The Top-100 Most-Cited Articles on Meningioma

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Key words
- Analysis
- Articles
- Bibliometric
- Citation
- Meningioma
- Neurosurgery

Abbreviations and Acronyms
CY: Citation per year
SJR: SCImago Journal Rank
SNIP: Source-normalized impact per paper

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BACKGROUND: **There is an abundance of articles published on meningioma.**

OBJECTIVE: **To identify the 100 most-cited articles on meningioma and to perform a bibliometric analysis.**

METHODS: **In November 2016, we performed a title-specific search of the Scopus database using "meningioma" as our search query term without publication date restrictions. The top 100 most cited articles were obtained and reviewed.**

RESULTS: **The top 100 most cited articles received a mean 198 citations per paper. Publication dates ranged from 1953 to 2013; most articles were published between 1994 and 2003, with 50 articles published during that period. *NEUROSURGERY* published the greatest number of top cited articles (22 of 100). The most frequent study categories were laboratorial studies (31 of 100) and natural history studies (28 of 100). Nonoperative management studies were twice as common as operative management studies in the top-cited articles. Neurosurgery as a specialty contributed to 50% of the top 100 list. The most contributing institute was the Mayo Clinic (11%); the majority of the top cited articles originated in the United States (53%).**

CONCLUSIONS: **We identified the top 100 most-cited articles on meningioma that may be considered significant and impactful works, as well as the most noteworthy. In addition, we recognized the historical development and advances in meningioma research and the important contributions of various authors, specialty fields, and countries. A large proportion of the most cited articles were written by authors other than neurosurgeons, and many of these articles were published in non-neurosurgery journals.**

INTRODUCTION

The term "meningioma" was first described by Harvey Cushing in 1922 to describe tumors that originate from the dural sheath of the brain.[1] In their classic 1938 book, *Meningiomas, their Regional Behavior, Life History, and Surgical End Results*, Cushing and Louise Eisenhardt delivered a detailed explanation of meningiomas.[2] Meningiomas are generally benign neoplasms that represent approximately 36.4% of all central nervous system tumors and 53.4% of all benign central nervous system tumors.[3] In the United States, the overall incidence of meningioma is estimated to be approximately 7.86 per 100,000 population.[3]

There is a plethora of articles published on meningiomas, with various scopes that include natural history, epidemiology, etiology and genetics, and diagnostic and treatment strategies. However, because of the plethora of articles related to meningiomas, significant studies often are overlooked. Citation analysis serves to review the most-cited articles to identify publications that have the most recognition and impact in a given field and that represent landmark publications on the given topic.[4] Reflecting on historical trends in meningioma research can provide readers with a unique insight into the development and trends within a topic. Furthermore, it can provide useful information about scientific progress and the level of contributions made by individuals, countries, institutions, and journals. Lastly, these highly cited papers also may provide an educational guide to facilitate evidence-based clinical decision-making and operative techniques for trainees.

There are unquestionably several articles with important historical data that are not adequately valued by their citation counts alone. Nevertheless, the citation count remains an internationally accepted method by which an article's impact can be assessed. In the current study, we performed a bibliometric analysis of the 100 most impactful articles on meningiomas and analyzed their characteristics.

METHODS

Search Strategy

We performed a title-specific search of the Scopus database to identify highly cited articles on meningioma in November 2016. We used "meningioma" as our query term without restricting publication dates. The results were arranged in descending order according to the citation count. The

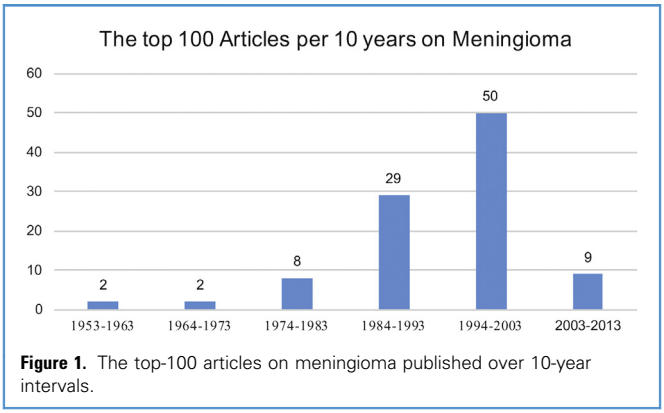

Figure 1. The top-100 articles on meningioma published over 10-year intervals.

top 100 most-cited articles were obtained and reviewed by the authors.

Data

The article title, all authors, first author's specialty, country of origin, journal of publication, year of publication, citation count, and study category were recorded. Per common practice, the senior author is the last-listed author in the author block.[5] Studies were divided into 7 categories as follows: natural history (observational, epidemiologic, prognostic, follow-up, pathologic, and radiologic studies that are linked to clinical evaluation), laboratory (animal, basic science, and pathologic studies without classification), nonoperative management (radiation therapies, medication-based therapies, and nonsurgical diagnostic studies), operative management (only surgical procedures and endovascular therapies), operative and nonoperative management (studies that included components of both operative and nonoperative management), classifications (pathologic, radiologic, and operative classification and grading studies), and review studies.

Bibliometric Parameters

We considered the following statistical parameters: author's h-index (which indicates each author's number of published articles and the number of citations received in other publications), SCImago Journal Rank (SJR; a parameter reflecting the scientific influence of a journal according to the number of listed citations it receives and the importance of the journal that the citation came from), journal source-normalized impact per paper (SNIP, which accounts for citations from the same discipline and provides a reflection of how discipline-specific a journal is), and article citation per year (CY, where we divided the number of received citations for a given article by the number of years since its publication).

The h-indices for authors who had 4 or more of the top 100 articles, as well as the SNIP and SJR scores for the top 5 journals according to the number of articles contributed to the top 100 articles, were obtained from the Scopus database.

RESULTS

Article Analysis

Our query produced 10,302 articles; the top 100 according to the citation count were identified per our aforementioned parameters (**Supplementary Table 1**). The top 100 most cited articles received a mean 198 citations per paper. The publication dates ranged from 1953 to 2013. We performed an analysis of publication trends by 10-year intervals according to the publication date range; between 1994 and 2003, 50 articles were published (**Figure 1**). The most frequently cited article (1026 citations) was "The Recurrence of intracranial Meningiomas After Surgical Treatment" by Simpson et al.[6] in the *Journal of Neurology, Neurosurgery, and Psychiatry* (1957).

Analysis of the top 10 articles showed that their citation counts ranged between (285 and 1026); all the top 10 papers were published before 1999, and the United States accounted for 5 of the top 10 papers (**Table 1**). We also analyzed the top 10 articles according to CY to overcome the analysis bias towards older studies; we found that the article by Simpson et al. was not in the top 10 (**Table 2**), and that the article by Mirimanoff et al. ranked sixth among the top 10 (**Table 2**), whereas it had ranked second according to citation count (**Table 1**). Laboratory studies and natural history studies contributed to 31% and 28% of the top 100 articles, respectively (**Table 3**). When we assessed the specialties of contributions, neurosurgery contributed to 50% of top 100 articles (**Table 4**). The Mayo Clinic contributed to 11 of the top 100 articles (**Table 5**). The United States was the country providing the most contributions (53%) to the top 100 articles (**Table 6**).

Author and Journal Analysis

The top 100 articles were contributed by 160 authors. Analysis of the top 10 authors according to their number of articles in the top 100, regardless of their positions of authorship, showed that A. Perry and B. W. Scheithauer both had 8 articles; however, Scheithauer had an author's h-index of 108, whereas that of Perry was 67 (**Table 7**). As for the most senior authors contributing to the top 100 cited articles, R. L. Martuza was the senior author who contributed most to the top 100 articles (**Table 1**). The top 100 articles on Meningioma were published in 33 journals. We evaluated the top 5 journals that contributed to 58 articles from our list; NEUROSURGERY had the greatest number of articles ($n = 22$), whereas the *Journal of Neurosurgery* had the second greatest number, with 20 articles (**Table 8**).

DISCUSSION

The significant escalation in the literature and exponential increase in biomedical information and resources created a unique set of difficulties for today's learner and researcher. To process a large amount of information in an efficient and timely manner, citation analysis reviews the most cited articles to identify those publications that have the most impact in a given field. A series of recent studies have identified the most cited articles in various medical fields such as anesthesiology,[7] critical care,[8] emergency medicine,[9] ophthalmology,[10] orthopedic surgery,[11] otolaryngology,[12] plastic surgery,[13] urology,[14] and neurosurgery.[4,15-23] More recent papers

Table 1. The Top 10 Most-Cited Publications on Meningioma

Rank	Citations	First Author	Last Author	Title	Year	Journal	Country
1	1026	Simpson, D.	None*	the Recurrence of intracranial Meningiomas After Surgical Treatment	1957	*Journal of Neurology, Neurosurgery, and Psychiatry*	United Kingdom
2	622	Mirimanoff, R.O.	Martuza, R.L.	Meningioma: Analysis of Recurrence and Progression Following Neurosurgical Resection	1985	*Journal of Neurosurgery*	United States
3	400	Goldsmith, B.J.	Larson, D.A.	Postoperative Irradiation for Subtotally Resected Meningiomas. A Retrospective Analysis of 140 Patients Treated from 1967 to 1990	1994	*Journal of Neurosurgery*	United States
4	397	Perry, A	Wollan, P.C.	'Malignancy' in Meningiomas: A Clinicopathologic Study of 116 Patients, with Grading Implications.	1999	*Cancer*	United States
5	364	Perry, A.	Lohse, C.M.	Meningioma Grading: An Analysis of Histologic Parameters	1997	*American Journal of Surgical Pathology*	United States
6	359	Ruttledge, M.H.	Rouleau, G.A.	Evidence for the Complete inactivation of the NF2 Gene in the Majority of Sporadic Meningiomas	1994	*Nature Genetics*	Canada and Sweden
7	313	Almefty, O.	Smith, R.R.	Petrosal Approach for Petroclival Meningiomas	1988	*Neurosurgery*	United States
8	304	Jääskeläinen, J.	Servo, A.	Atypical and Anaplastic Meningiomas: Radiology, Surgery, Radiotherapy, and Outcome	1986	*Surgical Neurology*	Finland
9	300	Jääskeläinen, J.	None*	Seemingly Complete Removal of Histologically Benign intracranial Meningioma: Late Recurrence Rate and Factors Predicting Recurrence in 657 Patients. A Multivariate Analysis	1986	*Surgical Neurology*	Finland
10	285	Weber, R.G.	Lichter, P.	Analysis of Genomic Alterations in Benign, Atypical, and Anaplastic Meningiomas: toward a Genetic Model of Meningioma Progression	1997	*Proceedings of the National Academy of Sciences of the United States of America*	Germany and Sweden.

*Single-author publication.

have addressed topics and subspecialties within the field of neurosurgery, such as the spine,[16,19,20,22] pediatric neurosurgery,[15] skull base,[21,23] and subarachnoid hemorrhage.[18] Another method of assessing impactful articles was presented recently by Wang et al.,[24] who analyzed the most trending works in neurosurgery by quantifying the distribution of an article based on modern electronic information sources, including the number of views and downloads on blogs as well as mentions and posts on social media (e.g., Twitter and Facebook), using Altmetrics (alternative metrics). That type of studies reflects the interest of both the public and scientific community on neurosurgical articles.

In 2010, a study by Ponce and Lozano[4] reported the top 100 most-cited articles in neurosurgery using a citation index; however, only 2 were specific to meningioma: "The Recurrence of Intracranial Meningiomas After Surgical Treatment" by Simpson (1957),[6] and "Meningioma: Analysis of Recurrence and Progression Following Neurosurgical Resection" by Mirimanoff et al. (1985).[25]

The number of citations is a reliable method for quantifying an article's quality and the impact of its contribution to the scientific community.[26] By identifying articles that are ranked in the highest percentile of citations, insight is gained into the history, development, and evaluation of the quality of research, as well as changes in clinical practice and the current trends and future directions within a given field. Not surprisingly, we found that the most-cited articles on meningioma were not limited to neurosurgery; in fact, a large number were written by authors of different specialties, including pathology, neurology, genetics, radiology, medical and radiation oncology, and others (**Table 4**).

The top 100 most-cited articles were published in 33 different journals between 1953 and 2013. NEUROSURGERY was the most frequent journal in our top-100 list, with 22 articles, followed by the *Journal of Neurosurgery* with 20 articles. Other top journals included *Cancer Research* ($n = 6$), *International Journal of Radiation Oncology*

Table 2. The Top 10 Articles According to CY

Rank	CY	First Author	Last Author	Title	Year	Journal	Country
1	45.67	Clark, V.E.	Günel, M.	Genomic Analysis of Non-NF2 Meningiomas Reveals Mutations in TRAF7, KLF4, AKT1, and SMO	2013	*Science*	United States and Turkey
2	30.6	Abdel-Rahman, M.H.	Davidorf, F.H.	Germline BAP1 Mutation Predisposes to Uveal Melanoma, Lung Adenocarcinoma, Meningioma, and Other Cancers	2011	*Journal of Medical Genetics*	United States
3	25.375	Gardner, P.A.	Prevedello, D.M.	Endoscopic Endonasal Resection of Anteriorcranial Base Meningiomas	2008	*Neurosurgery*	United States
4	23.35	Perry, A.	Wollan, P.C.	'Malignancy' in Meningiomas: a Clinicopathologic Study of 116 Patients, with Grading Implications	1999	*Cancer*	United States
5	22	Kondziolka, D.	Flickinger, J.C.	Radiosurgery as Definitive Management of intracranial Meningiomas	2008	*Neurosurgery*	United States
6	20	Mirimanoff, R.O.	Martuza, R.L.	Meningioma: Analysis of Recurrence and Progression Following Neurosurgical Resection	1985	*Journal of Neurosurgery*	United States
7	19.8	Couldwell, W.T.	Weiss, M.H.	Petroclival Meningiomas: Surgical Experience in 109 Cases	1996	*Journal of Neurosurgery*	United States
8	19.7	Aghi, M.K.	Barker, F.G.	Long-Term Recurrence Rates of Atypical Meningiomas After Gross total Resection with or without Postoperative Adjuvant Radiation	2009	*Neurosurgery*	United States
9	19.5	Perry, A.	Lohse, C.M.	Meningioma Grading: an Analysis of Histologic Parameters	1997	*American Journal of Surgical Pathology*	United States
10	18.8	Goldsmith, B.J.	Larson, D.A.	Postoperative Irradiation for Subtotally Resected Meningiomas. A Retrospective Analysis of 140 Patients Treated from 1967 to 1990	1994	*Nature Genetics*	United States

CY, citation per year.

Biology Physics ($n = 5$), and *Surgical Neurology* (now known as *World Neurosurgery*, $n = 5$) (Table 8). In our analysis, the top 5 most contributing journals to our study were compared via the SNIP and SJR scoring system. *Cancer Research* was ranked as the third most contributing journal in our study with the greatest SNIP (5.372) and SJR (1.921) scores (Table 8).

We found an average citation count of 198 (range 131–1026) in the top 100 papers on meningioma. Most papers in the decades before 1985 focused on understanding this condition's natural history, epidemiology, histopathology, grading, and outcome after surgical resection, as well as the role of radiotherapy. Between 1985 and 2000, numerous articles concentrated on the natural history, epidemiology, histopathology, and grading as well (including those on malignant meningiomas); however, greater attention began to shift toward understanding the role of radiation therapy/radiosurgery pre- or postsurgical resection as well as survival analysis. In addition, many articles reviewed the molecular and genetic components of meningioma, introduced novel medical agents, and described surgical challenges with skull base meningioma. Papers published since 2000 provided stronger-quality data with deeper knowledge of genetic and molecular studies, introduced novel technologies and more nonsurgical management options, and better described minimally invasive surgeries. The most productive decade of meningioma research in our top-100 list was in 1994–2003, with 50

Table 3. Study Categories in the Top-100 Articles on Meningioma

Study Category	Percentage
Laboratory study	31
Natural history study	28
Nonoperative management study	22
Operative management study	11
Classification study	5
Review study	2
Operative and nonoperative management study	1

Table 4. Specialties of Contributions in the Top-100 Articles on Meningioma

Specialty	Percentage
Neurosurgery	50
Pathology	16
Oncology	13
Genetics	10
Radiology	6
Preventive medicine	2
Neurology	2
Ophthalmology	1

articles published in that period (Figure 1). This is similar to other published citation analysis studies on neurosurgical topics, such as epilepsy, Parkinson disease, and aneurysmal subarachnoid hemorrhage, which revealed that a majority of highly cited articles were published in 1990–1999.[18,27,28]

Laboratory studies were the most popular study category in the top 100 articles, with a total of 31 works. The second most common category was natural history studies, with 28 articles. Surprisingly, nonoperative management studies were twice as popular as operative management studies, with 22 and 11 articles, respectively. Among nonoperative management studies, 20 articles involved the role of radiation therapy and radiosurgery in meningioma. The fact that many studies are related to radiation therapy and radiosurgery is interesting in that meningiomas appear to be best treated in a multidisciplinary and multimodal fashion. Additional topics investigated under the nonoperative management category include the role of antiprogesterone agents with unresectable meningiomas[29] and the use of hydroxyurea for the treatment of unresectable and recurrent meningiomas.[30] These 2 articles were the 17th and 80th on our top-100 list, respectively. The remaining study categories were classifications, reviews, and operative and nonoperative management studies (Table 3). When examining studies by research title, we found that no top-100 article focused on randomized controlled trials; these are lacking in the field of neurosurgery as a whole, and meningioma as a topic is no different. It remains to be seen whether randomized trials on meningioma will gain popularity going forward.

Table 5. Top 5 Institutions Contributing to the Top-100 Articles on Meningioma

Institution	Number of Articles
Mayo Clinic	11
University of Pittsburgh	6
Massachusetts General Hospital	6
Karolinska University Hospital	5
Washington University in St. Louis, School of Medicine	5

Table 6. Top Countries of Contribution in the Top-100 Articles on Meningioma

Country	Percentage
United States	53.09
Germany	13.27
Canada	7.07
Sweden	6.19
Japan	5.3
Austria	2.65
Finland	2.65
France	1.76
Italy	1.76
Turkey	1.76
Brazil	0.88
Denmark	0.88
Hungary	0.88
Israel	0.88
United Kingdom	0.88

Table 7. The Most Common Authors in the Top-100 Articles

Author	Number of Articles	Author's h-Index
Perry, A.	8	67
Scheithauer, B.W.	8	108
Flickinger, J.C.	7	86
Kondziolka, D.	7	90
Stafford, S.L.	6	36
Collins, V.P.	5	75
Lohse, C.M.	5	70
Lunsford, L.D.	6	87
Gutmann, D.H.	4	73

Among the most frequently cited articles, publication dates ranged from 1953[31] to 2013[32]; the most cited article in our top-100 list was Simpson's 1957 article in the *Journal of Neurology, Neurosurgery, and Psychiatry* (Figure 2).[6] The Simpson grading system has been used widely to determine prognoses and to compare the outcomes of different surgical approaches. This study has been consistently cited since publication in 1957, with a total of 1026 citations; it is also one of the most cited works in the neurosurgical literature as identified by Ponce and Lozano.[4]

The second most cited article was in the *Journal of Neurosurgery*, authored by Mirimanoff et al. (1985).[25] This article outlined the prognoses, recurrence rates, and tumor progressions in 225 patients with meningioma who underwent only surgical resection. In this paper, the authors recommended that radiotherapy be considered in the overall treatment plan of meningioma. Their conclusion may explain why the meningioma literature has focused on assessing the role of radiation therapy and why there are 20 articles on our list that focused on evaluating the role of radiation therapy and radiosurgery. Furthermore, despite not being the most cited article in our top-100 list, this paper currently is accumulating citations at a rapid pace; it has been cited 622 times since its publication in 1985, with an average of 20 citations per year. This is a faster pace than the paper of Simpson, which has received an average of 17.4 citations per year. the greater number of average citations per year indicates that this work has had a greater impact on the management of meningioma.

The third most-cited article was the 1994 work of Goldsmith et al.[33] in the *Journal of Neurosurgery*, which received 400 citations. These authors described 140 patients who underwent radiation therapy after subtotal resection of meningioma. They showed that radiation therapy is effective and safe,

Table 8. The Top-5 Journals Containing the Top-100 Articles on Meningioma

Rank	Journal	Number of Citations	SNIP	SJR
1	*Neurosurgery*	22	1.444	1.414
2	*Journal of Neurosurgery*	20	1.764	1.673
3	*Cancer Research*	6	1.921	5.372
4	*international Journal of Radiation Oncology Biology Physics*	5	1.630	2.274
5	*World Neurosurgery "Surgical Neurology"*	5	0.852	0.652

SNIP, source-normalized impact per paper; SJR, SCImago journal rank.

with results that are considerably superior to observation alone after subtotal resection. Another noteworthy article on our top-100 list was by Clark et al.,[32] which has received 137 citations since publication in 2013. It is the most recently published paper on our top-100 list and is one of the few articles published in a high-impact factor journal (*Science*). However, this article was ranked 84th on our list, with the highest number of citations per year, 45.67 (Table 2). Many authors have published citation analyses in the field of neurosurgery[19,34-37] and have included the CY for each paper in their data. Although CY is used to overcome the bias of total citation counts, it has its own inherent bias toward recently published papers. Nevertheless, CY is used primarily to evaluate the current relevance of an article to the scientific community, regardless of its time of publication. For example, those searching for publications of historical importance might read papers with high total citation counts but low CY. Alternatively, researchers who wish to understand the current practice patterns might benefit more from articles with both high total citation counts and CY.

These publications encompass a wide variety of authors, institutions, journals, and topics. The United States had a strong influence; 53% of the top articles originated from institutions in that country, whereas 13% were from Germany, and 7% from Canada (Table 6). When we examined the publications by individual first authors, we found that A. Perry and B. W. Scheithauer each had 8 articles; however, Scheithauer had an author's h-index of 108, whereas Perry's was 67 (Table 7). R. L. Martuza was the senior author with the most contributions to the top-100 articles; one article was the second most cited paper in our list (Table 1).

Three institutions in particular have made a significant contribution to this topic. The Mayo Clinic, University of Pittsburgh, and Massachusetts General Hospital collectively have produced 23 articles on our top-100 list (Table 5). The top

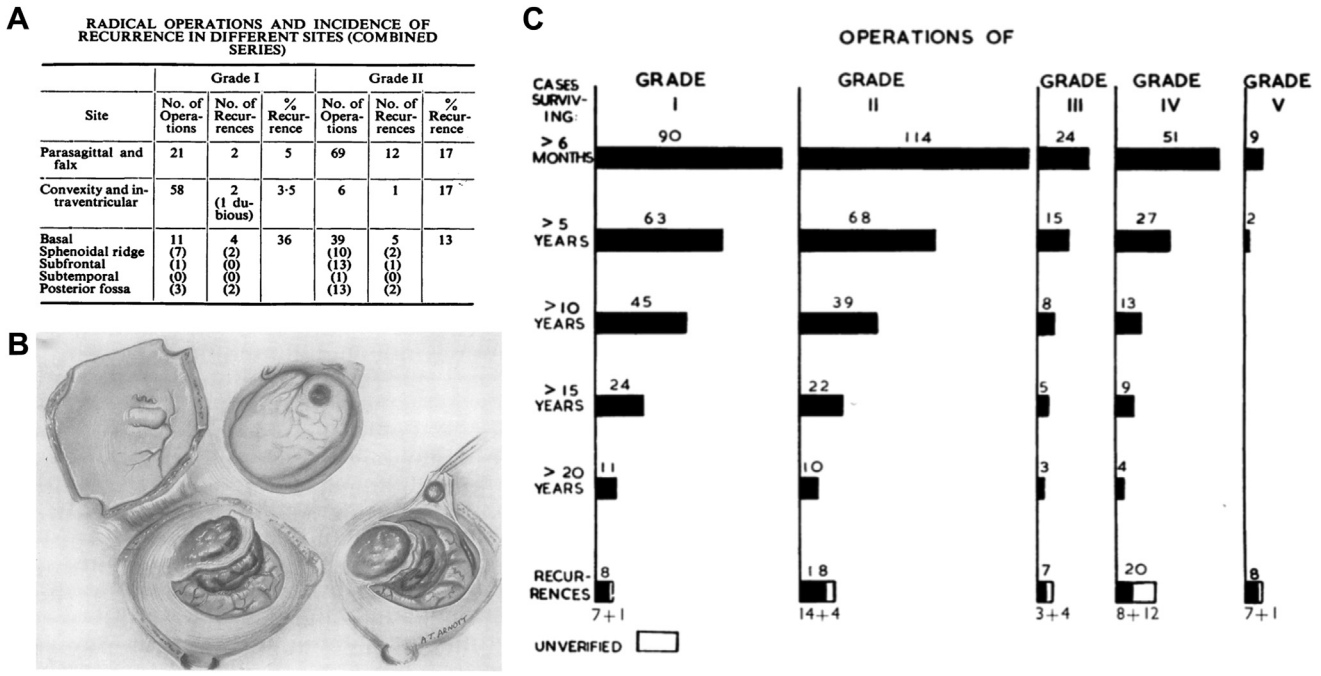

Figure 2. Original figures from the report of Simpson.[6] (**A**) Radical operations and incidences of recurrence at different sites (combined series). (**B**) Surgical diagram of a meningioma of the cerebral convexity; a second smaller meningioma lies near it, and could easily escape notice. (**C**) Diagram showing the operation grades, survival times, and frequencies of recurrence in the combined Oxford and London series. These figure panels were reproduced from Simpson,[6] with permission from BMJ Publishing Group Ltd.

3 most contributing specialties to the top 100 most cited articles are neurosurgery (50%), pathology (16%), and oncology (13%), respectively (Table 4).

Although we specifically classified the studies into categories in this report, separate analyses of each of the categories were not performed. Furthermore, bibliometric studies contain several inherent limitations. Currently, the Scopus database includes papers published between 1823 and 2017, albeit without full bibliometric representation for papers published before 1996.[38] Therefore, we may have missed older citations, resulting in the omission of studies dating back to the early 20th century. Second, the aforementioned analysis bias toward accumulated citations for older studies may provide an inaccurate reflection of the articles' impacts; however, we addressed this by using CY.[39,40] For example, our number 1 article by Simpson received 1026 citations since its publication but was ranked the 12th most common according to CY. Third is the existence of self-citations, in-house citations (where multiple authors share authorship as a collaboration rather than a representation of their own work), and omission bias (when authors reference only articles that support their hypotheses).[41-43] We quantified the number of self-citations in our top-100 list to assess their influence and discovered that, self-citation contributes to only 2.8% of the total citation counts on average; this represents only a small portion of such counts. Fourth is the possibility of citation obliteration by incorporation. i.e., information presented in classic papers become common knowledge and are not referenced.[19] Fifth is the inclusion of only English-language articles. Additional limitations include incomplete citations (as a strategy of attracting readers rather than representing the most impactful articles)[19] and the validity of the notion that the citation count directly reflects an article's importance and impact.[26]

CONCLUSIONS

Bibliometric studies have several common limitations. Using the Scopus database, we identified the top 100 most-cited articles on meningioma that may be considered significant and impactful works, as well as the most noteworthy. In addition, we recognized the historical development and advances in meningioma research, and the important contributions of various authors, specialty fields, and countries to the body of literature concerning this disease. A large proportion of the most cited articles were written by authors other than neurosurgeons, and many of these articles were published in non-neurosurgery journals. Randomized clinical trials were absent from the most cited articles on meningioma; it remains to be seen whether such trials will be cited more frequently in the coming years. These top-cited articles may guide future research and serve as an educational guide for trainees.

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REFERENCES

1. Cushing H. The meningiomas (dural endotheliomas): their source, and favoured seats of origin. *Brain*. 1922;45:282-316.
2. Cushing H, Eisenhardt L. *Meningiomas, Their Classification, Regional Behavior, Life History and Surgical End Results*. Springfield, IL, Baltimore: Charles C. Thomas; 1938.
3. Ostrom QT, Gittleman H, Fulop J, Liu M, Blanda R, Kromer C, et al. CBTRUS Statistical Report: primary brain and central nervous system tumors diagnosed in the United States in 2008–2012. *Neuro Oncol*. 2015;17(suppl 4):iv1-iv62.
4. Ponce FA, Lozano AM. Highly cited works in neurosurgery. Part I: the 100 top-cited papers in neurosurgical journals. *J Neurosurg*. 2010;112:223-232.
5. Bhattacharya S. Authorship issue explained. *Indian J Plast Surg*. 2010;43:233-234.
6. Simpson D. The recurrence of intracranial meningiomas after surgical treatment. *J Neurol Neurosurg Psychiatry*. 1957;20:22-39.
7. Tripathi RS, Blum JM, Papadimos TJ, Rosenberg AL. A bibliometric search of citation classics in anesthesiology. *BMC Anesthesiol*. 2011;11:24.
8. Rosenberg AL, Tripathi RS, Blum J. The most influential articles in critical care medicine. *J Crit Care*. 2010;25:157-170.
9. Munzer BW, Love J, Shipman BL, Byrne B, Cico SJ, Furlong R, et al. An analysis of the top-cited articles in emergency medicine education literature. *West J Emerg Med*. 2017;18:60-68.
10. Ohba N, Nakao K, Isashiki Y, Ohba A. The 100 most frequently cited articles in ophthalmology journals. *Arch Ophthalmol-Chic*. 2007;125:952-960.
11. Kavanagh RG, Kelly JC, Kelly PM, Moore DP. The 100 classic papers of pediatric orthopaedic surgery: a bibliometric analysis. *J Bone Joint Surg Am*. 2013;95:e134.
12. Lenzi R, Fortunato S, Muscatello L. Top-cited articles of the last 30 years (1985–2014) in otolaryngology—head and neck surgery. *J Laryngol Otol*. 2016;130:121-127.
13. Sinha Y, Iqbal FM, Spence JN, Richard B. A bibliometric analysis of the 100 most-cited articles in rhinoplasty. *Plast Reconstr Surg Glob Open*. 2016;4:e820.
14. Nason GJ, Tareen F, Mortell A. The top 100 cited articles in urology: an update. *Can Urol Assoc J*. 2013;7:E16-E24.
15. Wilcox MA, Khan NR, McAbee JH, Boop FA, Klimo P Jr. Highly cited publications in pediatric neurosurgery. *Childs Nerv Syst*. 2013;29:2201-2213.
16. Skovrlj B, Al Maaieh M, Guzman J, Caridi J, Cho SK. The 100 classic papers in spinal deformity surgery. *Spine Deform*. 2014;2:241-247.
17. Khan NR, Lee SL, Brown M, Reding J, Angotti J, Lepard J, et al. Highly cited works in skull base neurosurgery. *World Neurosurg*. 2015;83:403-418.
18. Alotaibi NM, Nassiri F, Badhiwala JH, Witiw CD, Ibrahim GM, Macdonald RL, et al. The most cited works in aneurysmal subarachnoid hemorrhage: a bibliometric analysis of the 100 most cited articles. *World Neurosurg*. 2016;89:587-592.
19. Cohen J, Alan N, Zhou J, Hamilton DK. The 100 most cited articles in metastatic spine disease. *Neurosurg Focus*. 2016;41:E10.
20. De la Garza-Ramos R, Benvenutti-Regato M, Caro-Osorio E. The 100 most-cited articles in spinal oncology. *J Neurosurg-Spine*. 2016;24:810-823.
21. Hardesty DA, Ponce FA, Little AS, Nakaji P. A quantitative analysis of published skull base endoscopy literature. *J Neurol Surg B Skull Base*. 2016;77:24-31.
22. Skovrlj B, Steinberger J, Guzman JZ, Overley SC, Qureshi SA, Caridi JM, et al. The 100 most influential articles in cervical spine surgery. *Global Spine J*. 2016;6:69-79.
23. Zhang M, Singh H, Almodovar-Mercado GJ, Anand VK, Schwartz TH. Required reading: the most impactful articles in endoscopic endonasal skull base surgery. *World Neurosurg*. 2016;92:499-512.
24. Wang J, Alotaibi NM, Ibrahim GM, Kulkarni AV, Lozano AM. The spectrum of altmetrics in neurosurgery: the top 100 "trending" articles in neurosurgical journals. *World Neurosurg*. 2017;103:883-895.e1.
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.

26. Moed HF. New developments in the use of citation analysis in research evaluation. *Arch Immunol Ther Exp (Warsz)*. 2009;57:13-18.

27. Ponce FA, Lozano AM. The most cited works in Parkinson's disease. *Mov Disord*. 2011;26:380-390.

28. Ibrahim GM, Snead OC, Rutka JT, Lozano AM. The most cited works in epilepsy: trends in the "Citation Classics". *Epilepsia*. 2012;53:765-770.

29. Grunberg SM, Weiss MH, Spitz IM, Ahmadi J, Sadun A, Russell CA, et al. Treatment of unresectable meningiomas with the antiprogesterone agent mifepristone. *J Neurosurg*. 1991;74:861-866.

30. Schrell UM, Rittig MG, Anders M, Koch UH, Marschalek R, Kiesewetter F, et al. Hydroxyurea for treatment of unresectable and recurrent meningiomas. II. Decrease in the size of meningiomas in patients treated with hydroxyurea. *J Neurosurg*. 1997;86:840-844.

31. Castellano F, Ruggiero G. Meningiomas of the posterior fossa. *Acta Radiol Suppl*. 1953;104:1-177.

32. Clark VE, Erson-Omay EZ, Serin A, Yin J, Cotney J, Ozduman K, et al. Genomic analysis of non-NF2 meningiomas reveals mutations in TRAF7, KLF4, AKT1, and SMO. *Science*. 2013;339:1077-1080.

33. Goldsmith BJ, Wara WM, Wilson CB, Larson DA. Postoperative irradiation for subtotally resected meningiomas. A retrospective analysis of 140 patients treated from 1967 to 1990. *J Neurosurg*. 1994;80:195-201.

34. Bohl MA, Ponce FA. Assessing the relevancy of highly cited works in neurosurgery. PART I: the 100 most relevant papers in neurosurgical journals. *World Neurosurg*. 2017;104:927-938.

35. Kim ES, Yoon DY, Kim HJ, Jeon HJ, Lee JY, Cho BM, et al. Citation classics in neurointerventional research: a bibliometric analysis of the 100 most cited articles. *J Neurointerv Surg*. 2017;9:508-511.

36. Zhou J, Agarwal N, Hamilton DK, Koltz MT. The 100 most influential publications pertaining to intracranial aneurysms and aneurysmal subarachnoid hemorrhage. *J Clin Neurosci*. 2017;42:28-42.

37. Alan N, Cohen J, Ozpinar A, Agarwal N, Kanter AS, Okonkwo DO, et al. Top 50 most cited articles on primary tumors of the spine. *J Clin Neurosci*. 2017;42:19-27.

38. Jacso P. The h-index, h-core citation rate and the bibliometric profile of the Scopus database. *Online Inform Rev*. 2011;35:492-501.

39. Gisvold SE. Citation analysis and journal impact factors—is the tail wagging the dog? *Acta Anaesthesiol Scand*. 1999;43:971-973.

40. Seglen PO. Citation rates and journal impact factors are not suitable for evaluation of research. *Acta Orthop Scand*. 1998;69:224-229.

41. Dumont JE. The bias of citations. *Trends Biochem Sci*. 1989;14:327-328.

42. Marx W, Schier H, Wanitschek M. Citation analysis using online databases: feasibilities and shortcomings. *Scientometrics*. 2001;52:59-82.

43. Braun T. The reliability of total citation rankings. *J Chem Inf Comput Sci*. 2003;43:45-46.

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SUPPLEMENTARY DATA

Supplementary Table 1. List of the Top-100 Articles in Meningioma

Rank	Citations	Citation per Year (Rank)	First Author	Title	Year	Journal
1	1026	17.4 (12th)	Simpson, D.	The Recurrence of intracranial Meningiomas After Surgical Treatment	1957	*Journal of Neurology, Neurosurgery, and Psychiatry*
2	622	20 (6th)	Mirimanoff, R.O.	Meningioma: Analysis of Recurrence and Progression Following Neurosurgical Resection	1985	*Journal of Neurosurgery*
3	400	18.8 (10th)	Goldsmith, B.J.	Postoperative Irradiation for Subtotally Resected Meningiomas. A Retrospective Analysis of 140 Patients Treated from 1967 to 1990	1994	*Journal of Neurosurgery*
4	397	23.3 (4th)	Perry, A	'Malignancy' in Meningiomas: A Clinicopathologic Study of 116 Patients, with Grading Implications	1999	*Cancer*
5	364	19.1 (9th)	Perry, A.	Meningioma Grading: An Analysis of Histologic Parameters	1997	*American Journal of Surgical Pathology*
6	359	16.3 (12th)	Ruttledge, M.H.	Evidence for the Complete inactivation of the NF2 Gene in the Majority of Sporadic Meningiomas	1994	*Nature Genetics*
7	313	11.1 (27th)	Almefty, O.	Petrosal Approach for Petroclival Meningiomas	1988	*Neurosurgery*
8	304	10.1 (37th)	Jääskeläinen, J.	Atypical and Anaplastic Meningiomas: Radiology, Surgery, Radiotherapy, and Outcome	1986	*Surgical Neurology*
9	300	10 (39th)	Jääskeläinen, J.	Seemingly Complete Removal of Histologically Benign intracranial Meningioma: Late Recurrence Rate and Factors Predicting Recurrence in 657 Patients. A Multivariate Analysis	1986	*Surgical Neurology*
10	285	15 (16th)	Weber, R.G.	Analysis of Genomic Alterations in Benign, Atypical, and Anaplastic Meningiomas: toward a Genetic Model of Meningioma Progression	1997	*Proceedings of the National Academy of Sciences of the United States of America*
11	271	8.2 (64th)	Adegbite, A.B.	The Recurrence of intracranial Meningiomas After Surgical Treatment	1983	*Journal of Neurosurgery*
12	263	13.1 (20th)	Carneiro, S.S.	Solitary Fibrous Tumor of the Meninges: A Lesion Distinct from Fibrous Meningioma: A Clinicopathologic and Immunohistochemical Study	1996	*American Journal of Clinical Pathology*
13	252	10.9 (28th)	Mahmood, A.	Atypical and Malignant Meningiomas: A Clinicopathological Review	1993	*Neurosurgery*
14	252	10 (38th)	Kawase, T.	Anterior Transpetrosal-Transtentorial Approach for Sphenopetroclival Meningiomas: Surgical Method and Results in 10 Patients	1991	*Neurosurgery*
15	245	7.6 (68th)	Chan, R.C.	Morbidity, Mortality, and Quality of Life Following Surgery for intracranial Meningiomas. A Retrospective Study in 257 Cases	1984	*Journal of Neurosurgery*
16	244	10.6 (35th)	Black, P.M.	Meningiomas	1993	*Neurosurgery*
17	239	9.5 (45th)	Grunberg, S.M.	Treatment of Unresectable Meningiomas with the Antiprogesterone Agent Mifepristone	1991	*Journal of Neurosurgery*
18	237	15.8 (13th)	Stafford, S.L.	Meningioma Radiosurgery: Tumor Control, Outcomes, and Complications Among 190 Consecutive Patients	2001	*Neurosurgery*
19	227	8.4 (60th)	Rohringer, M.	incidence and Clinicopathological Features of Meningioma	1989	*Journal of Neurosurgery*
20	220	15.7 (14th)	Lee, J.Y.K.	Stereotactic Radiosurgery Providing Long-Term Tumor Control of Cavernous Sinus Meningiomas	2002	*Journal of Neurosurgery*
21	218	10.9 (30th)	Mathiesen, T.	Recurrence of Cranial Base Meningiomas	1996	*Neurosurgery*
22	216	8.3 (62nd)	Takahashi, J.A.	Gene Expression of Fibroblast Growth Factors in Human Gliomas and Meningiomas: Demonstration of Cellular Source of Basic Fibroblast Growth Factor mRNA and Peptide in Tumor Tissues	1990	*Proceedings of the National Academy of Sciences of the United States of America*

Continues

Supplementary Table 1. Continued

Rank	Citations	Citation per Year (Rank)	First Author	Title	Year	Journal
23	213	7.3 (69th)	Seizinger, B.R.	Molecular Genetic Approach to Human Meningioma: Loss of Genes and Chromosome 22	1987	*Proceedings of the National Academy of Sciences of the United States of America*
24	212	9.6 (44th)	Demonte, F.	Outcome of Aggressive Removal of Cavernous Sinus Meningiomas	1994	*Journal of Neurosurgery*
25	212	7.3 (70th)	Barbaro, N.M.	Radiation therapy in the Treatment of Partially Resected Meningiomas	1987	*Neurosurgery*
26	208	10.9 (29th)	Hsu, D.W.	Progesterone and Estrogen Receptors in Meningiomas: Prognostic Considerations	1997	*Journal of Neurosurgery*
27	204	12 (24th)	Kondziolka, D.	Long-Term Outcomes After Meningioma Radiosurgery: Physician and Patient Perspectives	1999	*Journal of Neurosurgery*
28	203	25.3 (3rd)	Gardner, P.A.	Endoscopic Endonasal Resection of Anterior Cranial Base Meningiomas	2008	*Neurosurgery*
29	200	8.6 (57th)	Duma, C.M.	Stereotactic Radiosurgery of Cavernous Sinus Meningiomas as an Addition or Alternative to Microsurgery	1993	*Neurosurgery*
30	200	8.33 (61st)	Maier, H.	Classic, Atypical, and Anaplastic Meningioma: Three Histopathological Subtypes of Clinical Relevance	1992	*Journal of Neurosurgery*
31	199	13.2 (19th)	Henze, M.	PET Imaging of Somatostatin Receptors Using [68GA]DOTA-D-Phe1-Tyr3-Octreotide: First Results in Patients with Meningiomas	2001	*Journal of Nuclear Medicine*
32	198	19.8 (7th)	Couldwell, W.T.	Petroclival Meningiomas: Surgical Experience in 109 Cases	1996	*Journal of Neurosurgery*
33	198	9.4 (49th)	Wellenreuthe, R.	Analysis of the neurofibromatosis 2 gene reveals molecular variants of meningioma	1995	*American Journal of Pathology*
34	194	9.2 (52nd)	Simon, M.	Allelic Losses on Chromosomes 14, 10, and 1 in Atypical and Malignant Meningiomas: A Genetic Model of Meningioma Progression	1995	*Cancer Research*
35	191	7.9 (66th)	Kallio, M.	Factors Affecting Operative and Excess Long-Term Mortality in 935 Patients with intracranial Meningioma	1992	*Neurosurgery*
36	181	15 (15th)	Provenzale, J.M.	Peritumoral Brain Regions in Gliomas and Meningiomas: investigation with Isotropic Diffusion-Weighted MR Imaging and Diffusion-Tensor MR Imaging	2004	*Radiology*
37	181	6.4 (78th)	Taylor, B.W., Jr.	The Meningioma Controversy: Postoperative Radiation Therapy	1998	*International Journal of Radiation Oncology, Biology, Physics*
38	179	10.5 (36th)	Morita, A.	Risk of injury to Cranial Nerves After Gamma Knife Radiosurgery for Skull Base Meningiomas: Experience in 88 Patients	1999	*Journal of Neurosurgery*
39	178	4.3 (93rd)	Jellinger, K.	Histological Subtypes and Prognostic Problems in Meningiomas	1975	*Journal of Neurology*
40	176	22 (5th)	Kondziolka, D.	Radiosurgery as Definitive Management of Intracranial Meningiomas	2008	*Neurosurgery*
41	176	9.7 (43rd)	Perry, A.	The Prognostic Significance of MIB-1, p53, and DNA Flow Cytometry in Completely Resected Primary Meningiomas	1998	*Cancer*
42	176	9.2 (51st)	Palma, L.	Long-Term Prognosis for Atypical and Malignant Meningiomas: A Study of 71 Surgical Cases	1997	*Journal of Neurosurgery*
43	175	6.4 (77th)	Samii, M.	Surgery of Petroclival Meningiomas: Report of 24 Cases	1989	*Neurosurgery*
44	174	4.2 (94th)	Schoenberg, B.S.	Nervous System Neoplasms and Primary Malignancies of Other Sites: the Unique Association Between Meningiomas and Breast Cancer	1975	*Neurology*
45	172	9.5 (46th)	Subach, B.R.	Management of Petroclival Meningiomas by Stereotactic Radiosurgery	1998	*Neurosurgery*
46	172	9.5 (47th)	Bostrom, J.	Mutation of the PTEN (MMAC1) Tumor Suppressor Gene in a Subset of Glioblastomas but Not in Meningiomas with Loss of Chromosome Arm 10q	1998	*Cancer Research*

Continues

Supplementary Table 1. Continued

Rank	Citations	Citation per Year (Rank)	First Author	Title	Year	Journal
47	172	9 (53rd)	Perry, A.	The Immunophenotypic Spectrum of Meningeal Hemangiopericytoma: A Comparison with Fibrous Meningioma and Solitary Fibrous Tumor of Meninges	1997	*American Journal of Surgical Pathology*
48	172	9.05 (54th)	Condra, K.S.	Benign Meningiomas: Primary Treatment Selection Affects Survival	1997	*International Journal of Radiation Oncology Biology Physics*
49	171	10.6 (32nd)	Hug, E.B.	Management of Atypical and Malignant Meningiomas: Role of High-Dose, 3D-Conformal Radiation Therapy	2000	*Journal of Neuro-Oncology*
50	170	10.6 (33rd)	Antiheimo, J.	Population-Based Analysis of Sporadic and Type 2 Neurofibromatosis-Associated Meningiomas and Schwannomas	2000	*Neurology*
51	170	6.2 (80th)	Preston-Martin, S.	Risk Factors for Gliomas and Meningiomas in Males in Los Angeles County	1989	*Cancer Research*
52	170	5.8 (82th)	Dumanski, J.P.	Deletion Mapping of a Locus on Human Chromosome 22 involved in the Oncogenesis of Meningioma	1987	*Proceedings of the National Academy of Sciences of the United States of America*
53	169	4.9 (91st)	Levy, Jr.	Spinal Cord Meningioma	1982	*Journal of Neurosurgery*
54	168	11.2 (26th)	Debus, J.	High Efficacy of Fractionated Stereotactic Radiotherapy of Large Base-of-Skull Meningiomas: Long-Term Results	2001	*Journal of Clinical oncology*
55	167	12.8 (21st)	Nakamura, M.	The Natural History of incidental Meningiomas	2003	*Neurosurgery*
56	167	9.2 (50th)	Stafford, S.L.	Primarily Resected Meningiomas: Outcome and Prognostic Factors in 581 Mayo Clinic Patients, 1978 Through 1988	1998	*Mayo Clinic Proceedings*
57	164	11.7 (25th)	Fahlbusch, R.	Pterional Surgery of Meningiomas of the Tuberculum Sellae and Planum Sphenoidale: Surgical Results with Special Consideration of Ophthalmological and Endocrinological Outcomes	2002	*Journal of Neurosurgery*
58	164	5.7 (86th)	Di Chiro, G.	Glucose Utilization By intracranial Meningiomas as an index of Tumor Aggressivity and Probability of Recurrence: A PET Study	1987	*Radiology*
59	162	10.8 (31st)	Filippi, C.G.	Appearance of Meningiomas on Diffusion-Weighted Images: Correlating Diffusion Constants with Histopathologic Findings	2001	*American Journal of Neuroradiology*
60	160	12.3 (23rd)	Pollock, B.E.	Stereotactic Radiosurgery Provides Equivalent Tumor Control to Simpson Grade 1 Resection for Patients with Small- to Medium-Size Meningiomas	2003	*International Journal of Radiation oncology Biology Physics*
61	160	8.9 (55th)	Hakim, R.	Results of Linear Accelerator-Based Radiosurgery for intracranial Meningiomas	1998	*Neurosurgery*
62	155	5.7 (87th)	Elster, A.D.	Meningiomas: MR and Histopathologic Features	1989	*Radiology*
63	154	8.5 (58th)	Kondziolka, D.	Judicious Resection and/or Radiosurgery for Parasagittal Meningiomas: Outcomes from a Multicenter Review	1998	*Neurosurgery*
64	153	30.6 (2nd)	Abdel-Rahman, M.H.	Germline BAP1 Mutation Predisposes to Uveal Melanoma, Lung Adenocarcinoma, Meningioma, and Other Cancers	2011	*Journal of Medical Genetics*
65	152	8 (65th)	Provias, J.	Meningiomas: Role of Vascular Endothelial Growth Factor/Vascular Permeability Factor in Angiogenesis and Peritumoral Edema	1997	*Neurosurgery*
66	152	7.2 (72nd)	Zorludemir, S.	Clear Cell Meningioma: A Clinicopathologic Study of A Potentially Aggressive Variant of Meningioma	1995	*American Journal of Surgical Pathology*
67	152	3.7 (96th)	Wara, W.M.	Radiation Therapy of Meningiomas	1975	*American Journal of Roentgenology*
68	151	9.4 (48th)	Gutmann, D.H.	Loss of DAL-1, A Protein 4.1-Related Tumor Suppressor, Is an Important Early Event in the Pathogenesis of Meningiomas	2000	*Human Molecular Genetics*

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Supplementary Table 1. Continued

Rank	Citations	Citation per Year (Rank)	First Author	Title	Year	Journal
69	148	9.8 (41st)	Bostrom, J.	Alterations of the Tumor Suppressor Genes CDKN2A (P16ink4a), P14arf, CDKN2B (P15ink4b), and CDKN2C (P18ink4c) in Atypical and Anaplastic Meningiomas	2001	*American Journal of Pathology*
70	147	5.2 (89th)	Hakuba, A.	A Combined Retroauricular and Preauricular Transpetrosal-Transtentorial Approach to Clivus Meningiomas	1988	*Surgical Neurology*
71	147	3.3 (98th)	Limas, C.	Meningeal Melanocytoma ("Melanotic Meningioma"). Its Melanocytic Origin as Revealed by Electron Microscopy	1972	*Cancer*
72	146	6.6 (76th)	De Jesus, O.	Long-Term Follow-Up of Patients with Meningiomas involving the Cavernous Sinus: Recurrence, Progression, and Quality of Life	1996	*Neurosurgery*
73	146	4.7 (92nd)	Jääskeläinen, J.	the Growth Rate of intracranial Meningiomas and Its Relation to Histology. An Analysis of 43 Patients	1985	*Surgical Neurology*
74	144	5.76 (85th)	Harrison, M.J.	Radiation-induced Meningiomas: Experience At the Mount Sinai Hospital and Review of the Literature	1991	*Journal of Neurosurgery*
75	144	5.5 (88th)	Dumanski, J.P.	Molecular Genetic Analysis of Chromosome 22 in 81 Cases of Meningioma	1990	*Cancer Research*
76	143	14.3 (17th)	Schuz, J.	Cellular Phones, Cordless Phones, and the Risks of Glioma and Meningioma (interphone Study Group, Germany)	2006	*American Journal of Epidemiology*
77	141	14.1 (18th)	Heuser, M.	High Meningioma 1 (MN1) Expression as a Predictor for Poor Outcome in Acute Myeloid Leukemia with Normal Cytogenetics	2006	*Blood*
78	140	12.7 (22nd)	Lusis, E.A.	integrative Genomic Analysis Identifies NDRG2 as a Candidate Tumor Suppressor Gene Frequently inactivated in Clinically Aggressive Meningioma	2005	*Cancer Research*
79	140	8.7 (56th)	Gezen, F.	Review of 36 Cases of Spinal Cord Meningioma	2000	*Spine*
80	139	7.3 (71st)	Schrell, U.M.H.	Hydroxyurea for Treatment of Unresectable and Recurrent Meningiomas. II. Decrease in the Size of Meningiomas in Patients Treated with Hydroxyurea	1997	*Journal of Neurosurgery*
81	139	5.7 (83rd)	Miralbell, R.	The Role of Radiotherapy in the Treatment of Subtotally Resected Benign Meningiomas	1992	*Journal of Neuro-oncology*
82	139	5.7 (84th)	Bricolo, A.P.	Microsurgical Removal of Petroclival Meningiomas: A Report of 33 Patients	1992	*Neurosurgery*
83	138	10.6 (34th)	Flickinger, J.C.	Gamma Knife Radiosurgery of Imaging-Diagnosed Intracranial Meningioma	2003	*International Journal of Radiation oncology Biology Physics*
84	137	45.6 (1st)	Clark. V.E.	Genomic Analysis of Non-NF2 Meningiomas Reveals Mutations in TRAF7, KLF4, AKT1, and SMO	2013	*Science*
85	137	9.7 (42nd)	Sadetzki, S.	Radiation-induced Meningioma: A Descriptive Study of 253 Cases	2002	*Journal of Neurosurgery*
86	137	4 (95th)	Carella, R.J.	Role of Radiation Therapy in the Management of Meningioma	1982	*Neurosurgery*
87	137	3.7 (97th)	Donnell, M.S.	Estrogen-Receptor Protein in Intracranial Meningiomas	1979	*Journal of Neurosurgery*
88	136	19.7 (8th)	Aghi, M.K.	Long-Term Recurrence Rates of Atypical Meningiomas After Gross Total Resection with or without Postoperative Adjuvant Radiation	2009	*Neurosurgery*
89	136	9.9 (40th)	Kalamarides, M.	Nf2 Gene Inactivation in Arachnoidal Cells Is Rate-Limiting for Meningioma Development in the Mouse	2002	*Genes and Development*
90	135	8.4 (59th)	Perry, A.	Merlin, DAL-1, and Progesterone Receptor Expression in Clinicopathologic Subsets of Meningioma: A Correlative Immunohistochemical Study of 175 Cases	2000	*Journal of Neuropathology and Experimental Neurology*

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Supplementary Table 1. Continued

Rank	Citations	Citation per Year (Rank)	First Author	Title	Year	Journal
91	135	5.6 (81st)	Murphy, M.	Identification and Characterization of Genes Differentially Expressed in Meningiomas	1993	*Cell Growth & Differentiation: The Molecular Biology Journal of the American Association for Cancer Research*
92	134	6.6 (74th)	Dziuk, T.W.	Malignant Meningioma: An indication for initial Aggressive Surgery and Adjuvant Radiotherapy	1998	*Journal of Neuro-Oncology*
93	133	6.6 (75th)	Milosevic, M.F.	Radiotherapy for Atypical or Malignant intracranial Meningioma	1996	*International Journal of Radiation oncology Biology Physics*
94	133	6.3 (79th)	Elexpuru-Camiruaga, J.	Susceptibility to Astrocytoma and Meningioma: Influence of Allelism At Glutathione 5-Transferase (GSTT1 and GSTM1) and Cytochrome P-450 (CYP2D6) Loci	1995	*Cancer Research*
95	133	5.1 (90th)	Yamashita, J.	Recurrence of intracranial Meningiomas, with Special Reference to Radiotherapy	1980	*Surgical Neurology*
96	133	8.2 (63rd)	Bendszus, M.	Efficacy of Trisacryl Gelatin Microspheres Versus Polyvinyl Alcohol Particles in the Preoperative Embolization of Meningiomas	2000	*American Journal of Neuroradiology*
97	132	6.9 (73rd)	Langford, L.A.	Telomerase Activity in Ordinary Meningiomas Predicts Poor Outcome	1997	*Human Pathology*
98	132	3 (99th)	Zankl, H.	Cytological and Cytogenetical Studies on Brain Tumors—IV. Identification of the Missing G Chromosome in Human Meningiomas as No. 22 by Fluorescence Technique	1972	*Humangenetik*
99	132	2 (100th)	Castellano, F.	Meningiomas of the Posterior Fossa	1953	*Acta Radiologica. Supplementum*
100	131	7.7 (67th)	Pipper, D.R.	Hyperostosis Associated with Meningioma of the Cranial Base: Secondary Changes or Tumor invasion	1999	*Neurosurgery*