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Global Research Status and Future Trends of Unilateral Biportal Endoscopy (UBE) for the Treatment of Spinal Degenerative Diseases in Older Adults: A Bibliometric Analysis of the Past Decade

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Abstract: *Increasing attention has been devoted to the application of unilateral biportal endoscopy (UBE) in the treatment of spinal degenerative diseases in elderly patients. This study aims to examine the current global landscape and emerging trends in this field. The Web of Science Core Collection—Science Citation Index Expanded (WOS-SCI-Expanded) was searched for studies related to UBE for the treatment of spinal degenerative diseases in older adults published between January 1, 2015, and December 31, 2024. Bibliometric methods were used to analyze and index the retrieved records. VOSviewer version 1.6.19 was used for visualization, including co-authorship, co-occurrence, bibliographic coupling, and co-citation analyses, and overall research trends in recent years were evaluated. A total of 624 articles met the search criteria. The annual volume of global research and publications on UBE for spinal degenerative diseases in older adults increased steadily. South Korea made the largest contribution to global research in this field and had the highest total number of citations and h-index. World Neurosurgery and Acta Neurochirurgica were among the journals with the highest publication output. Brown University, the Catholic University of Korea, Lifespan Health, and Rhode Island Hospital were the four leading contributing institutions. Research in this field could be broadly categorized into seven major areas, including mechanistic research, clinical research, and tissue engineering. Clinical research is predicted to become the next major research hotspot. Based on current global research trends, the number of publications concerning UBE for spinal degenerative diseases in older adults is expected to continue increasing. South Korea is currently the leading contributor to this field. Future research is likely to increasingly focus on clinical investigations of UBE for the treatment of spinal degenerative diseases in elderly patients, which may emerge as a key research hotspot in this field.*

Keywords: *unilateral biportal endoscopy, UBE, spinal degenerative diseases, older adults, treatment, global trends, bibliometrics, visualization analysis*

1. Introduction

Unilateral biportal endoscopy (UBE) is a frontier minimally invasive spinal surgical technique that has developed rapidly in recent years[1]. In this procedure, two small portals, each approximately 1 cm, are established through a unilateral approach on the patient's back—one for endoscopic visualization and the other for instrument manipulation—while continuous saline irrigation provides clear exposure of the intraspinal structures[2]. Its core value lies in the following: the endoscope delivers a high-definition, magnified field of view, whereas the independent instrument portal allows surgical instruments to be crossed and maneuvered as flexibly as in open surgery. As a result, UBE is markedly superior to conventional uniportal endoscopy in managing complex pathologies, such as severe spinal canal stenosis, giant disc herniation, and foraminal stenosis[3]. Intraoperatively, it avoids the large incisions, muscle dissection, and destruction of spinal structures associated with traditional open surgery, thereby substantially reducing blood loss, pain, and tissue injury and accelerating postoperative recovery[4]. The operative principles of UBE more closely resemble the open surgery familiar to surgeons, which lowers the difficulty of transitioning from open or tubular minimally invasive procedures to fully endoscopic techniques[5]. UBE is applicable to a variety of procedures,

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including lumbar discectomy[6], spinal canal decompression[7], and interbody fusion (UBE-LIF), and it offers unique advantages, particularly in highly demanding cases[8]. As a representative approach that integrates the concepts of open surgery with the advantages of endoscopic minimally invasive surgery, UBE is becoming an essential instrument for managing complex spinal disorders, improving surgical precision, and enhancing the quality of patient recovery, thereby advancing spinal surgery toward greater minimally invasiveness and precision[9].Spinal degenerative diseases are a major health burden among older adults. However, the global development and research trends concerning the application of UBE to spinal degenerative diseases in this population have not been adequately characterized. Therefore, it is necessary to summarize the current research landscape and identify promising keywords and future directions. Scientific publications constitute a core output of research and an important indicator of research contribution.

Bibliometric analysis can provide information derived from literature databases and bibliometric characteristics, which allows qualitative and quantitative assessment of how research activity trends over time[10]. It offers a means of tracking the development of a given field and comparing the contributions made by scholars, journals, institutions, and countries; meanwhile, it is also used to inform policy making and the development of clinical practice guidelines[10]. This approach has been successfully used to evaluate research trends in osteoarthritis[11], hypertension[12] , diabetes [13], and myocardial injury[14]. To our knowledge, the quantity and quality of research in the field of UBE for spinal degenerative diseases in older adults have not previously been systematically reported. Therefore, this study aimed to evaluate the current research status and global trends in UBE for spinal degenerative diseases in older adults.

2. Materials and Methods

2.1 Data Source

Bibliometric analyses were conducted using the Web of Science Core Collection—Science Citation Index Expanded (WOS-SCI-Expanded), which is widely regarded as a high-quality database for bibliometric research[15].

2.2 Search Strategy

The search strategy was as follows: Topic = (unilateral biportal endoscopy OR unilateral biportal endoscopic technique OR unilateral biportal endoscopic surgery), publication date = January 1, 2015, to December 31, 2024, language = English, and document type = Thesis[16].

2.3 Data Collection

Complete bibliographic records, including titles, publication years, author names, countries, journal names, author affiliations, keywords, and abstracts, were retrieved from the WoS database and imported into Microsoft Office Mondo 2016. Two authors (WJ and JYN) independently screened and extracted the records and entered and compiled the data. The data were subsequently cleaned and analyzed manually in Microsoft Office Mondo 2016 and GraphPad Prism 10[17].

2.4 Bibliometric Analysis

Bibliometric analysis has become an important tool for the global assessment and investigation of scientific fields and uses mathematical and statistical methods to evaluate large bodies of literature and research trends [18,19]. The analytical functions of WOS were used to characterize the basic features of the eligible publications [20]. The h-index, an established bibliometric indicator, was used as a measure of research impact. An h-index of h indicates that a scientist or country has published h articles, each of which has been cited at least h times[21].

A logistic growth model, f(x) = a/(1 + e^(b−cx)), was used to model publication trends and predict future growth. GraphPad Prism 10 was used to generate the temporal distribution of publications. The independent variable x represented the publication year, and the dependent variable f(x) represented the total number of publications. Annual publication output, the top 20 countries, authors, institutions, funding agencies, research areas, total citation frequency, journals, average citation frequency, and h-index were analyzed using Microsoft Office 2016. VOSviewer (VOS) was used for the visualization

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analysis of publications; this software has previously been applied to bibliographic coupling, co-citation analysis, and co-authorship analysis[22].

3. Results

3.1 Global Publication Trends

3.1.1 Total Global Publication Output

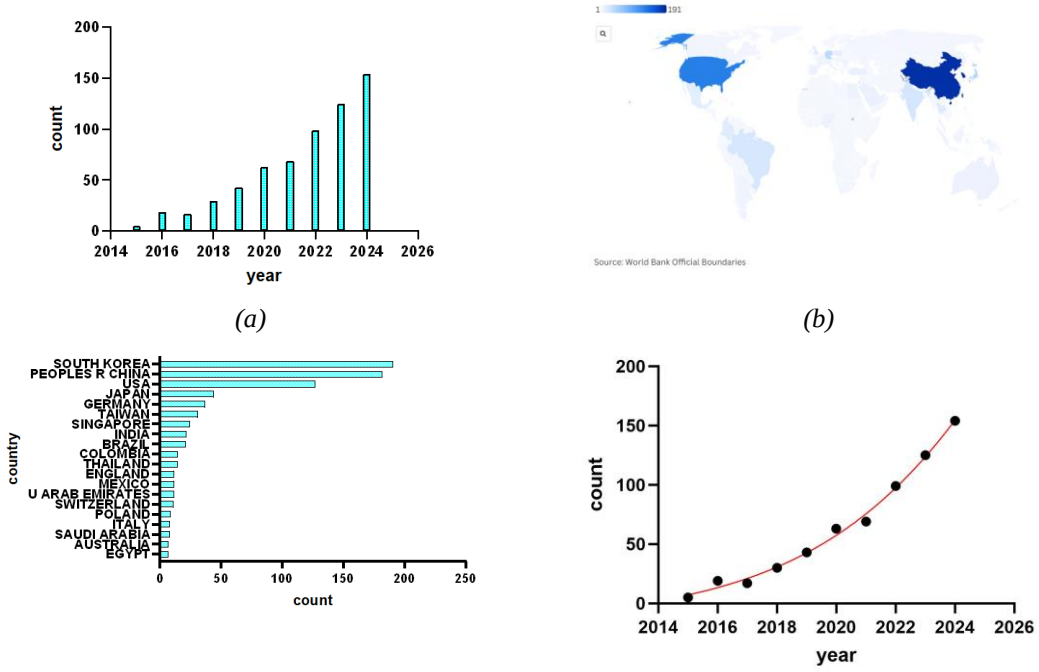
A total of 624 articles published between January 1, 2015, and December 31, 2024, met the search criteria. Most studies were published during 2022–2024 (378 articles, 60.58%). Analysis of the annual publication output showed a clear and sustained increase in the number of global publications from 2015 to 2024. In addition, relative research interest in this field increased markedly in recent years (Figure 1a).

3.1.2 Contributions by Country

A total of 57 countries and regions contributed to this field. South Korea had the largest number of relevant publications (191, 30.61%), followed by China (182, 29.17%), the United States (127, 20.35%), Japan (44, 7.05%), and Germany (37, 5.93%) (Figure 1b and c).

3.1.3 Global Publication Trends

A temporal curve of publication output was generated using a logistic growth model to predict future trends. Figure 1d shows the fitted curve of the growth-trend model, which projects the number of global publications over the coming years[23].



(a)Total number of publications and research interest related to UBE for spinal degenerative diseases in older adults.(b) Global distribution of research related to UBE for spinal degenerative diseases in older adults.(c) Top 20 countries by the number of publications on UBE for geriatric degenerative spinal disorders.(d) Fitted curve predicting the increase in global publication output over the coming years.

Figure 1: Trends in global publications on UBE for the treatment of degenerative spinal diseases in elderly patients and related research.

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3.2 Publication Quality by Country

3.2.1 Total Citation Frequency

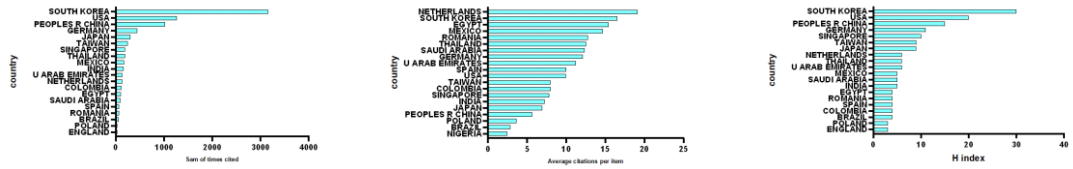
Among all countries and regions, publications from South Korea had the highest total citation frequency (3,164 citations). The United States ranked second in total citation frequency (1,265), followed by China (449), Japan (306). The Taiwan region of China had a total citation frequency of 249 (Figure 2a).

3.2.2 Average Citation Frequency

The Netherlands had the highest average citation frequency (19.14 citations per publication), followed by South Korea (16.57), Egypt (15.43), Mexico (14.67), and Romania (12.80) (Figure 2b).

3.2.3 h-Index

South Korea had the highest h-index (30), followed by the United States (20), China (15), Germany (11), and Singapore (10) (Figure 2c).



(a) *(b)* *(c)*

(a) Total citation frequency of publications by country on UBE for degenerative spinal diseases in the elderly and related research.(b) Average citation frequency of publications by country on UBE for degenerative spinal diseases in the elderly and related research.(c) h-index of publications by country on UBE for degenerative spinal diseases in the elderly and related research.

Figure 2: Publication quality of different countries.

3.3 Evaluation of Global Publications

3.3.1 Journal Analysis

World Neurosurgery ranked first in publication output, with 85 articles (impact factor [IF] = 2). Acta Neurochirurgica published 29 articles (IF = 2.816), while European Spine Journal and International Journal of Spine Surgery each published 26 articles (IF = 2.6 and 1.7, respectively) related to UBE for spinal degenerative diseases in older adults. The 20 journals with the highest publication output are shown in Figure 3a.

3.3.2 Funding Sources

Figure 3b depicts the top 20 funding sources. The National Natural Science Foundation of China supported 23 studies (ranking first), whereas Grants-in-Aid for Scientific Research (KAKENHI) supported 10 (ranking second).

3.3.3 Authors

The 20 most prolific authors collectively published 337 articles, accounting for 54.01% of all publications in this field (Figure 3c). Telfeian, Albert E., published 37 articles related to UBE for spinal degenerative diseases in older adults, followed by Kim, Hyeun-Sung Harrison, with 33 articles. Kim, Jin-Sung, and Heo, Dong Hwa, published 24 and 21 articles, respectively.

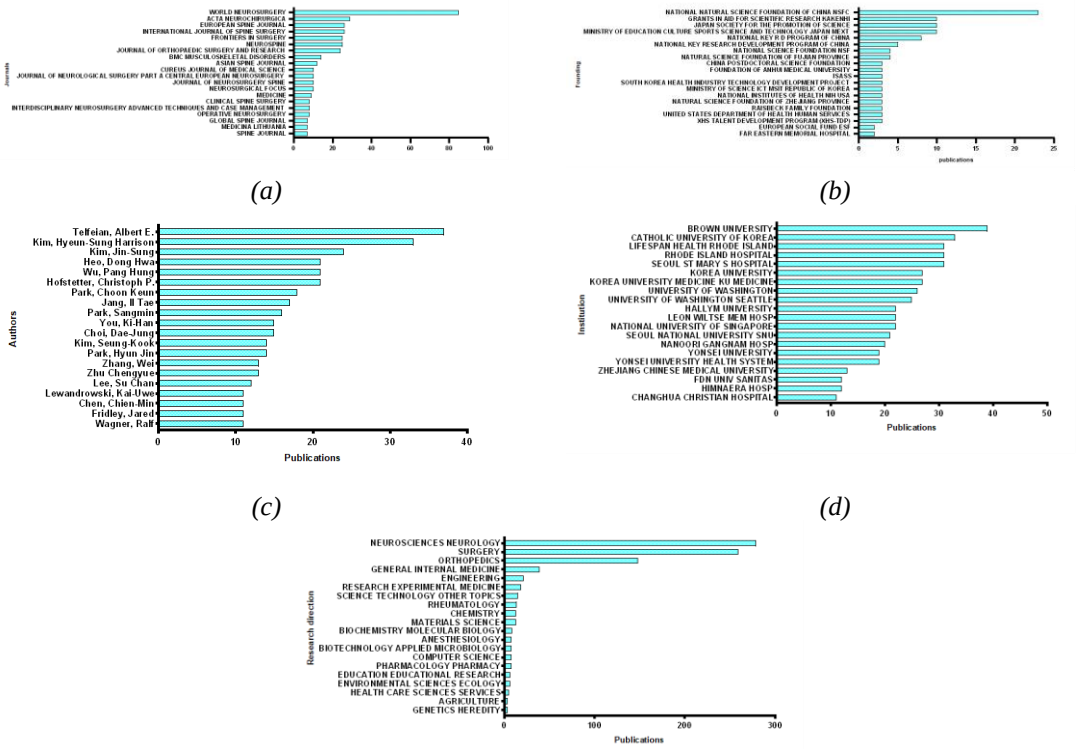
3.3.4 Institutions

The 20 leading institutions collectively published 463 articles, accounting for 74.20% of all publications in the field (Figure 3d). Brown University and the Catholic University of Korea published 39 and 33 articles, respectively.

3.3.5 Research Areas

The distribution of research areas related to UBE for spinal degenerative diseases in older adults is shown in Figure 3e. Neurosciences and neurology, surgery, orthopedics, general internal medicine, and engineering were the most frequently represented research areas.

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(a) *(b)* *(c)* *(d)* *(e)*

(a) Number of articles published by the top 20 journals on studies of UBE for the treatment of degenerative spinal diseases in elderly patients.(b) Number of articles published by the top 20 funding sources on studies of UBE for the treatment of degenerative spinal diseases in elderly patients.(c) Number of articles published by the top 20 authors on studies of UBE for the treatment of degenerative spinal diseases in elderly patients.(d) Number of articles published by the top 20 publication institutions on studies of UBE for the treatment of degenerative spinal diseases in elderly patients.(e) Top 20 research directions related to studies of UBE for the treatment of degenerative spinal diseases in elderly patients.

Figure 3: Evaluation of global publications on UBE for the treatment of degenerative spinal diseases in elderly patients.

3.4 Bibliographic Coupling Analysis

3.4.1 Journals

VOSviewer was used to analyze the journal names of all publications, with a minimum threshold of more than five publications per journal (Figure 4a). A total of 203 journals were identified based on their total link strength. The five journals with the highest total link strength were World Neurosurgery (10,968), Frontiers in Surgery (5,032), Journal of Orthopaedic Surgery and Research (3,797), Neurospine (3,299), and International Journal of Spine Surgery (3,286).

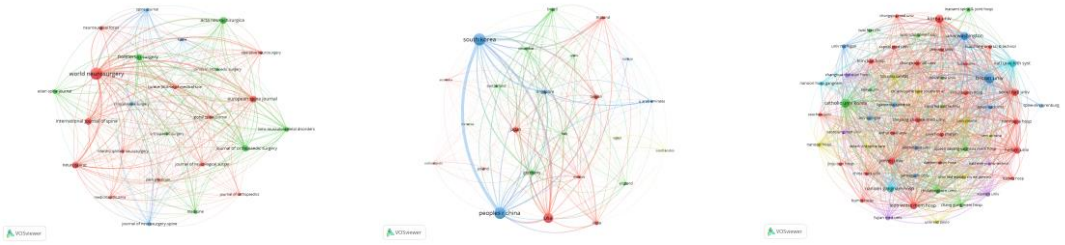
3.4.2 Countries

VOSviewer was used to analyze the countries represented in the publications, with a minimum threshold of more than five publications per country (Figure 4b). A total of 25 countries met this threshold. The five countries and regions with the highest total link strength were South Korea (47,179), China (37,697), the United States (28,330), Germany (12,230), and Taiwan, China (11,157).

3.4.3 Institutions

VOSviewer was used to analyze the institutions represented in the publications, with a minimum threshold of five publications per institution (Figure 4c). A total of 61 institutions met this threshold. The five institutions with the highest total link strength were the Catholic University of Korea (9,580), Yonsei University Health System (7,408), Nanoori Gangnam Hospital (7,275), Brown University (6,870), and Seoul National University (6,558).

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(a) *(b)* *(c)*

(a) Network visualization of 59 journals related to research on UBE for the treatment of degenerative spinal diseases in the elderly.(b) Network visualization of 22 countries involved in research on UBE for the treatment of degenerative spinal diseases in the elderly.(c) Network visualization of 181 institutions involved in research on UBE for the treatment of degenerative spinal diseases in the elderly.

Figure 4: Bibliographic coupling analysis of research on UBE for spinal degenerative diseases in older adults.

3.5 Co-authorship Analysis

3.5.1 Authors

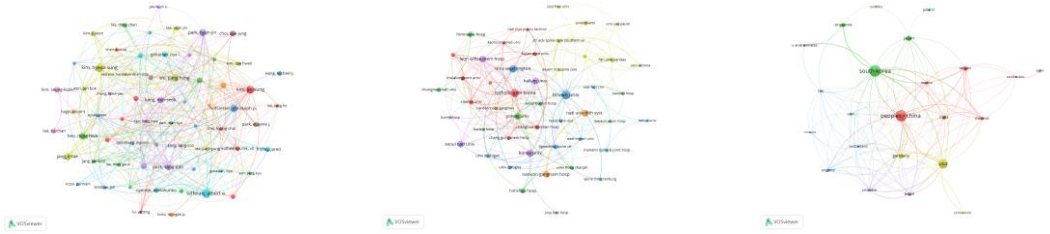
Co-authorship analysis indicated that the relevance of an item depended on the number of co-authored publications. VOSviewer was used to analyze 88 authors, with a minimum threshold of five publications per author (Figure 5a). The five authors with the highest total link strength were Kim, Hyeun-Sung Harrison (total link strength = 84), Telfeian, Albert E. (total link strength = 79), Kim, Jin-Sung (total link strength = 73), Park, Hyun Jin (total link strength = 73), and Jang, Il Tae (total link strength = 69).

3.5.2 Institutions

VOSviewer was used to analyze 61 institutions represented by more than five publications (Figure 5B). The five institutions with the highest total link strength were the Catholic University of Korea (58), Brown University (53), University of Washington (46), Hallym University (42), and Korea University (37).

3.5.3 Countries

VOSviewer was used to analyze publications from 25 countries, with a minimum threshold of five publications per country (Figure 5c). The five countries with the highest total link strength were South Korea (total link strength = 127), the United States (total link strength = 125), Germany (total link strength = 90), China (total link strength = 80), and Colombia (total link strength = 68).



(a) *(b)* *(c)*

(a) Co-authorship network visualization of 88 authors in research on UBE for the treatment of degenerative spinal diseases in the elderly.(b) Institutional collaboration network visualization of 61 institutions involved in research on UBE for the treatment of degenerative spinal diseases in the elderly.(c) International collaboration network visualization of 25 countries involved in research on UBE for the treatment of degenerative spinal diseases in the elderly.

Figure 5: Co-authorship analysis of research on UBE for spinal degenerative diseases in older adults.

3.6 Co-citation Analysis

3.6.1 Articles

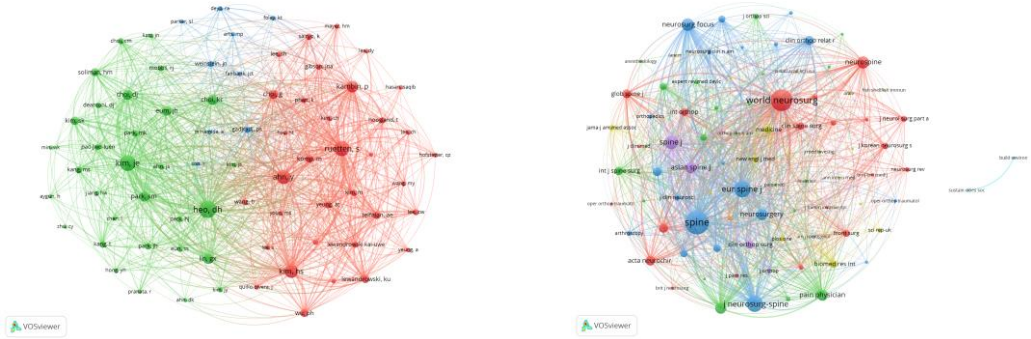
In co-citation analysis, the relevance between items is determined by the number of times they are

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cited together. VOSviewer was used to analyze 56 articles that met a minimum threshold of more than 20 co-citations (Figure 6a). The five studies with the highest total link strength were Eum JH, 2016, Journal of Neurosurgery: Spine, 24, 602, DOI: 10.3171/2015.7.SPINE15304; Heo DH, 2017, Neurosurgical Focus, 43, DOI: 10.3171/2017.5.FOCUS17146; Lin GX, 2019, World Neurosurgery, 125, 425, DOI: 10.1016/j.wneu.2019.02.038; Kim SK, 2018, Journal of Orthopaedic Surgery and Research, 13, DOI: 10.1186/s13018-018-0725-1; and Heo DH, 2019, Neurosurgical Focus, 46, DOI: 10.3171/2019.2.FOCUS197.

3.6.2 Journals

VOSviewer was used for co-citation analysis of journal titles, with a minimum threshold of more than 20 citations per journal. Ninety journals were identified according to total link strength (Figure 6b). The five journals with the highest total link strength were Spine (31,120), World Neurosurgery (27,841), European Spine Journal (16,898), Journal of Neurosurgery: Spine (16,786), and The Spine Journal (11,761).



(a) *(b)*

(a) Network map of co-cited references in the field.(b) Network map of co-cited journals.

Figure 6: Co-citation networks.

4. Discussion

4.1 Global Publication Output and Quality

Reference analysis and visualization of research trends can provide insights into the current progress of a research field and help predict its future development[24]. Therefore, this study aimed to evaluate the contributions of countries, institutions, funding agencies, and major research focuses in the field of UBE for the treatment of degenerative spinal diseases in the elderly.

Research on UBE for spinal degenerative diseases in older adults is a rapidly expanding and increasingly active field. As demonstrated in the present study, the annual number of publications has increased significantly. Research interest in this topic has also risen sharply in recent years. A total of 57 countries contributed relevant publications. Based on the available data, we predicted future publication output, and the model suggests that a greater number of in-depth and comprehensive studies will be published over the coming years. This positive outlook may, in turn, encourage researchers to conduct further high-quality investigations.

4.2 Research Trends in UBE for Geriatric Degenerative Spinal Diseases

According to the analysis of country contributions, South Korea had the highest number of publications in this field. The National Natural Science Foundation of China and Grants-in-Aid for Scientific Research (KAKENHI) ranked first and second, respectively, in terms of the number of publications supported. South Korea made the greatest overall contribution to research on UBE for the treatment of degenerative spinal diseases in the elderly, with the highest total citation frequency and h-index, suggesting that it may be regarded as a pioneer and leader in this field. China ranked second in terms of the overall number of publications. Meanwhile, South Korea ranked first in both total citation frequency and h-index.

Bibliographic coupling refers to the situation in which two publications cite a third publication [25].

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We used bibliographic coupling to characterize similarities among publications from three perspectives: journals, institutions, and countries. The core journals in research on UBE for spinal degenerative diseases in older adults included Spine, World Neurosurgery, European Spine Journal, Journal of Neurosurgery: Spine, and The Spine Journal, which had high total link strength and were more likely to report current developments in this field. World Neurosurgery and Acta Neurochirurgica had the highest publication output, indicating their prominent position in the international literature on UBE for spinal degenerative diseases in older adults.

Brown University had the highest total link strength and may therefore be considered a leading institution in this field. The three institutions with the highest publication output—Catholic University of Korea, Yonsei University Health System, and Nanoori Gangnam Hospital—were all located in South Korea, consistent with the country's leading position in this research area. Almost all of the top 20 institutions were located in the five countries with the highest number of publications. These findings suggest that the development of leading research institutions plays an indispensable role in strengthening a country's academic research capacity[26].

As shown in Figure 3d, Telfeian, Albert E. and Kim, Hyeun-Sung Harrison were the leading contributors in terms of publication output.We should closely monitor further research and newly published studies to keep abreast of the latest developments in the use of UBE for the treatment of degenerative spinal diseases in the elderly. Co-authorship is important for advancing scientific research by promoting research innovation, knowledge sharing, and improvements in research quality. Co-authorship analysis can be used to evaluate collaboration among countries, institutions, and authors. Authors, institutions, and countries with higher total link strength tend to have stronger collaborative relationships. For example, Kim, Hyeun-Sung Harrison, The Catholic University of Korea, and South Korea represent potential key collaborators for future research.

The purpose of co-citation analysis is to assess the influence of research based on the number of times cited. The present findings indicate that landmark studies on UBE for the treatment of degenerative spinal diseases in the elderly have received substantial citations and provide numerous valuable references for subsequent research. In addition, Spine and World Neurosurgery are among the most frequently cited journals in this field.

5. Conclusions

This study characterized global research trends in UBE for spinal degenerative diseases in older adults. South Korea was the largest contributor and occupied a leading position in global research in this field. World Neurosurgery had the highest publication output among the journals identified. The number of studies on UBE for spinal degenerative diseases in older adults is expected to continue increasing in the coming years, and clinical research may emerge as a major future research hotspot.

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Grant No. 2022sy008

References

[1] REIS J P G, PINTO E M, TEIXEIRA A,et al. Unilateral biportal endoscopy: review and detailed surgical approach to extraforaminal approach[J/OL]. EFORT open reviews, 2025, 10(3): 151-155. DOI:10.1530/EOR-24-0137.

[2] PARK D K, WENG C, ZAKKO P,et al. Unilateral Biportal Endoscopy for Lumbar Spinal Stenosis and Lumbar Disc Herniation[J/OL]. JBJS essential surgical techniques, 2023, 13(2): e22.00020. DOI:10.2106/JBJS.ST.22.00020.

[3] JIANG H W, CHEN C D, ZHAN B S,et al. Unilateral biportal endoscopic discectomy versus percutaneous endoscopic lumbar discectomy in the treatment of lumbar disc herniation: a retrospective study[J/OL]. Journal of Orthopaedic Surgery and Research, 2022, 17(1): 30. DOI:10.1186/s13018-022-02929-5.

[4] LI Z, ZHOU W, LIANG J, et al. Clinical Efficacy and Complications of Spinal Surgery Unilateral

ISSN 2706-6819 Vol.8, Issue 3: 29-38, DOI: 10.25236/IJFM.2026.080304

Biportal Endoscopy for Cervical Spondylosis: A Systematic Review and Meta-Analysis[J/OL]. World Neurosurgery, 2025, 194: 123386. DOI:10.1016/j.wneu.2024.10.115.
[5] TAN B, YANG Q Y, FAN B, et al. Decompression via unilateral biportal endoscopy for severe degenerative lumbar spinal stenosis: A comparative study with decompression via open discectomy[J/OL]. Frontiers in Neurology, 2023, 14: 1132698. DOI:10.3389/fneur.2023.1132698.
[6] YU Z, YE C, ALHENDI M A,et al. Unilateral Biportal Endoscopy for the Treatment of Lumbar Disc Herniation[J/OL]. Journal of Visualized Experiments: JoVE, 2023(202). DOI:10.3791/65497.
[7] XU X, ZHANG Z, WANG Z,et al. [Unilateral biportal endoscopy-assisted decompression strategy for lateral lumbar spinal stenosis][J/OL]. Chinese Journal of Reparative and Reconstructive Surgery, 2025, 39(5): 612-619. DOI:10.7507/1002-1892.202502068.
[8] PENG W, ZHUANG Y, CUI W,et al. Unilateral Biportal Endoscopy for the Resection of Thoracic Intradural Extramedullary Tumors: Technique Case Report and Literature Review[J/OL]. International Medical Case Reports Journal, 2024, 17: 301-309. DOI:10.2147/IMCRJ.S444226.
[9] YU K. [Brief history, global trends, and Chinese mission of unilateral biportal endoscopy technique][J/OL]. Chinese Journal of Reparative and Reconstructive Surgery, 2022, 36(10): 1181-1185. DOI:10.7507/1002-1892.202207009.
[10] HASSAN W, DUARTE A E. Bibliometric analysis: A few suggestions[J/OL]. Current Problems in Cardiology, 2024, 49(8): 102640. DOI:10.1016/j.cpcardiol.2024.102640.
[11] INTERNATIONAL FOOT AND ANKLE OSTEOARTHRITIS CONSORTIUM, MENZ H B, MUNTEANU S E,et al. Foot osteoarthritis research: A bibliometric analysis[J/OL]. Osteoarthritis and Cartilage, 2025, 33(4): 491-499. DOI:10.1016/j.joca.2024.12.009.
[12] LOU Y, SUN N, ZHANG M, et al. Trends in exercise for hypertension: a bibliometric analysis[J/OL]. Frontiers in Cardiovascular Medicine, 2023, 10[2026-09-09]. https://www.frontiersin.org/journals/cardiovascular-medicine/articles/10.3389/fcvm.2023.1260569/full. DOI:10.3389/fcvm.2023.1260569.
[13] LOU Y, SUN N, ZHANG M, et al. Trends in exercise for hypertension: a bibliometric analysis[J/OL]. Frontiers in Cardiovascular Medicine, 2023, 10: 1260569. DOI:10.3389/fcvm.2023.1260569.
[14] ZENG X, SHU B, ZENG Q, et al. A bibliometric and visualization analysis of global research status and frontiers on autophagy in cardiomyopathies from 2004 to 2023[J/OL]. International Journal of Surgery, 2024, 110(12): 7687-7700. DOI:10.1097/JS9.0000000000001876.
[15] LIU T, WASSELL N, LIU J, et al. Mapping Research Trends of Adapted Sport from 2001 to 2020: A Bibliometric Analysis[J/OL]. International Journal of Environmental Research and Public Health, 2022, 19(19): 12644. DOI:10.3390/ijerph191912644.
[16] PALMA-LOZANO D, TAPIA-SEQUEIROS G, GALEAS-TORRE M K, et al. Global production and research trends on precocious puberty in the Web of Science database from 2000 to 2023: A bibliometric approach[J/OL]. Pediatric Endocrinology, Diabetes, and Metabolism, 2024, 30(4): 190-197. DOI:10.5114/pedm.2024.146683.
[17] CAI R, LIN H, MAO Q, et al. Research hotspots and trends in cancer rehabilitation: a bibliometric analysis (2013–2023)[J/OL]. Supportive Care in Cancer, 2025, 33(4): 296. DOI:10.1007/s00520-025-09355-3.
[18] BELTER C W. Bibliometric indicators: opportunities and limits[J/OL]. Journal of the Medical Library Association: JMLA, 2015, 103(4): 219-221. DOI:10.3163/1536-5050.103.4.014.
[19] WU J, NIU Z, LI X, et al. Understanding multi-scale spatiotemporal energy consumption data: A visual analysis approach[J/OL]. Energy, 2023, 263: 125939. DOI:10.1016/j.energy.2022.125939.
[20] ASKI S K, AKBARI R, HANTOUSHZADEH S,et al. A bibliometric analysis of Intrauterine Growth Restriction research[J/OL]. Placenta, 2020, 95: 106-120. DOI:10.1016/j.placenta.2020.03.010.
[21] JOSHI M A. Bibliometric indicators for evaluating the quality of scientifc publications[J/OL]. The Journal of Contemporary Dental Practice, 2014, 15(2): 258-262. DOI:10.5005/jp-journals-10024-1525.
[22] ZHANG S, YAN H, SUN W. Global hotspots and trends in Acanthosis nigricans research: A bibliometric and visualized analysis[J/OL]. Skin Research and Technology, 2024, 30(9): e70054. DOI:10.1111/srt.70054.
[23] MCCABE F J, DALTON D M, MCCABE J P. Does country of origin influence research outcomes in operative interventions for lumbar spinal stenosis?[J/OL]. European Spine Journal: Official Publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society, 2021, 30(4): 846-854. DOI:10.1007/s00586-020-06691-2.
[24] BELINCHÓN ROMERO I. Bibliometric Indicators of the Status of Clinical Research in Dermatology in Spain: Implications for the Future[J/OL]. Actas Dermo-Sifiliograficas, 2018, 109(1): 2.

ISSN 2706-6819 Vol.8, Issue 3: 29-38, DOI: 10.25236/IJFM.2026.080304

DOI:10.1016/j.ad.2017.09.002.
[25] SANTOS P S, DOS SANTOS N, MOCCELINI B S,et al. The top 100 most-cited papers authored by Dr. Jens Ove Andreasen: A bibliometric analysis[J/OL]. Dental Traumatology: Official Publication of International Association for Dental Traumatology, 2021, 37(3): 365-382. DOI:10.1111/edt.12664.
[26] SABANCI BARANSEL E, UÇAR T, ÇELIK O T. Mapping Publication Status and Exploring Hotspots in a Research Field: Breastfeeding[J/OL]. Journal of Human Lactation: Official Journal of International Lactation Consultant Association, 2023, 39(3): 441-455. DOI:10.1177/08903344231174232.