

Progress and Frontiers of Research on Dexmedetomidine in Perioperative Medicine: A Bibliometric Analysis

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Background: Dexmedetomidine has received increasing attention for its sedative, analgesic, anxiolytic, anti-inflammatory and anti-stress effects in perioperative medicine. Numerous studies have been carried out to explore its influence on perioperative patients.

Objective: This study aimed to identify the most influential literature, trends and hotspots in dexmedetomidine research by bibliometric analysis.

Methods: Articles and reviews related to dexmedetomidine in perioperative medicine were collected from Web of Science Core Collection. VOSviewer and Citespace software were used for bibliometric analysis and data visualization.

Results: A total of 1652 suitable publications were extracted from the database for analysis, including 1,497 articles and 155 reviews. The number of publications in the field of dexmedetomidine research has increased markedly since 2013, with China being the major contributor, followed by United States. *BMC Anesthesiology* published the highest number of papers on this topic. *Anesthesiology* ranked first in terms of average citations per paper and co-citation journal. Ji Fuhai was the most prolific author, and Ma Daqing was the most cited authors. The main hotspots during this period were “elderly patients”, “postoperative cognitive dysfunction”, “injury” and “risk factors”.

Conclusion: This study presents an overview of the development related to dexmedetomidine in perioperative medicine using bibliometric analysis. Dexmedetomidine research is thriving and expanding rapidly around the world. The effect of dexmedetomidine on cognitive function has been the latest research hotspot. To advance research in this field, more rigorous and scientific multi-center studies should be designed and further cooperation and academic exchange should be strengthened.

Keywords: perioperative medicine, dexmedetomidine, bibliometrics, anesthesia

Introduction

Perioperative medicine, which aims to enhance high-quality postoperative recovery of patients, refers to the entire period from the beginning of the patient's surgical treatment to the end, and can generally be divided into three phases: preoperative preparation, intraoperative operation and postoperative recovery.^{1,2} Dexmedetomidine, as a potent and highly selective α -2 adrenoceptor agonist with sedative, analgesic, anxiolytic, and sympatholytic effects, has been widely used in perioperative medicine.^{3,4} Several clinical studies have demonstrated that dexmedetomidine can prevent surgery-related adverse events and enhance patient outcomes, including reduced preoperative anxiety, lessened surgical stress, improved immune function and minimized postoperative complications.^{5,6} Unlike other sedative drugs, dexmedetomidine can produce a state of unconsciousness like natural sleep, which allows for easy arousal and co-operation with minimal inhibition of respiratory function.³ Dexmedetomidine is also a potential adjunct in peripheral nerve block, promoting better postoperative analgesia and prolonging the effects of local anesthesia.^{7,8}

As a pediatric premedication, dexmedetomidine has advantages with anxiolysis, ease of separation from parents, improving perioperative sedation and analgesia and reducing postoperative agitation.^{9–11} Additionally, dexmedetomidine

has been shown to reduce myocardial oxygen consumption by decreasing certain physiological parameters, thereby reducing the occurrence of postoperative cardiac complications such as myocardial ischemia. This reduction in complications has been associated with an improvement in the 5-year survival rate of patients who underwent cardiac surgery.¹² Furthermore, the use of prophylactic low-dose dexmedetomidine has also been found to significantly decrease the occurrence of delirium during the first 7 days after non-cardiac surgery in intensive care units.¹³ From the above, it is evident that numerous papers related to dexmedetomidine research have been published in international journals. Consequently, a bibliometric analysis is essential to better comprehend the current state of research and development trends in this field, providing a systematic organization and in-depth analysis of research dynamics.

Bibliometric analysis is a method of assessing the quality of literature by using mathematical and statistical techniques to analyze the literature retrospectively and look for data correlations.^{14,15} Bibliometric analysis can help researchers to understand the latest advances, hotspots and predict future trends in this cutting-edge field and help in choosing the direction of research.¹⁶ In this study, the bibliometric analysis was implemented to analyze the use of dexmedetomidine in perioperative medicine, quantifying essential information and identifying the most influential academic publications, trends and hotspots to provide new ideas for subsequent research.

Materials and Methods

Search Strategy and Data Collection

The related literature published before 31 December 2022 was obtained from Science Citation Index Expanded (SCI-E) databases. To eliminate any bias derived from the database updates, we collected all comprehensive publications on the same day. The search strategies were set as follows: TS = (Post\$operat* OR pre\$operat* OR intra\$operat* OR peri\$operat* OR Post\$surgical OR pre\$surgical) AND TI = (Dexmedetomidine). All retrieved records were exported in the “Plain Text File” format with “Record Content” selected “Full Record and Cited References”. Only articles and reviews with language restriction to English were extracted for further analysis. The detailed search flow and results are shown in Figure 1. Our bibliometric analysis included studies investigating perioperative dexmedetomidine use across all age groups, from pediatric to geriatric populations, without age restrictions.

Bibliometrics and Visualization Analysis

We used VOSviewer 1.6.19 and CiteSpace6.2.4 for the bibliometric analysis and data visualization. Manual reviews were conducted to standardize the names of institutions and authors to ensure consistency in the bibliometric analysis. The plain text was imported into VOSviewer to construct and visualize bibliometric networks based on citation, bibliographic

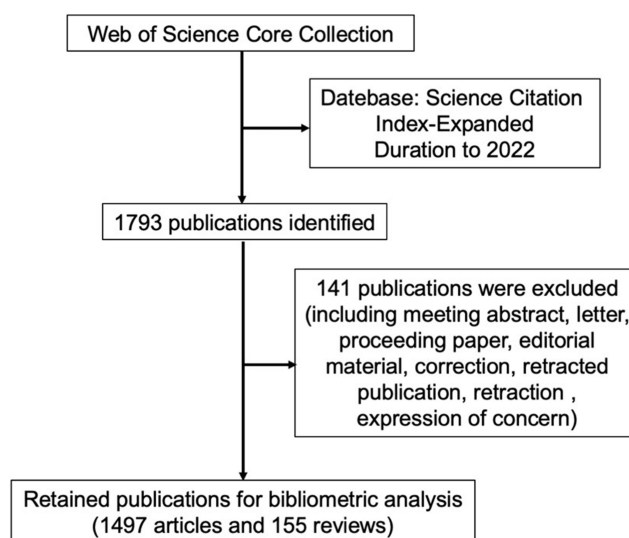


Figure 1 Flow Chart for the Publications Selection.

coupling, co-citation, or co-authorship relations. Altogether, VOSviewer also provided the collaborative relationships among institutions, knowledge structure, research hotspots and trends. Citespace is another important scientometric tool that is commonly used to create mapping and visualization of bibliographic data.¹⁴ These analytic tools offered objective and diverse perspectives on the development of the research on dexmedetomidine in perioperative medicine.

Results

Annual Publications and Trends

There were 1,652 correlative records from the Web of Science core database during 1991–2022, including articles (n=1,497) and reviews (n=155) for bibliometric analysis. The annual number of publications and their cumulative numbers on dexmedetomidine in perioperative medicine is shown in Figure 2. Those publications increased sluggishly between 1991 and 2012. Noteworthy, the last decade has witnessed a consistent and accelerated increase. Specifically, the number of publications in this field has grown over 100 per year and the upward trends has become more noticeable since 2016.

Distribution of Countries/Regions

During the period from 1991 to 2022, 57 countries and regions published research publications related to this topic. Table 1 demonstrates the top 15 countries/regions with the highest number of publications. China produced the largest proportion of publications, followed by United States (US) and South Korea. However, US had the highest mean citations per publication. Inconsistent with the number of publications, England had the highest mean number of citations per paper, followed by Finland and the US of these top 15 countries/regions. As shown in Figure 3A, the number of publications from China has increased significantly over the last 10 years. To improve visual clarity, VOSviewer was used to analyze the cooperation between countries/regions for each published paper (Figure 3B). The size of the circle represents the total link strength and the thickness of the connecting lines indicates the level of collaboration between the countries/regions. The US has the greatest total link strength and cooperates with a wide range of countries/regions. We also found that the most frequent cooperation was between China and US.

Distribution of Institutions

Approximately 1,421 institutions were participated in research on dexmedetomidine in perioperative medicine. The top 15 prolific institutions were analyzed in Table 2. It was notable that 12 institutions were from China, the other three came from South Korea, Egypt and Canada. The top 6 Chinese institutions all produced more than 30 publications, while the

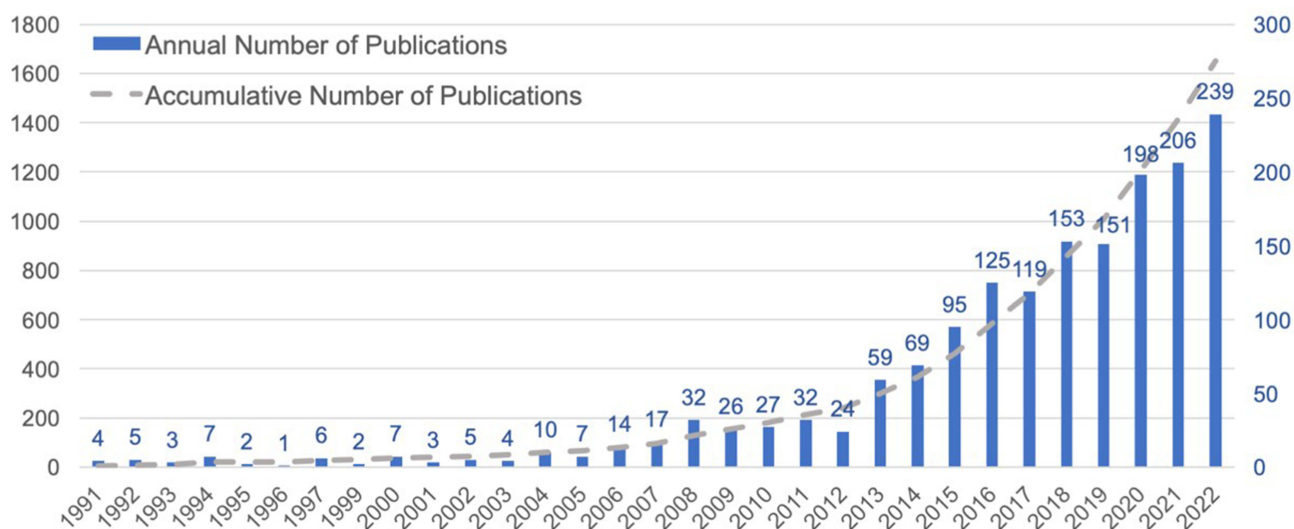


Figure 2 The Number of Annual and Accumulative Publications.

Table 1 The Top 15 Countries/Regions with the Most Publications

Rank	Country/Region	Publications	Total Citations	Mean Citations/Publication
1	China	825	11,243	13.63
2	The United States	243	10,529	43.33
3	South Korea	116	2057	17.73
4	Turkey	108	3210	29.72
5	Egypt	61	1292	21.18
6	Canada	47	1534	32.64
7	Japan	45	843	18.73
8	India	40	621	15.53
9	England	34	2409	70.85
10	Finland	31	1846	59.55
11	Italy	25	394	15.76
12	Brazil	22	288	13.09
13	Germany	19	805	42.37
14	Iran	19	109	5.74
15	Australia	15	433	28.87

mean citations per paper were less than 25. Interestingly, although the University of Toronto offered the least publications of the top 15 institutions, it had the highest average number of citations per paper. In contrast, many of the Chinese institutions had low citation counts per paper, despite their comparatively high number of total publications.

Distribution of Journals

All publications were published in 436 journals, most of which originated in anesthesiology-related fields. Table 3 lists the top 15 prolific journals. *BMC Anesthesiology* was the most popular journal with 65 publications, followed by *Medicine* (n = 62) and *International Journal of Clinical and Experimental Medicine* (n = 62), while their total citations were modest. Regarding citations, the top three journals were *Anesthesia and Analgesia*, *Anesthesiology* and *British Journal of Anaesthesia* which were the authoritative journals in anesthesiology. Expectedly, *Anesthesiology* was ranked first in mean citations per paper. Regrettably, none of the top 15 journals had an impact factor over 12, with the highest impact factor being the *British Journal of Anesthesia* (IF=11.7).

Analysis of Authors

A total of 7,733 authors made contributions to all of the publications on dexmedetomidine in perioperative medicine. The top 15 authors with the highest number of publications were analyzed and exhibited in Table 4. Ji Fuhai was the most prolific author in this field, followed by Liu Hong and Peng Ke. Ji Fuhai and Peng Ke came from the same institution and had fruitful cooperation with Liu Hong from the US. Inconsistent with the number of papers, the top three researchers of mean citations were Ma Daqing, Kallio Antero and Scheinin Harry. The H-index is a metric that evaluates a researcher's academic influence by analyzing both their number of publications and citation frequency, providing a comprehensive score of their scholarly impact. The highest H-index owner was Ma Daqing, followed by Scheinin Harry and Tobias Joseph D. The collaborative relationships of researchers with more than 4 publications were shown in Figure 4. Although many authors had published relevant papers, their distributions were decentralized indicated that the partnerships were regional and more large-scale, high-quality collaborations were needed in the future.

Analysis of Keywords and Burst Keywords

The analysis of keywords is particularly important in bibliometrics, not only as the core of the paper but also their more condensed information and representativeness when presenting domain analyses. Research hotspots can be determined by keyword co-occurrence analysis, which is defined as the frequency of two keywords occurring simultaneously in the same paper. There were 3,395 keywords extracted from all publications. Expectedly, dexmedetomidine was the most

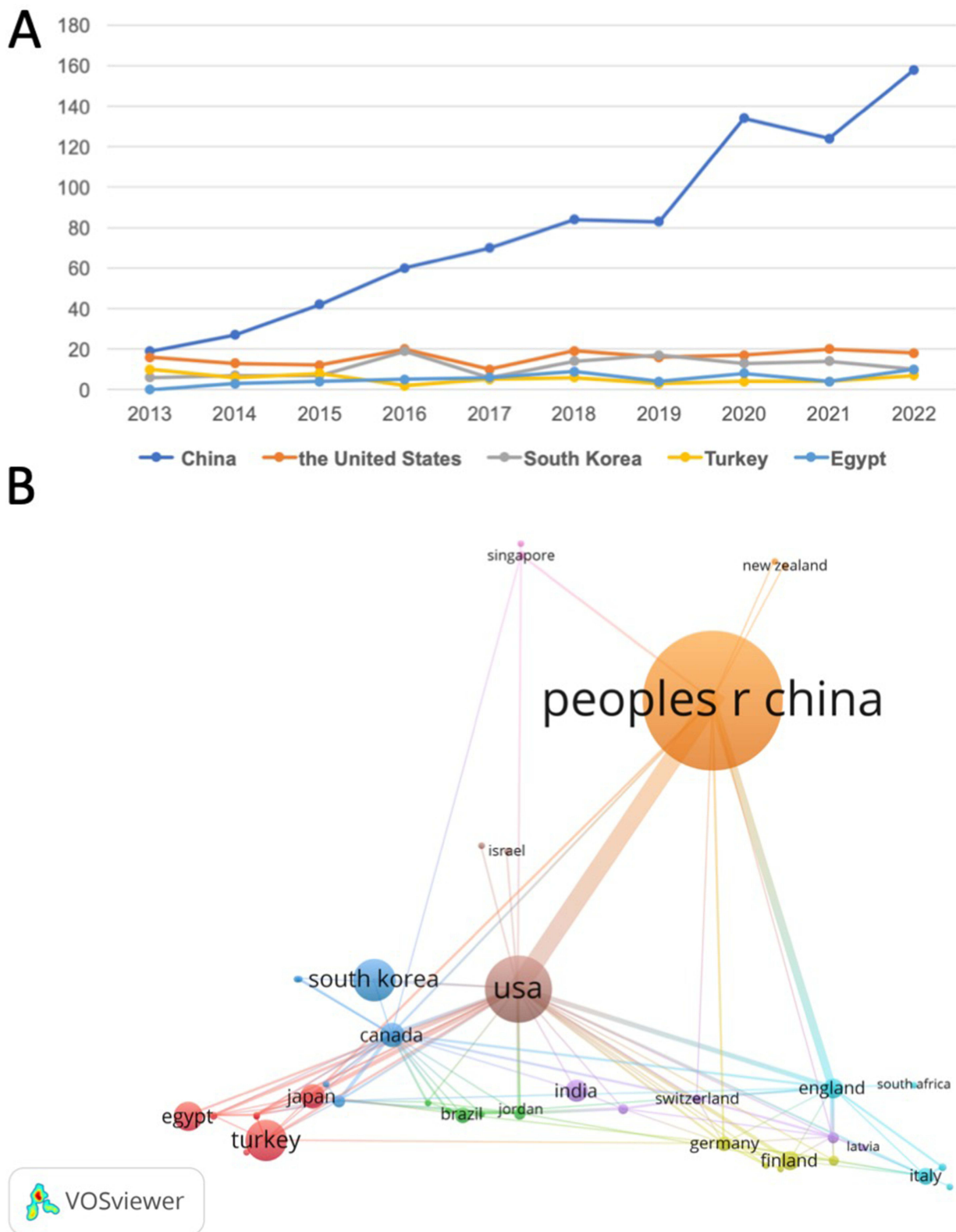


Figure 3 (A) Growth Trends of the Top 5 Countries from 2013 to 2022; **(B)** The Network Visualization Map of Collaborations between Countries/Regions.

Table 2 The Top 15 Institutions with the Most Publications

Rank	Organization	Country	Publications	Total Citations	Mean Citations/Publication
1	Anhui Medical University	China	41	599	14.61
2	Sun Yet-sen University	China	38	635	16.71
3	Soochow University	China	35	870	24.86
4	Capital Medical University	China	34	373	10.97
5	Fudan University	China	32	419	13.09
6	Nanjing Medical University	China	31	489	15.77
7	Yonsei University	South Korea	28	704	25.14
8	Shanghai Jiao Tong University	China	26	310	11.92
9	Shandong University	China	25	481	19.24
10	Assiut University	Egypt	24	300	12.50
11	Zhejiang University	China	21	371	17.67
12	Peking University	China	20	802	40.10
13	Qingdao University	China	20	322	16.10
14	Sichuan University	China	20	185	9.25
15	University of Toronto	Canada	19	1019	53.63

Table 3 The Top 15 Journals with the Most Publications

Rank	Source	Publications	Citations	Mean Citations/Publication	IF(2022)
1	BMC Anesthesiology	65	833	12.82	2.4
2	Medicine	64	764	11.94	1.6
3	International Journal of Clinical and Experimental Medicine	62	246	3.97	N/A
4	Anesthesia and Analgesia	56	4386	78.32	6.6
5	Pediatric Anesthesia	46	1619	35.20	2.1
6	Journal of Clinical Anesthesia	40	1273	31.83	9.4
7	British Journal of Anesthesia	35	2628	75.09	11.7
8	Experimental and Therapeutic Medicine	34	477	14.03	2.8
9	European Journal of Anesthesiology	31	1047	33.77	4.2
10	Anesthesiology	29	3143	108.38	9.0
11	Journal of Anesthesia	28	504	18.00	2.9
12	Frontiers in Pharmacology	26	189	7.27	6.0
13	Journal of International Medical Research	25	265	10.60	1.6
14	Minerva Anestesiologica	25	471	18.84	3.4
15	PLoS One	25	791	31.64	3.8

frequent keyword. These keywords except dexmedetomidine occurred more than 20 times were mapped by VOSviewer software. As shown in [Figure 5A](#), the size of the circles represents the frequency of occurrence of keywords.

“Sedation”, “anesthesia”, “surgery”, “propofol” and “analgesia” were the top 5 high-frequency keywords with the bigger size of the circles. Those keywords were divided into 5 clusters with different colors. The red cluster mainly related functional impairment of tissue or organ with the keywords such as “delirium”, “ischemia”, “stress” and “inflammation”. The green cluster focused mainly on sedation and general anesthesia, including “sedation”, “anesthesia” and “propofol”. The blue cluster involved the studies on regional anesthesia containing “analgesia”, “bupivacaine” and “nerve block”. The green cluster was mainly in association with pediatric anesthesia and anxiolytic, including the keywords such as “children”, “anxiety” and “midazolam”. The violet cluster contained the studies on clinical trials, comprising “meta-analysis”, “double-blind” and “efficacy”. [Figure 5B](#) demonstrated the evolution of high-frequency keywords. Evidence-based medicine, protection of vital organs of dexmedetomidine in the perioperative medicine are key areas of current research.

Table 4 The Top 15 Authors with the Most Publications

Rank	Author	Publications	Citations	Mean Citations/Publication	H-Index
1	Ji, Fuhai	23	802	34.87	21
2	Liu, Hong	14	495	35.36	28
3	Peng, Ke	14	376	26.86	20
4	Wang, Dong-xin	11	592	53.82	29
5	Ren, Chunguang	10	131	13.10	22
6	Tobias, Joseph D.	10	245	24.50	44
7	Zhang, Wei	10	188	18.80	28
8	Zhang, Ye	10	167	16.70	18
9	Ma, Daqing	9	865	96.11	61
10	Scheinin, H	9	714	79.33	49
11	Zhang, Jing	9	77	8.56	14
12	Aksu, Recep	8	146	18.25	12
13	Fares, Khaled Mohamed	8	115	14.38	9
14	Kallio, A	8	758	94.75	21
15	Zhang, Zongwang	8	129	16.13	14

“Burst keywords” refers to the phenomenon of keywords being referenced frequently within a specific time, thereby indicating the research hotspots and frontier areas. Figure 5C showed the top 15 keywords with the strongest citation bursts of the last decade. “Clonidine” became research hotspot from 2013 to 2016 with the highest strength, followed by “elderly patients” and “pediatric patients”. There is no doubt that the use of dexmedetomidine in pediatric and geriatric

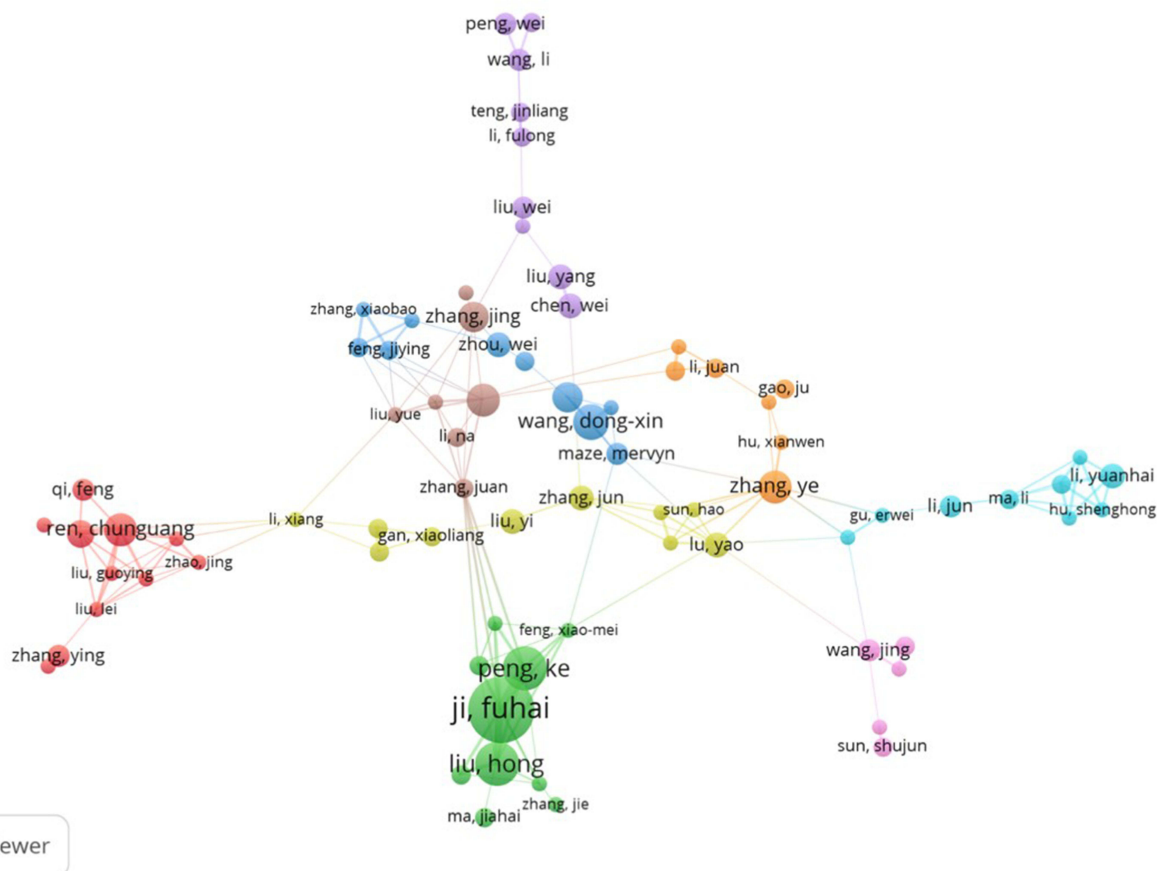
**Figure 4** The Distribution Map of Authors.

Table 6 The Top 10 Co-Cited References with the Most Co-Citations

Rank	Representative Author (Publication Year)	Average Citations	Title	Journal Name	IF (2022)	Type of Research
1	Weerink et al 2017	22.4	Clinical Pharmacokinetics and Pharmacodynamics of Dexmedetomidine	Clin Pharmacokinet	5.8	Review
2	Su et al 2016	17.2	Dexmedetomidine for prevention of delirium in elderly patients after non-cardiac surgery: a randomized, double-blind, placebo-controlled trial	Lancet	202.7	RCT
3	Wang et al 2019	14.7	Effects of dexmedetomidine on perioperative stress, inflammation, and immune function: systematic review and meta-analysis	Br J Anesth	11.7	Meta-analysis
4	Deiner et al 2017	12.4	Intraoperative Infusion of Dexmedetomidine for Prevention of Postoperative Delirium and Cognitive Dysfunction in Elderly Patients Undergoing Major Elective Noncardiac Surgery: A Randomized Clinical Trial	JAMA Surg	16.7	RCT
5	Djaiani et al 2016	11.8	Dexmedetomidine versus Propofol Sedation Reduces Delirium after Cardiac Surgery: A Randomized Controlled Trial	Anesthesiology	9.0	RCT
6	Duan et al 2018	11.0	Efficacy of perioperative dexmedetomidine on postoperative delirium: systematic review and meta-analysis with trial sequential analysis of randomized controlled trials	Br J Anesth	11.7	Meta-analysis
7	Turan et al 2020	10.5	Dexmedetomidine for reduction of atrial fibrillation and delirium after cardiac surgery (DECADE): a randomized placebo-controlled trial	Lancet	202.7	RCT
8	Kaye et al 2020	10.0	Dexmedetomidine in Enhanced Recovery After Surgery (ERAS) Protocols for Postoperative Pain	Curr Pain Headache Rep	3.9	Review
9	Lee et al 2019	9.7	Dexmedetomidine: present and future directions	Korean J Anesthesiol	5.2	Review
10	Subramaniam et al 2019	9.3	Effect of Intravenous Acetaminophen vs Placebo Combined with Propofol or Dexmedetomidine on Postoperative Delirium Among Older Patients Following Cardiac Surgery: The DEXACET Randomized Clinical Trial	JAMA	157.3	RCT

Anesthesiology had the highest number of co-citations among all journals, reflecting its authoritative position in the field of anesthesiology.

We also listed the top 10 co-citation references based on annual average citations during the last decade in Table 6. Five of these were RCTs, three reviews, and two meta-analysis. The RCTs published in top journals have led the way in advancing dexmedetomidine research. Both two meta-analyses published in *British Journal of Anesthesia*. The most cited paper was a review published in *Clinical Pharmacokinetics*. Additionally, not all papers were published in journals with high impact factors.

Discussion

We conducted a bibliometric analysis of 1,652 publications on dexmedetomidine in perioperative medicine collected from Web of Science Core Collection by 2022 to summarize the general situation, research hotspots and trends. Although dexmedetomidine may cause bradycardia and delayed awakening, it is widely used during the perioperative period because of its unique sedative effects and minimal respiratory depression.^{17,18}

By analyzing the growth in publications, we can obtain information on research outputs and trends in this field. The development of dexmedetomidine research in the perioperative period can be divided into two phases: “fluctuating

growth” and “spurting growth”. Since 2013, there has been an overall rapid upward trend in the number of annual publications in this area, indicating a gradual increase of research interest in the perioperative use of dexmedetomidine. Chinese researchers have made an irreplaceable contribution to this growing trend. Ji’s retrospective research about perioperative use of dexmedetomidine reduced the incidence of complications and mortality after cardiac surgery published in *Circulation*. It was one of the most far-reaching studies in anesthesiology that year, and became an important catalyst for subsequent research.¹⁹

The number of publications can sometimes partly reflect the country’s academic dominance in the field. Although China has since emerged as the most prolific country in the last decade, it needs to expand the width and depth of research to increase international influence. The US remains an undeniable position in this field because it has the widest collaborative network. Despite the modest number of publications, we cannot ignore the importance of the United Kingdom (UK) in this field. Our study found that several publications involving British researchers were widely cited, which led to the UK being the most highly cited country for mean number of citations per paper.^{13,20–22} Additionally, the results of the study showed China had become a major contributor to highly productive research institutions. Inter-institutional collaborations were mainly concentrated within the same country or region, and there were relatively little cross-country collaborations. Therefore, we suggest enhancing national and inter-institutional collaborations to promote the progress of scientific research.

We next analyzed the contributions of authors. The top 3 prolific authors had close cooperation for over 10 years. Their studies on dexmedetomidine were multifaceted. The types of studies included RCTs, meta-analyses and basic research.^{12,23–25} However, their RCTs were mostly single-center studies with limited generalizability of findings. Wang Dongxin was another prolific author from China, mainly contributing to research on the effects of dexmedetomidine on delirium, analgesia and sleep quality.^{26–28} The highly cited publication on dexmedetomidine for preventing delirium in elderly patients after non-cardiac surgery, published in *Lancet*, was a collaboration with Daqing Ma from Imperial College London.¹³ Among the top 15 most prolific authors in this field, Ma had the highest h-index, demonstrating his significant academic influence in this research area. Tobias, Joseph D from the USA mainly focused on dexmedetomidine in pediatric patients.^{29,30} Scheinin, Harry and Kallio, Antero were pioneers in this field. They carried out the early research to evaluate the effects of dexmedetomidine and promoted its approval for analgesia and sedation of critically ill patients on mechanical ventilation in the intensive care unit.^{31,32} While there was some collaboration among these prolific authors, it was limited and localized.

BMC Anesthesiology, *Medicine* and *International Journal of Clinical and Experimental Medicine* were the top-3 journals for publications on dexmedetomidine in the perioperative period. Furthermore, they had a certain academic influence in anesthesiology. *International Journal of Clinical and Experimental Medicine* was no longer included in SCIE. Those journals including *Anesthesia and Analgesia*, *Journal of Clinical Anesthesia*, *British Journal of Anesthesia* and *Anesthesiology* that authors should focus on if they are concerned about high-quality studies on dexmedetomidine.

Keywords are a summary of the article’s research and subject information. After removing duplicates, we filtered out the five most frequently occurring keywords: “sedation”, “analgesia”, “cardiac surgery”, “children” and “delirium”. It was obvious that these five keywords represent five research hotspots for the perioperative use of dexmedetomidine. Dexmedetomidine, which produces both sedation and a degree of wakefulness, is becoming more widely used in patients undergoing mechanical ventilation.³³ Although dexmedetomidine reduced the duration of mechanical ventilation and delirium in critical patients, the results were no different from those of patients who received propofol.³⁴ Additionally, a recent retrospective cohort study has also shown that perioperative infusion of dexmedetomidine is associated with an improved 5-year survival rate in patients undergoing cardiac surgery.¹² Despite progress in these hotspots, more efforts are needed for further research. The emergence of the high-frequency keywords “double-blind” and “meta-analysis” is an indication that researchers are gradually paying more attention to quality control.

The research trends could be identified from the burst keywords and overlay visualization. “Postoperative cognitive dysfunction”, “postoperative delirium”, “elderly patients”, “inflammation” and “neuroinflammation” have appeared more frequently in recent years. Furthermore, the six persistent burst keywords were “postoperative delirium”, “elderly patients”, “postoperative cognitive dysfunction”, “injury”, “risk factors” and “dysfunction”. We therefore concluded that the study of dexmedetomidine for postoperative cognitive dysfunction is a current topic that may receive more

attention in the next few years. Stacie Deiner and Alparslan Turan's RCTs showed that intraoperative dexmedetomidine did not prevent and reduce postoperative delirium.^{35,36} However, dexmedetomidine showed a lower incidence of postoperative delirium than propofol in healthy older adults undergoing lower extremity orthopedic surgery.³⁷ The conflicting findings suggest that dexmedetomidine's effectiveness may depend on multiple factors: timing of administration, patient characteristics, and surgical procedures. Future well-controlled multicenter studies should focus on standardizing protocols and investigating optimal patient selection criteria to develop evidence-based guidelines for clinical use. Meanwhile, most researchers have focused on neuroinflammation to explore its mechanisms.^{38,39} It is important to design more rigorous and scientific studies to provide high-quality evidence about the use of dexmedetomidine in perioperative medicine and to increase research into the exact mechanisms in the future.

While our bibliometric analysis identified significant research interest in both pediatric and geriatric populations through keyword analysis, a detailed examination of age-specific outcomes was beyond the scope of this study. Our analysis included publications covering all age groups where dexmedetomidine was used perioperatively, from pediatric to geriatric populations. Future systematic reviews specifically focusing on age-stratified outcomes of perioperative dexmedetomidine use would be valuable to better understand its efficacy and safety across different age groups.

Our study has some limitations. First, the data was obtained from Web of Science core database, which is the most widely used and recommended database for bibliometric analysis. It is likely that many studies from Chinese or other English-language databases have not yet been indexed, and future studies might benefit from incorporating additional databases. Second, as a quantitative study, bibliometric analysis is not an assessment of the quality of the published papers. Finally, due to the low citation frequency, newly published and potentially influential papers may not have been included in our study. Therefore, research and trends in dexmedetomidine may be subject to change as bibliometric data are updated.

Conclusion

Our study elucidated the current research hotspots and emerging trends of dexmedetomidine in perioperative medicine by a bibliometric analysis. Research on dexmedetomidine is flourishing all over the world and continues to expand at a rapid pace. China is undoubtedly the largest contributor and remains a dominant role in global research. The effect of perioperative application of dexmedetomidine on cognitive function has been the latest research hotspot. In the future, we need to design more rigorous and scientific multi-center studies to provide high-quality evidence, and further strengthen collaborations and academic exchanges to advance research in this field.

Data Sharing Statement

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

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.

Disclosure

The authors declare that they have no competing interests.

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