

ORIGINAL ARTICLE

Bibliometric Analysis of Studies on Postoperative Delirium: A Web of Science Database Example

Postoperatif Deliryuma İlişkin Çalışmaların Bibliyometrik Analizi: Web of Science Veritabanı Örneği

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ABSTRACT

Aim: In this study, it was aimed to present the bibliometric analysis of the articles published in the Web of Science (WoS) Core database on postoperative delirium.

Method: In line with the purpose of the research, the word group "postoperative delirium" was scanned in the WoS database, and the obtained data were analyzed with the VOS viewer 1.6.19 program. The citation per publications (CPP) score was calculated to identify the most productive countries, authors and journals in terms of number of publications.

Results: It was observed that the most used keywords related to postoperative delirium were delirium (n=1131), postoperative delirium (n=444), and elderly (n=209). On the subject of postoperative delirium, Edward R Marcantonio is the author with the most publications with 83 articles, United States America (USA) is the country with the most publications with 1220 publications, Anesthesia and Analgesia is the journal with the most publications. JAMA was determined as the journal with the highest citation per publications (CPP) score with 418 points. In publications on postoperative delirium, it was revealed that the countries that cooperated most with participants from different countries were the USA (n = 502), the United Kingdom (UK) (n = 279), Australia (n=193), Germany (n=184) and Canada (n = 171) respectively.

Conclusion: As a result of the research, it has been determined that there has been a great increase in the number of publications on postoperative delirium, especially in recent years. This can be interpreted as the scientific world's increasing interest in the subject of postoperative delirium in recent years.

Keywords: Postoperative delirium, bibliometric analysis, database

Öz

Amaç: Bu çalışmada postoperatif deliryum ile ilgili Web of Science (WoS) Çekirdek veri tabanında yayınlanan makalelerin bibliyometrik analizinin sunulması amaçlanmıştır.

Yöntem: Araştırmanın amacı doğrultusunda "postoperatif deliryum" kelime grubu WoS veri tabanında taranmış, elde edilen veriler VOSviewer 1.6.19 programı ile analiz edilmiştir. Yayın sayısı açısından en üretken ülkelerin, yazarların ve dergilerin belirlenmesi amacıyla citation per publications (CPP) skoru hesaplanmıştır.

Bulgular: Postoperatif deliryuma ilişkin en çok kullanılan anahtar kelimelerin sırasıyla deliryum (n=1131), postoperatif deliryum (n=444), yaşlı (n=209) kelimeleri olduğu görülmüştür. Postoperatif deliryum konusunda Edward R Marcantonio 83 makale ile en fazla yayına sahip yazar, United States America (USA) 1220 yayına en çok yayına sahip ülke, Anesthesia and Analgesia en çok yayın yapılan dergi, JAMA 418 puanla citation per publications (CPP) skoru en yüksek dergi olarak belirlenmiştir. Postoperatif deliryum konulu yayınlarda farklı ülkeden katılımcılarla en çok iş birliği yapan ülkelerin USA (n=502), United Kingdom (UK) (n=279), Avustralya (n=193), Almanya (n=184) ve Kanada (n=171) olduğu ortaya çıkmıştır.

Sonuç: Araştırma sonucunda postoperatif deliryuma ilişkin yayın sayılarında özellikle son yıllarda büyük bir artış olduğu saptanmıştır. Bu durum postoperatif deliryum konusuna bilim dünyasının son dönemlerde artan bir ilgisinin olduğu şeklinde yorumlanabilir.

Anahtar Kelimeler: Postoperatif deliryum, bibliyometrik analiz, veritabanı

Introduction

Postoperative delirium is a clinical condition that occurs acutely after various surgical procedures, takes a long time for patients to recover, and is characterized by sudden-onset deterioration in attention and cognitive functions. It is among the most common postoperative complications, especially in the elderly population (1-3). Delirium, which is among the common symptoms of acute brain dysfunction, can be seen in 70% of patients after surgery. However, despite the high incidence, there are literature findings showing that there are deficiencies in the diagnosis of patients with

delirium (4, 5). However, the faster diagnosis and the underlying cause of delirium are detected, the sooner it may be possible for the patient to respond to treatment (6-8). Delays in the diagnosis of postoperative delirium can lead to long-term consequences such as increased hospital stay with higher morbidity and mortality (9). In addition, it has been reported in the literature that postoperative delirium (10), which is frequently seen in the elderly after surgery, has an increased incidence in pediatric patients (11). This situation has resulted in the fact that the subject of postoperative delirium has

been frequently studied in the scientific world in recent years. Therefore, it is thought that there is a need for bibliometric analysis studies in which the studies related to postoperative delirium are summarized and analyzed in the literature. In the scans, no study including bibliometric analysis of studies on postoperative delirium was found. Therefore, in this study, it is aimed to make a bibliometric analysis of the studies on postoperative delirium in the Web of Science (WoS) database, which is an internationally important database.

Materials and Methods

In this study, the document analysis method, one of the qualitative research methods, was used. In the study where studies on postoperative delirium were examined using the bibliometric analysis method, the data were obtained from the Web of Science (WoS) database. Bibliometric analysis studies have an important function in reviewing the research conducted in the past in a certain field or subject and the results obtained from these studies as a whole (12). Bibliometric analysis; trends of research conducted within a certain period of time on a certain subject, the scientific dimension and impact of researchers, publications and journals, etc. provides an opportunity to analyze the properties (13). According to Hosseini et al. (14), bibliometric analysis studies consist of data collection, bibliometric data processing, analysis-visualization and transfer of findings. In the research, bibliometric analysis was carried out in line with these stages.

The studies obtained from the WoS database in text format were analyzed in terms of parameters such as keyword, author, country of publication, journal name, number of publications, number of citations, cooperation between countries and publication year. In addition, citation per publications (CPP) score was calculated to determine the productivity of publishing countries, authors and journals. $CPP = \text{Total citation from WoS (TC)} / \text{Number of Articles}$ formula was used to calculate the CPP score (15). Based on the CPP score, the top three places in terms of productivity in both country, author and journal category were determined.

The studies extracted from the WoS database in text format were also analyzed in terms of parameters such as publication year, keyword, author, institution, country, journals in which the publications were made, and the number of citations received by the publications. The VOSviewer program was used to create and visualize the bibliometric mapping. Within the scope of the study, a search was made on 10.08.2023 by typing the word "postoperative delirium" in the subject field in the basic search section of the WoS database. Accordingly, 6210 studies were identified. The studies were written in English, limited to research article type studies, and 3960 articles were included in the study (Figure 1). Publications made in 2023 (n=424) were not included in the study since the year has not been completed yet.

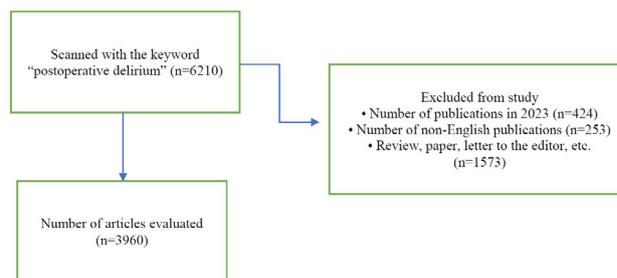


Figure 1. Selection of suitable research articles for the study

Results

Bibliometric analysis findings regarding publications on postoperative delirium are presented under subheadings. The subheadings discussed are presented as follows: keyword analysis, author analysis, countries and number of publications, the most published and cited journals on postoperative delirium, publication citation analysis, findings on cross-country publication cooperation and the number of publications by year.

Keyword analysis

Key words used in publications on postoperative delirium were evaluated considering the criteria of being used at least 3 times. Accordingly, it was seen that 404 words out of 5015 keywords met this condition. The most frequently used keywords are delirium (n=1131), postoperative delirium (n=444), elderly (n=209), cardiac surgery (n=199) and hip fracture (n=184).

Author analysis

While the distribution of the studies on postoperative delirium according to the authors was discussed, the authors who had at least two publications on the subject were included in the evaluation. Information about the top ten authors in the list according to the number of publications and citations is presented in Table 1.

Table 1. Author analysis by number of publications and citations

Author publication analysis		Author citation analysis	
Author name	Publication number	Author name	Citation Number
Marcantonio Edward R.	83	Inouye Sharon K.	7360
Inouye Sharon K.	77	Marcantonio Edward R.	5339
Jones Richard N.	42	Jones Richard N.	3202
Xie Zhongcong	32	Fong Tamara G.	1663
Fong Tamara G.	31	Rudolph James I	1604
Spies Claudia D.	26	Saczynski Jane S.	1506
Schmitt Eva M.	24	Sieber Frederick E.	1253
Sieber Frederick E.	23	Maze Mervyn	1248
Wang Dong-Xin	22	Ma Daqing	1213
Travison Thomas G	22	Spies Claudia D.	1179

The author with the most publications on postoperative delirium is Marcantonio Edward R. with 83 publications, followed by Inouye Sharon K. with 77 publications. In terms of the number of citations, Inouye Sharon K. ranks first with 7360 citations, and Marcantonio Edward R.

ranks second with 5539 citations. In terms of productivity, the three most productive writers according to the CPP score are; Inouye Sharon (CPP=95.58), Jones Richard (CPP=76.23) and Marcantonio Edward R. (CPP=64.32).

Countries and publication numbers

There are publications from 81 countries in the WoS database on postoperative delirium. The number of publications, the number of citations and CPP scores of the 10 countries with the highest number of publications are presented in Table 2.

Table 2. Number of publications, citations and CPP score by country

Country name	Publication Number	Citation Number	CPP	Country name	Publication Number	Citation Number	CPP
USA	1220	49241	40.36	Netherlands	195	7555	38.74
China	709	9769	13.77	South Korea	194	3277	16.89
Germany	303	7936	26.19	UK	180	6436	35.75
Japan	297	4856	16.35	Australia	159	4361	27.42
Canada	222	8491	38.24	Italy	119	3426	28.78

When Table 2 is examined, the country with the highest number of publications is the United States (USA) (n=1220). This country is followed by China with 709 publications and Germany with 303 publications. The three most cited countries according to the number of citations are USA (n=49241), China (n=9769) and Germany (n=7936) in the same way as the countries with the most publications. According to the CPP score, the three countries with the highest productivity scores are USA (40.36), Netherlands (38.74) and Canada (38.24). Turkiye ranks 11th in the number of publications by country with 105 publications. In terms of the number of citations, Turkiye ranks 20th with 1234 citations.

The visual mapping obtained from the VoS viewer program regarding the number of publications by countries is presented below.

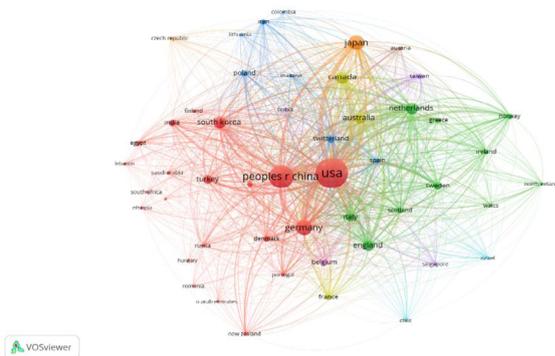


Figure 2. Distribution of publications by country

Most published and cited journals on postoperative delirium

The journals that published the most articles on postoperative delirium and ranked in the top ten

among the journals with the highest number of citations are presented in the table below.

Table 3. Insert here

When Table 3 is examined, the journal with the most publications on postoperative delirium is Anesthesia and Analgesia (n=101). This journal is followed by Journal of the American Geriatrics Society (n=88) and BMJ Open (n=74). In the list of most cited journals, the Journal of the American Geriatrics Society (n=5472) ranks first, Anesthesia and Analgesia (n=5084) ranks second, and Anesthesiology (n=4889) ranks third.

In addition, within the scope of the analysis of the journals, the CPP score was calculated with the formula presented in the method section and the journals in the first three ranks were determined. The journal that ranks first in terms of productivity according to the CPP score is JAMA. The journal's CPP score is 418. According to the CPP score, the second ranked journal is Critical Care Medicine (CPP=97.8), and the third ranked journal is Journals of Gerontology Series A-Biological Sciences and Medical Sciences (CPP=69.22).

Publication citation analysis

In the analysis of citations to publications on postoperative delirium, it was determined that the number of publications with more than 100 citations was 200. Of the publications on the subject, 38 publications (0.9%) were not cited at all. Information about the 10 most cited publications is presented in a table below (Table 4).

Table 3. Publication and citation analysis of journals on postoperative delirium

Journal Publication Analysis			Journal Citation Analysis		
Journal Name	Publication Number	Impact Factor	Journal Name	Publication Number	Impact Factor
Anesthesia and Analgesia	101	6.627	Journal of the American Geriatrics Society	5472	7.538
Journal of the American Geriatrics Society	88	7.538	Anesthesia and Analgesia	5084	6.627
BMJ Open	74	3.006	Anesthesiology	4889	8.986
British Journal of Anaesthesia	72	11.719	British Journal of Anaesthesia	4049	11.719
Plos One	71	3.752	JAMA (9)*	3762	157.335
BMC Anesthesiology	60	2.376	Critical care medicine (20)*	1956	9.296
Journal of Cardiothoracic and Vascular Anesthesia	55	2.894	Plos One	1668	3.752
Anesthesiology	54	8.986	Journals of Gerontology Series A- Biological Sciences and Medical Sciences (22)*	1523	6.591
Journal of Clinical Anesthesia	53	9.375	American Journal of Geriatric Psychiatry (31)*	1427	7.996
Pediatric Anesthesia	50	2.129	Annals of Surgery (23)*	1373	13.787

Note: *Number of publications for journals that are included in the citation count list but not in the publication number list

Table 4. Publication citation analysis

Publication name	Authors	Journal Name	WoS Citation Number	Publication Year
Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU).	Ely, E. W., Inouye, S. K., Bernard, G. R., Gordon, S., Francis, J., May, L., ... & Dittus, R.	Jama	1874	2001
Predictors of cognitive dysfunction after major noncardiac surgery	Monk, T. G., Weldon, B. C., Garvan, C. W., Dede, D. E., Van Der Aa, M. T., Heilman, K. M., & Gravenstein, J. S.	The Journal of the American Society of Anesthesiologists	799	2008
Methodologic innovation in creating clinical practice guidelines: insights from the 2018 society of critical care medicine pain, agitation/sedation, delirium, immobility, and sleep disruption guideline effort	Devlin, J. W., Skrobik, Y., Rochweg, B., Nunnally, M. E., Needham, D. M., Gelnas, C., ... & Alhazzani, W.	Critical care medicine	759	2018
Cognitive trajectories after postoperative delirium	Saczynski, J. S., Marcantonio, E. R., Quach, L., Fong, T. G., Gross, A., Inouye, S. K., & Jones, R. N.	New England Journal of Medicine	702	2012
The impact of delirium in the intensive care unit on hospital length of stay	Ely, E., Gautam, S., Margolin, R., Francis, J., May, L., Speroff, T., ... & Inouye, S.	Intensive care medicine	680	2001
A clinical prediction rule for delirium after elective noncardiac surgery	Marcantonio, E. R., Goldman, L., Mangione, C. M., Ludwig, L. E., Muraca, B., Haslauer, C. M., ... & Lee, T. H.	Jama	640	1994
European Society of Anaesthesiology evidence-based and consensus-based guideline on postoperative delirium	Aldecoa, C., Bettelli, G., Bilotta, F., Sanders, R. D., Audisio, R., Borozdina, A., ... & Spies, C. D.	European Journal of Anaesthesiology	524	2017
Tumor necrosis factor- α triggers a cytokine cascade yielding postoperative cognitive decline	Terrando, N., Monaco, C., Ma, D., Foxwell, B. M., Feldmann, M., & Maze, M.	Proceedings of the National Academy of Sciences	507	2010
Relationship between pain and opioid analgesics on the development of delirium following hip fracture	Morrison, R. S., Magaziner, J., Gilbert, M., Koval, K. J., McLaughlin, M. A., Orosz, G., ... & Siu, A. L.	The Journals of Gerontology Series A: Biological Sciences and Medical Sciences	469	2003
Preoperative anxiety, postoperative pain, and behavioral recovery in young children undergoing surgery	Kain, Z. N., Mayes, L. C., Caldwell-Andrews, A. A., Karas, D. E., & McClain, B. C.	Pediatrics	429	2006

When the publications were examined in terms of citations, it was determined that there were 2566 publications with at least 5 citations. As seen in Table 4, in terms of the number of citations, Ely et al.'s study "Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU)", published in 2001, comes first with 1874 citations. This study is based on Monk's (2008) "Predictors of Cognitive Dysfunction after Major Noncardiac Surgery" with 799 citations and

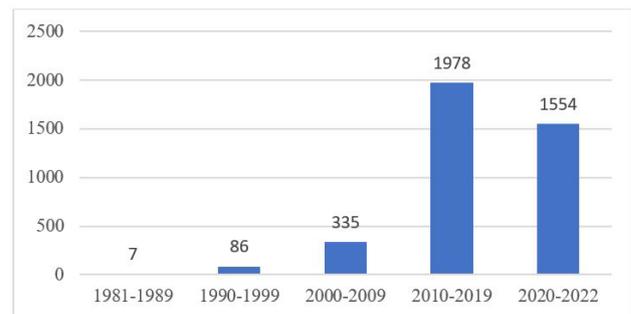
Devlin et al.'s (2018) "Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility and Sleep Disruption in Adult Patients in the ICU" with 759 citations.

Findings on cross-country publication cooperation

When we examine the publications in terms of cooperation between different countries, the countries that cooperate the most with participants from different countries are the USA (n=502), the United Kingdom (UK) (n=279), Australia (n=193), Germany (n=184) and Canada (n=171) respectively. Three countries do not have any collaborative work with different countries. These countries are the Czech Republic, Ethiopia and Romania.

Number of publications by years

The first publication identified on the subject dates back to 1981 and belongs to a researcher named Leary E. Tune from America. It was determined that the number of publications made after the 2000s was 3867 (97.65% of all articles). The analysis results of examining the publications in ten-year periods are presented graphically below.

**Graphic 1.** Number of Publications by Years

When evaluated in ten-year periods, it was seen that the period with the most publications was between 2010-2019 with the number of publications in 1978. It was determined that there were 86 publications between 1990-1999 and 335 publications between 2000-2009. The publication numbers for 2020, 2021, 2022 are 443, 530, 581, respectively.

Discussion and Conclusion

This study aims to make a bibliometric review of the articles scanned in the WoS database related to postoperative delirium. In this regard, articles are analyzed in terms of parameters such as the most used keywords, authors, countries and number of publications, most published and cited journals, publication citation analysis, cross-country publication cooperation status, publication year, CPP scores of journals, countries and authors. has been evaluated. It was observed that there were 3960 research articles regarding postoperative delirium published in English in WoS between 1981 and 2022. The first and only article on the subject was published in 1981, and 581 articles were published in 2022. It can be said that the scientific world's interest in the subject has increased based on the increase in the number of publications

on postoperative delirium in recent years.

Analysis results of the authors who published on postoperative delirium showed that the authors named Marcantonio Edward R, Inouye Sharon and Jones Richard ranked in the top three in all three categories although their rankings differed in terms of publication, number of citations and CPP score. Based on this finding, it can be said that the three authors mentioned are well-known and influential scientists in the scientific world on postoperative delirium.

As a result of the study, it was determined that researchers from 81 countries had studies on postoperative delirium. It has been revealed that the three countries with the most publications on the subject are the USA, China and Germany. The USA and Germany, which were found to be the countries with the most publications in the study results, are also included in the lists of the countries with the most publications in different bibliometric studies conducted in the field of medicine in the literature (16,17) and countries with a high level of development (18). This is compatible with the results of our study. However, it is noteworthy that in recent years China has also been included in the publication rankings in medical research.

Anesthesia & Analgesia is the first journal to publish articles on postoperative delirium. Anesthesia & Analgesia journal is the publication of the International Anesthesia Research Society and publishes 12 issues per year. The journal is a journal with a high impact factor and the language of publication is English (19). It is among the leading journals in the field of anesthesia in terms of quality. It may be a suitable journal option for researchers who will publish on postoperative delirium in the future. The most cited article on postoperative delirium is the study titled "Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU)" published by Ely et al. in 2001 and has 1874 citations. Ely et al. (5) aimed to examine a delirium assessment tool for mechanically ventilated patients and to determine the rate of delirium in such patients. As a result of the study, the researchers concluded that delirium is quite common in mechanically ventilated patients and that the CAM-ICU assessment tool appears to be rapid, valid and reliable for diagnosing delirium in the intensive care setting. It was interpreted that the development of a measurement tool for the diagnosis of delirium in the study would contribute to the high rate of citations to this publication by publications that use or examine this tool. The most productive journal according to CPP score is JAMA (CPP=418). Although the number of publications is low (n=9), JAMA journal attracts attention with the high number of citations it receives (n=3762). This finding is consistent with the journal having a very high impact factor (157.335).

In the research, it was determined that the countries that collaborated most with participants from different countries in their publications were USA (n=502), UK

(n=279), Australia (n=193), Germany (n=184) and Canada (n=171). The USA, UK, Australia are among the countries that cooperate with different countries the most, similar to the results of this research, in the bibliometric analysis study on health literacy by Akyüz (20).

Cognitive changes affecting patients after anesthesia and surgery have been known for over 100 years. Research on cognitive change after anesthesia and surgery gained momentum in the 1980s, with many studies using detailed neuropsychological tests to evaluate cognitive change after cardiac surgery (21), and cognitive changes such as postoperative delirium still attract the attention of researchers. As a result of this study, it is thought that researchers who are interested in the subject of postoperative delirium will have an idea about topics such as keywords, publishing journals and researchers, and the study results will be guiding in the process of planning and publishing their new studies.

This study, which provides bibliometric results for studies on postoperative delirium scanned in WoS also has some limitations. First of all, the results of this study are limited to studies published as research articles in English on postoperative delirium in the WoS database. Researchers who will conduct research similar to this study can make international comparisons by scanning other databases such as Pubmed, Scopus, and Google Scholar. In addition, it is recommended that researchers, who will work in the field of anesthesia in the future, should conduct bibliometric analysis studies on different keywords.

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