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REVIEW

Frontiers and Emerging Trends in Edaravone Research: A Bibliometric Analysis of Molecular Basis and Clinical Studies Using CiteSpace and VOSviewer

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Purpose: Edaravone is a potent free-radical scavenger and antioxidant that has been widely investigated for its therapeutic potential in neurodegenerative diseases and oxidative stress-related conditions. Although previous studies have explored its molecular structure, pharmacological effects, and clinical applications, a comprehensive bibliometric analysis of its research trends and future directions remains lacking.

Methods: This study employed bibliometric methods to analyze edaravone-related publications from 2000 to 2024, using the Web of Science Core Collection database. The analysis examined publication trends; contributions by countries, institutions, and authors; and keyword clustering. Data visualization tools, such as CiteSpace and VOSviewer, were utilized to identify research clusters and emerging trends in edaravone research.

Results: The findings revealed a significant increase in edaravone-related publications, with China, Japan, and the United States as the leading contributors. Notable researchers, including Abe K and Yoshino H, have made substantial contributions to this field. Four major research clusters were identified: free radical scavenging, cerebral infarction, amyotrophic lateral sclerosis, and oxidative stress. Emerging trends suggest a growing interest in edaravone dexbornel for acute ischemic stroke treatment, as well as its potential applications in blood-brain barrier interactions and Alzheimer's disease.

Conclusion: This bibliometric analysis highlights the growing interest in edaravone and its potential clinical application, particularly in neuroprotection. While this study provides valuable insights into current research trends, future studies should incorporate a broader range of sources and languages to obtain a more comprehensive understanding of the impact and scope of edaravone.

Keywords: bibliometric, edaravone, free radical scavenger, stroke, amyotrophic lateral sclerosis

Introduction

Edaravone (radicava) is a potent free-radical scavenger and active antioxidant developed by Mitsubishi Tanabe Pharma Corporation in Japan.[1,2] It exhibits multiple pharmacological effects, including free radical scavenging, inhibition of lipid peroxidation, prevention of neuronal apoptosis, and anti-necrotic and anti-cytokine activities.[3] Edaravone has been approved by the US Food and Drug Administration (FDA) for the treatment of amyotrophic lateral sclerosis (ALS), where the neuroprotective mechanism primarily involves the mitigation of oxidative damage to cells.[4,5] In China and Japan, edaravone is primarily approved for improving neurological symptoms, activities of daily living, and functional impairments associated with acute cerebral infarction. Its therapeutic mechanism in acute cerebral infarction involves inhibition of oxidative damage in brain cells, thereby reducing ischemic and hypoxic brain tissue injury and cerebral edema.[6,7] Furthermore, numerous clinical studies have suggested that edaravone has therapeutic potential in conditions associated with oxidative stress, including acute myocardial infarction, acute cerebral hemorrhage, acute liver injury, and acute kidney injury.[8–10]

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In recent years, functionalization and structural modifications based on the edaravone scaffold have become a focal point of research, aiming to address the limitations associated with single-target therapeutic strategies and enhance overall efficacy through multi-pathway regulation. A representative example is edaravone dexborneol, a multi-target derivative that retains the free radical-scavenging capability of edaravone while introducing dexborneol to regulate neuroinflammatory processes, such as suppression of NLRP3 inflammasome activation and pro-inflammatory cytokine secretion.[11,12] Clinical trials have demonstrated enhanced therapeutic benefits in acute ischemic stroke, including improved functional outcomes and synergistic effects when combined with reperfusion therapy, underscoring the translational potential of such structural modifications.[13,14]

Despite extensive research on edaravone's mechanisms of action, pharmacological effects, and clinical applications, bibliometric analyses assessing research trends and emerging areas of interest remain limited. This study employs bibliometric analysis to evaluate edaravone-related literature published between 2000 and 2024, providing insights into current research trends and identifying potential future research directions.

Materials and Methods

Data Source and Search Strategy

The Web of Science Core Collection (WoSCC) was selected as the primary database for literature retrieval because of its extensive coverage of high-impact scientific journals, which has been widely recognized in previous bibliometric studies.[15] A literature search was conducted for relevant studies published between 2000 and July 24, 2024, with publication types restricted to articles and reviews; retractions, conference proceedings, and book chapters were excluded. The search was limited to English language publications. The search query used was TS (topic search) = ((“edaravone” OR “edarabone”) OR “radicava”). The search strategy is illustrated in Figure 1. Articles were included if they contained “edaravone” and relevant Medical Subject Headings (MeSH) terms in the title, abstract, or keywords, and were published between 2000 and July 2024. Articles with incomplete bibliographic information, duplicate publications, and non-article formats such as newspaper articles, conference papers, and technical reports were excluded.

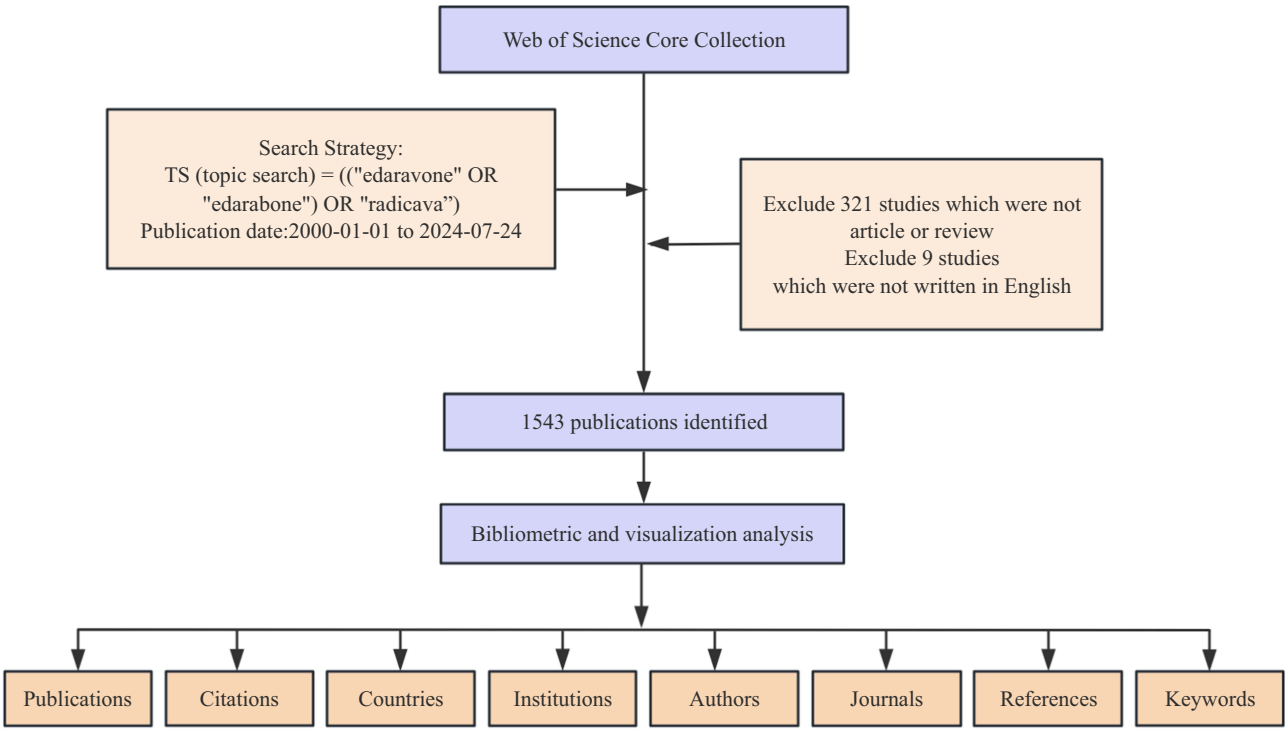

Figure 1 Detailed flowchart steps of the search strategy in screening publications.

Data Analysis

Data were exported from WoSCC in plain-text format, including article titles, authors, publication years, countries/regions, institutions, keywords, citations, abstracts, and references. Two researchers (S.L.C.Y. and R.Z.) independently reviewed the abstracts and, when necessary, the full text of the articles. Discrepancies were resolved by a third researcher. Bibliometric analysis and visualization were conducted using CiteSpace 6.2 R3, VOSviewer, GraphPad Prism 10, and Tableau.[16] CiteSpace was used to generate keyword clusters, detect research bursts, and construct keyword timeline maps to identify emerging trends and research developments.[17] VOSviewer was employed to establish collaboration networks among countries, institutions, and authors as well as to analyze keyword co-occurrence patterns.[18] GraphPad Prism 10 was used to visualize annual publication trends and citation distributions using line and bar charts, whereas Tableau was used to create geographical distribution maps of publication volumes by country.

Results

Analysis of the Number of Publications and Citations

Between 2000 and July 2024, 1,864 publications were retrieved, of which 1,534 were identified as relevant to edaravone, comprising 1,374 research articles and 160 review articles. The detailed search strategy and visualization process are presented in Figure 1. Research interest in edaravone began to emerge in 2003 with a steady increase in publications over time, peaking in 2022. Since then, the number of publications and citations has remained stable from 2022 to 2024 (Figure 2).

Analysis of Country Contributions

Edaravone research has received global interest with contributions from scholars across 61 countries (Figure 3A). The top 10 countries by publication count are listed in Table 1, with China leading at 566 publications (9,755 citations), followed by Japan with 492 publications (13,044 citations), and the United States with 152 publications (3,547 citations). Despite their significant contributions, collaboration between these leading countries remains relatively limited, as illustrated in Figures 3B and C. Notably, the average citation per paper varies across countries, with China (17.42) exhibiting a lower citation impact than Japan (27.01), South Korea (25.04), and the United States (24.80). These differences suggest that, while China has the highest research output, Japan and other countries may have a greater influence per publication.

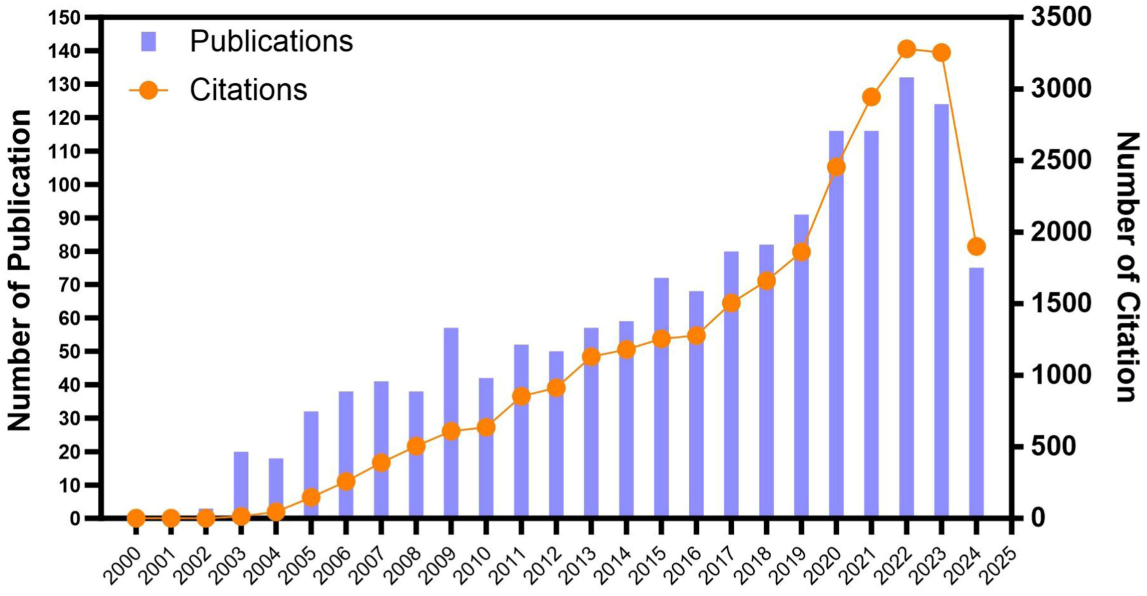

Figure 2 Annual publication volume and citations of edaravone from 2000 to 2024.

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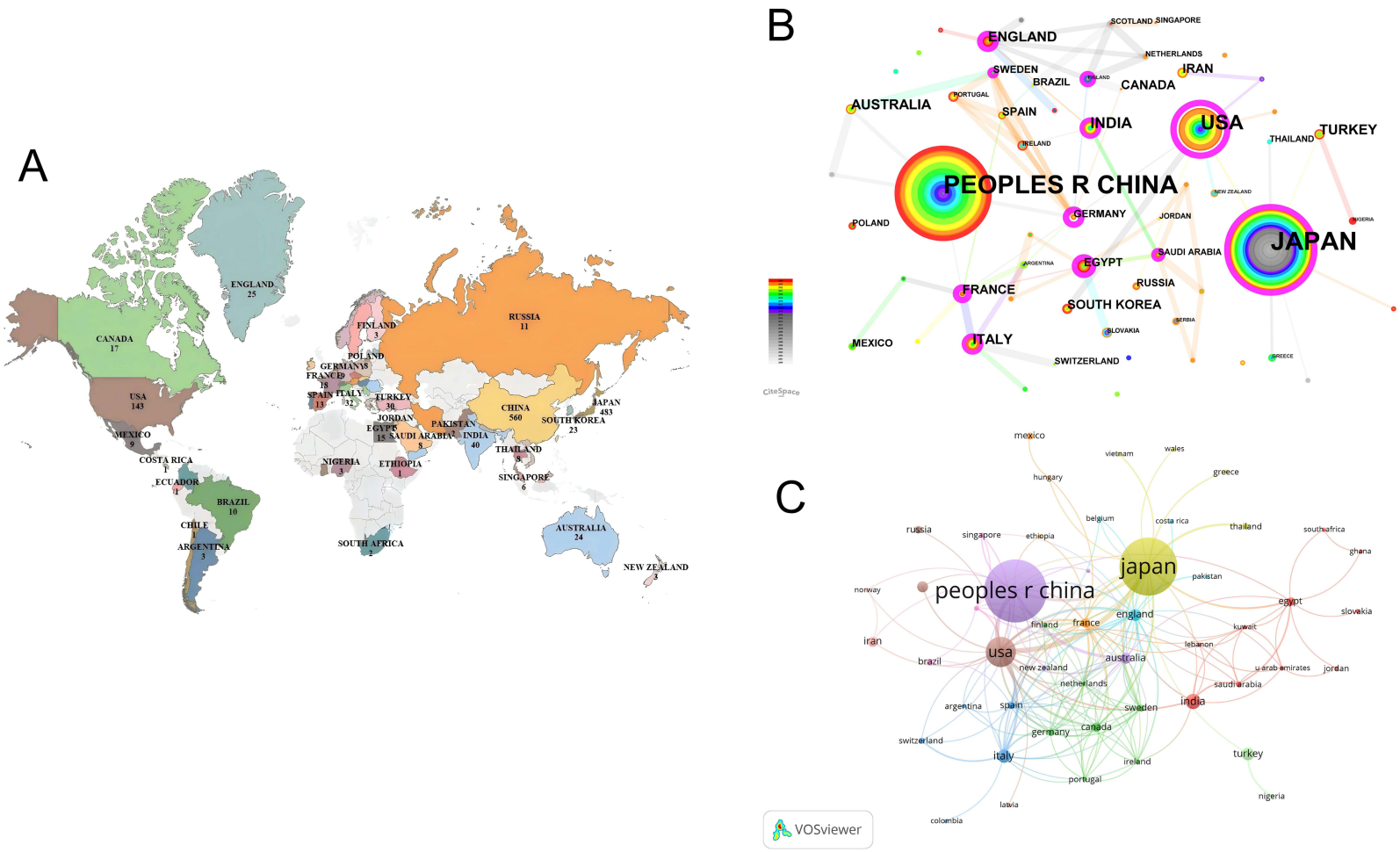

Figure 3 Analysis of Country Contributions **(A)**. Geographic distribution of global publications on edaravone. **(B)**. National collaboration network map presented by CiteSpace. **(C)**. National collaboration network map presented by VOSviewer.

Table 1 Top Ten Productive Countries/Regions

Rank	Country	Publications	Citations	Average Citations	Centrality	h-Index
1	China	566	9,755	17.42	0.07	49
2	Japan	492	13,044	27.01	0.33	53
3	USA	152	3,547	24.8	0.63	33
4	India	45	790	19.75	0.14	17
5	Italy	35	548	17.13	0.11	14
6	Turkey	33	275	9.17	0.06	11
7	UK	26	274	10.96	0.23	11
8	Australia	25	601	10.96	0.01	15
9	South Korea	25	319	25.04	0	9
10	Iran	22	160	13.87	0	8

Abbreviations: USA, United States; UK, United Kingdom.

Analysis of Institutional Contributions

As presented in Table 2, six of the top ten institutions contributing to edaravone research are based in China: China Pharmaceutical University, Peking Union Medical College, Fudan University, Nanjing Medical University, the Chinese Academy of Sciences, and Capital Medical University. Japan is represented by Mitsubishi Tanabe Pharma Corporation, Okayama University, and the University of Tokyo, whereas the United States is represented by Harvard University. Among these institutions, Mitsubishi Tanabe Pharma Corporation leads to research output with 47 publications, whereas Okayama University demonstrates the highest research impact, with an average citation count of 48.74 per publication. The collaboration network among these institutions is illustrated in Figures 4A and B, highlighting the varying degrees of research partnerships and institutional influence in edaravone studies.

Analysis of Contributions by Prolific Authors and Co-Cited Authors

Between 2000 and 2024, 798 authors contributed to edaravone research. Table 3 highlights the top 10 most prolific authors, with Abe K leading at 29 publications (1,545 citations), followed by Takahashi Fumihiro (12 publications, 779 citations) and Kondo K (11 publications, 999 citations). Co-authorship analysis, conducted using CiteSpace and VOSviewer, reveals that Abe K, Watanabe K, and Xu J have the most extensive research networks, occupying central positions in the collaboration network, as illustrated in Figure 5. These findings suggest that, while certain authors dominate in terms of output and influence, collaborative efforts within the field remain concentrated among a few key researchers.

Table 2 Top 10 Productive Institutions

Rank	Institution	Publications	Citations	Average Citations	Centrality	H-Index
1	Mitsubishi Tanabe Pharma Corporation	47	1,605	34.15	0.13	20
2	Okayama University	39	1,901	48.74	0.06	20
3	China Pharmaceutical University	25	402	16.08	0.01	11
4	Peking Union Medical College	26	300	11.54	0.14	10
5	Fudan University	20	451	22.55	0.03	12
6	Nanjing Medical University	22	414	18.82	0.01	10
7	Harvard University	20	736	36.8	0.09	13
8	University of Tokyo	23	1,495	65	0.02	18
9	Chinese Academy of Sciences	18	807	44.83	0.03	14
10	Capital Medical University	9	338	19.88	0.1	9

Abbreviation: Peking Union Medical College, Chinese Academy of Medical Sciences -Peking Union Medical College.

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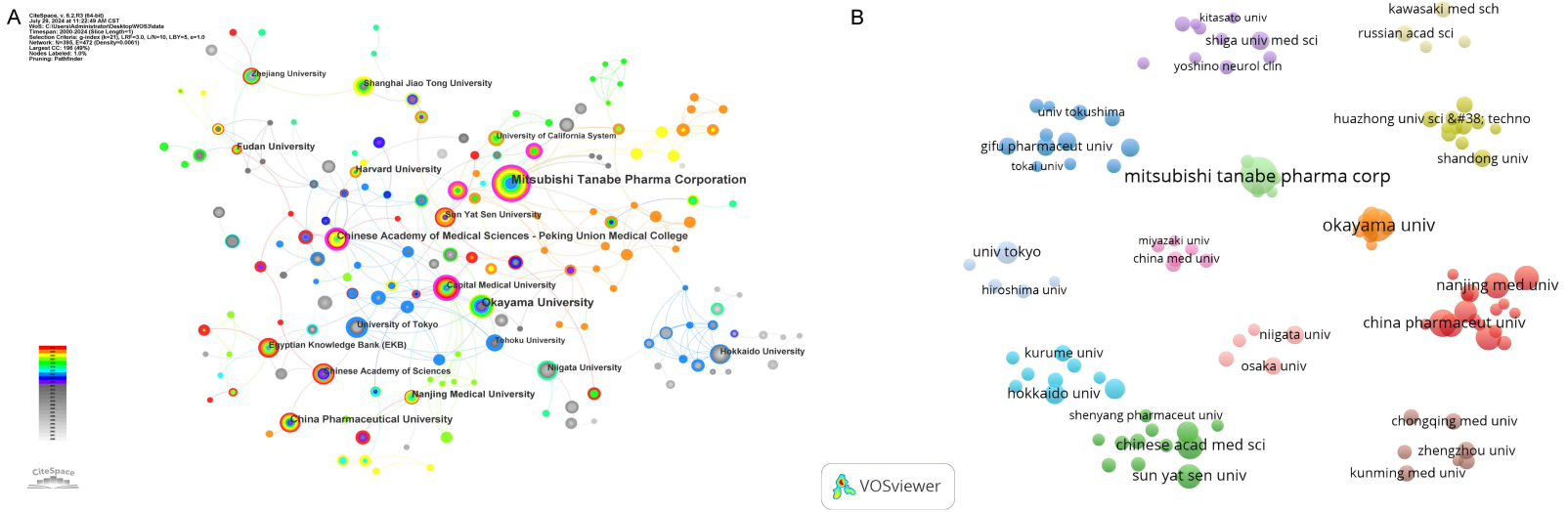

Figure 4 Collaboration network map of institutions presented by CiteSpace (**A**) and by VOSviewer (B).

Table 3 Top 10 Productive Authors

Rank	Author	Publications	Citations	Average Citations	Centrality	H-Index
1	Abe, Koji	29	1,545	53.28	0.03	18
2	Takahashi, Fumihiro	12	779	64.92	0.02	7
3	Kondo, Kazuoki	11	999	90.82	0.01	7
4	Akimoto, Makoto	10	957	95.7	0	5
5	Apple, Stephen	9	113	12.56	0.01	5
6	Tanaka, Masahiko	5	715	143	0	4
7	Yamamoto, Yorihiro	11	218	19.82	0	8
8	Aoki, Masashi	10	1,038	103.8	0	8
9	Hishikawa, Nozomi	8	143	17.88	0	7
10	Nakamaru, Yoshinobu	6	59	9.83	0	4

Analysis of Journal Contributions

To analyze the distribution of cited journals, CiteSpace was used to generate a dual map overlay atlas.[19] The results indicate that most edaravone-related articles are published in journals spanning multiple disciplines, including mathematics, medicine, ecology, biology, physics, and psychology, whereas citations predominantly occur in journals focusing on statistics, environment, physics, chemistry, health, and medicine (Figure 6A). A total of 200 journals has published research on edaravone, covering key topics, such as chemical structure, stroke, cell biology, pharmacological mechanisms, and neuroscience (Figure 6B). Notably, the top 10 journals in terms of publication volume were predominantly classified within JCR Q1 or Q2, indicating their relatively high impact in the field. Among them, "Amyotrophic Lateral Sclerosis and Frontotemporal Degeneration" has the highest number of publications (Figure 6C). These findings suggest that edaravone research is widely disseminated across interdisciplinary fields and has a strong presence in high-impact journals.

Analysis of a Highly Co-Cited Study

Table 4 presents the top 10 most influential papers on edaravone research. The most frequently cited study, "Safety and efficacy of edaravone in well-defined patients with amyotrophic lateral sclerosis: a randomized, double-blind, placebo-controlled trial", authored by Abe K and published in Lancet Neurology in 2017, has received 80 citations.[20] In total, 72 studies were co-cited more than ten times, highlighting their significant impact on the field. The co-citation network, as depicted in Figure 7, illustrates the interconnections among these influential studies, reflecting key research themes and foundational work in edaravone-related investigations.

Analysis of Keywords

A total of 2,966 keywords were extracted from 1,543 publications, with 123 keywords identified as high-frequency terms (frequency > 5). Using CiteSpace, these keywords were categorized into nine clusters, with the top five being #0, cerebral infarction; #1, oxidative stress; #2, free radical scavenger; #3, amyotrophic lateral sclerosis; and #5, Alzheimer's disease (Figures 8A and B). The top 20 keywords with the highest bursts from 2000 to 2024 are shown in Figure 8C, where the red lines indicate the duration of the burst period. Among them, "ischemia" and "brain edema" exhibited the longest burst durations, signifying sustained research interest over time. Additionally, Figure 8D illustrates the evolution of research hotspots across the top nine clusters, revealing the progression from early mechanistic studies to later clinical applications and the development of edaravone derivatives. This shift highlights the expanding scope of edaravone research, from fundamental pharmacological mechanisms to broader therapeutic applications.

Discussion

Bibliometric analysis provides a systematic approach for evaluating the attributes and evolution of scientific literature, encompassing document characteristics and associated metrics. Previous reviews of edaravone have primarily focused on

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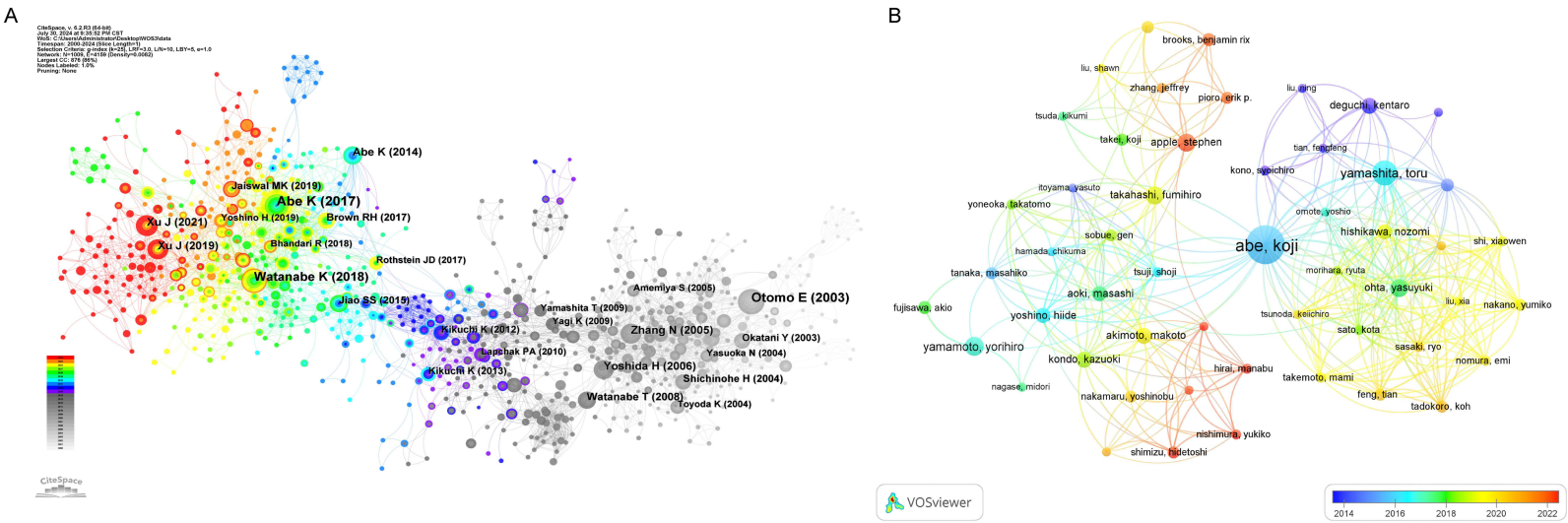

Figure 5 Co-authorship network of authors in Citespace (**A**) and in VOSviewer (B).

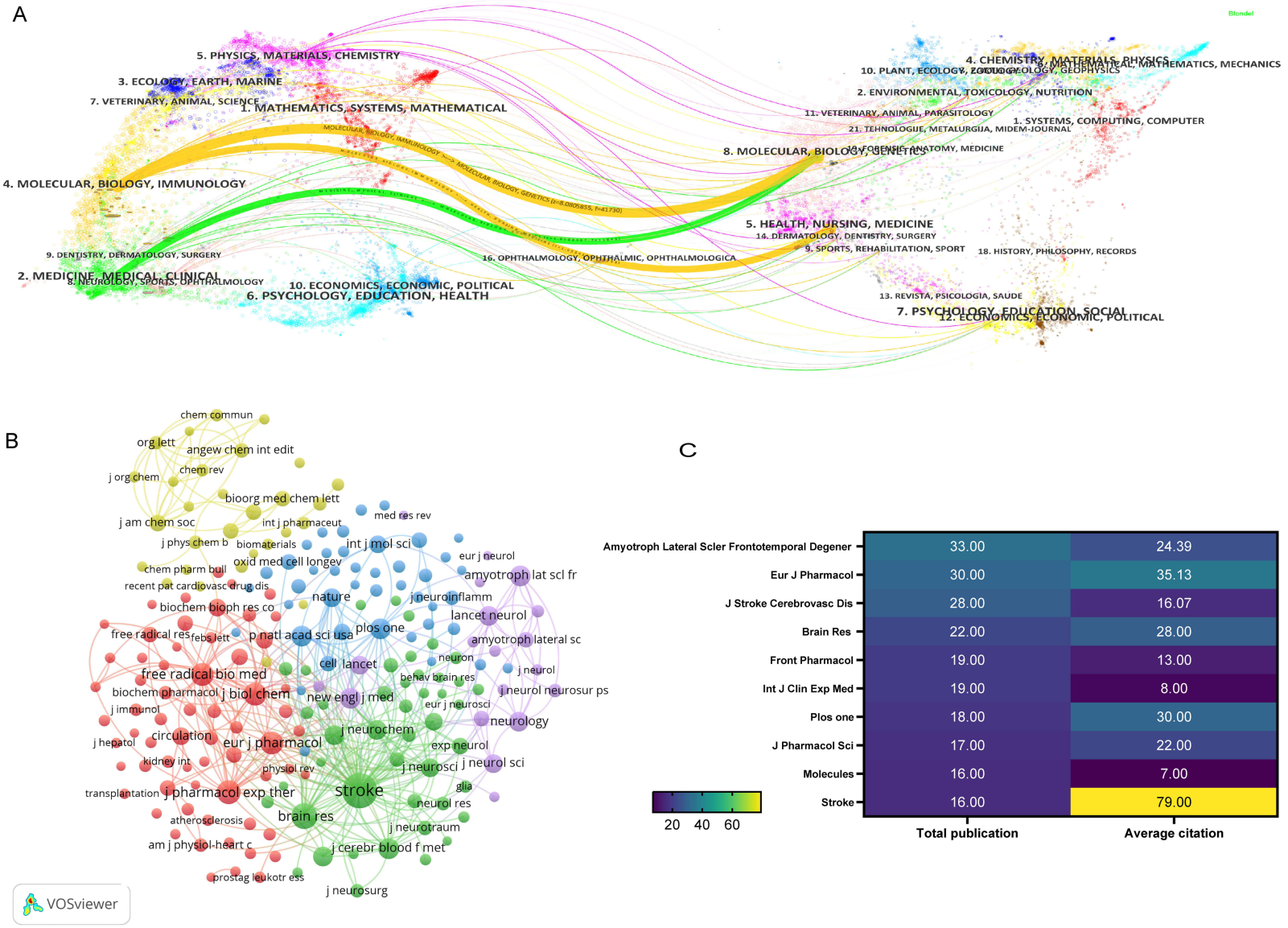

Figure 6 Analysis of Journal Contributions **(A)**. Dual map overlays about the related journals. **(B)**. Co-citation cluster graph of published journals. **(C)**. Heat map of total journal publications and average citations.

Table 4 Co-Cited Top 10 Literature

Rank	Year	First Author	Title	Journal	Co-Citations
1	2017	Abe K	Safety and efficacy of edaravone in well-defined patients with amyotrophic lateral sclerosis: a randomized, double-blind, placebo-controlled trial	Lancet Neurol	80
2	2003	Otomo E	Effect of a novel free radical scavenger, edaravone (MCI-186), on acute brain infarction	Cerebrovasc Dis	65
3	2018	Watanabe K	How is edaravone effective against acute ischemic stroke and amyotrophic lateral sclerosis?	J Clin BiochemNutr	55
4	2021	Xu J	Edaravonedexborneol versus edaravone alone for the treatment of acute ischemic stroke	Stroke	38
5	2005	Zhang N	Edaravone reduces early accumulation of oxidative products and sequential inflammatory responses after transient Focal ischemia in mice brain	Stroke	37
6	2006	Yoshida H	Neuroprotective effects of edaravone: a novel free radical scavenger in cerebrovascular Injury	CNS Drug Rev	37
7	2014	Abe K	Confirmatory double-blind, parallel-group, placebo-controlled study of efficacy and safety of edaravone (MCI-186) in amyotrophic lateral sclerosis patients	Amytroph Lat Scl Fr	34
8	2019	Xu J	Safety and efficacy of edaravonedexborneol versus edaravone for patients with acute ischemic stroke: a Phase II, multicenter, randomized, double-blind, multiple-dose, active-controlled clinical trial	Stroke Vasc Neurol	34
9	2008	Watanabe T	The novel antioxidant edaravone: from bench to bedside	Cardiovasc Ther	30
10	2017	Brown RH	Amyotrophic lateral sclerosis	N Engl J Med	25

its molecular structure, pharmacological effects, and clinical applications; however, they have not provided a visual representation of its development and future trends. This study aimed to assess the contributions of countries, institutions, and authors to edaravone research, while identifying foundational literature, research focuses, and emerging trends. The following sections present a comprehensive discussion of the main findings of this study.

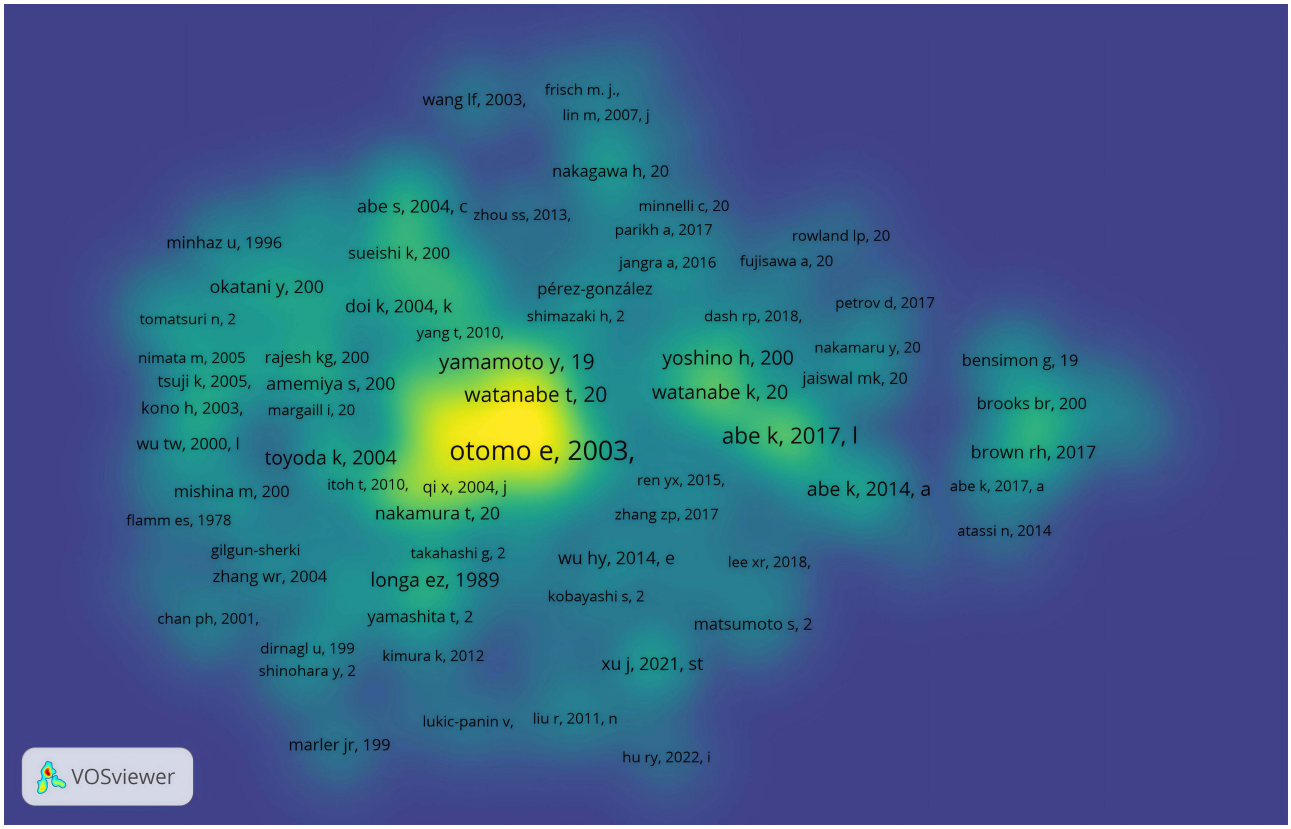

Figure 7 Density visualization of co-cited literature.

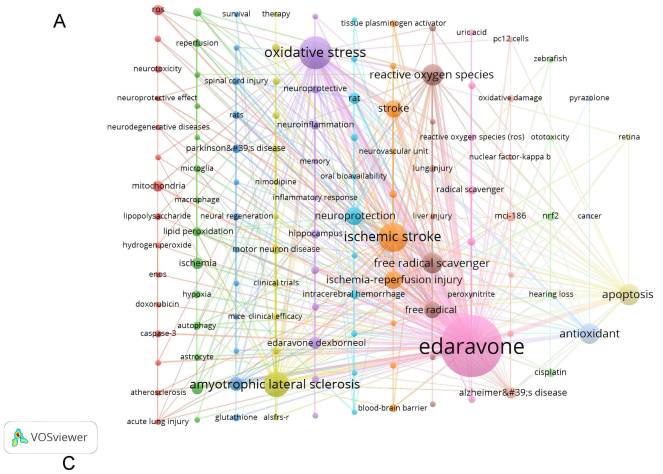

Figure 8 Keyword analysis **(A)**. Keyword co-occurrence analysis. (**B**). Graph of keyword clusters. **(C)**. Burst analysis diagram of the top 20 keywords. **(D)**. Timelines of keywords in Citespace.

Trends and Status of Global Publications

Over the past two decades, the number of publications and citations related to edaravone has increased steadily. Since 2020, annual publications have consistently exceeded 100, demonstrating a sustained interest in edaravone research. The leading contributors in terms of publication volume were China (566 papers), Japan (492 papers), and the United States (152 papers), collectively accounting for 78.88% of the global total (1,210 papers). Among the top ten most productive institutions, Chinese institutions dominate, with the Chinese Academy of Sciences and China Pharmaceutical University being particularly active in recent years. An analysis of the contributions from prolific and co-cited authors indicates that Japanese researchers have played a central role, with Abe Koji emerging as the most published and cited author (H-index: 18), while Yoshino H has the highest average citations per paper (125.7). In terms of journal contributions, stroke was a significant outlet for edaravone research, publishing 16 articles with an average citation count of 79 per article, indicating the high reference value of these publications.

Research Keyword Analysis

Analyzing keyword co-occurrences provides insights into core themes and emerging trends within a research field. Clustering analysis of 62 keywords with more than ten occurrences identified four major research themes: Cluster One (free radical scavenger), Cluster Two (cerebral infarction), Cluster Three (amyotrophic lateral sclerosis), and Cluster Four (oxidative stress). The timeline and burst keyword analyses indicate that terms related to free radicals have remained highly frequent from 2000 to 2024, reflecting the persistent interest in edaravone's role as a free radical scavenger. Additionally, recent research has expanded to include edaravone dexbornel and its dysfunction, suggesting a growing interest in new formulations and broader therapeutic applications.

Cluster One: Free Radical Scavenger

This cluster included 22 keywords, such as free radical, edaravone, electron spin resonance, liver injury, and reactive oxygen species (ROS). The central theme revolves around the chemical mechanisms and pharmacological actions of edaravone as a free-radical scavenger. Under physiological conditions, hydroxyl radicals exhibit high cytotoxicity, oxidizing organic compounds such as amino acids, nucleic acids, and proteins, ultimately leading to diseases including cancer, circulatory system disorders, and metabolic dysfunctions. Hence, scavenging free radicals represents a viable clinical strategy for mitigating oxidative damage.[21]

Edaravone, launched in Japan in 2001, donates electrons to neutralize free radicals, thereby reducing oxidative stress-related cellular damage.[22] Following intravenous administration, edaravone crosses the blood-brain barrier, penetrates the brain tissue, and protects neuronal cells from oxidative toxicity.[23,24] Kono H. demonstrated that edaravone effectively blocks free radicals following liver ischemia-reperfusion, preventing organ damage.[25]

Cluster Two: Cerebral Infarction

This cluster included keywords such as ischemic stroke, clinical efficacy, drug combination, and neuroprotective effects. The primary focus was on the clinical efficacy and mechanisms of edaravone as an adjunct therapy for cerebral infarction. Acute ischemic stroke (AIS) is a major cerebrovascular disorder caused by the sudden interruption of cerebral blood supply, leading to neurological deficits and posing a significant global health and economic burden.[26,27]

The FDA-approved thrombolytic agent alteplase remains the standard treatment for AIS; however, its use is associated with an increased risk of intracerebral hemorrhage, partially due to elevated matrix metalloproteinase-9 (MMP-9) activity.[28,29] A preclinical study demonstrated that combining edaravone with alteplase reduced MMP-9 expression, thereby mitigating hemorrhagic risk compared with alteplase alone.[30]

Edaravone is currently recommended in multiple clinical guidelines and has become an integral component of AIS treatment. Meta-analyses indicate that edaravone significantly lowers National Institute of Health Stroke Scale (NIHSS) scores, improves neurological outcomes, and reduces intracerebral hemorrhage incidence without increasing treatment-related mortality.[3,31] However, most randomized controlled trials (RCTs) and cohort studies have been conducted in Asia,

highlighting the need for additional data from diverse populations to further validate the efficacy of edaravone in stroke management.[32–34]

Cluster Three: Amyotrophic Lateral Sclerosis

This cluster included keywords such as amyotrophic lateral sclerosis (ALS), cell therapy, motor neuron disease, and ALSFRS-R slope. The primary focus was on the therapeutic mechanisms and clinical applications of edaravone in ALS. ALS is a progressive neurodegenerative disease characterized by motor neuron degeneration resulting in muscle weakness, atrophy, and eventual paralysis.[35,36]

Edaravone exerts neuroprotective effects by inhibiting ROS production and mitigating mitochondrial oxidative stress in motor neurons.[37,38] Preclinical studies using ALS mouse models indicated that edaravone significantly delayed motor dysfunction progression, reduced muscle weakness, and protected neuronal integrity.[39] Following regulatory approval in the United States and Canada (2017–2018), edaravone became the second drug approved for ALS treatment.[40] A Phase III clinical trial involving 192 ALS patients demonstrated that edaravone significantly slowed the decline in ALSFRS-R score ($P = 0.0013$), confirming its clinical efficacy while maintaining a safety profile comparable to that of placebo.[20]

Cluster Four: Oxidative Stress

This cluster included 15 keywords, such as bilirubin oxidation, acute lung injury, and coronary artery. This central theme focuses on the role of edaravone in mitigating oxidative stress-related damage and its potential therapeutic applications in various diseases. Oxidative stress, resulting from an imbalance between ROS production and clearance, contributes to multiple pathologies including ALS, diabetes, and cardiovascular diseases.[41]

As an antioxidant, edaravone mitigates oxidative stress-induced neuronal damage by scavenging post-ischemic free radicals.[42] Inoue et al demonstrated that edaravone protects mitochondrial structures in brain cells by reversing oxidative stress and lipid peroxidation-induced damage following cerebral infarction.[43] Tajima et al further reported that edaravone ameliorated LPS-induced acute lung injury (ALI) in mice by reducing oxidative stress.[44] Additionally, edaravone may slow the progression of age-related macular degeneration, glaucoma, and retinopathy by modulating the JNK and p38 MAPK pathways.[45]

Emerging Frontiers in Edaravone Research

Recent keyword analyses highlight emerging research directions, including edaravone dexbornel, blood-brain barrier interactions, Alzheimer's disease, and dysfunction-related mechanisms. Edaravone dexbornel, a novel edaravone-dexbornel combination, demonstrated improved 90-day functional outcomes in patients with AIS compared to edaravone alone.[46] Moreover, Van et al reported that edaravone enhanced the osteogenic potential of transplanted cells by reducing oxidative stress-induced dysfunction.[47]

Future research on edaravone is expected to further explore its antioxidant and free radical-scavenging properties, particularly in stroke and ALS treatments. Expanding investigations into its mechanistic pathways and novel clinical applications are essential for advancing edaravone-based therapeutics.

Innovation of This Study

The innovation of this paper is mainly reflected in three aspects: First, it breaks through the limitation of traditional bibliometric studies that merely focus on trend description, and for the first time systematically integrates bibliometric analysis with edaravone's molecular mechanisms (such as free radical scavenging, NLRP3 inflammasome regulation, and other multi-target effects) and clinical applications (such as synergistic effects in the treatment of acute ischemic stroke and ALS), forming a closed-loop analytical framework of "literature trends-molecular basis-clinical translation". Second, using tools like CiteSpace and VOSviewer, it not only sorts out core research clusters including free radical scavenging, cerebral infarction, ALS, and oxidative stress but also accurately identifies emerging frontiers such as the application of edaravone dexborneol, blood-brain barrier interactions, and potential in Alzheimer's disease. Third, it comprehensively analyzes global research networks (collaboration patterns among countries, institutions, and authors) and knowledge structures, providing a panoramic reference for edaravone from basic research to clinical translation, thus filling the gap of lacking systematic integrated analysis in this field.

Limitations

This study provides a comprehensive bibliometric analysis and visualization of the knowledge structure and evolving research trends in edaravone-related studies. However, this study has several limitations. First, the analysis was restricted to English language publications, which may have led to the omission of relevant studies published in other languages, potentially affecting the comprehensiveness of the findings. Second, this study relied solely on WoSCC, one of the most authoritative and widely used databases in bibliometric research. While WoSCC offers extensive coverage of high-impact journals, it excludes certain publications indexed in other databases such as PubMed, Scopus, and Embase, which may have influenced the completeness of the dataset. Future studies that incorporate a broader range of databases and multilingual literature may provide a more comprehensive understanding of edaravone research trends.

Conclusion

This study employed bibliometric methods to conduct a comprehensive analysis of the knowledge structure and developmental trends of edaravone research in the neuroscience field. The findings reveal a clear upward trajectory in edaravone-related studies, with China, Japan, and the United States emerging as primary contributors. Keyword clustering analysis highlights edaravone's multifaceted roles as a free radical scavenger, therapeutic agent for stroke, and treatment for amyotrophic lateral sclerosis. Despite the limitations of this study, including its focus on English-language publications and the exclusive use of WoSCC database, the analysis offers valuable insights into edaravone's research landscape and potential clinical applications. Future research should incorporate a broader range of literature sources and languages to provide a more comprehensive and globally representative perspective of the therapeutic potential of edaravone.

Data Sharing Statement

The data for this study is available, as all articles included in this review are publicly accessible through the Web of Science.

Ethics Approval and Consent to Participate

Because this study did not involve human trials or data, it was not subject to ethical approval.

Acknowledgments

S.LCY and L.WS contributed equally to this paper. All the authors have read and agreed to the published version of the paper.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

We declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

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