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ORIGINAL RESEARCH

The Development of Publications on Catheter-Related Bladder Discomfort: A Bibliometric Analysis

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Background: Catheter-related bladder discomfort (CRBD) is a risk factor that impacts postoperative recovery and still troubles patients and healthcare staff. The present study is a bibliometric analysis of CRBD.

Methods: The publications on CRBD were retrieved from the Web of Science Core Collection. VOSviewer and Excel were applied to present the current status and hot spots of CRBD research. We analyzed parameters such as the annual number of publications, countries/regions, organizations, authors, journals, and keywords of the articles in this area by generating visualization graphs.

Results: A total of 127 articles were eligible, recorded by 78 journals, and drafted by 672 authors from 169 organizations in 26 countries/regions. The main type of these articles is randomized trial. Park Hee-Pyoung, Kim Hyun-Chang, and Cui Yuanshan are the most productive authors with 5 articles. Sichuan University, Seoul National University, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Capital Medical University, and Qingdao University published more articles on CRBD worldwide. China ranks No. 1 in terms of the number of publications, followed by South Korea and India. Journals specialized in anesthesiology, such as BMC Anesthesiology, Journal of Anesthesia, and British Journal of Anesthesia, are more popular with researchers in this area. The research hot spots of CRBD have concentrated on the prevention and treatment of CRBD.

Conclusion: Though formal research on CRBD started late, there is a rising tendency for the number of publications. Authors and academic teams from Asia have made significant contribution to CRBD. Journals specialized in anesthesiology are priorities for publishing articles. Previous studies mainly focused on the pharmacological and pharmacological methods to CRBD. However, CRBD is not fully settled. Either clinical or experimental studies are still needed to further improve CRBD.

Keywords: catheter-related bladder discomfort, CRBD, bibliometric analysis, hot spots

Background

Catheter-related bladder discomfort (CRBD) often manifests as symptoms such as burning pain and frequent urination in the suprapubic area. The first appearance of CRBD is usually during the early stage of anesthesia recovery, which causes the emergence agitation.[1] As a result, the nursing staff and doctors will make more efforts to help with postoperative recovery. More importantly, CRBD has been reported to result in exacerbating postoperative pain, increasing postoperative complications, impacting quality of life, and prolonging the duration of postoperative recovery.[2,3] Preventions and treatments for CRBD have been paid much attention. The mainstream is local anesthetics, analgesics, and antispasmodics.[4,5] Nefopam, dexmedetomidine, and gabapentin have been recommended, though the results were based on a limited sample size.[4–6] Besides, it is reported that 10% to 50% of the patients with urinary catheterization suffer from CRBD even if they are pre-administered with

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the recommended drugs.[7–9] Therefore, studies on CRBD are still in urgent need. Consequently, the researchers need to understand the current status and hotspots in this field.

Bibliometrics, a branch of information science, has been widely used to analyze publications in a certain area qualitatively and quantitatively via mathematical and statistical methods.[10–12] By analyzing the basic bibliometric parameters, such as the publication number, authors, organizations, countries/regions, journals, and keywords, readers can have a macro knowledge of the research status and hot spots in a certain field. VOSviewer and Excel are frequently used in bibliometric analysis.[12,13] However, there is a lack of CRBD studies from a bibliometric vision. Based on VOSviewer and Excel software, we did a bibliometric analysis to identify the current status and global trend of CRBD.

Methods

Literature Selection Strategy

On 27 December 2023, using the Web of Science (WoS) Core Collection, we retrieved the articles that were indexed by catheter-related bladder discomfort and its thesauri. The specific retrieval strategy was as follows: TS=(catheter-related bladder discomfort) OR TS=(catheter related bladder discomfort) OR TS=(CRBD) OR TS=(catheter-associated bladder discomfort) OR TS=(catheter-related bladder pain). We further limited the document types to article, review article, and case report.

A manual review of the records was subsequently conducted by two investigators independently. Catheterization that did not go through the urethral canal, such as percutaneous suprapubic catheterization, was excluded. The exclusion criteria were determined before literature retrieval. Bifurcations of the investigators were resolved by consulting a senior professor.

Literature Analyses

The 29 items, identifying the author, article title, journal, abstract, keywords, institution, country, cited times, usage count, reference, funding, and other characteristics, were extracted from the database. The bibliometric parameters were exported as a plain text file and an Excel file.

VOSviewer (V. 1.6.20) and Microsoft Excel (V. 2021) were applied to analyses and visualizations. By reading the method section, we first determined the study types of these articles, such as a randomized trial, review, meta-analysis, retrospective study, prospective observational study, and other types. Then we calculated the annual publication counts and cumulative citations in Excel. Citation analyses of the author, institution, country/region, and journal were performed by VOSviewer. The number of publications and citations were also obtained from VOSviewer. The relatedness of the nodes in VOSviewer figures is determined by the number of times they cite each other. Lastly, VOSviewer was applied to do a co-occurrence analysis for the keywords. Both Author Keywords (added by the authors) and Keywords Plus (added by WoS) were analyzed.

To avoid duplications in the science maps, we merged the synonyms. For instance, the synonyms for CRBD, urinary catheter, and prostate resection were unified CRBD, urinary catheter, and prostate resection, respectively.

Results

There were 297 records on CRBD in the WoS Core Collection, 127 of which were eligible. The flowchart of this study is depicted in Figure 1. As for study designs, there were 75 (59.06%) randomized trials, 5 (3.94%) review articles, 11 (8.66%) meta-analysis studies, 3 (2.36%) retrospective studies, 9 (7.09%) prospective observational studies and 24 (18.90%) other types (Figure 1).

Publication and Citation Analyses

Except for 2010, every year had publications on CRBD since 2005. Generally, the publication count slowly increased until a burst in 2020. With 19 publications, 2023 was the most productive year, followed by 2020, 2021 and 2022. The cumulative citations increased rapidly before 2016. The publication and cumulative citation trends are displayed in Figure 2. The 10 highly cited articles are exhibited in Table 1.

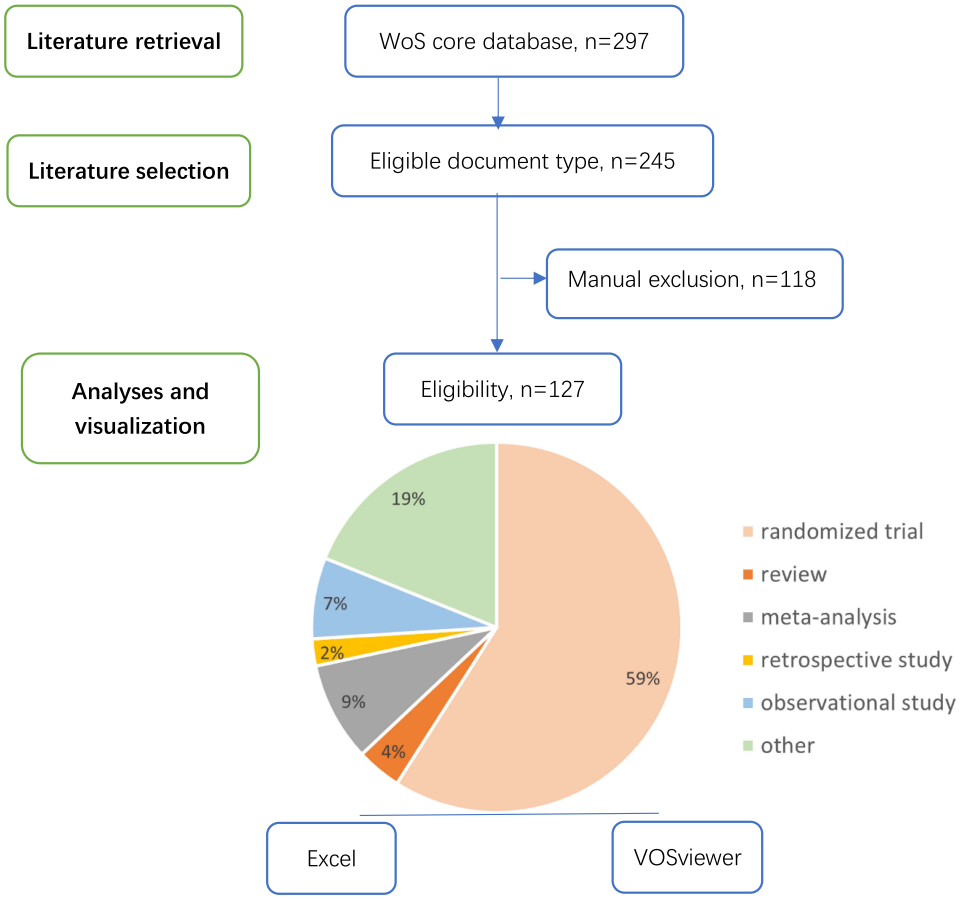

Figure 1 Flowchart of the present study and study type composition of the publications.

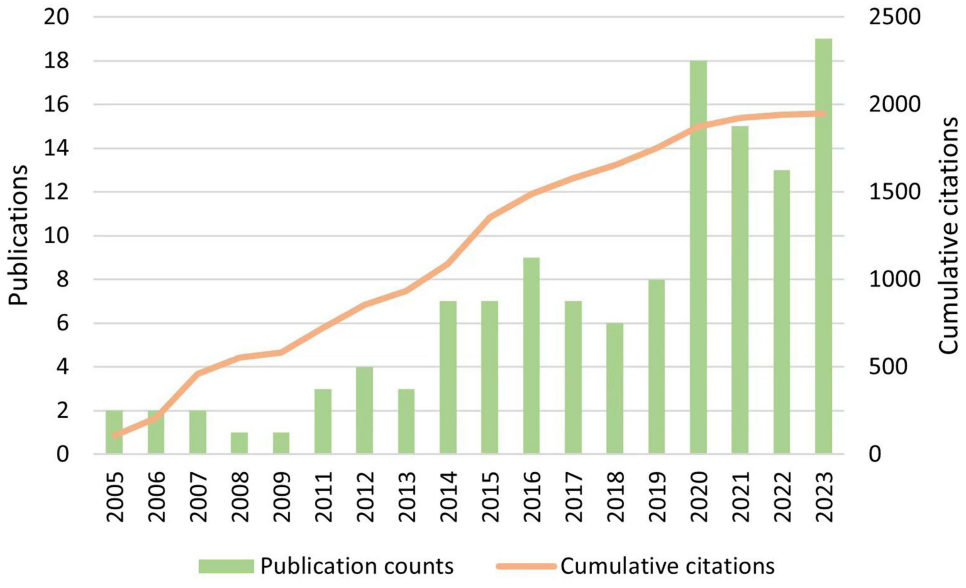

Figure 2 The trends of publication number and cumulative citations.

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Table 1 The Top-10 Frequently Cited Articles

Rank	Article Title	Source Title	Citations	Publication Year
1	Comparison of efficacy of oxybutynin and tolterodine for prevention of catheter related bladder discomfort: a prospective, randomized, placebo-controlled, double-blind study	British Journal of Anaesthesia	129	2006
2	The efficacy of tolterodine for prevention of catheter-related bladder discomfort: a prospective, randomized, placebo-controlled, double-blind study	Anesthesia and Analgesia	99	2005
3	Evaluation of intra-operative tramadol for prevention of catheter-related bladder discomfort: a prospective, randomized, double-blind study	British Journal of Anaesthesia	92	2008
4	Predictors of catheter-related bladder discomfort in the post-anaesthesia care unit	Annales Francaises D Anesthesie ET DE Reanimation	87	2011
5	An evaluation of the efficacy of gabapentin for prevention of catheter-related bladder discomfort: a prospective, randomised, placebo-controlled, double-blind study	Anesthesia and Analgesia	87	2007
6	Management of catheter-related bladder discomfort in patients who underwent elective surgery	Journal of Endourology	85	2015
7	Ketamine for treatment of catheter related bladder discomfort: a prospective, randomized, placebo controlled and double blind study	British Journal of Anaesthesia	71	2006
8	Sublingual oxybutynin reduces postoperative pain related to indwelling bladder catheter after radical retropubic prostatectomy	British Journal of Anaesthesia	67	2007
9	Efficacy of gabapentin for prevention of postoperative catheter-related bladder discomfort in patients undergoing transurethral resection of bladder tumor	Urology	56	2012
10	Efficacy of butylscopolamine for the treatment of catheter-related bladder discomfort: a prospective, randomized, placebo-controlled, double-blind study	British Journal of Anaesthesia	53	2013

Author Analyses

In total, 672 authors contributed to the articles. Figure 3 shows the author networks. The publication counts have slight differences. Park Hee-Pyoung, Kim Hyun-Chang, and Cui Yuanshan published 5 articles, ranking 1 in this field (Figure 3A). The articles from Agarwal were most frequently cited (Figure 3A). Other highly cited authors included Kapoor, Singhal, etc. (Figure 3A). However, these articles were published years ago (Figure 3B). Authors, such as Cui, Lu, Rath, etc., were more active in recent years (Figure 3B).

Institution Analyses

A total of 169 institutions were involved in the research on CRBD. Sichuan University, Seoul National University, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Capital Medical University, and Qingdao University published more articles (Figure 4A). However, the average cited times of Sanjay Gandhi Post Graduate Institute of Medical Sciences and CHU Henri Mondor Hospital were relatively higher than the others (Figure 4A). The articles from Capital Medical University, Qingdao University, All India Institute of Medical Sciences, and IMS BHU were relatively newly published (Figure 4B).

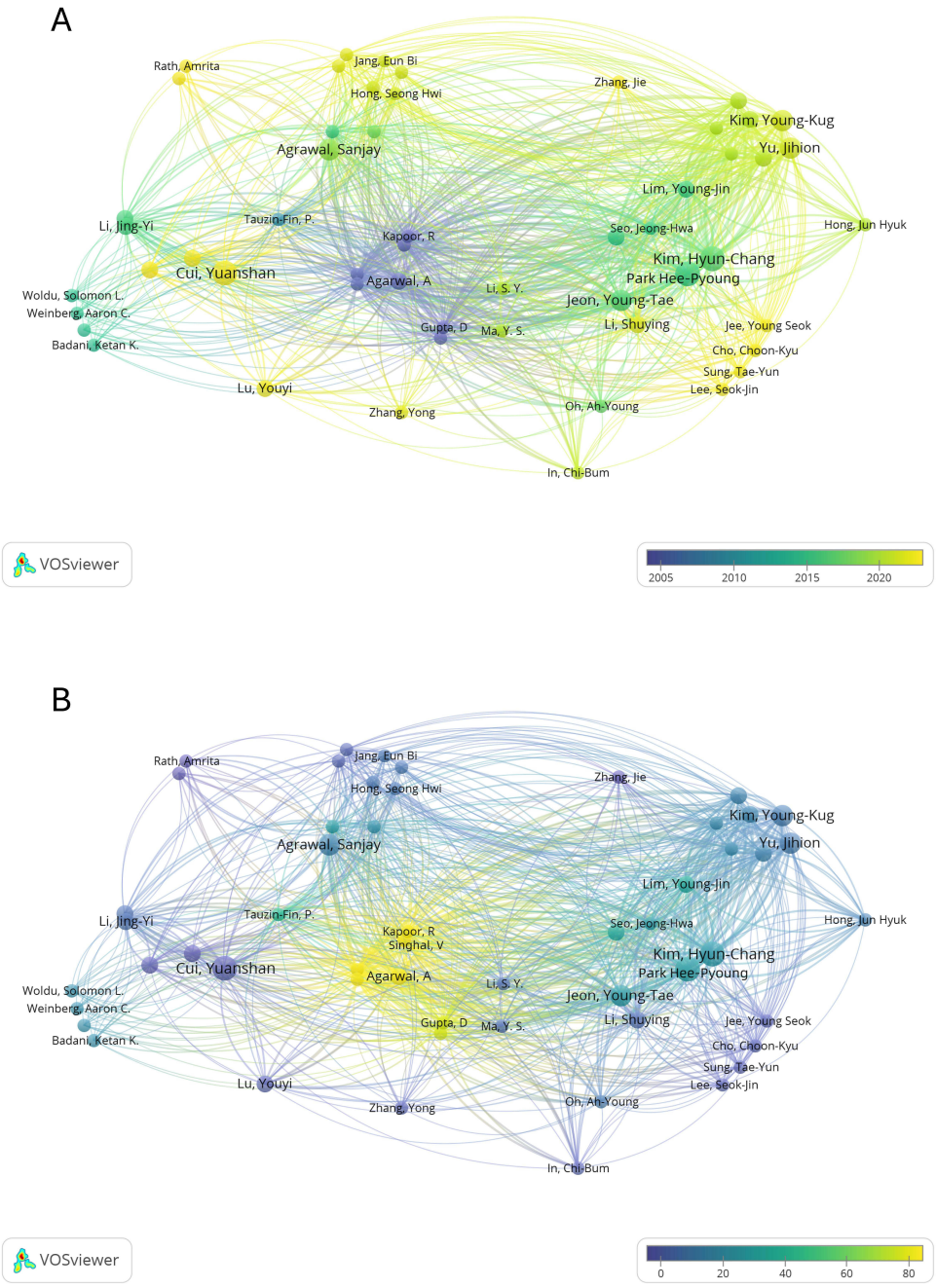

Figure 3 Author networks. (**A**) Visualization of the authors by average publication year. (**B**) Visualization of the authors by average citations. The map only shows the authors with at least 2 publications. The map only shows the largest cluster in which the items correlate with each other.

Country/Region Analyses

The authors of these articles came from 26 countries/regions (Figure 5A). Authors from China published the most articles, followed by South Korea and India (Figure 5A). The average publication years of Thailand and Jordan were relatively fresh, while the average cited frequencies of India, France, and Iran were larger than other countries/regions (Figure 5B and C, respectively).

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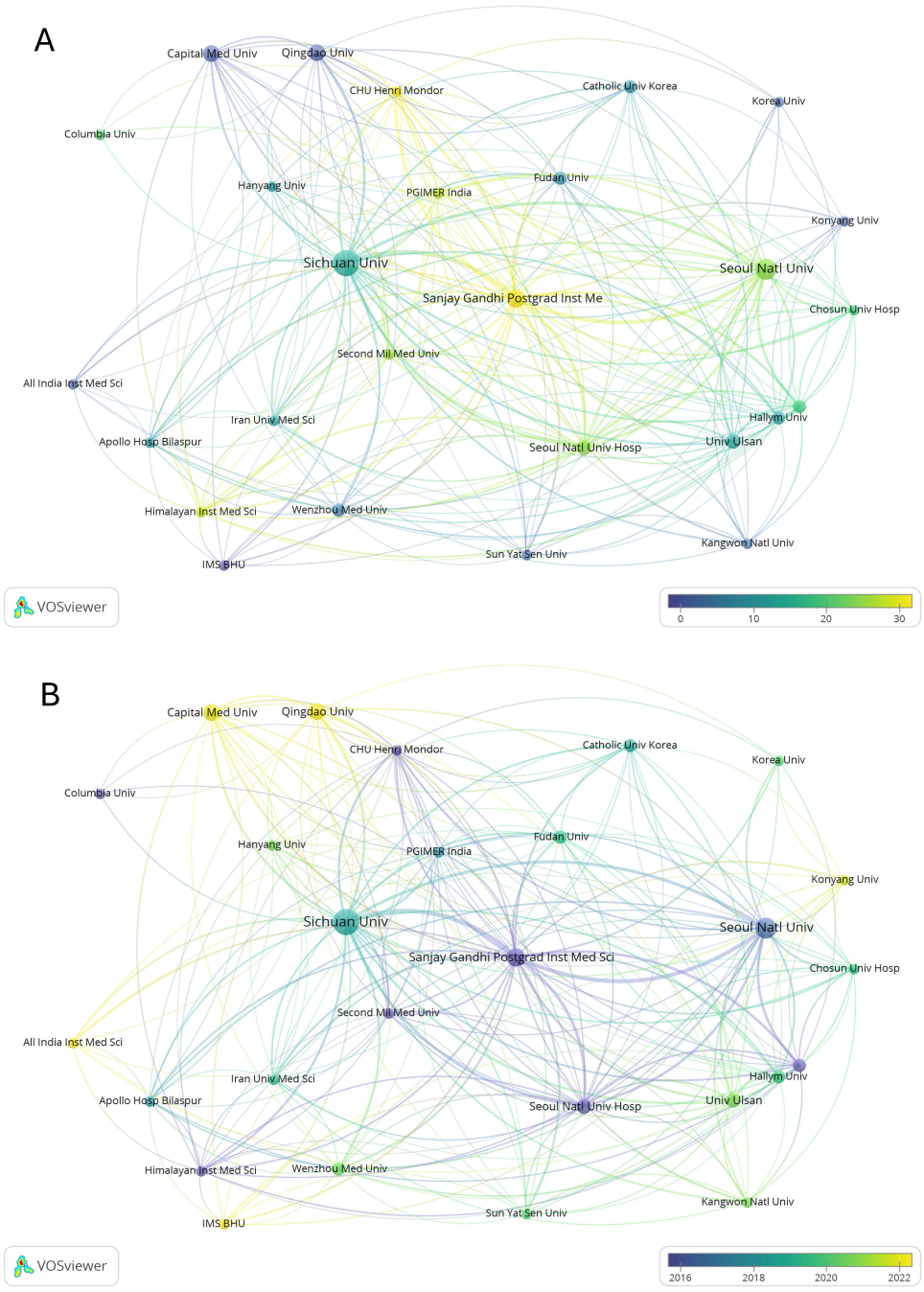

Figure 4 Institution networks. (**A**) Visualization of the institutions by average citations. (**B**) Visualization of the institutions by average publication year. The map only shows the institutions with at least 2 publications. The map only shows the largest cluster in which the items correlate with each other.

Journal Analyses

These articles were recorded in 78 journals. Journals specialized in anesthesiology, such as BMC Anesthesiology, Journal of Anesthesia, and British Journal of Anesthesia, collected a large proportion of articles in this area (Figure 6). Many articles were also published in medicine-related journals, including Medicine, Journal of Clinical Medicine, Perioperative Medicine, Frontiers in Pharmacology, etc. (Figure 6). The articles from the British Journal of Anesthesia and Anesthesia and Analgesia had higher average citations (Figure 6A). However, these articles were published years ago (Figure 6B).

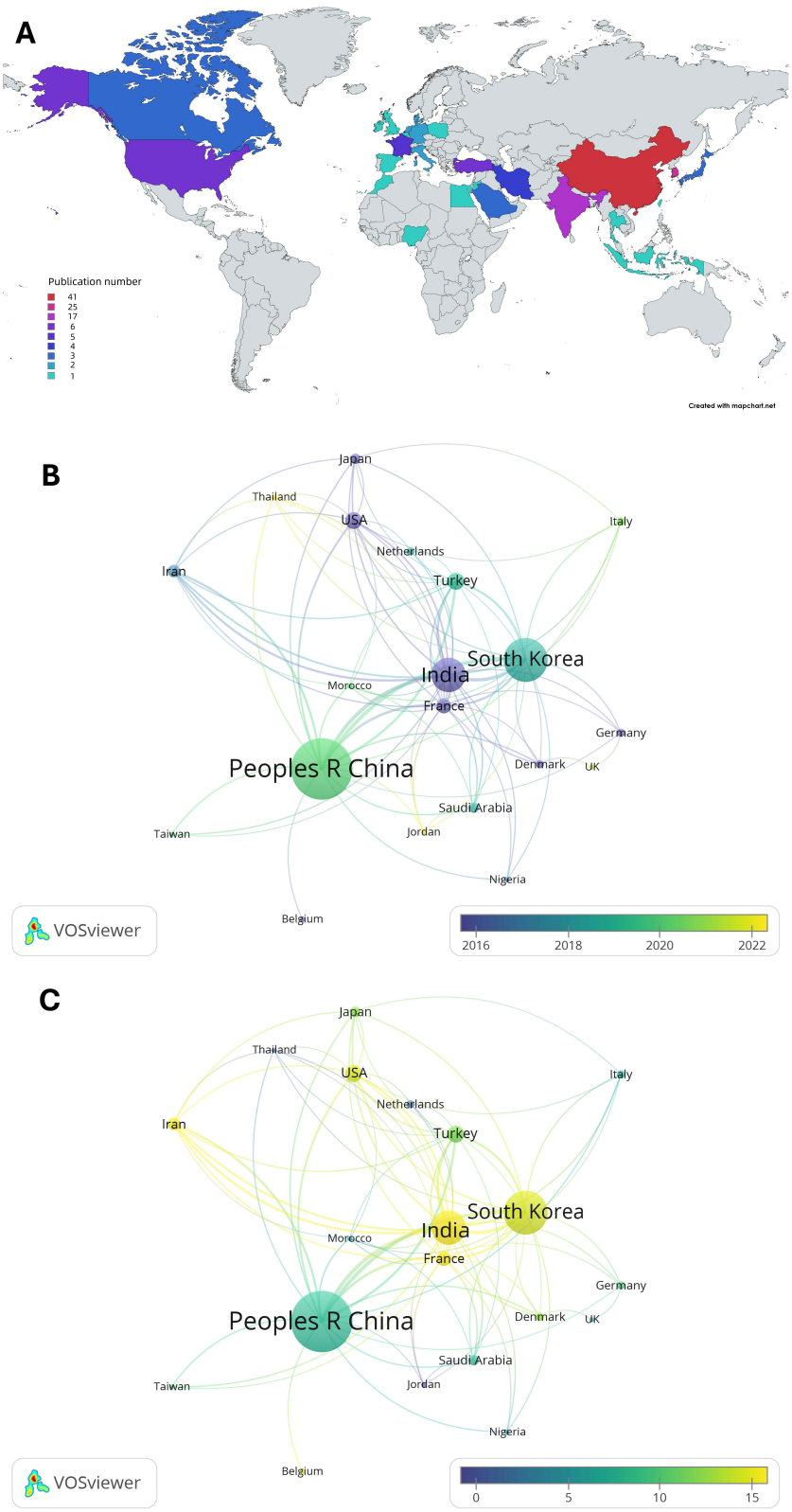

Figure 5 Country/region networks. (**A**) Global distribution of the countries/regions that published the studies. (**B**) Visualization of the countries/regions by average publication year. (**C**) Visualization of the countries/regions by average citations. Both map B and map C only show the largest cluster in which the items correlate with each other.

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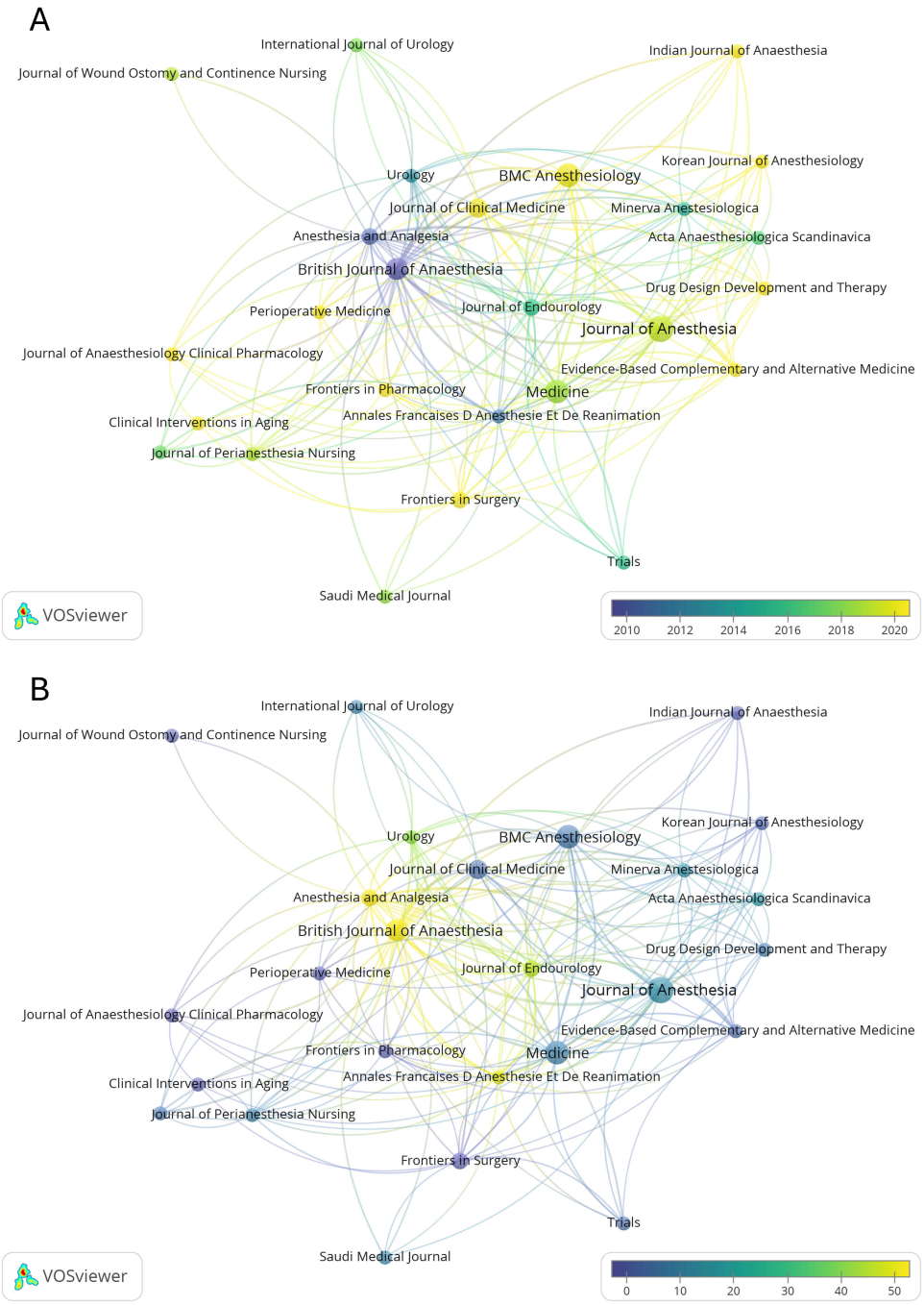

Figure 6 Citation analyses of the journals. (**A**) Visualization of the journals by average publication year. (**B**) Visualization of the journals by average citations. The map only shows the institutions with at least 2 publications. The map only shows the largest cluster in which the items correlate with each other.

Keywords Analyses

We analyzed both All Keywords (Author Keywords and Keywords Plus, Figure 7A) and Author Keywords (Figure 7B). As shown in Figure 7A, CRBD, prevention, tolterodine, efficacy, and oxybutynin had a high appearance, while recovery, nefopam, and meta-analysis were frequently used recently. Nevertheless, keywords added by the authors indicated that the perioperative medication for CRBD mainly included tolterodine, nefopam, oxybutynin, gabapentin, tramadol, ketamine, lidocaine, and dexmedetomidine (Figure 7B). The pudendal nerve block was the most commonly studied technological method (Figure 7B). Moreover, males were the main subjects (Figure 7B).

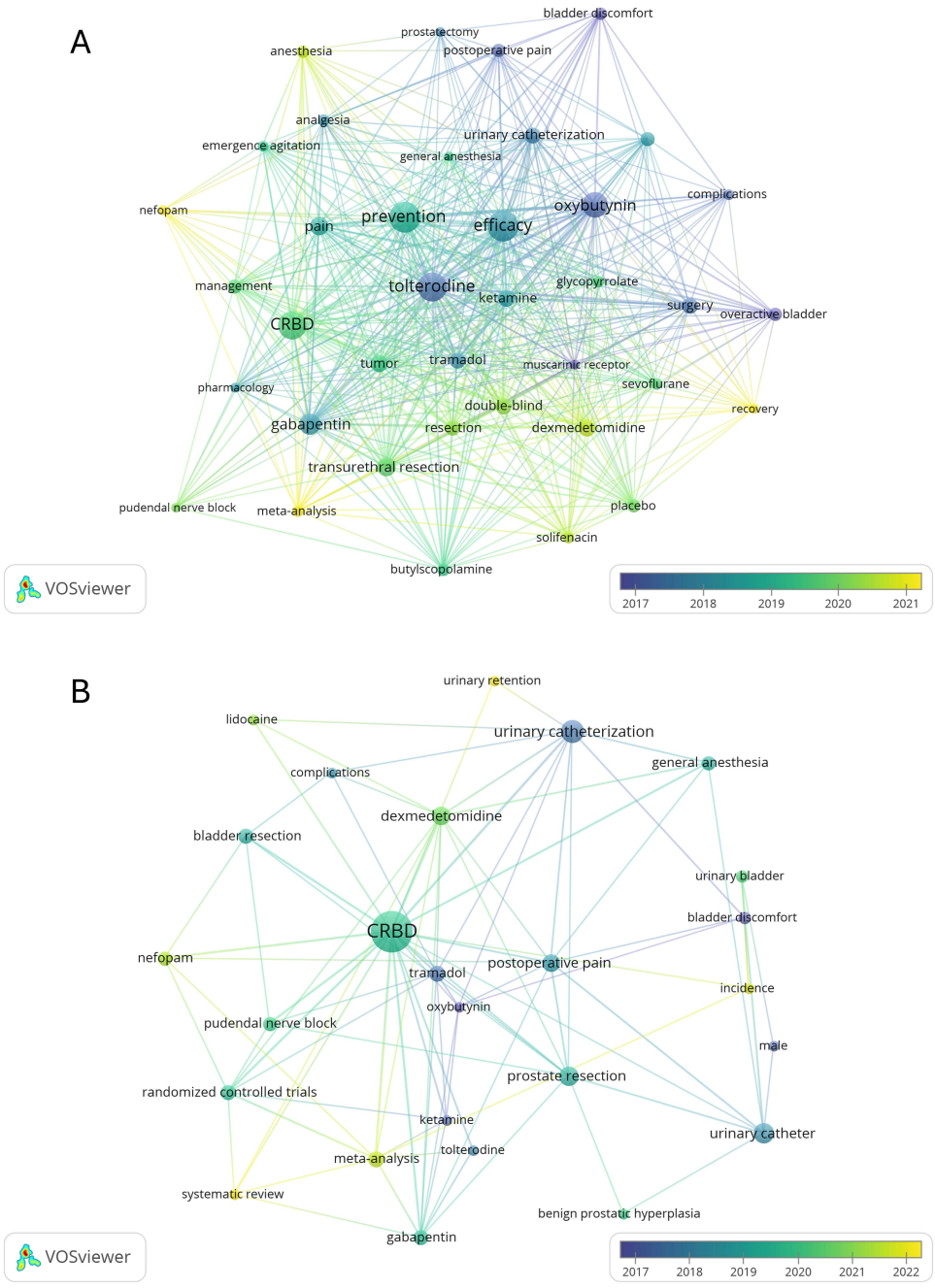

Figure 7 Co-occurrence analyses of the keywords. (**A**) Analysis of keywords added by the authors and WoS. (**B**) Analysis of keywords added by the authors. The items in the map have at least 5 times of appearance in the articles.

Discussion

In the present study, we analyzed 127 articles that investigated CRBD. The publications related to CRBD were dynamically increased, with a booming trend since 2019. A total of 672 authors from 169 institutions and 26 countries/regions participated in these studies. The majority of related studies were concentrated in Asia. Most of these articles were published in Anesthesiology-related journals. The research mainly focused on the prevention and treatment of CRBD.

According to the results, the first international report on "catheter-related bladder discomfort" was published in 2005.[14] This is a randomized controlled trial that investigated whether tolterodine could prevent CRBD. The results of this study indicated that preoperative tolterodine could decrease the incidence and severity of CRBD, eliciting some strong reactions in this field. The next year, a similar article entitled

https://doi.org/10.2147/TCRM.S493703

Comparison of efficacy of oxybutynin and tolterodine for prevention of catheter-related bladder discomfort: a prospective, randomized, placebo-controlled, double-blind study

was published by the British Journal of Anaesthesia.[15] It was the most frequently cited article. An interesting point is that the proportions of randomized trials of both top-10 cited articles and all 127 articles are approximately 60%. Randomized trials are generally regarded as the most effective method to evaluate the efficiency of treatments. The analyses of the study design claimed that the prevention and treatment for CRBD might be mainstream, which is consistent with our analyses for keywords. Another interesting point is that the most productive and influential countries/regions in the CRBD area are from Asia. In most scientific areas, countries/regions from North America and Europe take the leading position.[10–12]

CRBD often includes feelings of burning, pain, and/or urination. As a result, these discomforts can induce adverse emotions and behaviors, such as agitation, fiddling with limbs, and attempts to pull out the urethral catheter.[16,17] Effective intervention can significantly decrease the incidence and severity of CRBD at the early stage after surgery.[18] Thus, it is of great importance for anesthesiologists to take measures. Consequently, related studies were mainly conducted by anesthesiologists, which is in line with our analyses.

To reduce the incidence and severity of CRBD, both pharmacologic and technological research have been conducted.[4] Our results of keywords analyses manifested that tolterodine, nefopam, oxybutynin, gabapentin, tramadol, ketamine, lidocaine, dexmedetomidine, and pudendal nerve block were hotspots. A meta-analysis concluded that all the hot medicines significantly alleviated postoperative CRBD.[4] However, CRBD is not fully settled. The overall incidence of CRBD after surgery was reported to be more than 30%, and moderate to severe CRBD was more than 10% among patients preconditioned by the highly recommended dexmedetomidine.[4] Moreover, the efficiency of peripheral nerve block was similar to dexmedetomidine in reducing the severity of CRBD.[19] Therefore, either clinical or experimental studies are still needed to further improve CRBD.

Limitations

Several limitations of this bibliometric analysis should be pointed out. We only searched in WoS Core Collection for the publications, leading to article omittance. Moreover, we only enrolled in English publications, which may also ignore some high-quality papers in other languages. However, this problem is inevitable Due to the limitations of VOSviwer, the scientific maps cannot show all items, for instance, the maps only show the largest cluster in which the items correlate with each other. Although we removed some duplicates by creating a thesaurus file, keywords overlap was unavoidable during the visualization process. Besides, describing the links among the items is also difficult for complex relationships. Therefore, we only highlighted some information that we considered helpful for the researchers.

Conclusion

In summary, there is a rising tendency in the number of publications on CRBD. China is the leading country in terms of publication number, while the average article influence of India is most wide. Sichuan University is the most productive institution in CRBD research. Park Hee-Pyoung, Kim Hyun-Chang, and Cui Yuanshan have the most publications on CRBD. Additionally, journals specialized in anesthesiology record a large proportion of articles in this area. Our results indicate that previous studies mainly focused on the pharmacological and non-pharmacological methods of CRBD. However, CRBD is not fully settled. Either clinical or experimental studies are still needed to further improve CRBD.

Data Sharing Statement

The data can be provided by the corresponding author upon reasonable requests.

Ethics of Approval Statement

This study is based on published articles, so ethics approval is not applicable.

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Disclosure

The authors declare no conflict of interest.

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