



A SCIENTOMETRIC ANALYSIS OF RESEARCH PAPERS PUBLISHED ON CERVICAL MYELOPATHY AS REFLECTED IN THE WEB OF SCIENCE

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Abstract

Purpose: This study investigates the observations of research publications in the field of Cervical Myelopathy Global Level as reflected in the Web of Science (WoS) core collection database during 2013-2022. **Methodology:** The data was interpreted by using Bibexcel and VoSviewer and tabulated using MS Excel. The results indicated that 5480 papers were published in the year of 2013 to 2022 and the loftiest number of publications, 551 (12.03%), was produced in 2021. **Objectives:** Using colourful Scientometrics approaches, the study presents of research published on Cervical Myelopathy as reflected in the Web of Science for Global and Indian output of citation analysis, keywords, times series analysis and Relative growth rate and doubling time, H-index, Degree of Collaboration (DC), International Collaboration, Institution based collaboration, most cited references, ranking of core journals and so on. We find multi and mega author benefactions which are added and dominate the Cervical Myelopathy exploration. **Conclusion:** The highest numbers of research articles (551, 12.03%) were published from all over the Global output in 2021. The highest publications were published in the form of Article with 3703 (80.85%), Out of 85 scientific publications, the maximum number of outputs (= 1338, 29.21%) in USA research outputs. It was clearly evident that English was the most preferred language for the research publications in most of the countries.

Keywords: *Cervical Myelopathy, Spine, Web of Science, Scientometrics, Degree of Collaboration, Bibexcel.*



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1.INTRODUCTION

Scientometric is the 'The measurement of scientific output and the impact of scientific findings, on public policy.' The Scientometrics studies have enabled to develop a body of theoretical knowledge and a group of techniques and have facilitated it is application for the further growth of knowledge based on information.

Cervical Myelopathy is a form of Myelopathy that involves spinal cord compression in the cervical

spine (neck). Your cervical spine contains seven vertebrae (C1 to C7), with six intervertebral discs and eight nerve roots. The spinal cord travels inside the vertebral column constructed from the front by vertebrae, cushioned by the intervertebral discs, and from the back by the facet joints and lamina.

2. REVIEW OF LITERATURE

Kumar, V., Patel, S., & et al (2022) performed the Bibliometric analysis of the research papers

published on Cervical Spondylotic Myelopathy and reported the literature outputs and collaborative structure analysing bibliometric method from 1970 to 2020. The results reveal that the annual growth of countries, pre-dominant journals, top-cited articles and authors were identified using performance analysis. The United States topped the list and was followed by Canada in Cervical myelopathy research. The trend of research showed a shift toward non-invasive procedures. **Yin, M., Xu, C., & et al (2021)** studied the scientometric analysis in Cervical Spondylotic myelopathy literature. This study aimed to illustrate the overall knowledge structure and development trends of CSM. Research data sets were acquired from the Web of Science database from 2000 to 2019. VOS Viewer and cite space software were used to analyse the data. A Total of 2367 publications. Based on the analysis, it was identified that the primary research centres and noticed the top 20 institutions, authors' distribution, countries, H-index status and research hotspots were analysed. in CSM. The highest H- index was found for articles from the United States. **Narayanan M. K., Deora H (2022)** described the scientific publications in the field of Neurosurgery from 1973 to 2010. The data was collected through the Web of Science (WoS) Science Citation Index Expanded (SCI-Expanded). The results show that the study involved terms of research outputs, from- wise manuscripts, subject-wise, language-wise, countrywise and institution-wise outputs. This identified the World neurosurgery, with endoscopy and skull base being the topics achieving high impact. The World Neurosurgery author sub-specialisation and increased collaboration across specialities with more articles on the refinement of technique and outcome have emerged as recent trends. **Victoria P & Gomathi P(2021)** have carried out in the field of Leprosy from 2010 to 2020 for analysing the metric study. Data were analysed the Bibexcel software, and VosViewer and tabulated using MS Excel. A total of 4544 publications. The highest number of publications 456 (10.03%) was produced in 2020. The analysis includes various factors such as research growth rate, Proportion of authorship trends, length of papers, and collaborative countries. This study inferred that the rate of growth is related to the year-wise publication of leprosy research. **Bestwick, H., Teh, J. Q., & et al (2022)** assessed the quantitative and qualitative based scientific papers from various countries related to degenerative cervical myelopathy to examine the salient features of global wise literature output. The aim of this paper is to review current funding in DCM research and highlight future research funding opportunities. The Web of Science search engine was used to collect the publications for the period from 1995 to 2020. The global literature output of 621 was produced and the increased time trend for

the top funders was AO Spine (n= 87) supported the most DCM research followed by China (n=209). The major proportion data here showed 180 grants awarded specifically for DCM research.

3. SOURCE DATA OF CERVICAL MYELOPATHY IN INDIA

The source data of Cervical Myelopathy in India has been investigated by the researchers using the BibExcel software in the terms of year- wise total number of papers, citations, paper per author, H-index, annual growth rate and exponential growth rate, institution wise, Core journals ranking, international collaboration on Cervical Myelopathy etc. The table 1 shows the whole details of source data of Cervical Myelopathy research.

Table:-1 Cervical Myelopathy details

S.No	Item Details	Description
1	Source Topic	Cervical Myelopathy
2	Geographical area	Global
3	Database	Web of Science Core Collection
4	Query date	2023-04-11
5	Research data	5480
6	Citations	18537
7	Years	10 (2013-2022)
8	Cites/Year	10
9	Cites/Paper	1.5/0.52
10	Cites/Author	13477
11	H-Index	74

H- Index is one of the tools that measure both the scientific productivity and the impact of published work of a scientist or a researcher. To calculate it, only two pieces of information are required. The total number of papers published (Np) and the number of citations (Nc) for each paper. The index also can be applied to the productivity and impact of a group of scientists, departments or universities and countries.

4. OBJECTIVES OF THE STUDY

- To access the year wise publication and growth pattern of literature from Cervical Myelopathy
- To study the most prolific authors and core journals.
- To describe the institution wise and country wise production.
- To show the keywords of literature output and Degree of Collaboration.

- To examine the types of documents and to identify the languages.

5. METHODOLOGY

Web of Science Core Collection citation databases such as SCI-Expanded, SSCI, A&HCI were used to collect the data as the primary source. We selected the search item Cervical Myelopathy in the topic filed with the limitation of 10 years from 2013 to 2022. We found a total number of 4580 world records that were retrieved as a sample for data analysis. The retrieved data has different categories including articles, review, editorial material, meeting abstract, proceeding papers, biographical items. The data has been transferred to Excel spreadsheet for further analysis. For sample data and visual representation of author productivity, VoS viewer software and Bibexcel software have been employed.

6. DATA ANALYSIS AND DISCUSSION

Table:-2 Comparative growth of Global and Indian output with Cited Article and H-index

Years	Global Output	Percentage	Indian Output	Percentage	Citation Article	Times cited	H- Index
2021	551	12.03%	8	4.49%	968	1384	11
2020	538	11.75%	14	7.86%	2045	3070	20
2022	530	11.57%	14	7.86%	262	396	06
2019	518	11.31%	25	14.04%	2801	4070	23
2018	515	11.25%	22	12.35%	3797	5501	31
2017	484	10.57%	20	11.23%	4066	6367	35
2016	403	8.80%	23	12.92%	4105	6057	38
2015	397	8.67%	15	8.42%	5597	8686	45
2014	344	7.51%	22	12.35%	4564	6285	39
2013	300	6.55%	15	8.42%	5821	9249	49
Total	4580	100%	178	100%			

Table 2 brings out the growth pattern of research productivity between Global and India in Cervical Myelopathy for the year 2013 to 2022. The results mirror that maximum number of scientific papers more than three digits. The highest number of research articles (551, 12.03%) were published from all over the Global output in 2021 whereas in Indian literature outputs more than two digits. Throughout the world, the majority of Indian literature (25, 14.04%) was produced in 2019 with 968 Citation articles, 1384 Times cited and 11 H-index. It is identified from the Table 2 based on the papers in India, the colossal number of (=14, 11.75%) articles were published in 2020 with 2045 citations, 3070

times cited and 20 H-index. And the least number of papers (15, 8.42%) and below were found almost before 2013. The growth rate has gradually increased except 2015 in terms of Global productivity and the growth rate has slightly decreased compared with Global literature in Cervical Myelopathy during the study period.

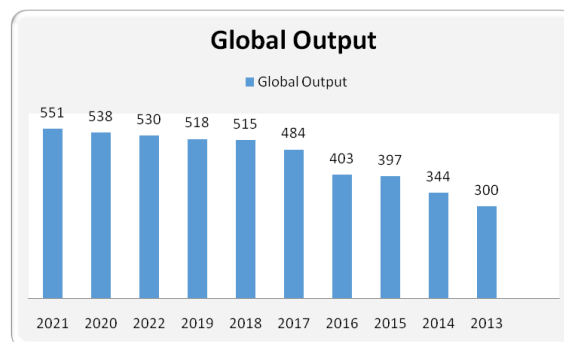


Figure 1 Global Output on Cervical Myelopathy

Table:-3 Document type of Cervical Myelopathy

S. No	Document Type	Records	Percentage
1	Article	3,703	80.85%
2	Review Article	503	10.98%
3	Editorial Material	176	3.84%
4	Letter	106	2.31%
5	Meeting Abstract	73	1.59%
6	Early Access	55	1.20%
7	Correction	14	0.31%
8	Proceeding Paper	9	0.20%
9	Book Review	2	0.04%
10	News Item	1	0.02%
11	Reprint	1	0.02%
12	Retracted Publication	1	0.02%
13	Retraction	1	0.02%

Table 3 shows the document type distribution of Global level and it is a contribution to Cervical Myelopathy research. It shows 13 document types such as: Article, Review Article, Editorial Material, Letter, Meeting Abstract, Early Access, Proceeding Paper, Book Review and so on. Among them the highest publications were published in the form of Article with 3703 (80.85%), followed by Review Article 503

(10.98%). The lowest publications were found in Article; News Item, Reprint, Retracted Publications and Retraction with 1 (0.02%).

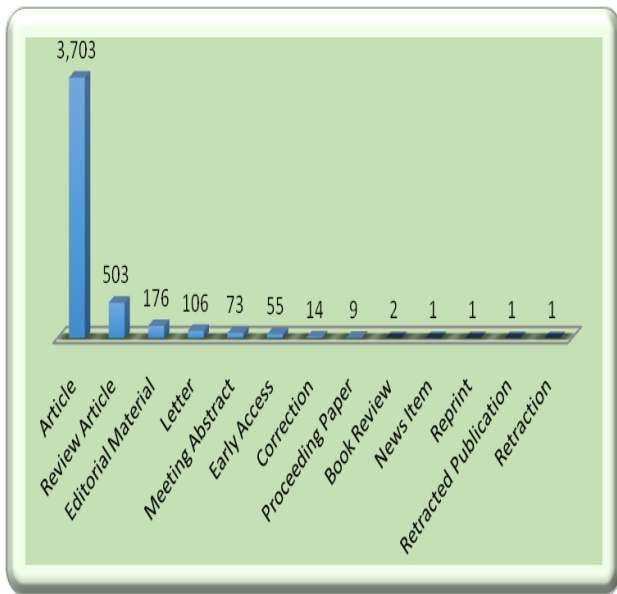


Figure 2 Document type of Cervical Myelopathy

And other countries are Canada, South Korea, England, Germany, Italy, and Switzerland, etc. respectively. The results indicate that very few papers were published by some big countries and it shows that the collaborative countries.

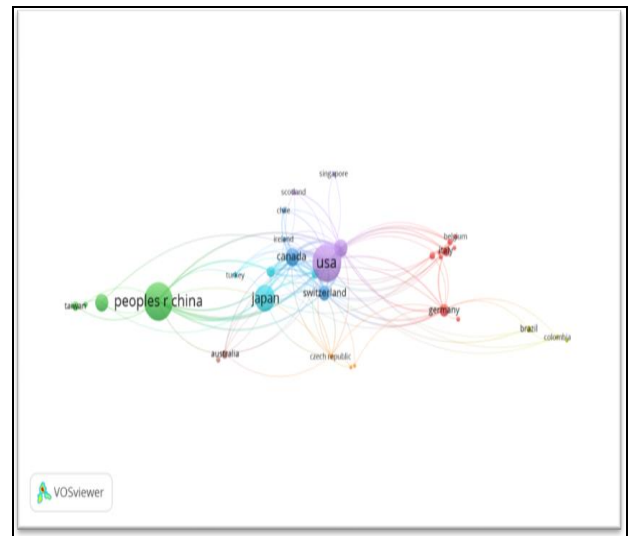


Figure 3 International Collaboration on Cervical Myelopathy

Table:-4 International Collaboration on Cervical Myelopathy (Top10)

S. No	Country	Records	Records
1	USA	1,338	29.21%
2	Peoples R China	1,121	24.48%
3	Japan	727	15.87%
4	Canada	313	6.83%
5	South Korea	292	6.38%
6	England	223	4.87%
7	Germany	211	4.61%
8	India	178	3.89%
9	Italy	112	2.45%
10	Switzerland	109	2.38%

Table:-5 Language wise distribution of Cervical Myelopathy

S. No	Languages	Records	Percentage
1	English	4,526	98.82%
2	German	22	0.48%
3	Spanish	14	0.31%
4	Czech	8	0.18%
5	French	4	0.09%
6	Portuguese	3	0.07%
7	Hungarian	1	0.02%
8	Slovenian	1	0.02%
9	Turkish	1	0.02%

Table 4 indicates the international collaborative research on Cervical Myelopathy in Global level. Out of 85 scientific publications, the maximum number of outputs (= 1338, 29.21%) in USA research outputs. The other countries such as Peoples R China (=1121, 24.48%), Japan (=727, 15.87%) got third position and then India got Seventh place (=178, 3.89%) in the research field of Cervical Myelopathy.

Table 5 depicts the language wise (9 languages) distribution in Cervical Myelopathy research. It was clearly evident that English was the most preferred language for the research publications in most of the countries. Majority of the papers were in the English language 4526 (98.82%), followed by German 22 (0.48%), Spanish 14 (0.31%) and Czech 8 (0.18%) and so on.

Table:-6 Authorship pattern on Cervical Myelopathy

Years	1	2	3	4	5	6	7	8	9	10	10+	Total
2013	9	15	21	43	54	61	31	23	16	12	15	300
2014	8	26	26	48	59	59	38	32	20	8	20	344
2015	16	24	44	55	62	78	42	33	14	11	18	397
2016	16	27	32	52	50	91	41	34	21	13	26	403
2017	18	19	41	59	73	80	62	47	21	18	46	484
2018	17	24	46	71	77	87	58	49	15	18	53	515
2019	11	31	41	58	80	81	66	45	32	24	49	518
2020	15	20	56	67	76	69	61	35	41	22	76	538
2021	13	28	38	46	74	69	62	45	44	21	111	551
2022	8	15	36	43	71	71	65	55	34	30	102	530
Total	131	229	381	542	676	746	526	398	258	177	516	4580

(Note: 1* Single Author 2* Two Author 3* Three Author 4* Four Author 5* Five Author 6* Six Author 7* Seven Author 8* Eight Author 9* Nine Author 10* Ten Author 10 above Ten Author)

Table:-7 Relative Growth Rate (RGR) and Doubling Time (DT)

Years	Records	Cumulative	W1	W1	W2-W1	Mean RGR	0.693/R(a)	Mean DT
2013	300		5.7			1.5		0.52
2014	344	644	5.84	6.46	0.62		1.117742	
2015	397	1041	5.98	6.94	0.96		0.721875	
2016	403	1444	5.99	7.27	1.28		0.541406	
2017	484	1928	6.18	7.56	1.38		0.502174	
2018	515	2443	6.24	7.8	1.56		0.444231	
2019	518	2961	6.24	7.99	1.75		0.396	
2020	538	3499	6.28	8.16	1.88		0.368617	
2021	551	4050	6.31	8.3	1.99		0.348241	
2022	530	4580	6.27	8.42	2.15		0.322326	
Total	4580							

Table 7 describes analysis of Relative Growth Rate (RGR) and Doubling Time (DT) for the total research output of Cervical Myelopathy at the global level. It is calculated that globally 300 research publications were found in (2013), and it will increase gradually to 530 in 2022. It can be observed that the relative growth rate of Cervical Myelopathy falls between 0.62 in 2013 and 2.15 in the year 2022.

It also evaluated the doubling time for the literature output of Cervical Myelopathy at the global level. It revealed that the declining trend and range was from 1.11 in 2013 to 0.32 in 2022. Therefore, the results show that the relative growth rate has a decreasing trend in terms of publications. In contrast, the doubling time has seen the increasing movement in Cervical Myelopathy during the research period.

Table:-8 Degree of Collaboration (DC)

Single Author(NS)	Percentage	Multi Authors(NM)	Percentage	Total	DC=NM/NS+NM
131	2.86%	4449	97.14%	4580	97.00%

To evaluate the authorship pattern in terms of single versus multi-authored literature outputs in Cervical Myelopathy during the period of study, the

degree of collaboration (DC) is used. (DC) is defined as the ratio of the number of collaborative research papers to the total number of research papers in the

discipline during a certain period of time. This formula is suggested by Subramanyam (1983) is used and it is expressed as: $C = \frac{Nm}{Nm+Ns}$

Where, C- denotes the degree of collaboration in a discipline; Nm- indicates the number of multi-authored research papers in the discipline published during the year; Ns- represents the number of single authored papers in the discipline published during the same year. While, it is observed based on the formula and it is found that the degree of collaboration in the Cervical Myelopathy analysis is 97.00%.

Table:-9 Times Series Analysis

Years	Records(Y)	X	X	XY
2013	300	-5	25	1500
2014	344	-4	16	1376
2015	397	-3	9	1191
2016	403	-2	4	806
2017	484	-1	1	484
2018	515	0	0	0
2019	518	1	1	518
2020	538	2	4	1076
2021	551	3	9	1653
2022	530	4	16	2120
Total	4580		85	10

In this Study, the straight-line equation under time series analysis is used to identify and evaluate the future development of Cervical Myelopathy Literature.

Straight line $Y_c = a + Bx$

Estimated literature in 2023 is when $X = 2033 - 2023 = 10$

$$458 + 8.5 * 10 \quad 466.5 * 10 = 4665$$

Estimated literature in 2030 is when $X = 2038 - 2023 = 15$

$$458 + 8.5 * 15 \quad 466.5 * 15 = 6997$$

The predicted value of scientific publications for the year 2033 is 4665, and the expected amount of publications for the year 2038 is 6997.

It is divided that the formula time series analysis shows the predicted value of literature output in Cervical Myelopathy for the period between 2033 and 2038. The results represent future growth and research trends in publications of Cervical Myelopathy in all over the world. The inferences prove that a gradual decreasing trend at the publications of Cervical

Myelopathy research. Hence, it needs more attention to study for the betterment of Cervical Myelopathy, growth in terms of scientific publications.

Table:-10 Ranking of core Journals on Cervical Myelopathy (Top 10 Journals Out of 55)

S. No	Journal	Records	Percentage
1	Spine	395	8.62%
2	World Neurosurgery	372	8.12%
3	European Spine Journal	265	5.79%
4	Journal of Neurosurgery Spine	200	4.37%
5	Spine Journal	175	3.82%
6	Clinical Spine Surgery	170	3.71%
7	Global Spine Journal	130	2.84%
8	Journal of Clinical Neuroscience	129	2.82%
9	Medicine	107	2.34%
10	Neurosurgery	102	2.23%

Table 10 illustrates 55 core journals and categorized rank-wise production. The most productive and top ranked journal is 'Spine' with 395 records (= 8.62%) and 'World Neurosurgery' has occupied second place with 372 records (= 8.12%). The third rank has got 'European Spine Journal' positioned with 265 records count along with (=5.79%) core journals.

Table:-11 Institution and University based distribution (Top 10 Out 3355)

S.No	Institution	Records	Percentage
1	University of Toronto	243	5.31%
2	University Health Network Toronto	192	4.19%
3	University of California System	174	3.80%
4	Naval Medical University	127	2.77%
5	Jefferson	114	2.49%

	University		
6	Johns Hopkins University	91	1.99%
7	Nagoya University	89	1.94%
8	Hebei Medical University	87	1.90%
9	Peking University	87	1.90%
10	Tokyo Medical Dental University Tmdu	87	1.90%

Table 11 indicates that the literature outputs from Institutions and Universities in the field of Cervical Myelopathy during the study period. Out of 3355 institutions, we have chosen to analyze only the top most productive research papers which are published by the eminent scholars and faculty members of the Cervical Myelopathy Department. The table 11 illustrates the results with the highest number of articles (=243, 5.31%) published by the University of Toronto and the same articles with (=192, 4.19%) published by 'University Health Network Toronto' they have placed in the first and second positions. The other institutions and universities listed in the table above have placed in the next level positions based on the research papers of Cervical Myelopathy.

Table:-12 Highly Productive Keywords on Cervical Myelopathy Top 10 out of 501

S. No	Keywords	Records
1	Myelopathy	898
2	Spondylotic Myelopathy	860
3	Fusion	687
4	Surgery	568
5	Spine	526
6	Decompression	516
7	Outcomes	456
8	Laminoplasty	397
9	Ossification	368
10	Diskectomy	358

The table 12 and below picture reveals the frequency of Cervical Myelopathy research. The research has been taken up the occurring words. The word "Myelopathy" has been repeatedly used 898 times by Cervical Myelopathy research scientists during the study period, followed by "Spondylotic

"Myelopathy" 860 times. The word "Fusion" occupies the third position being used 687 times.

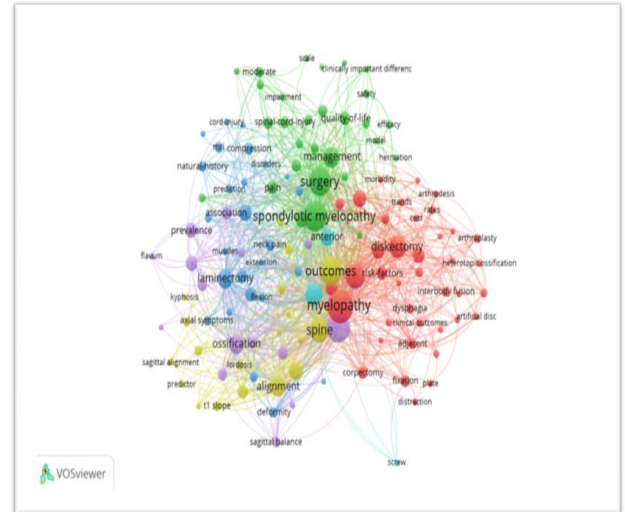


Figure 4 Keywords on Cervical Myelopathy

7. FINDINGS AND CONCLUSION

The Scientometric study is the best way to evaluate scientific publications in any subject area. Cervical Myelopathy is one of the diseases in the medical field of research. The major findings are that the highest number of research articles (551, 12.03%) were published from all over the Global output in 2021. The highest publications were published in the form of Article with 3703 (80.85%), Out of 85 scientific publications, the maximum number of outputs (= 1338, 29.21%) in USA research outputs. It was clearly evident that English was the most preferred language for the research publications in most of the countries. Majority of the papers were in the English language 4526 (98.82%). The maximum number of articles were 516, which were published by the above ten authors. And the lowest numbers of articles 131 were published by the one author. Relative Growth Rate (RGR) and Doubling Time (DT) for the total research output of Cervical Myelopathy at the global level. It is calculated that globally 300 research publications were found in the founding year (2013), and it increased gradually to 530 in 2022. In contrast, the doubling time has seen the increasing movement in Cervical Myelopathy during the research period. It is observed based on the formula and it is found that the degree of collaboration in the Cervical Myelopathy analysis is 97.00%. The results represent future growth and research trends in publications of Cervical Myelopathy in all over the world. The most productive and top ranked journal is 'Spine' with 395 records (= 8.62%). that the highest number of articles (=243, 5.31%) published by the 'University of Toronto'. The word "Myelopathy" has

been repeatedly used 898 times by Cervical Myelopathy research scientists during the study period. As far as the research concerned, researchers have identified that this is the first Scientometrics study which is done in the field of Cervical Myelopathy research output Global level for the period of 2013 to 2022.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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