



Scientometric Analysis of Global and Indian Stroke Research with Focus on Contributions of Ayurveda: An Analytical Review

¹Kruti Raicha, ²Anup Thakar

ABSTRACT:

Background: Stroke is a leading cause of morbidity and mortality. Due to its rising prevalence, researchers and clinicians across the globe are focusing on its prevention and improving prognosis. This study presents the scientometric analysis of stroke research focusing on contributions of Ayurveda. **Objectives:** The objective of this study is to analyse research trends in Indian and global stroke literature, to identify major research domains and emerging themes and to evaluate the contribution of Ayurveda in stroke research. **Materials and Methods:** This is an analytical review done by using descriptive scientometric analysis technique. Science Direct, PubMed database, Google Scholar and AYUSH Research Portal were searched to collect publication data of last 10 years (2016-2025). The search results were analyzed for indicators such as publication count, document type, subject areas, journal titles, publication trend and contributions of Ayurveda. **Results:** Total 32 Ayurveda publications on clinical research on stroke were retrieved. Among all stroke publications, majority were Research articles. In India, most of these publications appeared in "Materials Today: Proceedings" and in Ayurveda, "Journal of Ayurveda and Integrative Medicine" was the most productive journal for stroke research. There was a shift in stroke research trends from emergency management including anticoagulants and thrombectomy to long-term recovery, rehabilitation, and personalized care in the recent years. Ayurveda contributes to integrative stroke management, with evidence supporting role of Panchakarma and herbal formulations in post-stroke rehabilitation and functional recovery. **Conclusion:** The study depicts rising trends in stroke research globally and in India. Focusing on integrating conservative medicine with complementary medicine is need of an hour.

KEYWORDS: Analytical review, Ayurveda, Scientometric analysis, Stroke

RECEIVED ON:
15-06-2026

REVISED ON:
04-08-2026; 06-09-2026

ACCEPTED ON:
11-09-2026

Access This Article Online:

Quick Response Code:



Website Link:

<https://jahm.co.in>

DOI Link:

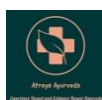
<https://doi.org/10.70066/jahm.v14i8.2862>

Corresponding Author Email:

krutiraicha@gmail.com

CITE THIS ARTICLE AS

Kruti Raicha, Anup Thakar. Scientometric Analysis of Global and Indian Stroke Research with Focus on Contributions of Ayurveda: An Analytical Review. Journal of Ayurveda and Holistic Medicine (JAHM) 2026; 14(8):70-84.



1. INTRODUCTION

A stroke is defined as an emergency medical condition that occurs when there is interruption in blood flow to the brain, either due to a blockage or bleeding; due to lack of blood flow, it can lead to brain cell death and serious complications. Strokes are often associated with increased mortality and need immediate treatment. The types of strokes are ischaemic stroke, haemorrhagic stroke and transient ischaemic attack (TIA).

There are some modifiable and non-modifiable risk factors for stroke. The modifiable risk factors are: Hypertension which is the leading contributor to stroke. Individuals with hypertension have a nearly three times higher risk of stroke compared to those without hypertension; Tobacco use is associated with approximately two-fifths of all stroke deaths among individuals under the age of 65; and other risk factors include high blood cholesterol, diabetes mellitus, high levels of low-density lipoprotein cholesterol, overweight and obesity, physical inactivity, unhealthy diet (particularly diets high in sodium and low in fruits and vegetables), harmful use of alcohol, use of illicit drugs (e.g. cocaine), air pollution, high fasting blood glucose and kidney dysfunction. Non-modifiable risk factors include age, a prior stroke and pre-existing cardiac conditions (e.g. atrial fibrillation, heart failure), and chronic kidney disease.

The symptoms of stroke include sudden dizziness, loss of balance or coordination, sudden vision loss, facial droop, weakness in one or both arms and slurred or strange speech. When a stroke is suspected, it should be treated as a health emergency. Immediate diagnostic using appropriate imaging (a CT or MRI scan) should be carried out. Lifestyle changes and effective management of high blood pressure can significantly reduce the risk of stroke.

Rehabilitation is a critical component of stroke care and recovery. It aims to help individuals regain functional abilities, improve quality of life, and restore independence to the greatest extent possible. Stroke rehabilitation should begin as soon as the person is medically stable – ideally within the first few days after the stroke. Rehabilitation

involves a multidisciplinary approach, including physiotherapy, occupational therapy, speech and language therapy, neuropsychological and cognitive therapy and psychological support and counselling. [1]

Key facts:

- a) In 2021, stroke was the third leading cause of death and disability globally, with an estimated 93.8 million cases. [1]
- b) In 2021, there were 11.9 million new cases of stroke. [1]
- c) The lifetime risk of stroke has increased by 50 % over the past 20 years, with 1 in 4 adults predicted to experience a stroke in their lifetime. [1]
- d) The global burden of stroke measured in Disability-Adjusted Life Years (DALYs) increased from 137 million in the year 2000 to 160 million in 2021. [2]
- e) Most of the stroke burden is attributable to 10 modifiable risk factors, including high blood pressure, air pollution, smoking, high LDL cholesterol, diet high in sodium, high fasting blood glucose, kidney dysfunction, excess body weight, physical inactivity, and harmful use of alcohol. [1]

In Ayurveda, there is no direct reference of stroke. Considering its resemblance in signs and symptoms, it can be correlated to *Pakshaghata* (hemiplegia/ hemiparesis) which is mentioned as one among of the *Vataja Nanatmaja Vikara* (diseases primarily due to *Vata*). [3] In all of the major Ayurveda classics, the causative factors, symptoms, diagnosis and management of *Pakshaghata* (hemiplegia/ hemiparesis) is mentioned in the chapter of *Vatavyadhi* (disorders of *Vata*).

Scientometrics can be defined as the quantitative study of science, scientific communication, and science policy. It includes the analysis of literature in a given field in search of patterns and relationships across different topics. As such, it is a tool to assess the growth and evolution of scientific output for most disciplines. [4] Very few scientometric analyses are done on stroke and its types but no study has been done focusing on contributions of Ayurveda.

2. OBJECTIVES OF THE STUDY:

- To analyze global research trends in stroke literature
- To assess India's contribution to stroke research
- To identify major subject areas and journals contributing to stroke research
- To evaluate the contribution of Ayurveda in stroke research

3. METHODS:

The present study is an analytical review done by using descriptive scientometric analysis technique. Science Direct and PubMed databases were searched for keywords: "Stroke", "Stroke in India", "Stroke AND (ayurveda OR ayurvedic)", "Stroke AND (ayurveda OR ayurvedic) in India", "Hemiplegia AND (ayurveda OR ayurvedic)", "Hemiplegia AND (ayurveda OR ayurvedic) in India"; and publications of

last 10 years (2016-2025) were retrieved. To ensure maximum coverage of Ayurveda literature, Google Scholar and AYUSH Research Portal were also searched. The search results were analyzed for indicators such as publication count, document type, subject areas, journal titles, publication trend and contributions of Ayurveda.

ScienceDirect is a searchable web-based bibliographic database, which provides access to full texts of scientific and medical publications of the Elsevier as well of several small academic publishers. PubMed is an openly accessible, free database which primarily includes the MEDLINE database of references and abstracts on life sciences and biomedical topics.

The database searched, search term used, filters applied and number of results are mentioned below. [Table 1](#)

Table 1: The database, search terms used, the filters applied and the results.

Database	Search term used	Filters applied	Notes	Number of results
Science Direct	"Stroke"	Date range: 2016-2025	Title/Abstract or Author specified keyword	388586
	"Stroke in India"	Date range: 2016-2025	Title/Abstract or Author specified keyword	31461
	"Stroke AND (ayurveda OR ayurvedic)"	Date range: 2016-2025	Title/Abstract or Author specified keyword	15
	"Stroke AND (ayurveda OR ayurvedic) in India"	Date range: 2016-2025	Title/Abstract or Author specified keyword	5
	"Hemiplegia AND (ayurveda OR ayurvedic)"	Date range: 2016-2025	Title/Abstract or Author specified keyword	1
	"Hemiplegia AND (ayurveda OR ayurvedic) in India"	Date range: 2016-2025	Title/Abstract or Author specified keyword	0
PubMed	"Stroke" [Title/abstract]	Date range: 2016-2025	Title/Abstract	202817
	"Stroke in India" [Title/abstract]	Date range: 2016-2025	Title/Abstract	42
	"Stroke AND (ayurveda OR ayurvedic)" [Title/abstract]	Date range: 2016-2025	Title/Abstract	31
	"Stroke AND (ayurveda OR ayurvedic) in India" [Title/abstract]	Date range: 2016-2025	Title/Abstract	26
	"Hemiplegia AND (ayurveda OR ayurvedic)" [Title/abstract]	Date range: 2016-2025	Title/Abstract	4
	"Hemiplegia AND (ayurveda OR ayurvedic) in India" [Title/abstract]	Date range: 2016-2025	Title/Abstract	4

4. RESULTS:

a. Global publications: A total of 3,88,586 publications were retrieved from ScienceDirect from the year 2016-2025, majority consisting of research articles accounting to 56.61% of total publications. [Figure 1] Majority of the articles (99.30%) were in English language. [Figure2] The details including document type, major subject areas, number and percentage of publications in India and globally is mentioned below. [Table 2]

On advance searching the database of PubMed, a total of 2,02,817 publications were retrieved from the year 2016-2025 with search term "Stroke" [Title/abstract].

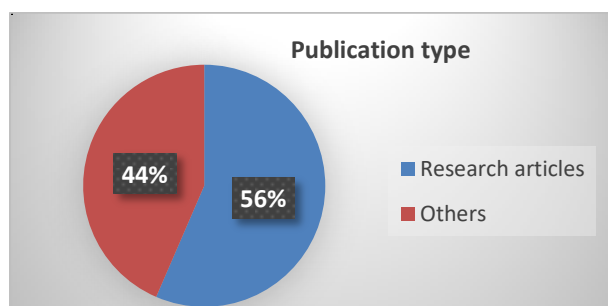


Figure 1: Pie-chart showing distribution of global Stroke publication type

Table 2: ScienceDirect data of Document types, Subject areas and Percentage distribution:

Document type	Numbers		Percentage	
	India	Global	India (31461)	Global (388586)
Research articles	15814	219985	50.26%	56.61%
Review articles	6542	51496	20.79%	13.25%
Conference abstracts	1475	37978	4.68%	9.77%
Book chapters	4045	24241	12.85%	6.24%
Short communications	454	9574	1.44%	2.46%
Editorials	255	8926	0.81%	2.29%
Correspondence	277	7209	0.88%	1.85%
Case reports	399	8149	1.26%	2.09%
Discussion	175	3447	0.55%	0.88%
Encyclopaedia	349	2955	1.11%	0.76%
Mini reviews	83	1427	0.26%	0.36%
News	38	711	0.12%	0.18%
Practice guidelines	74	972	0.23%	0.25%
Errata	13	474	0.04%	0.12%
Book reviews	8	134	0.025%	0.03%
Examinations	7	182	0.022%	0.05%
Data articles	16	207	0.05%	0.05%

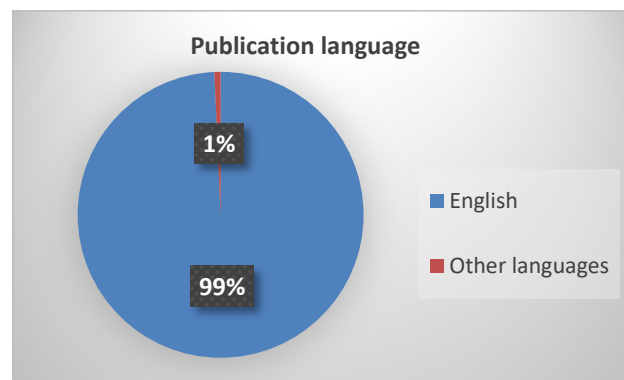


Figure 2: Pie-chart showing distribution of global Stroke publication language

b. Publications related to India: On searching the keyword "Stroke in India" in ScienceDirect retrieved 31,461 publications, of which majority (15,814) were research articles and 6,542 were review articles. [Table 2] Most of these publications appeared in the "Materials Today: Proceedings". [Table 6] In PubMed, searching the keyword "Stroke in India" [Title/Abstract] retrieved 42 publications. Data related to global and India-specific publications on stroke from ScienceDirect database is shown in graphical form. [Figure 3, 4]

Product reviews	3	60	0.01%	0.015%
Conference info	8	65	0.025%	0.016%
Video articles	2	46	0.006%	0.01%
Software publications	1	17	0.003%	0.004%
Replication studies	0	1	0.00%	0.0001%
Others	1423	10330	4.52%	2.65%
Subject Areas	India	Global	India (31461)	Global (388586)
Medicine and dentistry	13126	248630	41.72%	63.98%
Neuroscience	3196	55386	10.15%	14.25%
Biochemistry, Genetics and Molecular Biology	3904	45626	12.41%	11.74%
Engineering	3188	33128	10.13%	8.52%
Nursing and Health Professions	0	26195	0.00%	6.74%
Pharmacology, Toxicology and Pharmaceutical Science	2675	20732	8.50%	5.33%
Materials Science	2799	16198	8.89%	4.16%
Energy	2086	12064	6.63%	3.10%
Agriculture and Biological Sciences	2039	11747	6.48%	3.02%
Environmental Science	2226	12487	7.07%	3.21%
Chemistry	1553	0	4.94%	0.00%

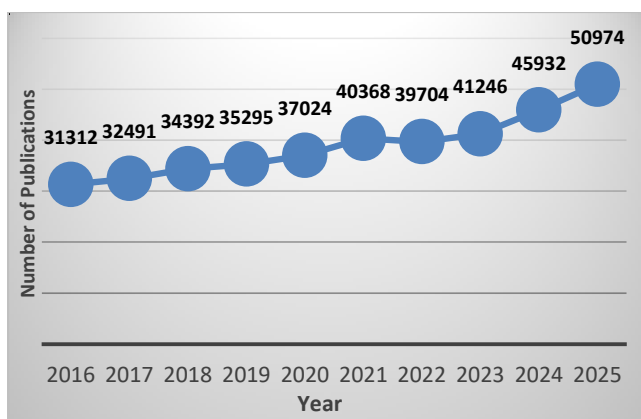


Figure 3: Year wise global publications related to Stroke from Science Direct.

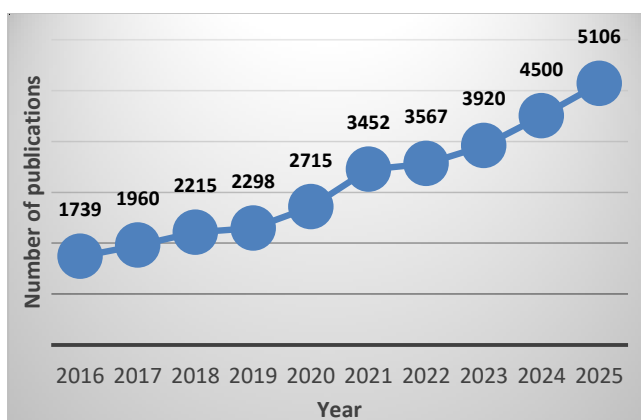


Figure 4: Year wise publications related to Stroke in India from Science Direct.

c. Ayurveda related Publications: To provide a clear visualization of the data, the keywords searched along with results of publications from last 10 years (2016-2025) were organized in tabular format for data obtained from ScienceDirect, PubMed, [Table 1] Google Scholar [Table 4] and AYUSH Research Portal. [Table 5]

From the results obtained, Ayurveda clinical articles on stroke were extracted and quantitative analysis was done focusing on Panchakarma therapies, palliative management and combination of both. [Figure 5] Among the palliative formulations, the top 10 frequently reported formulations were identified. [Table 3]

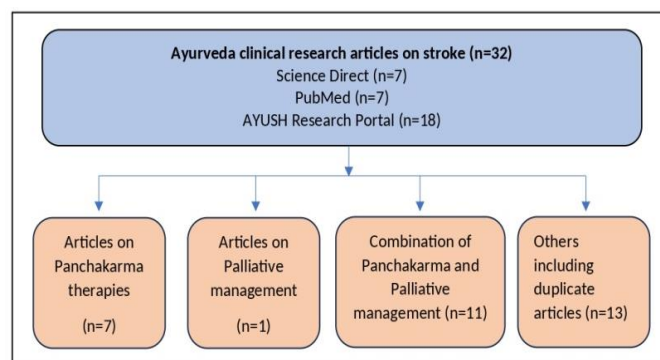


Figure 5: Quantitative analysis of Ayurveda clinical articles on Stroke

Table 3: Top 10 Ayurveda formulations for palliative management of Stroke

Sr. No.	Top 10 Formulations	Number of articles	Citation
1.	<i>Brihatvatachintamani Rasa</i>	4	[5-8]
2.	<i>Dhanadanayanadi Kashayam</i>	3	[7,8,11]
3.	Capsule Palsinuron	3	[7,9,10]
4.	<i>Yogaraja Guggulu</i>	2	[8,10]
5.	Tablet Anuloma DS	2	[5,7]
6.	<i>Hingwashtaka Choorna</i>	2	[10,12]
7.	<i>Mahamanjishthadi Kwatha</i>	1	[8]
8.	<i>Ksheerabala Taila</i> Capsule	1	[5]
9.	<i>Balarishta</i>	1	[8]
10.	<i>Ekangveera Rasa</i>	1	[5]

The summary of the research findings in some of the Ayurveda related publications is as follows:

Sylaja et. al. conducted a randomized controlled trial on 140 subjects to compare Ayurvedic Rehabilitation Therapy (ART) with conventional physiotherapy (PT) in ischemic stroke patients across four stroke centers in India. ART included *Dhanyamla Dhara* and *Ksheera Dhooma* for initial 7days; followed by *Patrapotala Sveda* for the next seven days; on 15th day, *Virechana* procedure was done followed by *Dhanyapinda Sveda*; from 16th day onwards till 29th day, *Madhutailika Basti* was done along with *Dhanyapinda Sveda* on every alternate day. The results showed that ART was safe but was not superior than physiotherapy in sensorimotor recovery or functional outcomes. This was the first RCT to scientifically evaluate Ayurveda in stroke rehabilitation. [13]

Ravi et. al. conducted a prospective case-control study on 52 patients to analyse the effect of Ayurvedic massage combined with physiotherapy in comparison to only physiotherapy in stroke rehabilitation. *Abhyanga* (Ayurvedic massage) was done for a total of 10 sessions; with suitable oil based on patient's *Prakriti* followed by steam application. Results showed that the patients who received Ayurvedic massage had lower MAS (Modified Ashworth

Scale) and need for antispastic drugs, achieved standing with minimal assistance sooner, and had better locomotion at discharge. [14]

Syed et. al. conducted a review study on *Ashwagandha* (*Withania somnifera*), showed its potential benefits for neuroprotective activity, especially in conditions like Alzheimer's, Parkinson's, and other neurological issues. Evidences were gathered from various studies which suggested that *Ashwagandha* might help reduce oxidative stress and inflammation, as well as prevent damage to neurons. However, the authors noted that more research is needed to fully understand how it works and how it can be used in clinically. [15]

Rani et. al. in another study, identified a natural compound from a plant called *Mandukaparni* (*Centella asiatica*). The specific compound is called madecassoside. This compound appears to inhibit an enzyme known as serine racemase, which is responsible for producing D-serine. D-serine plays a role in activating certain receptors in the brain. When those receptors are overactive, it can lead to conditions such as stroke and Alzheimer's. The study, which combined laboratory experiments and computational analysis, showed promising results regarding madecassoside's potential as a new treatment for neurological disorders. [16]

Harini et. al. conducted an observational study prospectively comparing outcomes in 2 cohorts of Acute Ischemic Stroke patients treated with whole-system classical Ayurveda therapy or conservative western medications. Ayurveda therapy included *Pathya* (Diet modification), *Abhyanga* (massage), *Nasya* (intranasal administration of herbal medications), oral administration of herbal medications, *Shirodhara* (dripping liquid medications on the head), *Virechana* (therapeutic purgation) and *Basti* (therapeutic enema). The results showed no significant differences in safety outcomes or functional disability outcomes between both the groups. [17]

Mundugaru et. al. conducted an experimental animal study of *Rasna* (*Pluchea lanceolata*) in ischemic brain injury evaluated its neuroprotective effects. In this study, hippocampal ischemia was induced in rats and then treated with different doses of a hydroalcoholic extract of the plant for 14 days. Results showed that the treatment reversed hippocampal neuronal damage and there was significant improvement in memory, learning, and locomotor function in rats; along with restoration of neuron structure, improved dendritic architecture, and reduced oxidative stress by enhancing antioxidant defenses. The study concluded that *Pluchea lanceolata* may have strong neuroprotective and antioxidant properties. This suggests its potential as an alternative or adjunct therapy for ischemic stroke. [18]

Jhelum et. al. conducted an experimental study on mouse model of transient cerebral ischaemia evaluated the neuro protective effects of *Sameerpannag Ras*. Mice were treated orally at a dose of 40 mg/kg body weight, twice daily for 3 and 7 days after induction of ischemia. Results showed significant improvement in neurological deficit scores, motor coordination, and grip strength. There was reduction in neuroinflammatory responses by suppressing inflammatory gene and protein expression in the brain. The study concluded that *Sameerpannag Ras* may exert neuroprotective effects in ischemic stroke through anti-inflammatory mechanisms. The study provided first mechanistic evidence of the drug in a stroke model. [19]

Jaideep et. al. conducted a randomized controlled trial on 50 patients of ischemic stroke to evaluate the effect of

Ayurvedic therapy on cardiac autonomic dysfunction; considering the fact that cardiac autonomic dysfunction in stroke has implications on morbidity and mortality. Patients in group I received conventional treatment (including antiplatelet agents or anticoagulants, antihypertensives, and medications for diabetes mellitus, hyperlipidemia along with physiotherapy and speech therapy as required); while patients in group II received conventional treatment and speech therapy as in Group I in addition they also received adjuvant Ayurveda treatment (*Abhyanga* (methodical massage) with *Niramisha Mahamasha Taila* and *Bhashpa Swedana* (steam therapy) from day 1 to day 14, *Matra Basti* with 60 mL of *Balaswagandhadi Taila* from day 8–14 and internal medication of *Ashtavarga Kashaya* orally, 15 mL TID with 15 mL warm water and *Ksheerabala 101* orally, 5 drops BD with 15 mL warm water for 14 days). Results showed that group II demonstrated significant improvements in heart rate variability, blood pressure regulation, and baroreflex sensitivity, indicating better cardiac autonomic function after treatment. The study concluded that adjunct Ayurvedic therapy positively modulates autonomic activity in stroke patients. [20]

Table 4: Keywords searched and results in Google Scholar (2016-2025)

Keyword Search	Results
"Stroke AND (ayurveda OR ayurvedic)"	16800
"Stroke AND (ayurveda OR ayurvedic) in India"	15600
"Hemiplegia AND (ayurveda OR ayurvedic)"	1420
"Hemiplegia AND (ayurveda OR ayurvedic) in India"	1280

Table 5: Keywords searched and results in AYUSH Research Portal

Medical System	Keyword Search	Category	Search field	Results
Ayurveda	Stroke	Preclinical Research	Article title	05
			Abstract	55
		Clinical Research	Article title	10
			Abstract	40
		Fundamental Research	Article title	05
			Abstract	31
		Drug Research	Article title	01

		Abstract	07
Hemiplegia	Preclinical Research	Article title	00
		Abstract	03
	Clinical Research	Article title	19
		Abstract	23
	Fundamental Research	Article title	03
		Abstract	03
	Drug Research	Article title	00
		Abstract	05
Pakshaghata	Preclinical Research	Article title	00
		Abstract	00
	Clinical Research	Article title	10
		Abstract	16
	Fundamental Research	Article title	02
		Abstract	05
	Drug Research	Article title	00
		Abstract	03

d. Publication/Journals titles: For the keyword “Stroke”, majority of the results were from “JACC (Journal of the American College of Cardiology)” journal (10,212) followed by “Journal of Stroke and Cerebrovascular Diseases” (5,865). Other notable journals were “International Journal of Cardiology”, “Journal of Vascular Surgery”, “Journal of the

Neurological Sciences” and others. Details of journal name, Global Publications and Publications related to India are mentioned below. [Table 6] In Ayurveda, “Journal of Ayurveda and Integrative Medicine (JAIM)” was among the most productive journal with 6 publications followed by “Journal of Ethnopharmacology” with 3 publications.

Table 6: Details of Journal titles of Global and stroke publications related to India

Sr. No.	Journal name	India	Global
1.	Annals of the Rheumatic Diseases	167	2099
2.	Annals of Vascular Surgery	0	1994
3.	Archives of Physical Medicine and Rehabilitation	0	3104
4.	Atherosclerosis	0	2289
5.	Biomedical Signal Processing and Control	168	0
6.	Biomedicine & Pharmacotherapy	181	0
7.	Blood	0	2003
8.	Canadian Journal of Cardiology	0	2083
9.	CHEST	0	1867
10.	Clinical Epidemiology and Global Health	133	0
11.	Diabetes & Metabolic Syndrome: Clinical Research & Reviews	224	0
12.	Energy	289	0
13.	Environmental Research	136	0
14.	Fuel	537	2578
15.	Heart, Lung and Circulation	0	2161
16.	Heart Rhythm	0	1946

17.	Heliyon	292	2330
18.	Indian Heart Journal	516	0
19.	International Journal of Biological Macromolecules	179	0
20.	International Journal of Cardiology	0	4489
21.	International Journal of Hydrogen Energy	284	0
22.	JACC	211	10212
23.	JACC: Cardiovascular Interventions	0	2624
24.	JACC: Case Reports	162	0
	Journal of Cleaner Production	137	0
25.	Journal of Clinical Neuroscience	0	1568
26.	Journal of Ethnopharmacology	165	0
27.	Journal of Stroke and Cerebrovascular Diseases	217	5865
28.	Journal of the Neurological Sciences	296	3852
29.	Journal of Vascular Surgery	0	4086
30.	Materials Today: Proceedings	1068	0
31.	Journal of Drug Delivery Science and Technology	132	0
32.	Procedia Computer Science	160	0
33.	Computers in Biology and Medicine	132	0
34.	Science of The Total Environment	211	0
35.	The American Journal of Cardiology	0	3639
36.	The Annals of Thoracic Surgery	0	2109
37.	The Journal of Cardiothoracic and Vascular Anaesthesia	0	1992
38.	The Journal of Heart and Lung Transplantation	0	2142
39.	The Journal of Thoracic and Cardiovascular Surgery	0	2454
40.	The Lancet	250	0
41.	World Neurosurgery	248	4243

Table 7: Progression of stroke publications in last 5 years (from 2021 to 2025)

Year	Number of Publications	
	India	Global
2021	3452	40368
2022	3567	39704
2023	3920	41246
2024	4500	45932
2025	5106	50974

e. Progression in publications: 2025 was the most beneficial year for publications on Stroke with 50,974 publications. Total 2,18,224 publications were done in the last 5 years. This indicates increase in the prevalence of stroke cases and therefore increasing demand of stroke

research. Details of number of stroke publications in India and global stroke publications in the last 5 years are mentioned below. [\[Table 7\]](#)

f. Trends in research in Stroke:

A significant change in stroke research was observed over the years. In the years 2011 to 2014, as it was understood that faster treatment could prevent permanent brain damage, the focus area of researches was to reduce the time taken to treat stroke. Researches focused on improving the use of anti-coagulant drugs like tPA and efforts to improve and strengthen emergency stroke-care systems were carried out. To identify the brain tissue that could still be saved after a stroke, imaging techniques like CT and MRI also improved. Testing of mechanical clot-removal

procedures were done; because both the technology and patient-selection methods were still developing, the initial studies showed limited success. [21-23]

Around the year 2015, several important clinical trials were reported which showed the effectiveness of mechanical thrombectomy for patients with large-vessel ischemic stroke. That was marked as a major turning point in stroke research which changed stroke treatment worldwide and became one of the biggest breakthroughs in modern neurology. Later, researches focused on improving thrombectomy devices, reducing treatment delays, and using advanced imaging methods to identify which patients would benefit the most were carried out. [24-27]

By 2018, studies were reported showing successful treatment of some patients even after many hours of stroke onset if brain imaging indicated that viable tissue remained. This greatly expanded the treatment window and improved patient outcomes. [28, 29]

From 2019 onward, several studies demonstrated incorporation of artificial intelligence and precision medicine with stroke research. Analysis of brain scans, detection of blocked vessels or bleeding spots and prediction of recovery became quicker and more accurate when AI-based systems began helping doctors. Another important research area is “Neuroprotection”; studies demonstrating therapies that could reduce brain-cell damage during and after restoration of blood flow. With the aim to improve motor recovery and quality of life after stroke, there was rapid advancement in rehabilitation research through robotic therapy, virtual reality, wearable devices, and brain-computer interface technologies. [30-32]

During this period, alongside modern medical research advances, Ayurveda also contributed to stroke-related research. In Ayurveda, stroke is often correlated with a condition called “*Pakshaghata*”, a condition mainly caused by aggravated and/or vitiated *Vata Dosha* leading to motor and sensory loss of a part or whole of the body. Studies have been reported to study the role of *Panchakarma*

therapies like *Abhyanga* (therapeutic oil massage), *Swedana* (sudation therapy), *Basti* (medicated enema) therapy, and several herbal oral medications in improving muscle strength, mobility, speech, and rehabilitation after stroke. [13, 33, 34]

Researches have been done to investigate herbs such as *Ashwagandha* (*Withania somnifera* L.), [35] *Brahmi* (*Bacopa monnieri*), [36,37] *Bala* (*Sida cordifolia* Linn.), *Rasna* (*Pluchea lanceolata* DC.), *Mandukparni* (*Centella asiatica* L.), *Guduchi* (*Tinospora cordifolia* Willd. Miers) etc. for their potential neuroprotective, anti-inflammatory, antioxidant, and rejuvenating effects. Some studies have been reported suggesting integration of Ayurveda interventions with physiotherapy and conventional rehabilitation could help improve functional recovery and quality of life in stroke patients. [13, 33] However, most of the works done are still a part of grey literature, suggesting a greater need for publications and performing larger scientific trials to generate stronger evidence.

It was observed that there is a shift in stroke research in recent years towards long-term recovery, regeneration, and personalized care, especially from 2023 to 2025. Research areas explored by scientists during this period includes stem-cell therapy, regenerative medicine, exosome therapy, neurogenesis; [38, 39] AI systems advancement and its integration in imaging, clinical records, biomarkers, and patient history to guide individualized treatment decisions; minimal invasive surgery, and digital rehabilitation. [40] There has been evolution of stroke research from emergency care to long-term stroke recovery and rehabilitation. Integrative systems such as Ayurveda have also made a remarkable contribution to establish better and efficient post-stroke care and rehabilitation.

5. DISCUSSION:

The present study is among the first scientometric analysis that gives a broad overview of global and Indian stroke research along with highlighting contributions of Ayurveda during the last decade (2016-2025). Previous bibliometric studies have focused on stroke research based on

parameters like global burden, rehabilitation, caregiver research and traditional medicine; however, limited attention has been given to Ayurveda contributions in stroke research. [41, 42] Therefore, this study fills an important gap by providing an integrative overview on research productivity, publication patterns, subject domains, journal distribution, and emerging trends.

Publication count: Increase in number of stroke publications was observed in the present study indicating growing stroke burden and attempts have been made on improving prevention, diagnosis, treatment and rehabilitation outcomes. [Figure 3, 4] Global Burden of Disease (GBD) Study and World Stroke Organization has highlighted increase in incidence and burden of stroke. [42,43] In the present study, increasing publication count during the last five years was observed, [Table 7] which is consistent with global epidemiological trends and expanding research priorities.

Document type: Majority of the publications of Indian and global stroke research were Original Research Articles, [Table 2] indicating stroke research driven by experimental, clinical, translational and epidemiological studies.

Subject areas: The findings demonstrate that stroke research has become increasingly multidisciplinary. Medicine and Dentistry accounted for majority of publications; however, contributions from Neuroscience, Molecular Biology, Pharmacology, Engineering, Materials Science, Environmental Science, and Computer Science were also observed. [Table 2] Complex pathophysiological mechanisms stroke makes it essential for interdisciplinary collaborations and require expertise from multiple scientific disciplines. [42]

India's contribution: The consistent growth in annual publication counts of Indian stroke publications, [Table 7] demonstrates gradual increase in India's contribution to stroke research. Burden of stroke is increasing in India due to rising prevalence of hypertension, diabetes mellitus, obesity, ageing populations, and lifestyle-related risk factors. Consequently, it is essential to develop cost-

effective preventive strategies, rehabilitation models, and evidence-based healthcare policies. [42]

Journal titles: The findings of the study demonstrate widespread diversity of stroke research among journals of different specialties including neurology, cardiology, vascular surgery, rehabilitation medicine, biomedical engineering, pharmacology, and public health. [Table 6] In Ayurveda, Journal of Ayurveda and Integrative Medicine contributed the most, which indicates increasing international visibility of research in integrative medicine. However, a large number of Ayurveda research are still within grey literature, dissertations, institutional repositories, or non-indexed journals, thus limiting international visibility and scientific validation.

Ayurveda stroke research: Our analysis from various databases showed that out of the 32 Ayurveda clinical articles on stroke (including clinical trials, case reports and case series), 34.37% articles were found on combination of Panchakarma therapies and palliative management, 21.87% on Panchakarma therapies and 3.12% on palliative management alone, which highlights majority of the patients getting benefitted by combination of *Shodhana* (purificatory) and *Shamana* (palliative management). [Figure 5] Articles on palliative management demonstrates frequent use of formulations like *Brihatvatachintamani Rasa* and *Yogaraja Guggulu* which reflects ayurvedic understanding of Stroke as *Pakshaghata* mentioned as a disorder of *Vata Dosha*. [Table 3]

Many studies on Ayurveda, including clinical, preclinical, fundamental and drug research, and postgraduate dissertations, are published in AYUSH-specific journals or repositories that are not fully indexed in databases, for that purpose an explicit search of AYUSH research portal was carried out and findings were summarized as follows:

- a) Preclinical studies have been carried out on *Tribulus terrestris* L., [44] *Sameerpannag Rasa* Mixture [19] and Sandalwood oil [45] demonstrating its neuroprotective effects.

- b) Clinical studies shows that Ayurvedic massage, [14] *Shirodhara* (pouring of medicated liquids overhead), [46] *Virechana* (therapeutic purgation), [47] *Agnilepa* (anointing body with hot substances) [48] and stage-wise Ayurveda management [49] have been found effective in stroke rehabilitation.
- c) Fundamental research was carried out on an individualized treatment protocol development in the management of stroke; [50] development of structured *Satvavajaya* module for stroke patient; [51] and integration of AYUSH (ayurveda and yoga) with National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS). [52]

Limitations and future scope: The present analysis was restricted to ScienceDirect, PubMed, Google Scholar and AYUSH Research Portal, therefore it doesn't include publications indexed exclusively in databases such as Scopus, Web of Science, or Embase. In this study, descriptive scientometric parameters were analysed, further evaluation of citation impact, collaboration networks, author productivity, institutional performance, or research quality need to be done.

6. CONCLUSION:

There is significant increase in stroke research in India and worldwide. It also brings forward the role of emergency care followed by long-term rehabilitation after stroke. This study highlights the role of Ayurveda in post-stroke rehabilitation. Researches have shown Ayurveda therapies and herbal medications beneficial in improving quality of life and functional recovery after stroke; however stronger scientific evidence is required to mainstream Ayurveda as a part of integrative approach in advance stroke care in future.

Authors Details:

^{1*}Ph.D. Scholar, Department of Panchakarma, Institute of Teaching and Research in Ayurveda, Jamnagar, India. **ORCID link:** <https://orcid.org/0009-0003-7636-7298>

²Professor and Head, Department of Panchakarma, Institute of Teaching and Research in Ayurveda, Jamnagar, India. **ORCID link:** <https://orcid.org/0000-0003-2863-6927>

Authors Contribution:

Conceptualization: KR

Data collection and literature search: KR

Writing – original draft preparation: KR

Reviewing & editing: AT

Approval of final manuscript: All authors

Acknowledgements - The author acknowledges the support of the Institute of Teaching and Research in Ayurveda that provided the necessary resources and environment for conducting this work.

Data Availability Statement: The data supporting the findings of this review are derived from the studies cited in the article. Additional data related to the review process are available from the corresponding author upon reasonable request.

Ethical Statement: This article did not involve primary research with human participants or experimental animals; therefore, ethics committee approval and informed consent were not applicable.

Declaration of Generative AI: The authors declare this manuscript was written without the use of generative artificial intelligence tools. All the content, including text generation, data analysis and references was developed and reviewed by the author without assistance from AI technologies.

Conflict of Interest – The authors declare no conflicts of interest.

Source of Support – The authors declare no source of support.

Additional Information: Authors can order reprints (print copies) of their articles by visiting: <https://www.akinik.com/products/2281/journal-of-ayurveda-and-holistic-medicine-jahm>

Publisher's Note: Atreya Ayurveda Publications remains neutral with regard to jurisdictional claims in published maps, institutional affiliations, and territorial designations. The publisher does not take any position concerning legal status of countries, territories, or borders shown on maps or mentioned in institutional affiliations.

REFERENCES:

1. World Health Organization. Stroke [Internet]. 19 December 2025 [cited 2026 May 6]. Available from: <https://www.who.int/news-room/fact-sheets/detail/stroke>
2. GBD 2021 Stroke Risk Factor Collaborators. Global, regional, and national burden of stroke and its risk factors, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet Neurology* (Lancet Neurol.). 2024 Oct;23(10):973-1003. Available from: [https://doi.org/10.1016/S1474-4422\(24\)00369-7](https://doi.org/10.1016/S1474-4422(24)00369-7)
3. Satynarayana Shastri, editor. *Charaka Samhita of Charaka with Chakrapani's Dipika Commentary*. Sutra Sthana, Chapter 20, verse 10. Reprint ed. Varanasi: Chaukhambha Orientalia Publication, 2nd Edition; 2009; 399.

4. Leydesdorff L, Milojevid S. Scientometrics. In: Wright JD, editor. International Encyclopedia of the Social & Behavioral Sciences. 2nd ed. Elsevier; 2015. 322-327. <https://doi.org/10.1016/B978-0-08-097086-8.85030-8>
5. Belaguli G, Nithin SA. Stage-wise management of Pakshaghata (Ischemic stroke with left hemiplegia) through Ayurveda – A case report. Indian Journal of Ayurveda & Integrative Medicine KLEU (IJAIM KLEU). 2022;3(2):88–93. Available from: https://doi.org/10.4103/ijaim.ijaim_25_21
6. Mukhedkar AR, Thakar AB, Gandhi RS. An approach of Ayurveda clinical diagnosis in managing acute Pakshavadhya (~hemiplegia): A case report. Journal of Ayurveda Case Reports (JACR). 2023;6(3), 98–102. Available from: https://doi.org/10.4103/jacr.jacr_107_22
7. Nithin SA, Belaguli G, Mohan K. Customized Ayurveda Approaches In Modulating Brain Injury: A Case Report. Journal of Ayurveda Case Reports (JACR). 2022;5(2):68–73. Available from: https://doi.org/10.4103/jacr.jacr_46_22
8. Patra SR, Panda PK, Dash DP, Acharya R. A Case Study on the Management of Hemiplegia (Intracranial Hemorrhage) Through Various Panchakarma Modalities. Journal of Research in Ayurvedic Sciences (JIRAS). 2023;7(4):236–242. Available from: https://doi.org/10.4103/jiras.jiras_183_22
9. Mohan V, Divya B, Deva S. Ayurvedic Management of Pakshaghata (Left Hemiplegia) – A Case Study. International Journal of Ayurvedic Medicine (IJAM). 2021;12(3):733–741. Available from: <https://doi.org/10.47552/ijam.v12i3.1706>
10. Singh V, Sawarkar P, Sawarkar G, Parwe S. Hemiparesis Management – Cerebral Vascular Event (CVE) Through Panchakarma, Shamana Treatment and Physiotherapy: A Case Report. Journal Of Ayurveda and Integrated Medical Sciences (JAIMS). 2024;9(3):297–302. Available from: <https://doi.org/10.21760/jaims.9.3.46>
11. Bhasimon P, Mohan A, Sourabh R. Ayurveda as a Supportive Treatment: A Case Report On Integrative Management of Intracranial Haemorrhage. Journal Of Natural Remedies (JNR). 2024;24(2):373–378. Available from: <https://doi.org/10.18311/jnr/2024/35507>
12. Dhiman JK, Prasanth D, Mahapatra AK, Bhatted SK. Management of Cerebrovascular Accident (CVA) Through Ayurveda. Journal of Ayurveda Case Reports (JACR). 2017;1(2):22–29. Available from: <https://doi.org/10.4103/2456-5506.220727>
13. Sylaja PN, Nambiar V, Narayan S, Pr J, Kumar CS, Nk P, Menon MM, Berieau VB, Nair D, Dhasan A, Arora D, Verma SJ, Sharma M, Dhaliwal RS, Sarma PS, Pandian JD. Ayurvedic Treatment in the Rehabilitation of Ischemic Stroke Patients In India: A Randomized Controlled Trial (RESTORE). International Journal of Stroke (Int J Stroke). 2025 Dec;20(10):1214–1224. Available from: <https://doi.org/10.1177/17474930251349727>
14. Sankaran R, Kamath R, Nambiar V, Kumar A. A Prospective Study on the Effects of Ayurvedic Massage In Post-Stroke Patients. Journal of Ayurveda and Integrative Medicine (JAIM). 2019;10(2):126–130. Available from: <https://doi.org/10.1016/j.jaim.2018.02.137>
15. Syed AA, Reza MI, Singh P, Thombre GK, Gayen JR. Withania Somnifera in Neurological Disorders: Ethnopharmacological Evidence, Mechanism of Action and Its Progress in Delivery Systems. Current Drug Metabolism (Curr Drug Metab). 2021;22(7):561–571. Available from: <https://doi.org/10.2174/1389200222666210203182716>
16. Rani K, Tyagi M, Mazumder M, Singh A, Shanmugam A, Dalal K, Pillai M, Samudrala G, Kumar S, Srinivasan A. Accelerated Identification of Serine Racemase Inhibitor from Centella Asiatica. Scientific Reports (Sci Rep). 2020 Mar 13;10(1):4640. Available from: <https://doi.org/10.1038/s41598-020-61494-1>
17. Harini JA, Luthra A, Madeka S, Shankar P, Mandava P, Pervaje R, Aaron S, Purushotham A. Ayurvedic Treatment of Acute Ischemic Stroke: A Prospective Observational Study. Global Advances in Health and Medicine (Glob Adv Health Med). 2019 May 30;8. Available from: <https://doi.org/10.1177/2164956119849396>
18. Mundugaru R, Sivanesan S, Popa-Wagner A, Udaykumar P, Kirubakaran R, Kp G, Vidyadhara DJ. Pluchea Lanceolata Protects Hippocampal Neurons from Endothelin-1 Induced Ischemic Injury to Ameliorate Cognitive Deficits. Journal Of Chemical Neuroanatomy (J Chem Neuroanat). 2018 Dec;94:75–85. Available from: <https://doi.org/10.1016/j.jchemneu.2018.09.002>
19. Jhelum P, Wahul AB, Kamle A, Kumawat S, Kumar A, Bhutani KK, Tripathi SM, Chakravarty S. Sameerpannag Ras Mixture (SRM) Improved Neurobehavioral Deficits Following Acute Ischemic Stroke by Attenuating Neuroinflammatory Response. Journal Of Ethnopharmacology (J Ethnopharmacol). 2017 Feb 2;197:147–156. Available from: <https://doi.org/10.1016/j.jep.2016.07.059>
20. Jaideep SS, Nagaraja D, Pal PK, Sudhakara D, Talakad SN. Modulation Of Cardiac Autonomic Dysfunction in Ischemic Stroke Following Ayurveda (Indian System of Medicine) Treatment. Evidence-Based Complementary and Alternative Medicine (Evid Based Complement Alternat Med). 2014;2014:634695. Available from: <https://doi.org/10.1155/2014/634695>
21. Donnan GA, Davis SM, Parsons MW, Ma H, Dewey HM, Howells DW. How To Make Better Use of Thrombolytic Therapy in Acute Ischemic Stroke. Nature Reviews Neurology (Nat Rev Neurol). 2011;7(7):400–409. Available from: <https://doi.org/10.1038/nrneurol.2011.89>
22. Sanelli PC, Sykes JB, Ford AL, Lee JM, Vo KD, Hallam DK. Imaging and Treatment of Patients with Acute Stroke: An Evidence-Based Review. American Journal of Neuroradiology (AJNR). 2014;35(6):1045–1051. Available from: <https://doi.org/10.3174/ajnr.A3518>
23. Fugate JE, Rabinstein AA. Update On Intravenous Recombinant Tissue Plasminogen Activator for Acute Ischemic Stroke. Mayo Clinic Proceedings (Mayo Clin Proc). 2014;89(7):960–972. Available from: <https://doi.org/10.1016/j.mayocp.2014.03.001>

24. Berkhemer OA, Fransen PSS, Beumer D, van den Berg LA, Lingsma HF, Yoo AJ, Schonewille WJ, Vos JA, Nederkoorn PJ, Wermer MJH, van Walderveen MAA, Staals J, Hofmeijer J, van Oostayen JA, Lycklama à Nijeholt GJ, Boiten J, Brouwer PA, Emmer BJ, de Bruijn SFTM, van Dijk LC, Kappelle LJ, Lo RH, van Dijk EJ, de Vries J, de Kort PLM, van Rooij WJ, van den Berg JS, van Hasselt BA, Aerden LAM, Dallinga RJ, Visser MC, Bot JCA, Vroomen PC, Eshghi O, Schreuder THCM, Heijboer RJJ, Keizer K, Tielbeek AV, den Hertog HM, Gerrits DG, van den Berg-Vos RM, Karas GB, Steyerberg EW, Flach HZ, Marquering HA, Sprengers ME, Jenniskens SFM, Beenen LFM, van den Berg R, Oppenheim C, Majoie CBLM, van Zwam WH, Wijnhoud AD, van der Lugt A, Roos YB, Fonseca AC, Dippel DWJ. A Randomized Trial of Intraarterial Treatment for Acute Ischemic Stroke. *The New England Journal of Medicine* (N Engl J Med). 2015;372(1):11–20. Available from: <https://doi.org/10.1056/NEJMoa1411587>
25. Campbell BCV, Mitchell PJ, Kleinig TJ, Dewey HM, Churilov L, Yassi N, Yan B, Dowling RJ, Parsons MW, Oxley TJ, Wu TY, Brooks M, Simpson MA, Miteff F, Levi CR, Krause M, Harrington TJ, Faulder KC, Steinfort BS, Priglinger M, Ang T, Scroop R, Barber PA, McGuinness B, Wijeratne T, Phan TG, Chong W, Chandra RV, Bladin CF, Badve M, Rice H, de Villiers L, Ma H, Desmond PM, Parsons LS, Butcher KS, Peeling J, Genovese J, Flanagan P, Churilov L, Donnan GA. Endovascular Therapy For Ischemic Stroke With Perfusion-Imaging Selection. *The New England Journal of Medicine* (N Engl J Med). 2015;372(11):1009–1018. Available from: <https://doi.org/10.1056/NEJMoa1414792>
26. Goyal M, Demchuk AM, Menon BK, Eesa M, Rempel JL, Thornton J, Roy D, Jovin TG, Willinsky RA, Sapkota BL, Dowlatshahi D, Frei DF, Kamal NR, Montanera WJ, Poppe AY, Ryckborst KJ, Silver FL, Shuaib A, Tampieri D, Heran MK, Fox AJ, Hill MD. Randomized Assessment of Rapid Endovascular Treatment of Ischemic Stroke. *The New England Journal of Medicine* (N Engl J Med). 2015;372(11):1019–1030. Available from: <https://doi.org/10.1056/NEJMoa1414905>
27. Saver JL, Goyal M, Bonafe A, Diener HC, Levy EI, Pereira VM, Albers GW, Cognard C, Cohen DJ, Hacke W, Jansen O, Jovin TG, Mattie HP, Nogueira RG, Siddiqui AH, Yavagal DR, Baxter BW. Stent-Retriever Thrombectomy After Intravenous t-PA Vs. t-PA Alone in Stroke. *The New England Journal of Medicine* (N Engl J Med). 2015;372(24):2285–2295. Available from: <https://doi.org/10.1056/NEJMoa1415061>
28. Albers GW, Marks MP, Kemp S, Christensen S, Tsai JP, Ortega-Gutierrez S, McTaggart RA, Torbey MT, Kim-Tenser M, Leslie-Mazwi T, Sarraj A, Kasner SE, Ansari SA, Yeatts SD, Hamilton S, Mlynash M, Heit JJ, Zaharchuk G, Kim S, Carrozella J, Palesch YY, Martin CO, Lavori PW, Lansberg MG, Bammer R, DEFUSE 3 Investigators. Thrombectomy For Stroke At 6 To 16 Hours with Selection by Perfusion Imaging. *The New England Journal of Medicine* (N Engl J Med). 2018;378(8):708–718. Available from: <https://doi.org/10.1056/NEJMoa1713973>
29. Nogueira RG, Jadhav AP, Haussen DC, Bonafe A, Budzik RF, Bhuva P, Yavagal DR, Ribo M, Cognard C, Hanel RA, Sila CA, Hassan AE, Millan M, Levy EI, Mitchell P, Chen M, English JD, Shah QA, Silver FL, Pereira VM, Mehta BP, Baxter BW, Abraham MG, Cardona P, Veznedaroglu E, Hellinger FR, Feng L, Kirmani JF, Lopes DK, Jankowitz BT, Frankel MR, Costalat V, Vora NA, Yoo AJ, Malik AM, Furlan AJ, Rubiera M, Aghaebrahim A, Olivot JM, Tekle WG, Shields R, Graves T, Lewis RJ, Smith WS, Liebeskind DS, Saver JL, Jovin TG, DAWN Trial Investigators. Thrombectomy 6 To 24 Hours After Stroke with a Mismatch Between Deficit and Infarct. *The New England Journal of Medicine* (N Engl J Med). 2018;378(1):11–21. Available from: <https://doi.org/10.1056/NEJMoa1706442>
30. Campbell BCV, De Silva DA, Macleod MR, Coutts SB, Schwamm LH, Davis SM, Donnan GA. Ischaemic Stroke. *Nature Reviews Disease Primers* (Nat Rev Dis Primers). 2019;5(1):70. Available from: <https://doi.org/10.1038/s41572-019-0118-8>
31. Cramer SC, Dodakian L, Le V, See J, Augsburg R, McKenzie A, Zhou RJ, Chiu NL, Heckhausen J, Cassidy JM. Efficacy of Home-Based Telerehabilitation Vs In-Clinic Therapy for Adults After Stroke. *JAMA Neurology* (JAMA Neurol). 2021;78(9):1079–1087. Available from: <https://doi.org/10.1001/jamaneurol.2021.2338>
32. Ward NS, Brander F, Kelly K. Intensive Upper Limb Neurorehabilitation in Chronic Stroke: Outcomes, Evidence, And Future Directions. *The Lancet Neurology* (Lancet Neurol). 2019;18(8):800–812. Available from: [https://doi.org/10.1016/S1474-4422\(19\)30135-9](https://doi.org/10.1016/S1474-4422(19)30135-9)
33. Venketasubramanian N. A Prospective Study on the Effects of Ayurvedic Massage In Post-Stroke Patients. *Journal Of Ayurveda and Integrative Medicine* (JAIM). 2019;10(2):126–130. Available from: <https://doi.org/10.1016/j.jaim.2018.02.137>
34. Sowmiya S, Begum RF, Dhivya LS, Rajendran P, Harikrishnan N, Singh AS. Traditional, Complementary, And Integrative Medicine in the Management of Ischemic Stroke: A Narrative Review. *Frontiers in Pharmacology* (Front Pharmacol). 2025;16:1561688. Available from: <https://doi.org/10.3389/fphar.2025.1561688>
35. Singh N, Bhalla M, de Jager P, Gilca M. Ashwagandha in Brain Disorders: A Review of Recent Developments. *Journal of Ethnopharmacology* (J Ethnopharmacol). 2020;257:112876. Available from: <https://doi.org/10.1016/j.jep.2020.112876>
36. Dubey T, Chinnathambi S. Brahmi (Bacopa Monnieri): An Ayurvedic Herb Against Alzheimer's Disease. *Archives of Biochemistry and Biophysics* (Arch Biochem Biophys). 2019;676:108153. Available from: <https://doi.org/10.1016/j.abb.2019.108153>
37. Shalini VT, Neelakanta SJ, Sriranjini JS. Neuroprotection with Bacopa Monnieri: A Review of Experimental Evidence. *Molecular Biology Reports* (Mol Biol Rep). 2021;48(3):2653–2668. Available from: <https://doi.org/10.1007/s11033-021-06236-w>
38. Poondla N, Babaeizad A, Sheykhasan M. Exosome-Based Therapies and Biomarkers in Stroke: Current Advances and Future Directions. *Experimental Neurology* (Exp Neurol). 2025;391:115286. Available from: <https://doi.org/10.1016/j.expneurol.2025.115286>

39. Zhang Y, Xue J, Zhang K, Sun M. Basic Research Progress of Exosomes in the Diagnosis and Treatment of Stroke. Chinese Journal of Brain Diseases and Rehabilitation (Chin J Brain Dis Rehabil). 2025;15(5):309–313. Available from: <https://doi.org/10.3877/cma.j.issn.2095-123X.2025.05.010>
40. Marín-Medina DS, Arenas-Vargas PA, Arias-Botero JC, Gómez-Vásquez M, Jaramillo-López MF. Artificial Intelligence in Stroke Rehabilitation: From Acute Care to Long-Term Recovery. Neuroscience (Neuroscience). 2025;572:214–231. Available from: <https://doi.org/10.1016/j.neuroscience.2025.03.017>
41. Huang L, Shi X, Zhang N, Gao Y, Bai Q, Liu L, Zuo L. Bibliometric Analysis of Trends and Issues in Traditional Medicine for Stroke Research: 2004–2018. BMC Complementary Medicine and Therapies (BMC Complement Med Ther). 2020;20:39. Available from: <https://doi.org/10.1186/s12906-020-2832-x>
42. Feigin VL, Stark BA, Johnson CO. Global, Regional, And National Burden of Stroke and Its Risk Factors, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019. The Lancet Neurology (Lancet Neurol). 2021;20(10):795–820. Available from: [https://doi.org/10.1016/S1474-4422\(21\)00252-0](https://doi.org/10.1016/S1474-4422(21)00252-0)
43. Kim J, Thayabaranathan T, Donnan GA, Howard G, Howard VJ, Rothwell PM, Feigin VL, Norrving B, Owolabi M, Pandian J, Liu L, Cadilhac DA, Thrift AG. Global Stroke Statistics 2019. International Journal of Stroke (Int J Stroke). 2020;15(8):819–838. Available from: <https://doi.org/10.1177/1747493020909545>
44. Guo W, Wang Y, Fan M, Xie S, Zhao H, Wang J, Liu Y, Xu D, Xu Y. Integrating Metabolomics and Network Pharmacology to Explore the Protective Effect of Gross Saponins Of Tribulus Terrestris L. Fruit Against Ischemic Stroke in Rat. Journal Of Ethnopharmacology (J Ethnopharmacol). 2020;263:113202. Available from: <https://doi.org/10.1016/j.jep.2020.113202>
45. Younis NS, Mohamed ME. Sandalwood Oil Neuroprotective Effects on Middle Cerebral Artery Occlusion Model of Ischemic Brain Stroke. Pharmacognosy Magazine (Pharmacogn Mag). 2020;16(68):117–122. Available from: https://doi.org/10.4103/pm.pm_398_19
46. Masatkar PR. Clinical Effect of Shirodhara in Pakshaghata with Special Reference to Cerebral Ischemic Stroke. International Journal of Research in Ayurveda and Pharmacy (IJRAP). 2018;9(4):17–20. Available from: <https://doi.org/10.7897/2277-4343.094101>
47. Rais A, Tanwar SR, Prasher B, Thakar AB. Management of Stroke Through Virechana: A Case Report. Journal of Ayurveda Case Reports (JACR). 2019;2(2):9–17. Available from: https://doi.org/10.4103/jacr.jacr_6_19
48. Patil P, Diggavi M, Patil AS. Role of Agnilepa in Pakshaghata (Ischemic Stroke): A Case Study. International Journal of Research in Ayurveda and Pharmacy (IJRAP). 2021;12(4):4–8. Available from: <https://doi.org/10.7897/2277-4343.120495>
49. Belaguli G, Nithin SA. Stage-Wise Management of Pakshaghata (Ischemic Stroke with Left Hemiplegia) Through Ayurveda: A Case Report. Indian Journal of Ayurveda and Integrative Medicine (IJAIM). 2022;3(2):88–93. Available from: https://doi.org/10.4103/ijaim.ijaim_25_21
50. Sori A, Pervaje R, Prasad BS. An Individualized Treatment Protocol Development in the Management of Pakshaghata (Acute Stage of Ischemic Stroke): A Review. International Journal of Research in Ayurveda and Pharmacy (IJRAP). 2017;8(5):10–13. Available from: <https://doi.org/10.7897/2277-4343.085253>
51. Bushra O, Mangalasseri P. Focus Group Discussion on Development of Structured Satvavajaya Module for Stroke Patient. International Journal of Research in Ayurveda and Pharmacy (IJRAP). 2018;9(3):47–52. Available from: <https://doi.org/10.7897/2277-4343.09373>
52. Singh R, Ota S, Khanduri S, Rani S, Bhadula A, Sharma R, Shahi VK, Bharti, Srikanth N, Dhiman KS. Integration of AYUSH (Ayurveda and Yoga) with National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS): An Appraisal of Central Council for Research in Ayurvedic Sciences Research and Development Initiatives. Journal of Research in Ayurvedic Sciences (IRAS). 2018;2(1):27–36. Available from: https://doi.org/10.4103/jras.jras_6_18