignant progression in meningioma: documentation of a series and analysis of cytogenetic findings. J Neurosurg 2004;101:210-8.	238
36	Sahm F, Schrimpf D, Stichel D, Jones DT, Hielscher T, Schefzyk S, et al. DNA methylation-based classification and grading system for meningioma: a multicentre, retrospective analysis. Lancet Oncol 2017;18:682-94.	424
37	George B, Lot G, Boissonnet H. Meningioma of the foramen magnum: a series of 40 cases. Surg Neurol 1997;47:371-9.	226
38	Stafford SL, Pollock BE, Foote RL, Link MJ, Gorman DA, Schomberg PJ, et al. Meningioma radiosurgery: tumor control, outcomes, and complications among 190 consecutive patients. Neurosurgery 2001;49:1029-38.	415
39	Sahm F, Schrimpf D, Olar A, Koelsche C, Reuss D, Bissel J, et al. TERT promoter mutations and risk of recurrence in meningioma. J Natl Cancer Inst 2015;108:djv377.	233
40	Kondziolka D, Levy EI, Niranjan A, Flickinger JC, Lunsford LD. Long-term outcomes after meningioma radiosurgery: physician and patient perspectives. J Neurosurg 1999;91:44-50.	348
41	Goel A, Muzumdar D, Desai KI. Tuberculum sellae meningioma: a report on management on the basis of a surgical experience with 70 patients. Neurosurgery 2002;51:1358-64.	245
42	Perry A, Scheithauer BW, Stafford SL, Abell-Aleff PC, Meyer FB. "Rhabdoid" meningioma: an aggressive variant. Am J Surg Pathol 1998;22:1482-90.	253
43	Flickinger JC, Kondziolka D, Maitz AH, Lunsford LD. Gamma knife radiosurgery of imaging-diagnosed intracranial meningioma. Int J Radiat Oncol Biol Phys 2003;56:801-6.	234
44	Schüz J, Böhler E, Berg G, Schlehofer B, Hettinger I, Schlaefer K, et al. Cellular phones, cordless phones, and the risks of glioma and meningioma (Interphone Study Group, Germany). Am J Epidemiol 2006;163:512-20.	311
45	Maier H, Öfner D, Hittmair A, Kitz K, Budka H. Classic, atypical, and anaplastic meningioma: three histopathological subtypes of clinical relevance. J Neurosurg 1992;77:616-23.	355
46	Ayerbe J, Lobato RD, De la Cruz J, Alday R, Rivas JJ, Gómez PA, et al. Risk factors predicting recurrence in patients operated on for intracranial meningioma. A multivariate analysis. Acta Neurochir (Wien) 1999;141:921-32.	210
47	Heuser M, Beutel G, Krauter J, Döhner K, von Neuhoff N, Schlegelberger B, et al. High meningioma 1 (MN1) expression as a predictor for poor outcome in acute myeloid leukemia with normal cytogenetics. Blood 2006;108:3898-905.	271
48	Al-Mefty O. Clinoidal meningiomas. J Neurosurg 1990;73:840-9.	277
49	Benson VS, Pirie K, Green J, Casabonne D, Beral V. Lifestyle factors and primary glioma and meningioma tumours in the Million Women Study cohort. Br J Cancer 2008;99:185-90.	209
50	Pieper DR, Al-Mefty O, Hanada Y, Buechner D. Hyperostosis associated with meningioma of the cranial base: secondary changes or tumor invasion. Neurosurgery 1999;44:742-6.	295

These articles have been published in 25 different journals. 8 journals published at least 2 or more articles (Table 4). The highest number of articles (10) was published by the Journal of Neurosurgery, which is followed by the International Journal of Radiation Oncology, Biology Physics, and the Journal of Neurosurgery with 5 articles each. We identified 8 journals which published 2 or more of the 50 most cited articles on meningioma. Examining the 8 journals using the data obtained from SJR, with Scopus data, we have seen that the average number of citations per document (cites/doc.) was 4.14, the average total documents were 949.7 in 2020, and the average total number of citations for those documents was 18307.1.

DISCUSSION

We have listed 50 most-cited articles on meningiomas. We found that these articles were published on studies conducted in 12 different countries, while the US accounted for more than half (54%) of them (Figure 1). This result is in line with the findings of other bibliometric studies (6,10-14). It goes without saying that economic development lays a suitable ground for advances in science and technology (15). The US's ability to allocate funding and resources for scientific research thanks to its economic power enabled this country to outperform in this field, which can also be observed in the findings of this study. Based on our observation, it appears that an article on meningiomas is more likely to be cited highly if it was published in a subject-specific journal (Neurosurgery or Radiation oncology) by an English-speaking institution in the US. It is also not a coincidence that the five leading countries in terms of scientific publications are the US, Germany, Canada, France, and the UK, respectively, which enjoy developed economies and scientific productivity. In this vein, this study suggests that there is a linear relationship between the number of publications on meningiomas in these countries and their economic power. This situation gives important information about the influence of developed countries in conducting scientific studies.

When the article types were examined, the cytogenetic studies outnumbered articles in other fields. The World Health Organization (WHO) published its central nervous system classification in 1979, 1993, 2000, 2007, 2016, and 2020 (16). The importance of histomorphological features and molecular changes has increased in the last two updates. In this way, the WHO reduced the interobserver variability of histological interpretation in diagnostic criteria and to provide a more accurate classification of clinical outcomes. In accordance with this, cytogenetic studies have been widely cited and received interest in studies on meningiomas (Table 2).

Table 2. Frequent article contents

Article content	n
Cytogenetic	11
Non-surgical (radiosurgery)	10
Classification/score system	8
Progression	7
Epidemiology/etiology	6
Review	5
Surgical outcomes	2
Radiology/imaging	1

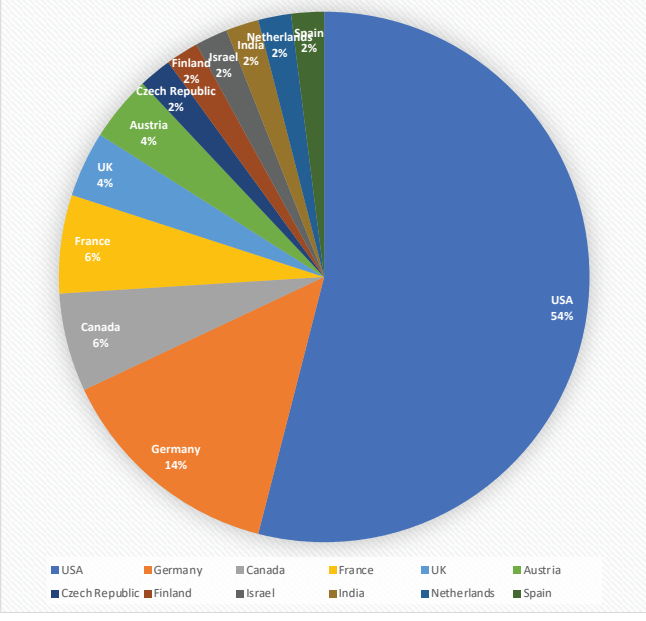

Figure 1. Publications by country

Table 3. Publishing institutes

Institute	Number of publications
Mayo Clinic	5
Yale University School of Medicine	3
University Heidelberg	3
University of Vienna	2
Harvard Medical School	2
University of Illinois at Chicago	2
University of Pittsburgh	2
University of Arkansas for Medical Sciences	2
Cleveland Clinic	2
Others (27 different institutes)	27

Table 4. SCImago Journal & Country Rank, with Scopus data

Journals	Number of publications	Cites/doc. (2 years)	Total docs. (2020)	Total cites (2020)
Journal of Neurosurgery	10	3.16	543	5314
International Journal of Radiation Oncology Biology Physics	5	3.48	584	6588
Neurosurgery	5	2.19	654	3032
American journal of surgical pathology	4	5.36	208	3719
Journal of neuro-oncology	3	3.63	282	3971
Cancer	2	4.63	727	9435
Surgical neurology	2	1.12	409	616
Proceedings of the National Academy of Sciences	2	9.56***	4191**	113782*
Average		4.14	949.7	18307.1

*Most published documents, **Most cited, ***Most cited/document

According to the Thomson ISI Web of Science® Database data, recently a significant increase has been observed in the number of articles on meningioma. In the early 2000s, approximately 500 articles on meningioma were published per year, while recently, this number has approached 1500 per year. Considering the publications year of the 50 most cited articles, it was seen that most articles (38%) were published between 2000-2009. Since our bibliometric study is mostly based on the number of citations, this time interval has been accepted as normal, since it takes time to publish the articles, capture sufficient interest, organize a new study, and publish this study as well. A review of other bibliometric studies also showed that the cited articles were mostly published in the same period (6,10-14).

As far as the journals in which the most cited articles were published are concerned, the Journal of Neurosurgery, International Journal of Radiation Oncology Biology Physics, Neurosurgery, American Journal of Surgical Pathology, Journal of Neuro-oncology, Cancer, Surgical Neurology, and Proceedings of the National Academy of Sciences (PNAS) are the leading ones, respectively (Table 4). Ten of the most cited articles (Table 4) and the most cited article (Table 1) were published in the Journal of Neurosurgery. This Journal is one of the most important sources for the international neurosurgery community. Having examined other journals, we noted that they included oncology as well as neurosurgery journals. This is because meningioma is a subject studied by radiation oncology and medical oncology physicians as well as by neurosurgery physicians. It is recommended that researchers interested in this subject should be cognizant of these journals. Additionally, it has been observed that the journal named PNAS has a higher number of total citations and citations per document compared to the other journals (Table 4).

CONCLUSION

In this study, we used bibliometric analysis methods to present a scientific summary of the 50 most cited articles on meningioma, which has been increasingly studied in the literature, published between 1970-2022. This summary reveals the contributions to this topic by journals, countries, authors, and institutions. Some important publications and journals have been identified for researchers. This bibliometric study provides a collection of data that will help design future research on meningiomas more efficiently, identify gaps, and develop new approaches.

ETHICS

Ethics Committee Approval: All procedures performed were in accordance with the 1964 Helsinki Declaration. This article does not contain any studies with human participants or animals performed by any of the authors.

Informed Consent: For this type of study formal consent is not required.

Authorship Contributions

Surgical and Medical Practices: Ö.Ö., Concept: Ö.Ö., O.B., Design: Ö.Ö., Data Collection or Processing: Ö.Ö., Analysis or Interpretation: Ö.Ö., Literature Search: Ö.Ö., Writing: Ö.Ö.

Conflict of Interest: No conflict of interest was declared by the authors.

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