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A Scientometric Study on 'Brain Tumor' Research Publication during the Period 2010-2019

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Abstract

The study attempts to find out the research output on Brain Tumor publications in India during the period 2010-2019 using the Scopus database. A total of 2444 research papers were found in Brain Tumor research from India during the mentioned period. The year 2019 is the most productive year with 525 (21.48%) of publications, followed by the year 2018 with 399 (16.32%) publications. The highest number 1507 (61.66%) of records were in the type of Articles, followed by Conference Paper with 495 (20.25%) of records, however, Jalai, R. is the most productive author in Brain Tumor research with 44 (1.8%) publications. Medicine was the most popular subject with 1093 (25.51%), followed by Computer Science 813 (18.98%) contributions. All India Institute of Medical Sciences, New Delhi was the most productive organization with 153 (6.26%) publications and Department of Biotechnology, Government of West Bengal was funded with highest 35 (1.43%) publications and the most preferred keyword was Brain Tumor used in 1349 (4.98%) of publications during the period of study.

Keywords: Scientometrics, Bibliometrics, Brain, Brain Tumor, Brain Neoplasms, Gliomas, Research in India.

1. Introduction

Scientometrics is concerned with the quantitative features and characteristics of science Scientometrics is a branch of the library and information science and can be used to measure and analyze the various aspects related to science. Scientometrics is a scientific discipline that performs consistent measurements of scientific activity and includes statistical, computational, and thesaurus methods and indicators as to terms, number of citations, etc. "A brain tumor is a collection, or mass, of abnormal cells in your brain. Your skull, which encloses your brain, is very rigid. Any growth inside such a restricted space can cause problems. Brain tumors can be cancerous (malignant) or noncancerous (benign). When benign or malignant tumors grow, they can cause the pressure inside your skull to increase. This can cause brain damage, and it can be life-threatening" (**Source:** https://www.healthline.com/health/brain-tumor). A total of 2444 publications were recorded in which only 482 research papers were open access while 1962 publications were other types accessible during the period of study.

2. **Review of literature**

Chen et al. (2020) conducted a scientometric analysis on the progress and prospects of recurrent Glioma using a web of science database. The results from the study showed that out of 4651 articles the author has evaluated the top 100 most cited articles. The number of citations from the top 100 cited articles on recurrent glioma ranged from 149 to 1471; most of these articles were published in oncology-specific journals (66) and were submitted by institutions in the United States (n = 67). The result also describes that the main problem is the treatment of recurrent glioma.

Shukla (2019) carried out a scientometric study on the literature of jaundice disease using the Scopus database for the period (1998-2017). It was found that a total of 3193 articles were published on jaundice disease and the highest numbers of papers are published between 2012 and 2015. This study also showed that the maximum annual growth rate was noted in the year 2000 and the highest doubling time was noted in the year 2017. S K Sarin from Institute of Liver and Biliary Sciences, Department of Hepatology, New Delhi was the most productive author with 26 contributions; 65 h-index; and 16691 citations. An another research study by Shukla published in 2019 on genetic disorder using the Scopus database during the period 2008 to 2017 in which the maximum 504 (13.72%) of publications were published in the year 2017 while the minimum 184 (5.01%) of records were published in the year 2008. Ghosh, K was the most prolific author with the maximum 66 contributions and 30 h-index, and a total 5078 citations during the period of study. A large number of 2421 records were medicine subject field, followed by biochemistry, genetics and molecular biology with 1435 records from the marked period of study.

Bansal, M., Gupta. R. & Bansal, J. (2017) carried out a scientometric study of celiac disease of World Publication Output for the period 2005-2014, and the Scopus database was used for the retrieval of data. The paper showed that 14317 publications are there on celiac disease, experiencing an annual average growth rate of 5.20% and citation impact of 12.53.The 15 most productive countries contributedto 83.89% share in world output, with the largest share of 21.40% coming from the U.S.A, followed by Italy 12.61%, U.K. 8.23%, Germany 5.41%, etc., during 2005-14. The 15 most productive organizations, authors, and journals contributed 15.06%, 10.71%, and 16.57% share of the world publication output during 2005-14. Nagalingam (2017) conducted a scientometric analysis on Parkinson's disease research trends in Asia during 2010-2017and the data was collected by searching a Scopus database. The study revealed that a total of 14064 published papers on this disease research during this period. The study showed that the documents with more than three authors have taken the 1st rank and Parkinsonism and related disorders get the maximum number of documents, followed by PLoS One and Neuroscience letters and so on. China became the leading country followed by Japan and Hattori, N. becomes the most productive author followed by Tan, E.K.

Ramesh, Gopalakrishnan & Balasubramani (2014) completed a bibliometric study on the growth of Indian research output on Brain Tumor using the Scopus database. The results from the study show that out of the total 147641 articles, India is producing 2880 (1.95%) articles on Brain Tumor. The maximum of research articles (341) is published in the year 2011. Out of the total 2880 Indian publications, 725 (25.2%) of papers were having more than five authors while only 140 (4.9%) of papers were single-authored. Most of the publications were contributed in the form of journals (73.99%), review (11.59%), conference paper (5.59%), etc. The Indian authors mostly collaborated with the United States authors

181 (6.61%) of publications. Sarkar, C. was the most productive author with 129 (4.48%) publications, followed by Sharma, M.C. who contributed 104 (3.61%) publications.

3. Objectives of the study

The main objectives of the study are as follows:

- To examine the year wise growth of publications in Brain Tumor research.
- To identify the document wise distribution of publications.
- To analyze the most productive author with their publications.
- To identify the institution wise distribution of publications.
- To analyze the most preferred keywords in brain tumor research.

4. Scope and Limitations of the study

The study is restricted to the scientometric analysis of Brain Tumor research in India for a period of ten years, i.e. 2010-2019 by using Scopus database.

5. Methodology

The data for the present study were retrieved from the Scopus database and the following search string used to collecting the data for the study: (TITLE-ABS-KEY("Brain Tumor") AND (LIMIT-TO (AFFILCOUNTRY, "India")) AND (LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR,2012) OR LIMIT-TO (PUBYEAR,2011) OR LIMIT-TO (PUBYEAR,2010))). The data was tabulated and analysed by using MS Excel application software.

6. Data Analysis and Interpretations

6.1 Year-wise distribution of publications of Brain Tumor research

Below table 1 shows the year-wise distribution of brain tumor research papers during the period of the last 10 years 2010 to 2019.

Table 1: Year-wise distribution of publications of Brain Tumor

S. N.	Year	No. of Publication	Cumulative Sum	Percentage
1	2010	97	97	3.97
2	2011	138	235	5.65
3	2012	118	353	4.83
4	2013	121	474	4.95
5	2014	165	639	6.75
6	2015	248	887	10.15
7	2016	323	1210	13.22
8	2017	310	1520	12.68
9	2018	399	1919	16.32
10	2019	525	2444	21.48
Total		2444	2444	100.0

On the observation of the particular table, it has been shown that the frequency of brain tumor publications is extremely high in the present era compared to begging years of the study. Brain tumors research papers show an increasing trend, but in the years 2012 and 2013, it shows a slight decrease in the number of publications. The maximum 525 (21.48%) of the research papers were published in the year 2019, followed by 2018 with 399 (16.32%) publications and the third-highest publications year was 2016 in which a total 323 (13.22%) of research papers were published in brain tumor research from the period of study. In another study conducted by (Gupta and Shukla, 2019) found that the maximum number of publications were published in last year of the study same as this study and minimum number of contributions were published in the beginning year of the study as same as this study.

6.2 Source type distribution of the publication in Brain Tumor research

Table 2 and figure 1 illustrates the source type distribution of Brain Tumor research output in which a maximum 1894 (77.50%) of research papers were published in Journals, followed by Conference Proceeding with 400 (16.37%) of research papers contributions, Book Series with 113 (4.62%) of publications, Book with 35 (1.43%) papers, and Trade Journal with only 2 (0.08%) papers contributed during the period of study.

Table 2: Source type distribution of the publication in Brain Tumor research

S.N.	Source Type	No. of Publication	Percentage
1	Journal	1894	77.50
2	Conference Proceeding	400	16.37
3	Book Series	113	4.62
4	Book	35	1.43
5	Trade Journal	2	0.08
	Total	2444	100.0

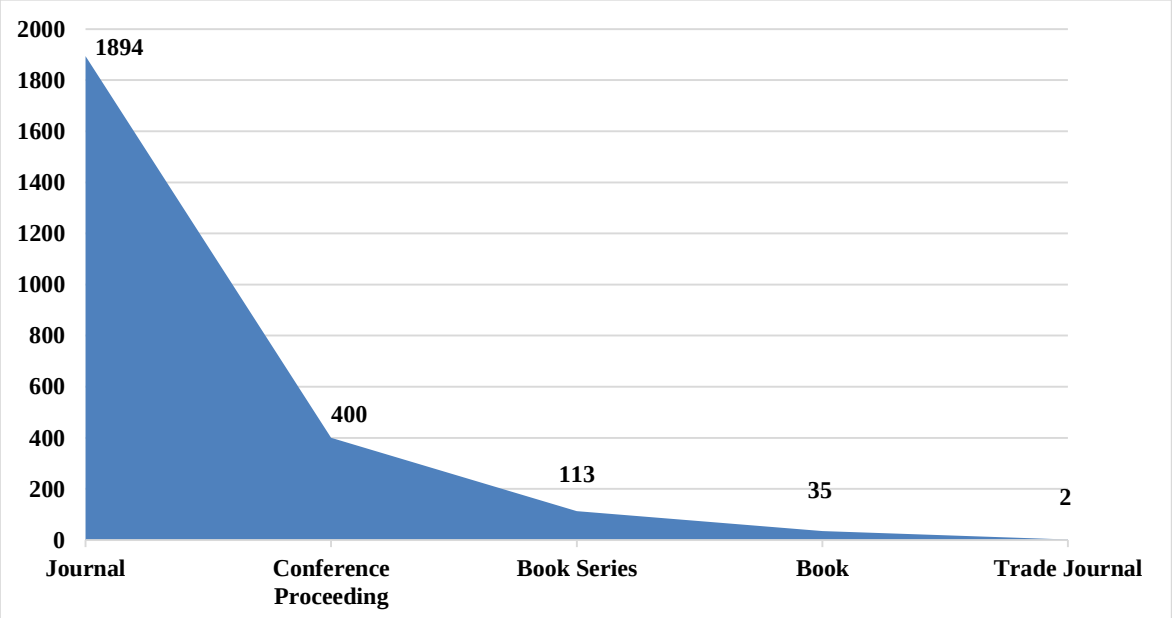

Figure 1: Source type distribution of the publication in Brain Tumor research

6.3 Document Type Distribution of Publications of Brain Tumor research

Table 3 and figure 2 shows the document type distribution of brain tumor research output for the period under study. It is clear from the analysis that the share of articles stood at 1st position and occupies 61.66% (1507) of total publications. The Conference paper with research publication occupies 20.25% (495) and it stood in the second position, Review with 8.14% (199) contribution, Letter with 3.81% (93) contributions, the Book Chapter with 2.50% (61) contributions and Note with 2.09% (51) followed by remaining documents.

Table 3: Document Type Distribution of Publications of Brain Tumor research

S.N.	Document Type	No. of Publication	Percentage
1	Article	1507	61.66
2	Conference Paper	495	20.25
3	Review	199	8.14
4	Letter	93	3.81
5	Book Chapter	61	2.50
6	Note	51	2.09
7	Editorial	22	0.90
8	Short Survey	5	0.20
9	Undefined	5	0.20
10	Book	2	0.08
11	Erratum	2	0.08
12	Retracted	2	0.08
Total		2444	100.0

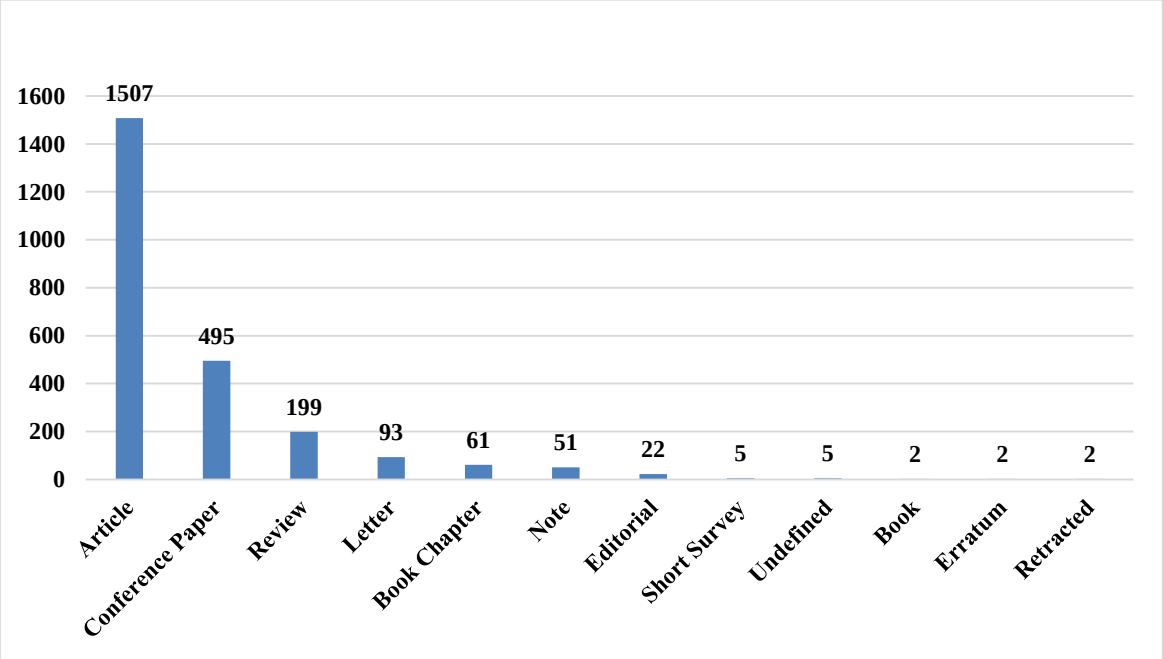

Figure 2: Document Type Distribution of Publications of Brain Tumor research

6.4 Top 20 most productive authors with their number of publications

Table 4 and figure 3 illustrates the top 20 most productive authors in brain tumor research during the period 2010-2019. The maximum 44 publications were contributed by Jalali, R., followed by Sarkar, C. with 43 contributions, Santosh, V. with 36 papers, Sharma, M.C. with 35 papers, Suri, V. with 34 papers, Moiyadi, A. with 29 papers, Gupta, T. with 25 papers, Shetty, P. with 24 papers, Arivazhagan, A. and Somasundaram, K. with 21 papers each, Epari, S. with 20 papers, Gupta, K. with 19 papers, Hegde, A.S. with 18 papers, Ghosal, N. and Kesavadas, C. with 17 papers each, Mallick, S., Moiyadi, A.V., Pathak, P., Salunke, P. and Singh, M. with 16 papers each during the period of study.

Table 4: Top 20 most productive authors with their number of publications

S.N.	Author Name	No. of Publication	Percentage
1	Jalali, R.	44	1.80
2	Sarkar, C.	43	1.76
3	Santosh, V.	36	1.47
4	Sharma, M.C.	35	1.43
5	Suri, V.	34	1.39
6	Moiyadi, A.	29	1.19
7	Gupta, T.	25	1.02
8	Shetty, P.	24	0.98
9	Arivazhagan, A.	21	0.86
10	Somasundaram, K.	21	0.86
11	Epari, S.	20	0.81
12	Gupta, K.	19	0.78
13	Hegde, A.S.	18	0.74
14	Ghosal, N.	17	0.70
15	Kesavadas, C.	17	0.70
16	Mallick, S.	16	0.65
17	Moiyadi, A.V.	16	0.65
18	Pathak, P.	16	0.65
19	Salunke, P.	16	0.65
20	Singh, M.	16	0.65

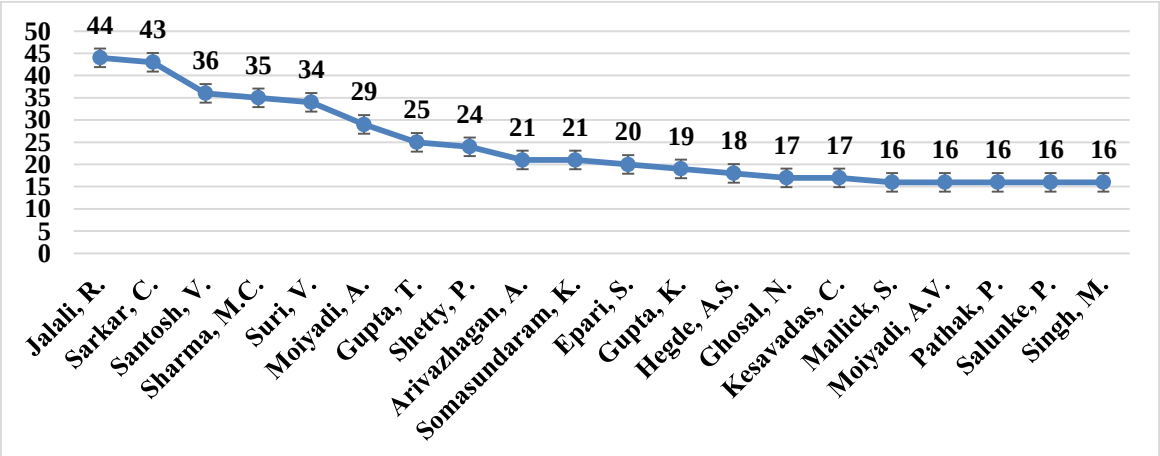

Figure 3: Top 20 most productive authors with their number of publications

6.5 Subject-wise distribution of Publications of Brain Tumor research

The subject-wise productivity of brain tumor research during the period under study is given in the table 5. Most of the publications belong to several subjects. Hence the total number of papers reached 4257, as the 2444 publications were included in this present study. The analysis showed that Medicine accounted for the largest share 1093 (25.67%), followed by Computer Science 813 (19.1%), Engineering 655 (15.39%), Biochemistry, Genetics and Molecular Biology 390 (9.16%), Neuroscience 284 (6.67%), Pharmacology, Toxicology, and Pharmaceutics 186 (4.37%) and followed by other subjects which shows a decreasing trend. The overall data has been shown in table 5 and figure 4.

Table 5: Subject-wise distribution of Publications of Brain Tumor research

S.N.	Subject Area	No. of Publication	Percentage
1	Medicine	1093	25.67
2	Computer Science	813	19.1
3	Engineering	655	15.39
4	Biochemistry, Genetics and Molecular Biology	390	9.16
5	Neuroscience	284	6.67
6	Pharmacology, Toxicology, and Pharmaceutics	186	4.37
7	Mathematics	173	4.06
8	Physics and Astronomy	114	2.68
9	Materials Science	96	2.26
10	Environmental Science	62	1.46
11	Chemistry	60	1.41
12	Chemical Engineering	55	1.29
13	Multidisciplinary	43	1.01
14	Energy	42	0.99
15	Decision Sciences	39	0.92
16	Business, Management, and Accounting	34	0.8
17	Health Professions	34	0.8
18	Agricultural and Biological Sciences	31	0.73
19	Social Sciences	31	0.73
20	Immunology and Microbiology	22	0.52

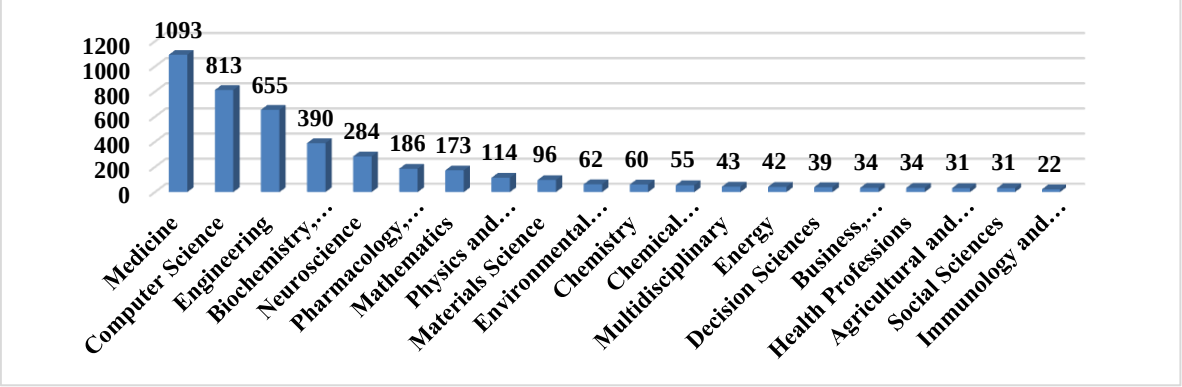

Figure 4: Subject-wise distribution of Publications of Brain Tumor research

6.6 Most productive Institution with their publications of Brain Tumor research

Table 6 indicates the Institution wise research productivity of brain tumor research output in India. It is noted All India Institute of Medical Sciences, New Delhi had contributed the highest number of research publications 153 (6.26%) and National Institute of Mental Health and Neuro Sciences contributed the second-highest number of research publications 108 (4.42%) and Tata Memorial Hospital has contributed the third-highest number of research publications with records 105 (4.3%) stands third and others. Postgraduate Institute of Medical Education & Research, Chandigarh ranked at 4th Position with 89 (3.64%) publications and followed by Anna University ranked 5th position with 51 (2.09%) publications and so on.

Table 6: Most productive affiliations with their publications of Brain Tumor research

S.N.	Affiliation	No. of Publication	Percentage
1	All India Institute of Medical Sciences, New Delhi	153	6.26
2	National Institute of Mental Health and Neurosciences	108	4.42
3	Tata Memorial Hospital	105	4.3
4	Postgraduate Institute of Medical Education & Research, Chandigarh	89	3.64
5	Anna University	51	2.09
6	Vellore Institute of Technology, Vellore	46	1.88
7	Sathyabama Institute of Science and Technology, Chennai	37	1.51
8	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	37	1.51
9	Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum	34	1.39
10	Sri Sathya Sai Institute of Higher Medical Sciences, Bangalore	33	1.35
11	Indian Institute of Science, Bengaluru	28	1.31
12	Noorul Islam University	27	1.15
13	Manipal Academy of Higher Education	25	1.02
14	K L Deemed to be University	24	0.98
15	Christian Medical College, Vellore	23	0.94
16	Indian Institute of Technology Delhi	23	0.94
17	PSNA College of Engineering and Technology, Din Digul (Tamil Nadu)	22	0.9
18	Amity University, Noida	21	0.86
19	King Edward Memorial Hospital India, Mumbai	20	0.82
20	King George's Medical University, Lucknow	20	0.82

6.7 Journal wise distribution of Brain Tumor research with their number of publications

The top 20 journals of brain tumor research during the period under study are given in table 7. The analysis shows that a majority of the articles of brain tumor for the study period is in Neurology India with 122 publications, International Journal of Applied Engineering Research with 42 publications, next is Advances in Intelligent Systems and Computing with 38 publications, International Journal of Engineering and Advanced Technology with 35, International Journal of Innovative Technology and Exploring Engineering with 33 publications, International Journal of Imaging Systems and Technology; and World Neurosurgery with 30 publications each and followed by other journals.

Table 7: Journal wise distribution of Brain Tumor research with their number of publications

S.N.	Journal Name	No. of Publication
1	Neurology India	122
2	International Journal of Applied Engineering Research	42
3	Advances in Intelligent Systems and Computing	38
4	International Journal of Engineering and Advanced Technology	35
5	International Journal of Innovative Technology and Exploring Engineering	33
6	International Journal of Imaging Systems and Technology	30
7	World Neurosurgery	30
8	Journal of Pediatric Neurosciences	27
9	Journal of Neurosciences in Rural Practice	25
10	Indian Journal of Cancer	24
11	International Journal of Recent Technology and Engineering	22
12	Journal of Cancer Research and Therapeutics	21
13	Journal of Advanced Research in Dynamical and Control Systems	20
14	Indian Journal of Pathology and Microbiology	19
15	Clinical Nuclear Medicine	18
16	Brain Tumor Pathology	17
17	Journal of Clinical Neuroscience	16
18	Neuropathology	16
19	Communications in Computer and Information Science	15
20	Indian Journal of Medical And Paediatric Oncology	15

6.8 Funding Agencies with their number of publications of Brain Tumor research

Table 8 depicts the top 20 funding agencies with their publications as the data obtained from the Scopus database. The analysis shows that the Department of Biotechnology, Government of West Bengal has the highest number of articles on Brain Tumor in India that is 35 publications. Department of Science and Technology, Government of Kerala stands second having some publications 27, followed by Indian Council of Medical Research with 26 of publications and Bangladesh Council of Scientific and Industrial Research stands at fourth position with 25 of publications. Science and Engineering Research Board stand at fifth position with 20 of publications and Department of Science and Technology, Ministry of Science and Technology, India stands at sixth position with 15 of publications and so on. Indian Institute of Technology Delhi with 4 publications and All India Council for Technical Education with only 3 publications stands at the 19th and 20th position respectively.

Table 8: Funding Agencies with their number of publications of Brain Tumor research

S.N.	Funding Sponsor	No. of Publication
1	Department of Biotechnology, Govt. of West Bengal	35
2	Department of Science & Technology, Govt. of Kerala	27
3	Indian Council of Medical Research	26
4	Bangladesh Council of Scientific & Industrial Research	25
5	Science & Engineering Research Board	20
6	Department of Science & Technology, Ministry of Science & Technology, India	15
7	Department of Biotechnology, Ministry of Science and Technology, India	14
8	University Grants Commission	14
9	University Grants Committee	13
10	National Institutes of Health	12
11	CouncilÂ of Â Scientific and Industrial Research, India	11
12	Board of Research in Nuclear Sciences	8
13	All-India Institute of Medical Sciences	7
14	Council of Scientific and Industrial Research	7
15	Department of Biotechnology, Ministry of Science and Technology	6
16	Ministry of Electronics and Information technology	6
17	Council of Scientific and Industrial Research, India	4
18	Department of Science and Technology, Ministry of Science and Technology	4
19	Indian Institute of Technology Delhi	4
20	All India Council for Technical Education	3

6.9 Top 20 Most productive keywords in Brain Tumor Research

There were at least three or more keywords have been given in each research publication, which were more than 27000 in the number. Table 9 and figure 5 contains the top 20 most significant keywords in Brain Tumor research as the data traced from Scopus. Brain Tumor was seen as the most significant keyword in terms of number of research papers it retrieved 1349 (4.98%), followed by Human 1279 (4.72%), Article 909 (3.36%), Humans 895 (3.31%), Magnetic Resonance Imaging 714 (2.64%), Brain Neoplasms 648 (2.39%), Brain 640 (2.36%), Tumours 616 (2.27%), Male 567 (2.09%), Female 538 (1.99%), Adult 513 (1.89%), Nuclear Magnetic Resonance Imaging and Technology 511 (1.89%), Image Segmentation 502 (1.85%), Priority Journal 457 (1.69%), Pathology 402 (1.48%), Glioma 346 (1.28%), Controlled Study 337 (1.24%), Brain Tumours 327 (1.21%), Case Report 318 1.17% and Human Tissue 315 (1.16%) during the period 2010-2019.

Table 9: Top 20 Most productive keywords in Brain Tumor Research

S.N.	Keyword	No. of Publication	Percentage
1	Brain Tumor	1349	4.98
2	Human	1279	4.72
3	Article	909	3.36
4	Humans	895	3.31
5	Magnetic Resonance Imaging	714	2.64
6	Brain Neoplasms	648	2.39
7	Brain	640	2.36
8	Tumors	616	2.27
9	Male	567	2.09
10	Female	538	1.99
11	Adult	513	1.89
12	Nuclear Magnetic Resonance Imaging	511	1.89
13	Image Segmentation	502	1.85
14	Priority Journal	457	1.69
15	Pathology	402	1.48
16	Glioma	346	1.28
17	Controlled Study	337	1.24
18	Brain Tumors	327	1.21
19	Case Report	318	1.17
20	Human Tissue	315	1.16

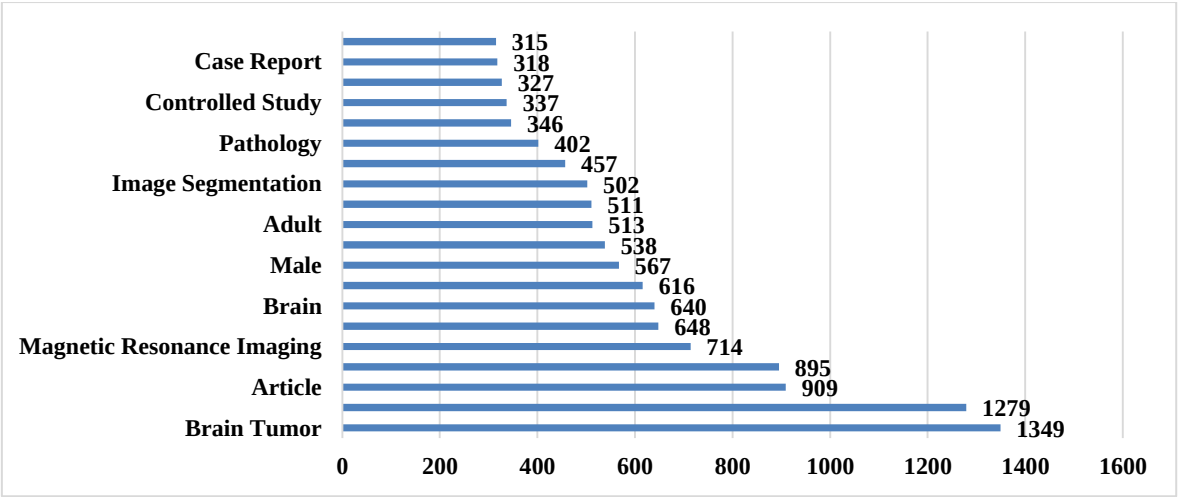

Figure 5: Top 20 Most productive keywords in Brain Tumor Research

7. Major Findings

The study examined various Scientometrics parameters in Brain Tumor research in India during the period 2010-2019.

- The yearly growth lies between 3.97% in 2010 and 21.48% in 2019 and out of total 2444 publications the maximum number of articles 525 (21.48%) on Brain Tumor is published in the year 2019.
- Jalai, R. is the most productive author in brain tumor research with 44 publications, followed by Sarkar, C. with 43 contributions.
- Medicine and Computer Science accounted for the largest share of 1093 (25.67%) and 813 (19.1%) of publications, respectively.
- Most of the publication is published in the form of article 1507 (61.67%). Most of the articles of brain tumor are published in the Neurology India 122 (8.63%).
- Brain Tumor is the most productive keyword and used in 1349 (4.98%) of brain tumor publication. 1894 (77.5%) of publications on brain tumors were published in the form of Journals.
- All India Institute of Medical Sciences, New Delhi has contributed the most 153 (6.26%) in the brain tumor research publications while a large number of 35 publications were funded by the Department of Biotechnology, Government of West Bengal during the period of study.

8. Conclusion

Scientometrics has practice applications for evaluating the library operations and surveys through statistical methods to make quantitative analysis possible. It is useful for the study and measurement of publication patterns of different forms of literature on one subject or the other. It has been estimated that most of the people are diagnosed with brain tumors globally. It has become urgency in medical science to accurately detect brain tumors since it deals with human life. For this reason, Computer science, Medical, Mathematical, researchers have combined their knowledge and efforts to better diagnose the disease for effective treatment. The scope of the future study of this area is that many equations and formulas encourage the

scientists to test and the researchers can take the data from different databases. Also, it may be beneficial for doctors who are currently studying the brain tumor.

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