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A Visualisation Analysis of Research Literature on Enhanced Recovery After Surgery for Fractures in the Elderly Using Citespace: 2004–2025

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Abstract: ***Objective:*** *To analyse the research trends in rapid recovery surgery for geriatric fractures in China from 2004 to 2025, thereby providing a reference for the current development of this field.* ***Methods:*** *All literature on rapid recovery surgery for geriatric fractures published between 2004 and 2025 and indexed in the CNKI database were analysed using CiteSpace software to generate visualisations of institutional collaborations, author collaborations and keywords.* ***Results:*** *The visualisations revealed that research in the field of geriatric fractures in China is predominantly focused on hip fractures, forming several relatively independent sub-clusters of author collaborations. High-frequency keywords included 'geriatric hip fracture', 'hip fracture', 'fracture of the femoral neck', 'intertrochanteric femoral fracture', 'Enhanced Recovery After Surgery (ERAS)', 'perioperative period', 'nursing', 'hip function' and 'complications'. Emerging terms such as 'perioperative management', 'nursing in Enhanced Recovery After Surgery', 'hip function' and 'intertrochanteric fractures in the elderly' are of significant importance for predicting future research frontiers.* ***Conclusion:*** *Through an analysis of research hotspots and frontiers in the field of Enhanced Recovery After Surgery (ERAS) for fractures in the elderly in China, it was found that ERAS nursing and functional rehabilitation for intertrochanteric femoral fractures in the elderly represent future research frontiers. Based on evidence-based medicine, multicentre studies should be conducted to refine the multidisciplinary team (MDT)-ERAS nursing system for hip fractures in the elderly, which will help promote the development of the field of ERAS for hip fractures.*

Keywords: Fractures in the elderly, Enhanced Recovery After Surgery (ERAS), Research hotspots, Research frontiers, Visualisation analysis, CiteSpace.

1. Introduction

Fractures in the elderly are predominantly hip fractures [1]. Hip fractures are often referred to as the 'last fracture' in older adults; fractures in this population are characterised by high incidence [2], high mortality [3] and high disability rates [1]. Due to the prolonged rehabilitation period and numerous complications following surgery, patients' quality of life and mental health [4] are severely affected. Enhanced Recovery After Surgery (ERAS) [5] utilises a series of optimised interventions to promote patient recovery, reduce postoperative complications, shorten hospital stays and accelerate the rehabilitation process [6]. A scientific knowledge graph is a research method that integrates bibliometrics, information visualisation and network analysis to mine literature data within a field, revealing the disciplinary knowledge structure, research hotspots, collaboration networks and evolutionary trajectories in the form of visualised graphs [7]. ERAS metrics, based on CiteSpace visualisation technology, can identify research hotspots, cutting-edge topics and knowledge clusters, thereby uncovering key research priorities in the field [8]. Enhanced Recovery After Surgery for fractures in the elderly has long been a focus of research, yet there are very few articles analysing hotspots in this area. Therefore, this paper utilises CiteSpace to map the research trajectory of ERAS, illustrating its characteristics and research frontiers, thereby providing a reference for domestic research.

2. Materials and Methods

2.1 Data Sources

CNKI possesses robust citation indexing capabilities, facilitating citation analysis; furthermore, it includes the most influential core academic journals across various fields, such as the natural sciences and biological sciences, and is updated weekly. The articles included therein reflect, to a certain extent, the current trends in disciplinary development both domestically and internationally [9]. Search terms included 'fractures in the elderly OR fractures in the aged' AND 'rapid recovery surgery OR enhanced recovery after surgery OR ERAS OR FTS' in the 'Article/Abstract' field, utilising a combination of subject and keyword fields. The search covered the period from 2004 to 7 August 2025. Following individual assessment, deduplication, organisation and deletion, a total of 406 literature records were obtained. After excluding conference abstracts, calls for papers and documents with incomplete information, 388 valid articles meeting the criteria were included.

2.2 Literature Analysis Methods

The visualisation tool used in this study, CiteSpace, is one of the leading international tools for literature visualisation and analysis [10]. It is suitable for the analysis of complex, multi-dimensional, time-varying and dynamic networks; for mapping knowledge graphs of a field's development; for directly presenting a comprehensive overview of information within a specific field; and for identifying key literature, hot research topics and cutting-edge directions within that field. Basic settings [11]: The time span was set from 2004 to 2025. Institutions, keywords and authors were designated as network nodes. The identified literature was imported into CiteSpace for visualisation analysis to construct a knowledge map of the research field. The colour and thickness of the

'growth rings' surrounding each node represent the duration and quantity of the analysed items, respectively; the purple outer ring of a node indicates its centrality; and the size of the node reflects the frequency of occurrence of the analysed item.

3. Results

3.1 Visual Analysis of Publishing Institutions

This study included literature on hip fractures in the elderly from the CNKI database covering the period 2004–2025 for bibliometric visualisation analysis. The visualisation of publishing institutions is shown in Figure 1. In terms of institutional collaboration, the core institution is represented by the Zhongda Hospital Affiliated to Southeast University. Multiple departments at this hospital—including the Department of Trauma and Orthopaedics, the Multidisciplinary Team (MDT) for Geriatric Hip Fractures, the Department of Intensive Care Medicine, the Department of Geriatrics, the Department of Anaesthesiology, the Operating Theatre, and the Nursing Department—have jointly published papers, forming a core research cluster within the region. In contrast, there are few connections between the remaining research institutions, indicating a low level of cross-institutional collaboration; most collaboration is limited to internal multidisciplinary cooperation within individual hospitals.

3.2 Visualisation Analysis of Authors

The author collaboration network reveals that multiple relatively independent sub-clusters of author collaboration have formed within the field of geriatric hip fractures in China, as shown in Figure 2. Key researchers include Zhang Xianmeng, Li Jianbin, Yang Minghui, Pu Haiwang, Zhang Wei and Ma Qingsong. Whilst collaboration within each research team is close, connections between different teams are sparse; academic exchange and collaboration across teams are insufficient, and a large-scale, nationwide core collaborative network has yet to be established.



Figure 1: Visualisation of publishing institutions

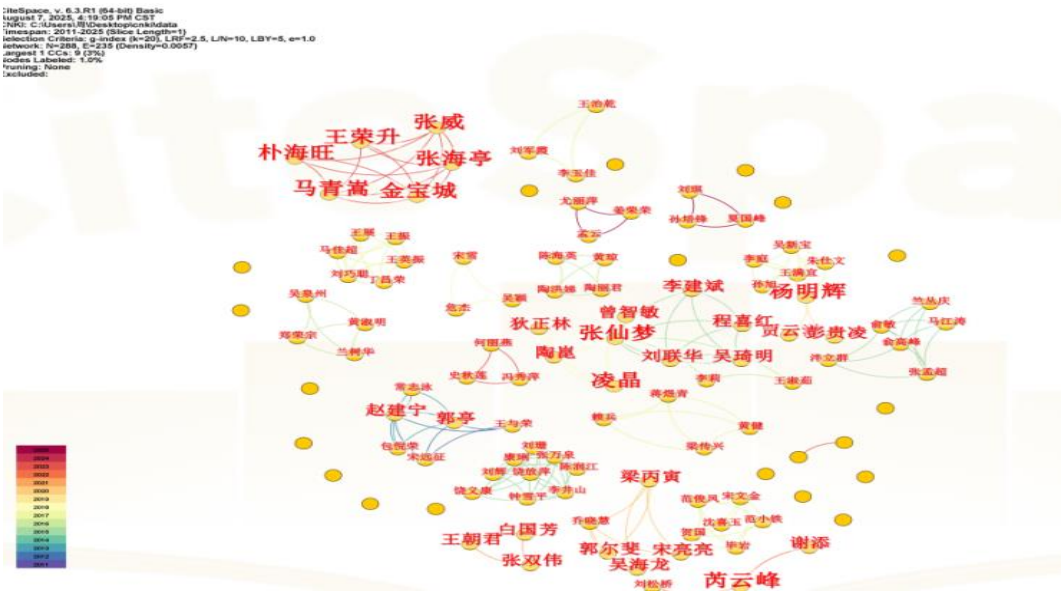


Figure 2: Author collaboration network diagram

3.3 Keyword Co-occurrence Analysis

CiteSpace utilises the principles of term frequency analysis to count the frequency of keyword occurrences and the frequency of co-occurrence between different keywords, whilst clearly visualising keyword frequency and clustering relationships. High-frequency keywords are often used to identify research hotspots within a particular [12]. CiteSpace was utilised to conduct a co-occurrence analysis of the top 50 most frequent keywords each year.

High-frequency keywords include ‘hip fractures in the elderly’, ‘hip fractures’, ‘femoral neck fractures’, ‘intertrochanteric fractures’, ‘Enhanced Recovery After Surgery (ERAS)’, ‘perioperative period’, ‘nursing’, ‘hip function’ and ‘complications’, as shown in Figure 3. Cluster analysis yielded 12 cluster labels, as shown in Figure 4. These are: advanced age, hip fracture, vertebroplasty, the ERAS concept, nursing, enhanced recovery after surgery, geriatric hip fracture, Harris score, perioperative management, intertrochanteric femoral fracture, hip fracture and the enhanced recovery after surgery concept. The clustering outline value S = 0.9261 indicates a high degree of reliability in the clustering results. The timeline diagram visually illustrates the evolution of each cluster over time, showing that the research themes have gradually expanded from the early focus on the diagnosis and treatment of fractures alone to include perioperative nursing, the application of the ERAS concept, hip function assessment and multidisciplinary collaboration.

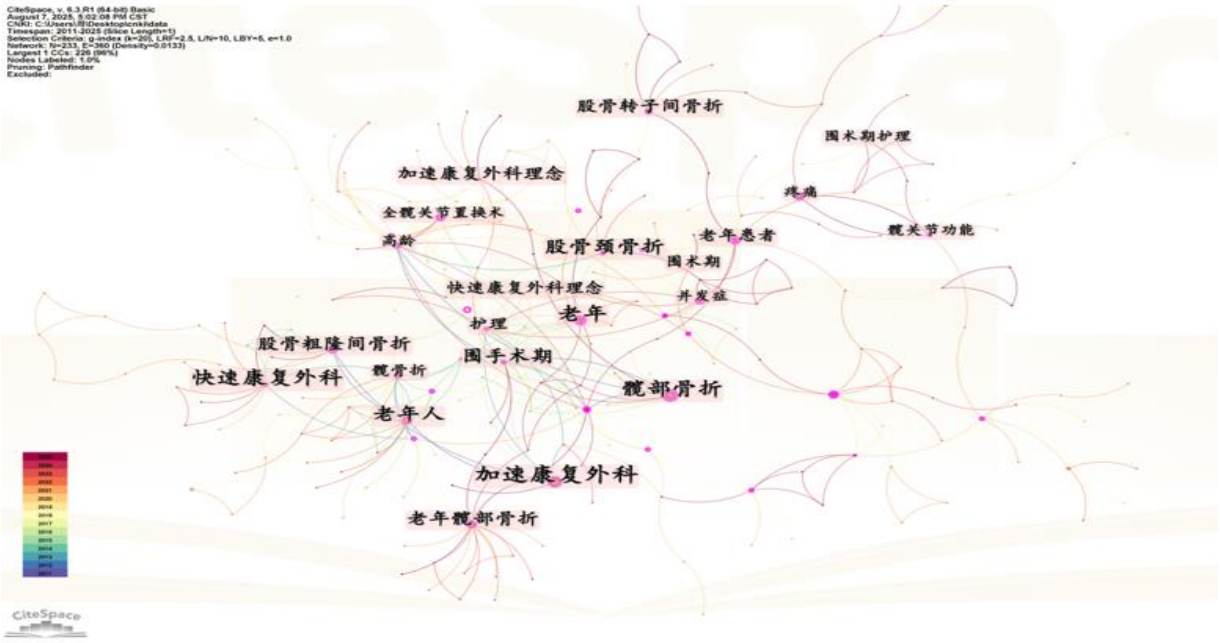


Figure 3: High-frequency keywords

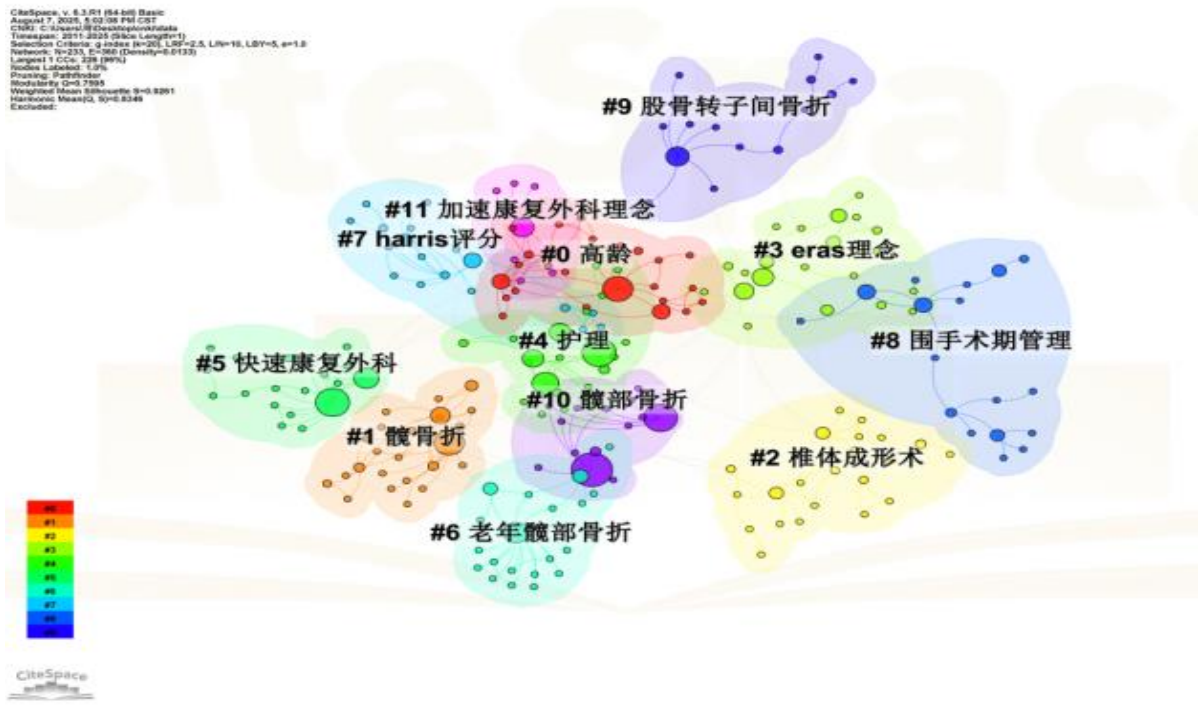


Figure 4: Cluster label map of high-frequency keywords

3.4 Keyword Emergence Analysis

CiteSpace features a trend detection function which, by examining the trends in terms with high frequency changes, enables a clear analysis and understanding of the research frontiers within a particular discipline. Research frontiers reflect emerging theoretical trends and new topics on the horizon, thereby enabling the prediction of scientific research trends and the identification of potential hotspots. Using keywords as nodes, a word emergence distribution map is generated. The keyword emergence analysis identified 12 keywords with strong emergence characteristics, as shown in Figure 5. The keyword timeline map is shown in Figure 6. From 2011 to 2016, the emerging keywords were predominantly 'elderly' and 'hip fractures', representing early research hotspots in this field; from 2012 to 2018, 'perioperative care' and 'enhanced recovery after surgery' became research hotspots; from 2016 to 2020, 'rehabilitation' and 'geriatric femoral neck fractures' continued to attract attention; since 2020, 'perioperative management', 'ERAS nursing', 'hip function' and 'intertrochanteric fractures in the elderly' have experienced a sustained surge in prominence, continuing through to 2025. These represent recent cutting-edge research priorities, indicating that the current research focus centres on the implementation of ERAS nursing, perioperative management of intertrochanteric fractures in the elderly, and postoperative recovery of hip function.

Top 12 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2011 - 2025
老年人	2011	2.89	2011	2016	
围手术期	2012	1.87	2012	2018	
髋骨折	2013	3.09	2013	2017	
加速康复外科理论	2013	2.1	2013	2017	
快速康复外科理论	2015	1.78	2015	2017	
康复	2016	2.89	2016	2019	
经皮椎体成形术	2016	1.81	2016	2017	
老年股骨颈骨折	2017	1.83	2017	2020	
围手术期管理	2020	1.76	2020	2022	
加速康复外科护理	2019	2.43	2022	2023	
髋关节功能	2019	1.92	2022	2025	
老年股骨粗隆间骨折	2017	1.88	2022	2025	

Figure 5: Keyword Emergence Map

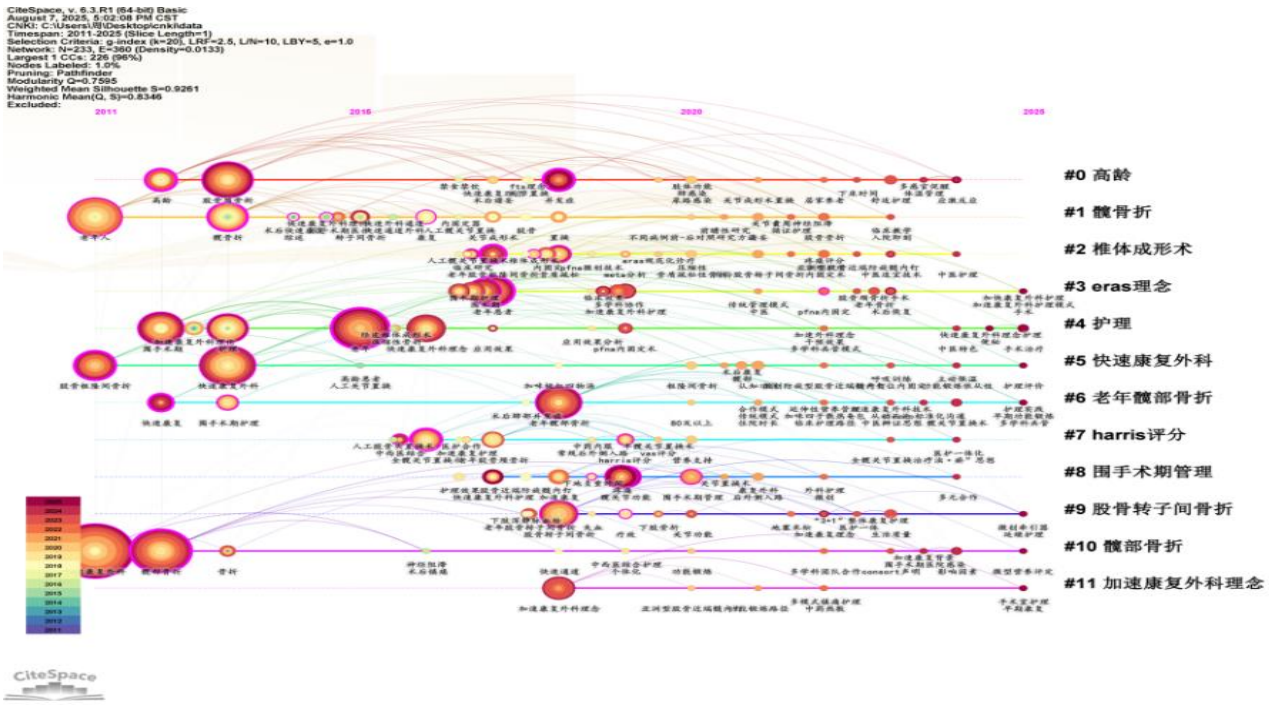


Figure 6: Keyword timeline map

4. Discussion

4.1 Research Output and Collaboration Characteristics

The visualisation results from this study indicate that hip fractures constitute the predominant type of fracture in the elderly. Research in the field of hip fractures in the elderly is concentrated in large Grade A tertiary hospitals. The Zhongda Hospital Affiliated to Southeast University has established an in-house multidisciplinary team (MDT), integrating resources from multiple disciplines including orthopaedics, geriatrics, anaesthesia, intensive care and nursing, and has consistently

produced relevant research, demonstrating the advantages of the MDT model in the diagnosis, treatment and rehabilitation of hip fractures in the elderly. However, the overall network density is low, with limited inter-hospital and inter-regional institutional collaboration; research is largely confined to single-centre, in-hospital studies, whilst multi-centre collaborative research remains insufficient. As elderly patients with hip fractures often present with multiple comorbidities and complex clinical conditions, it is difficult to develop universally applicable care protocols based solely on data from a single centre. In future, academic collaboration between medical institutions in different regions should be strengthened to conduct multi-centre, large-sample clinical studies and promote the standardised implementation of ERAS care protocols.

The results of the author collaboration network analysis indicate that several small, stable research teams have emerged in this field in China; however, links between these teams are weak, and there is a lack of a core national research community. This phenomenon suggests insufficient sharing of academic achievements and clinical experience among different research teams, which hinders the integration and translation of research findings. Moving forward, academic exchange platforms could be established to facilitate the exchange of ideas between different teams and promote the high-quality development of research into rehabilitation care for elderly patients with hip fractures.

4.2 Evolution of Research Themes and Shifts in Hot Topics

Keyword clustering, timeline mapping and emergent term analysis clearly illustrate the evolution of research hotspots in the field of hip fractures in the elderly from 2011 to 2025.Research themes have gradually shifted from an early focus on the diagnosis and surgical treatment of hip fractures in the elderly to perioperative management and the introduction of the Enhanced Recovery After Surgery (ERAS) concept; in recent years, the research focus has further shifted towards ERAS nursing, hip function rehabilitation and the refined management of intertrochanteric fractures. Early research focused on the selection of surgical approaches for elderly patients with hip fractures; with the introduction of the Enhanced Recovery After Surgery (ERAS) concept into the field of orthopaedics, scholars began to explore the integration of ERAS principles into the entire perioperative management process. In recent years, ERAS nursing and hip joint function have emerged as persistent hot topics, reflecting the increasingly important role of nursing in the management of hip fractures in the elderly. The focus of research has shifted from merely reducing surgical complications to postoperative functional recovery and improvements in quality of life, aligning with the current development trends in rapid recovery in orthopaedics. Intertrochanteric fractures of the femur, as a common subtype of hip fractures in the elderly, have continued to attract attention in recent years, suggesting that individualised care and stratified rehabilitation for different fracture classifications represent important directions for future research. The fact that the Harris score emerged as the core evaluation indicator in the clustering results indicates that domestic studies generally adopt the Harris hip function score to assess patients' postoperative rehabilitation outcomes; this relative uniformity in the selection of outcome measures facilitates the comparison of results across different studies.

4.3 Limitations and Future Directions

This study only searched the CNKI Chinese database and did not include foreign-language databases or grey literature, resulting in a bias in literature sources; furthermore, as CiteSpace constitutes a macro-level bibliometric analysis, it merely reflects publication characteristics and cannot evaluate the internal research quality of the literature. Judging by current research trends, there remains scope for further research into ERAS-related nursing care for elderly patients with hip fractures: (1) most studies are single-centre, resulting in limited levels of evidence; (2) there is insufficient research into individualised ERAS care plans for elderly patients with comorbidities, frailty or cognitive impairment; (3) there is a scarcity of studies on long-term follow-up and continuous rehabilitation care in the home setting. Future research could focus on ERAS care protocols for frail elderly patients with hip fractures, long-term postoperative functional rehabilitation and continuity of care. High-quality, multicentre studies should be conducted to further refine the integrated 'MDT+ERAS' care model for elderly patients with hip fractures, thereby improving postoperative hip function and long-term quality of life in this population.

The implementation of the ERAS model involves a holistic assessment of the patient's condition and early pain management to alleviate pain [13]. The application of ERAS principles in clinical practice can significantly shorten the length of hospital stay and reduce the readmission rate [14, 15]. Integrating multidisciplinary teams into the ERAS clinical pathway is a key challenge facing surgeons, nurses and other healthcare professionals.

ERAS is applied across almost all surgical specialties, with patient compliance and health outcomes serving as the primary evaluation indicators, fully affirming its clinical value [16-20]. ERAS shortens the length of hospital stay for elderly patients following hip fracture surgery, significantly reduces the incidence of complications, and does not increase the readmission rate. An analysis of the keywords reveals three key characteristics of ERAS: 'accelerated recovery', 'multidisciplinary collaboration' and 'evidence-based practice' [21]. China should draw on international models of multidisciplinary collaboration and operational management to break down barriers between domestic disciplines. Based on rigorous evidence-based medicine, relevant guidelines and legislation should be promptly updated and refined to optimise perioperative interventions, thereby addressing patients' health issues, shortening hospital stays, reducing hospital costs, preventing an increase in readmission rates, and improving patient satisfaction with their hospital stay.

The use of CiteSpace for visualisation analysis objectively reflects the geographical distribution and core institutions involved in ERAS research over the past two decades, facilitating the rapid and clear identification of reference points for disciplinary research; the analysis of keywords helps to identify research hotspots and cutting-edge developments within the discipline. However, the analytical

capabilities of this software are limited, and it is not yet capable of conducting citation analysis on databases such as PubMed; therefore, this study only extracted and analysed relevant literature from the CNKI database. As this data possesses significant academic and analytical value, this study is nonetheless able to illustrate, to a certain extent, the developmental trajectory of ERAS research in China, thereby providing a basis for the in-depth development and further study of E RAS within the country.

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