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Reviewed Article

Stereotactic Radiosurgery for Brain Metastasis

Reem Arif Alalawi[1], Selma Alazhar Khriji[2], Maram Abdullah Ambusaidi[2], Tariq Al–Saadi[3]

[1] Royal college of surgeons Ireland
[2] College of Medicine at Sultan Qaboos University
[3] Department of Neurosurgery – Cedars–Sinai Medical Centre, 8700 Beverly Blvd, Los Angeles, CA 90048.

Abstract

Background: Brain metastases pose a significant challenge in oncology, contributing to morbidity and mortality rates. These metastases originates from primary tumors in the breast, lung, and melanoma tumors and has promoted the exploration of several treatment modalities, including stereotactic radiosurgery (SRS). SRS is considered to be one of the most effective treatments for brain metastases due to its precision in delivering high doses of radiation with low damage to the surrounding tissues.

Method: A search of Scopus database was conducted using key terms like “stereotactic,” “radiosurgery,” “brain metastasis,” and “SRS”. Relevant articles were screened based on title, abstract, and full text. The top 100 articles, ranked by citation frequency, were included, and analysed for various details including title, first author, publication year, journal name, journal impact factor, country of first author, country of study, first author institution, corresponding author institution, study design, patient involvement, number of patients studied, primary aim, source of metastasis, and study conclusion.

Results: The top 100 cited articles on SRS for brain metastases were identified, with an average citation of 149 citations per article. The study found that the USA, followed by Japan and Switzerland, produced the highest number of publications on stereotactic radiosurgery for brain metastasis. The University of Pittsburgh was the leading institution in the USA. The analysis showed an increasing trend in publications from 2007 to 2017, with a peak in 2010, followed by a decline, potentially influenced by the COVID–19 pandemic.

Conclusion: Stereotactic radiosurgery (SRS) is an effective treatment for brain metastases, delivering precise high–dose radiation with rapid dose fall–off. This study revealed that the USA, particularly the University of Pittsburgh, has produced the most publications on this topic. This information can help clinicians and researchers identify valuable articles and journals related to SRS.

Keywords: Brain metastasis, Stereotactic, Radiosurgery, SRS

Introduction

Brain metastases, the spread of cancer cells from the primary tumor to the brain, are significant source of morbidity and mortality in advanced malignancies. Brain metastases anticipated to occur in approximately 20% to 40% of individuals diagnosed with cancer throughout their disease [(1)]. They are commonly associated with primary tumors in the breast, lung, and melanoma [(2)]. There are several treatment options available for brain metastases, including: whole–brain radiation therapy, surgical resection, and chemotherapy [(3)].

The management modalities of brain metastases have fundamentally changed recent years. Stereotactic radiosurgery alone, or combined with surgical resection as postoperative treatment, is now considered first line treatment or a limited number of brain metastases [(2)].

Stereotactic radiosurgery (SRS) and stereotactic radiation therapy (SRT) techniques that deliver high doses per fraction to various types of intracranial targets. Stereotactic radiosurgery (SRS) aims to radiate high doses per fraction of ionizing radiation to cranial targets with high spatial accuracy and rapid dose fall–off [(4)]. Stereotactic radiosurgery (SRS) is delivered in a single fraction, while multiple fraction delivery is known as stereotactic radiation therapy (SRT).

A study was conducted in 2021 to see the effectiveness of single–isocenter multi–target (SIMT) (SRS) in clinical

Corresponding author: Tariq Al–Saadi, MD, MSc, FRCS(C), Department of Neurosurgery – Cedars–Sinai Medical Centre, 8700 Beverly Blvd, Los Angeles, CA 90048. Email: tariq.al–saadi@mail.mcgill.ca

practice. The study demonstrates an excellent local control of multiple brain metastases was demonstrated by SIMT SRS, irrespective of the distance from the isocenter. 13 patients were involved and divided into three groups based on distance from the isocenter, near group distance of <3.2 cm), middle group distance of ≥3.2 cm and <6.4 cm), and far group distance of ≥6.4 cm. The median survival time was 17 months, with 63.7%, 11.5%, and 12.4% of metastases corresponding to almost disappeared, decreased, and stable, respectively [5].

A retrospective study viewed the survival rate following SRS alone for brain metastases. Relapse rates beyond two years following SRS alone for brain metastases are low in patients with no intracranial relapse within the first two years and with low–volume brain metastases. For patients suffering an intracranial relapse in the first two years or with large–volume intracranial disease, more frequent screening (every 3–4 months) remains prudent, as the risk of intracranial failure after two years is similar to the 50% to 60% rates commonly quoted for failure following SRS alone in years 0 to 2 [6]. This study provides valuable insight into the long–term management and recurrence pattern associated with SRS.

This paper aims to provide an updated summary of (SRS) for brain metastasis based on bibliometric analysis through a systemic review and quantitative analysis of published articles over the past 20 years.

Method

A bibliometric search was conducted through the Scopus library on June 10, 2022. Scopus database was chosen or its extensive worldwide coverage of medical articles and journals with a advanced search options. [7] The search was carried out by a single author (RA) and the terms that were used included "stereotactic, radiosurgery, brain metastasis, and SRS". All articles available in the database were included without a year–range limit, the earliest published article dated back to the year 1990.

The initial search yields 350 articles, which manually screened based on the title, abstract and full text by three authors (RA, SK, MB) to avoid bias, resulting in 182 articles post–screening. Exclusions included articles focusing on primary brain tumors, and/or treatment modalities other than SRS and non–English articles.

The articles then were filtered by citation count, and the top 100 Articles were included in this study. Data extracted including authors, total number of citations, year of publication, journal name, journal impact factor, country of first author, country of the study conducted, first author institution, corresponding author institution, study design, patient involvement, number of patients studied, primary aim/focus, source of metastasis, and study recommendations.

The extracted data was then used to determine the annual distribution of published articles over the past 20 years. Moreover, it was used to identify the top 20 neurological institutes contributing the largest number of articles based on the main or corresponding author affiliation.

Data was used to rank the 15 major journals based on the source impact measured by H–indexes. The H–index was employed to calculate the source impact of the journal. The H–index may be utilized by organizations, institutions, and periodicals, even with being most frequently utilized to evaluate author productivity and impact.

Ethical approval was not required for this study, as it was limited to analysing previously published data.

Results

This study conducts a comprehensive bibliometric analysis of stereotactic radiosurgery for brain metastases, focusing on identifying the most influential articles within the field of neurosurgery. By analysis citation data, author affiliations, and journal metrics, we seek to elucidate key trends, patterns, and contributors shaping research in this critical area of neurosurgical oncology.

Table (1) lists the 100 top–cited articles ranked from the greatest number of citations, along with their authors' names and citation numbers. The overall number of citations for 100 articles was 14900 citations, ranging from 829 to 43, with an average of 149 citations per article.

Table (2) highlights the top 20 neurological institutes that contributed to the largest number of articles based on the main or corresponding author affiliation. The University of Pittsburgh, Pennsylvania contributed to the most articles in a total of 15 papers, followed by Harvard Medical School with 6 articles. The University of Texas and the University of Southern California contributed to 5 articles each, the Cleveland Clinic Foundation, Memorial Sloan–Kettering Cancer Centre, the University of California, University of Iowa, and Wake Forest University Baptist Medical Centre took part in 3 articles each.

Twenty countries were contributing to the list. Figure (1) depicts the distribution of the number of articles in the leading countries. The USA is the leading country researching brain metastasis (n=73). Japan was the second in the list (n=10) followed by Switzerland (n=3).

The annual distribution of published articles from 2000 to 2021 is shown in Figure (2), which indicates that the year 2010 has the highest number of published articles (n=10), followed by 2015 (n=7). It is clear also that the recent year in our scope of search has the lowest number of published articles (n=1).

Table (3) highlights the distribution of the 15 major journals according to the source impact measured by H–indexed. The table also includes journal category, quartile, impact factor, and number of articles. That data reveals that the highest number of articles were contributed by the International Journal of Radiation and Oncology and Biology Physics with a total number of 19 articles, followed by the Journal of Neurosurgery with 18 articles and the Journal of Clinical Oncology with 4 articles. It is also clear that there is no significant correlation between the impact factor and the number of articles contributed by the top–cited articles.

Rank	Title	Authors names	Citation number
1	Tumor exome analysis reveals neoantigen–specific T–cell reactivity in an ipilimumab–responsive melanoma	Van Rooij N., Van Buuren M.M., Philips D., Velds A., Toebes M., Heemskerk B., Van Dijk L.J.A., Behjati S., Hilkmann H., El Atmioui D., Nieuwland M., Stratton M.R., Kerkhoven R.M., Keşmir C., Haanen J.B., Kvistborg P., Schumacher T.N.	829
2	CNS metastases in breast cancer	Lin, N.U., Bellon, J.R., Winer, E.P.	550
3	Postoperative stereotactic radiosurgery compared with whole brain radiotherapy for resected metastatic brain disease (NCCTG N107C/CEC·3): a multicentre, randomised, controlled, phase 3 trial	Brown, P.D., Ballman, K.V., Cerhan, J.H., Anderson, S.K., Carrero, X.W., Whitton, A.C., Greenspoon, J., Parney, I.F., Laack, N.N.I., Ashman, J.B., Bahary, J.–P., Hadjipanayis, C.G., Urbanic, J.J., Barker, F.G., II, Farace, E., Khuntia, D., Giannini, C., Buckner, J.C., Galanis, E., Roberge, D.	535
4	Neurocognitive Function of Patients with Brain Metastasis Who Received Either Whole Brain Radiotherapy Plus Stereotactic Radiosurgery or Radiosurgery Alone	Aoyama, H., Tago, M., Kato, N., Toyoda, T., Kenjyo, M., Hirota, S., Shioura, H., Inomata, T., Kunieda, E., Hayakawa, K., Nakagawa, K., Kobashi, G., Shirato, H.	427
5	The role of stereotactic radiosurgery in the management of patients with newly diagnosed brain metastases: A systematic review and evidence–based clinical practice guideline	Linskey, M.E., Andrews, D.W., Asher, A.L., Burri, S.H., Kondziolka, D., Robinson, P.D., Ammirati, M., Cobbs, C.S., Gaspar, L.E., Loeffler, J.S., McDermott, M., Mehta, M.P., Mikkelsen, T., Olson, J.J., Paleologos, N.A., Patchell, R.A., Ryken, T.C., Kalkanis, S.N.	380
6	Oligometastases treated with stereotactic body radiotherapy: Long–term follow–up of prospective study	Milano, M.T., Katz, A.W., Zhang, H., Okunieff, P.	335
7	Post–operative stereotactic radiosurgery versus observation for completely resected brain metastases: a single–centre, randomised, controlled, phase 3 trial	Mahajan, A., Ahmed, S., McAleer, M.F., Weinberg, J.S., Li, J., Brown, P., Settle, S., Prabhu, S.S., Lang, F.F., Levine, N., McGovern, S., Sulman, E., McCutcheon, I.E., Azeem, S., Cahill, D., Tatsui, C., Heimberger, A.B., Ferguson, S., Ghia, A., Demonte, F., Raza, S., Guha–Thakurta, N., Yang, J., Sawaya, R., Hess, K.R., Rao, G.	334
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9	The role of surgical resection in the management of newly diagnosed brain metastases: A systematic review and evidence–based clinical practice guideline	Kalkanis, S.N., Kondziolka, D., Gaspar, L.E., Burri, S.H., Asher, A.L., Cobbs, C.S., Ammirati, M., Robinson, P.D., Andrews, D.W., Loeffler, J.S., McDermott, M., Mehta, M.P., Mikkelsen, T., Olson, J.J., Paleologos, N.A., Patchell, R.A., Ryken, T.C., Linskey, M.E.	284
10	Multidisciplinary management of brain metastases	Eichler A.F., Loeffler J.S.	269
11	Stereotactic radiosurgery for melanoma brain metastases in patients receiving ipilimumab: Safety profile and efficacy of combined treatment	Kiess A.P., Wolchok J.D., Barker C.A., Postow M.A., Tabar V., Huse J.T., Chan T.A., Yamada Y., Beal K.	265
12	Oligometastases and oligo–recurrence: The new era of cancer therapy	Niibe Y., Hayakawa K.	259
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14	Stereotactic radiosurgery for cerebral metastatic melanoma: Factors affecting local disease control and survival	Mori Y., Kondziolka D., Flickinger J.C., Kirkwood J.M., Agarwala S., Lunsford L.D.	228

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15	Preliminary experience with MR–guided thermal ablation of brain tumors	Anzai Y., Lufkin R., DeSalles A., Hamilton D.R., Farahani K., Black K.L., Jolesz F.A.	214
16	Immunotherapy and stereotactic ablative radiotherapy (ISABR): A curative approach?	Bernstein, M.B., Krishnan, S., Hodge, J.W., Chang, J.Y.	213
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25	Clinical outcomes of melanoma brain metastases treated with stereotactic radiation and anti–PD–1 therapy	Ahmed, K.A., Stallworth, D.G., Kim, Y., Johnstone, P.A.S., Harrison, L.B., Caudell, J.J., Yu, H.M., Etame, A.B., Weber, J.S., Gibney, G.T.	177
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29	Concurrent Immune Checkpoint Inhibitors and Stereotactic Radiosurgery for Brain Metastases in Non–Small Cell Lung Cancer, Melanoma, and Renal Cell Carcinoma	Chen, L., Douglass, J., Kleinberg, L., Ye, X., Marciscano, A.E., Forde, P.M., Brahmer, J., Lipson, E., Sharfman, W., Hammers, H., Naidoo, J., Bettegowda, C., Lim, M., Redmond, K.J.	169
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31	Can standard magnetic resonance imaging reliably distinguish recurrent tumor from radiation necrosis after radiosurgery for brain metastases? A radiographic–pathological study	Dequesada I.M., Quisling R.G., Yachnis A., Friedman W.A.	167
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39	Analysis of radiosurgical results in patients with brain metastases according to the number of brain lesions: is stereotactic radiosurgery effective for multiple brain metastases?	Chang W.S., Kim H.Y., Chang J.W., Park Y.G., Chang J.H.	150
40	Indications and limitations of chemotherapy and targeted agents in non–small cell lung cancer brain metastases	Zimmermann S., Dziadziuszko R., Peters S.	149
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80	Cyberknife hypofractionated stereotactic radiosurgery (HSRS) of resection cavity after excision of large cerebral metastasis: Efficacy and safety of an 800 cGy × 3 daily fractions regimen	Wang, Che–Chuan; Floyd, Scott R; Chang, Chin–Hong; Warnke, Peter C; Chio, Chung–Ching; Kasper, Ekkehard M.; Mahadevan, Anand; Wong, Eric T; Chen, Clark	53
81	Adjuvant Gamma Knife radiosurgery following surgical resection of brain metastases: A 9–year retrospective cohort study	Hwang, Steven W; Abozed, Mohab M; Hale, Andrew; Eisenberg, Rebecca L; Dvorak, Tomasc; Yao, Kevin; Pfannl, Rolf; Mignano, John; Zhu, Jay–Jiguang; Price, Lori Lyn; Strauss, Gary M.; Wu, Julian k.	53
82	Stereotactic radiosurgery for brain metastases from gastrointestinal tract cancer	Hasegawa, Toshinori; Kondziolka, Douglas; Flickinger, John C.; Lunsford, L. Dade	53
83	Management of brain metastases in patients with melanoma	Tarhini, Ahmad A; Agarwala, Sanjiv S	51
84	LINAC–based stereotactic radiosurgery to the brain with concurrent vemurafenib for melanoma metastases	Ahmed, Kamran A; Freilich, Jessica M; Sloot, Sarah; Figura, Nicholas; Gibney, Geoffrey T; Weber, Jeffrey S; Sarangkasiri, Siriporn; Chinnaiyan, Prakash; Forsyth, Peter A; Etame, Arnold B; Rao, Nikhil G	51

Rank	Title	Authors names	Citation number
85	Radionecrosis induced by stereotactic radiosurgery of brain metastases: Results of surgery and outcome of disease	Telera, Stefano; Fabi, Alessandra; Pace, Andrea; Vidiri, Antonello; Anelli, Vincenzo; Carapella, Carmine Maria; Marucci, Laura; Crispo, Francescoa; Sperduti, Isabella; Pompili, Alfred	51
86	Evidence–Based guidelines for the management of brain metastases	Bhangoo, Sandeep S; Linskey, Mark E; Kalkanis, Steven N	50
87	Posterior fossa metastases: Risk of leptomeningeal disease when treated with stereotactic radiosurgery compared to surgery	Siomin, Vitaly E; Vogelbaum, Michael A; Kanner, Andrew A; Lee, Shih–Yuan; Suh, John H; Barnett, Gene H	50
88	Initial SRS for Patients with 5 to 15 Brain Metastases: Results of a Multi–Institutional Experience	Hughes, Ryan T; Masters, Adrianna H; McTyre, Emory R; Farris, Michael K; Chung, Caroline; Page, Brandi R; Kleinberg, Lawrence R; Hepel, Jaroslaw; Contessa, Joseph N; Chiang, Veronica; Ruiz, Jimmy; Watabe, Kounosukeh	50
89	The role of surgery, radiosurgery and whole brain radiation therapy in the management of patients with metastatic brain tumors	Ellis, Thomas L; Neal, Matthew T; Chan, Michael D	48
90	Gamma Knife Radiosurgery as a Therapeutic Strategy for Intracranial Sarcomatous Metastases	Flannery, Thomas; Kano, Hideyukia; Niranjan, Ajay; Monaco III, Edward A; Flickinger, John C; Kofler, Julia; Lunsford, L. Dadea; Kondziolka, Douglas	48
91	Current Management of Metastatic Brain Disease	Ranjan, Tulika; Abrey, Lauren E.	48
92	Ultrasound–guided extracranial radiosurgery: Technique and application	Meeks, Sanford L; Buatti, John M; Bouchet, Lionel G; Bova, Francis J; Ryken, Timothy C; Pennington, Edward C; Anderson, Kathleen M; Friedman, William A	48
93	Brain metastases in patients with no known primary tumor: The role of stereotactic radiosurgery	Maesawa, Satoshi; Kondziolka, Douglasa; Thompson, Todd P; Flickinger, John C.; Dade Lunsford L	48
94	Radiosurgery using a modified linear accelerator.	Alexander 3rd. E.; Loeffler J.S.	48
95	Gamma knife surgery in the management of brain metastases from lung carcinoma: A retrospective analysis of survival, local tumor control, and freedom from new brain metastasis	Jawahar, Ajay; Matthew, Ronnie E; Minagar, Alireza; Shukla, Deepti; Zhang, John H; Willis, Brian K; Ampil, Federico; Nanda, Anil	47
96	Stereotactic radiosurgery for intracranial malignancies.	Flickinger J.C.; Loeffler J.S.; Larson D.A.	46
97	Imaging changes after stereotactic radiosurgery of primary and secondary malignant brain tumors	Ross, Donald A.; Sandler, Howard M.; Balter, James M.; Hayman, James A.; Archer, Paul G.; Auer, Donna L.	45
98	Gamma Knife radiosurgery for the management of cerebral metastases from non–small cell lung cancer	Bowden, Greg; Kano, Hideyuki; Caparosa, Ellen; Park, Seong–Hyuna; Niranjan, Ajaya; Flickinger, Johnb; Lunsford, L. Dadea	43
99	Stereotactic radiosurgery for brain metastases from coloretal cancer	Schoeggl, Andrea; Kitz K; Reddy M; Zauner C.	43
100	Gamma knife radiosurgery for metastatic tumours in the brain stem	Shuto, Takashia; Fujino H; Asada H; Inomori S; Nagano H	43

Table (1): top 100 most cited articles with their author names and citation numbers.

N. O	Institute	Number of articles contributed
1	University of Pittsburgh	15
2	Harvard Medical school	6
3	The university of Texas	5
4	University of Southern California	5
5	Cleveland Clinic Foundation	3
6	Memorial Sloan–Kettering Cancer Center	3
7	University of California	3
8	University of Iowa	3
9	Wake Forest University Baptist Medical Center	3
10	Hokkaido University Graduate School of Medicine	2
11	Johns Hopkins University	2
12	Université de Sherbrooke	2
13	University of Florida	2
14	University of Vienna	2
15	University of Virginia	2
16	Yale University School of Medicine	2
17	Allegheny General Hospital	1
18	Swedish Neuroscience Institute	1
19	Chi Mei Medical Center	1
20	Chiba University Graduate School of Medicine	1

Table (2): top neurosurgical institutions contributing largest number of articles.

Discussion

Bibliometric analysis provides a quantitative analysis to examine the scholarly output within a given field. By systematically analysing citation patterns, author affiliations, country contributions, and journal impact, bibliometric studies offer valuable insights into the dissemination and impact of research literature [8].

Bibliometric Analysis (BA) impacts advancements in various research domains, most notably medicine. It provides researchers with a snapshot of the scope of published literature within the key fields of medical [9]. BA also helps identify and close any knowledge gaps that might go undetected. Therefore, we carried a BA on SRS treatment for brain metastasis and presented a thorough analysis of the top 100 articles on this topic [9].

These articles represent the foundation work that aids in understanding the practice of SRS for brain metastases. Researchers and clinicians can use the articles from this list as a resource for accessing key literature and understanding the progression of knowledge in this field.

The neurological institutes that contributed the most with published articles were the University of Pittsburgh in Pennsylvania (USA), followed by Harvard Medical School (USA), and then the University of Texas and Southern California (USA). This finding shows that the USA had the most contribution overall. The prominence of certain neurological institutes, such as the University of Pittsburgh and Harvard Medical School, highlights the role of leading academic centres in driving research on SRS for brain metastases. These institutions have demonstrated

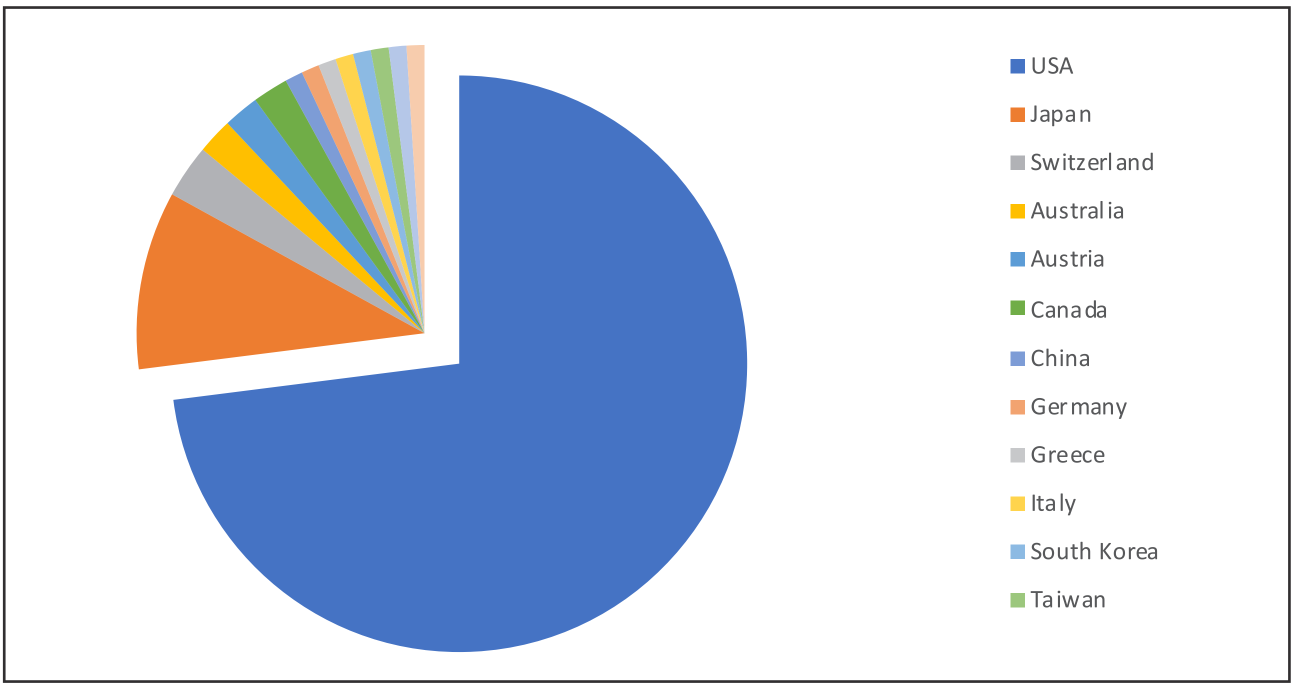

Figure (1): Distribution of the number of articles in the leading countries.

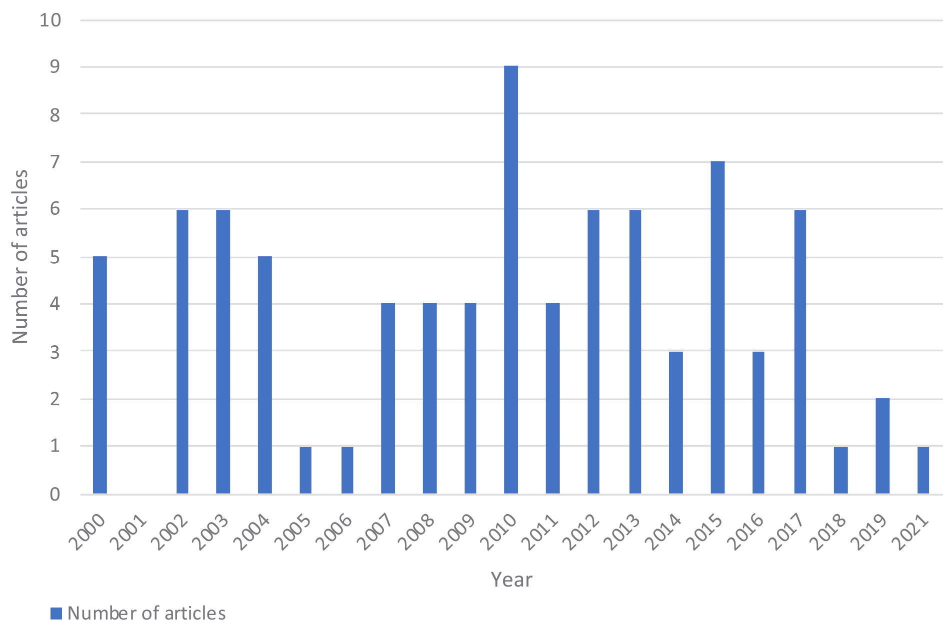

Figure (2): Annual distribution of published articles.

N. O	Journal title	H–index	Journal category	Quartile	Impact factor	Number of articles
1	Journal of Clinical Oncology	574	Cancer Research, Oncology, Medicine (miscellaneous)	Q1	44.54	4
2	The Lancet Oncology	355	Oncology	Q1	54·433	3
3	Archives of Neurology	290	Neurology	Q1		1
4	Annals of Oncology	258	Hematology, Oncology, Medicine (miscellaneous)	Q1	32.98	2
5	International Journal of Radiation Oncology Biology Physics	257	Cancer Research, Oncology, Radiation, Radiology, Nuclear Medicine and Imaging	Q1	7.038	19
6	International Journal of Cancer	242	Cancer Research, Oncology	Q1	7.396	1
7	European Journal of Cancer	224	Cancer Research, Oncology	Q1	9.162	1
8	Journal of Nuclear Medicine	221	Medicine (miscellaneous), Radiology, Nuclear Medicine and Imaging	Q1	11.082	1
9	Journal of Neurosurgery	219	Neurology (clinical), Surgery	Q1	4.13	18
10	Journal of Neurology, Neurosurgery and Psychiatry	216	Neurology (clinical), Surgery, Psychiatry and Mental Health	Q1	13.65	1
11	American Journal of Neuroradiology	185	Medicine (miscellaneous), Neurology (clinical), Radiology, Nuclear Medicine and Imaging	Q1	3.653	2
12	Nature Reviews Clinical Oncology	176	Oncology	Q1	65.01	2
13	Oncologist	172	Cancer Research, Oncology, Medicine (miscellaneous)	Q1	5.09	2
14	Cancer Treatment Reviews	142	Medicine (miscellaneous), Oncology, Radiology, Nuclear Medicine and Imaging	Q1	13.608	3
15	BMC Cancer	139	Cancer Research, Oncology, Genetics	Q2	4.42	1

Table (3): Distribution of the 15 major journals according to the source impact factor measured by H–indexed.

a strong commitment to advancing knowledge and innovation in neurosurgical oncology. Collaborations between academic centres and multidisciplinary research teams are likely contributing factors to their success in producing impactful research output.

The use of SRS in brain metastasis is a topic discussed globally in a manner that the articles we collected originated from 14 different countries. The USA was the leading country, marking roughly three–quarters (n=73 articles) of all published articles which demonstrates a significant output in this field. Japan, Switzerland, Australia, Austria, and Canada, come next right after. The countries with the fewest publications were China, Germany, Greece, Italy, South Korea, Taiwan, Netherlands, and the UK.

Overall, we found that the neurosurgical institutes in the US had had the most contribution in publishing articles in terms of quantity, on the SRS usage for brain metastases. The fact that it has one of the highest concentrations of neurosurgical institutes may help to explain this. Furthermore, research–intensive neurosurgery residency training is found to be more prevalent in the United States than in other nations, particularly Europe. This recently led to the USA's neurosurgery residency program involving research as a factor in accepting new medical graduates [10].

In analysing the annual distribution of publications published, there was an increasing trend in publication from 2007 to 2017, peaking in 2010 with 9 papers. Later, the publications have become less frequent in recent years. It can be attributed to the COVID–19 pandemic incident, which saw a shift in scientific attention away from the discipline of neurosurgery and a general decline in neurosurgical procedures during the length of the pandemic [11]. Additionally, the decline observed in recent years might indicate that certain research areas have become saturated, and funding has shifted within the neurosurgery community.

Jorge Hirsch, a physicist, invented the H–index in 2005, making it a relatively new term. It is used to determine how important a scientist's and a scientific organization's performance metric is since it is mostly dependent on the distribution of citation frequencies. It has recently been encouraged to be used instead of the impact factor (IF) [12]. Thus, we used the H–index to analysed the journals we included in our study and noted the top 15 major journals, we also recorded their IF and the number of articles involved. The major journal with the highest H–index was the Journal of Clinical Oncology, followed by the Lancet Oncology and Archives of Neurology. However, the journals with the highest number of articles in our scope of the study were the International Journal of Radiation Oncology Biology Physics and the Journal of Neurosurgery, which ranked in the middle of the overall journals based on H–indexes and their IF. Thus, we found in our analysis that there was no significant correlation between the impact factor and the number of articles contributed by the top–cited articles.

This study provides a snapshot of the current state of research on SRS for brain metastases. It offers valuable guidance for researchers, clinicians, and policymakers seeking to advance understanding and improve outcomes in the management of this challenging disease entity.

Limitations

Our study has few limitations. To begin with, the study is restricted to one source, which only included 100 top–cited articles on SRS in the fields of brain metastases for the past 20 years without reflecting the most recent research paper and other geographical areas. Additionally, according to our inclusion criteria, only English–language publications were included. Moreover, the citation numbers of each individual article are subject to change over time. However, data was collected at a specific point in time in this paper.

Future studies could explore additional bibliometric indicators, such as author collaboration networks, and citation contexts, to provide a more comprehensive understanding of research dynamics in this field.

Conclusion

In conclusion, this bibliometric analysis identified the 100 top–cited articles for brain metastases over the past 20 years on (SRS) and highlighted the significant findings. The study presented the most influential articles, top contributing institutions and countries, and the major journals leading this field. The majority of the studies focused on breast, melanoma, and lung cancer as the primary source of the metastases and showed increased interest in SRS as a treatment for brain metastases, with several institutions and journals involved in this research area. Overall, the findings of this study can guide future clinicians and researchers in managing brain metastases and identify the most influential articles in this field.

Acknowledgement

Funding and Conflict of Interest

Abbreviation

SRS: Stereotactic radiosurgery

SRT: Stereotactic radiation therapy

SIMT: Single–isocenter multitarget

BA: Bibliometric Analysis

USA: United States of America

COVID–19: Coronavirus disease of 2019

IF: Impact factor

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