DOI: 10.4274/anatoljmed.2025.15238
Anatol J Gen Med Res 2025;35(2):136-43

CLINICAL RESEARCH / KLİNİK ARAŞTIRMA

ANATOLIAN JOURNAL of GENERAL MEDICAL RESEARCH

The Learning Curve of Urological Surgeries: A PRISMA-compliant Bibliometric Analysis

Ürolojik Ameliyatların Öğrenme Eğrisi: PRISMA Uyumlu Bibliyometrik Bir Analiz

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Cite as: Arıkan Y, Emir B. The learning curve of urological surgeries: a PRISMA-compliant bibliometric analysis. Anatol J Gen Med Res. 2025;35(2):136-43

Abstract

Objective: With the expanding scope of urological surgery, all surgeons are adapting to new techniques. This situation entails the learning curve of many surgical methods. Therefore, we conducted a bibliometric analysis of these publications, hoping to show current research hotspots and future research trends.

Methods: Web of Science Core Collection (WoS index SCI-Exp, ESCI) articles were retrieved using a specified advanced query: [TS=("urology resident")] OR [TS=("learning curve")], and filtered by document type (article), Open Access, and WoS categories (Urology and Nephrology). A total of 422 articles were included in the study. Four hundred and eight were in English, 11 in Spanish and 3 in French. Two hundred and ninety two are in SCI Exp, 130 in ESCI index.

Results: The United States of America (USA) published 97 (23%) of all articles on the learning curve of urological surgery. After the USA, the highest number of articles were published in Korea with 36 (8.5%) and Italy with 29 (6.5%). International Brazilian Joural of Urology was the journal that published the most articles on this subject with 34 articles, followed by British Journal of Urology International (n=31) and Canadian Urological Association Journal (n=30). Among the articles analyzed, the keyword "learning curve" was the most common. This was followed by "outcomes", "complications", and "experience".

Conclusion: Considering the current upward trend in the number of publications related to the learning curve due to technological advances, the amount of quantitative data available for analysis is expected to increase in the future. This bibliometric analysis may contribute to the advancement of urological surgical practice and the improvement of patient care for those undergoing urological procedures.

Keywords: Learning curve, complications, urological surgeries

Öz

Amaç: Ürolojik cerrahi çeşitliliğinin artmasıyla beraber yeni yöntemlere her cerrah uyum sağlamaya çalışmaktadır. Bu durum birçok cerrahi yöntemin öğrenme eğrisini de beraberinde getirmektedir. Bu nedenle, mevcut araştırma noktalarını ve gelecekteki araştırma eğilimlerini göstermeyi umarak bu yayınların bibliyometrik bir analizini yaptık.

Yöntem: Web of Science Core Collection (WoS index SCI-Exp, ESCI) makaleleri belirtilen gelişmiş sorgu [TS=("üroloji asistanı")] olarak alınmıştır OR [TS=("öğrenme eğrisi")] ve belge türü makale, Açık Erişim, WoS kategorileri Üroloji Nefroloji ve toplam 422 makale çalışmaya dahil edildi. Dört yüz sekizi İngilizce, 11'i İspanyolca ve 3'ü Fransızca'dır. İki yüz doksan ikisi SCI Exp, 130'u ESCI indeksinde yer almaktadır.

Bulgular: Ürolojik cerrahilerin öğrenme eğrisi ile ilgili olarak Amerika Birleşik Devletleri (ABD) tüm makalelerin 97'sini (%23) yayınlamıştır. ABD'den sonra en fazla makaleler 36 (%8,5) ile Kore ve 29 (%6,5) ile İtalya'dan yayınlanmıştır. Bu konu ile ilgili Uluslararası Brezilya Üroloji Dergisi 34 makele ile en çok yayın

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Received/Geliş tarihi: 29.01.2025
Accepted/Kabul tarihi: 03.02.2025
Epub: 29.05.2025
Published date/Yayınlanma tarihi: 11.08.2025

Öz

yapan dergi olurken bunu ise sırasıyla İngiliz Üroloji Dergisi Uluslararası (n=31) ve Kanada Üroloji Derneği Dergisi (n=30) izlemiştir. Analiz edilen makaleler arasında en sık "learning curve" anahtar kelimesi yer almıştır. Bunu ise "outcomes", "complications" ve "experience" takip etmiştir.

Sonuç: Teknolojik ilerlemelere bağlı öğrenme eğrisi ile ilgili yayınlarının sayısındaki mevcut artış eğilimi göz önüne alındığında, bu analizle sağlanan nicel sonuçlar ilerleyen dönemde artış gösterecektir. Bu bibliyometrik analiz ürolojik cerrahi uygulamaların ilerlemesine ve ürolojik prosedürler geçiren hastaların bakım kalitesinin iyileştirilmesine katkıda bulunabilir.

Anahtar Kelimeler: Öğrenme eğrisi, komplikasyon, ürolojik cerrahiler

Introduction

Bibliometric analysis is an analytical method to understand the development of research and knowledge in specific fields, including urologic surgery. This analysis involves the quantitative evaluation of published literature to identify effective studies on the subject[1].

The learning curve in urologic surgery represents a surgeon's skill over time. Initially, a junior surgeon may encounter significant difficulties during procedures. However, as surgeons gain experience, their effectiveness increases with repeated practice, leading to improved patient outcomes[2]. Bibliometric analysis can illuminate this progression by assessing publication patterns of surgical outcomes, the frequency of specific urological procedures, and the impact of educational programs[3]. Key metrics to analyze include the number of publications over time, citation rates, authorship trends, and geographical distribution of research. Techniques such as co-citation analysis and keyword co-occurrence can help identify landmark articles and emerging topics in urologic surgery[4]. Furthermore, bibliometric analysis can reveal the link between research productivity and clinical outcomes[5]. A better description of the learning curve in the context of the literature is associated with the reduction in complication rates in urologic surgery[6]. Optimally defining the learning curve of any surgical procedure helps not only to improve surgical training but also to support further research efforts aimed at optimizing surgical procedures[7].

This study aims to show the development status and structure of the learning curve in urological surgical operations, and the development boundary and evolution path in the form of an information map. On this basis, it provides new insights into the learning curve in urological surgeries through comprehensive analysis and review.

Materials and Methods

Ethics committee approval was received for this study from the Non-Interventional Ethics Committee of University of Health Sciences Türkiye, İzmir Tepecik Education and Research Hospital (decision no: 2024/07-25, date: 19.08.2024). Web of Science Core Collection WoS indexes SCI-Exp and ESCI articles were taken using specified advanced query parameters: [TS=("urology resident")] OR [TS=("learning curve")], in addition to applying the criteria of document type: article, Open Access status, and WoS categories: Urology and Nephrology. A total of 422 articles met these criteria and were included in the study. Four hundred and eight were in English, 11 in Spanish and 3 in French. 292 are in SCI Exp, 130 in ESCI index. Our analysis included systematic reviews, meta-analyses, level 1-4 research articles, and review articles. WoS's analysis tools were used to record the range of countries, authors, and journals identified. The number of research articles published was used to measure research productivity. The number of citations was used as a criterion to measure the impact of the article. Among the results of articles on the learning curve of urological surgeries, the year, country, journal, institution, and author distribution of the article and the number of citations attributed to each article were evaluated. As a result of these analyses, the top 10 articles, journals, institutions, and authors were summarized graphically.

Statistical Analysis

The data were analyzed using VOSviewer (Leiden University, Netherlands; version 1.6.11) for visualizing research trends and collaboration networks. The analysis focused on: analysis of articles by year, analysis of articles by journal, most cited articles: authors, article titles, journals, publication years, and citation counts, keyword analysis, institutions associated with authors, analysis of inter-institutional publications, analysis of author collaboration, citation distribution by country.

Results

Number of Annual Publications

The first articles on the learning curve of urological surgeries were published in 2003, and the number of such

articles has steadily increased over the years. Currently, the highest number of publications occurred in 2023; 41 articles were written in this year. Between 2003 and 2024, it was determined that there were a total of 422 articles in SCI-E and ESCI on this subject (Figure 1).

Contribution Trends of Countries and Affliations

When the articles on the learning curve in urological surgery, were categorised by country, the United States of America (USA) published 97 (23%) of all articles. After the USA, the most articles were published in Korea with 36 (8.5%) and Italy with 29 (6.5%). When we analyse the published articles, in terms of the cooperation tendencies of the countries, Italy was the country that published the most articles with 16 (55.2%) of the 29 articles on this subject, followed by the USA with 13 (13.4%) articles and the United Kingdom with 9 (56.3%) articles. In the studies carried out by the countries, when the multiple country publication (MCP) is considered proportionally, the United Kingdom was the highest with a rate of 56.3%. This was followed by Italy with 55.2% and Germany with 41.2% (Figure 2). In terms of institutional

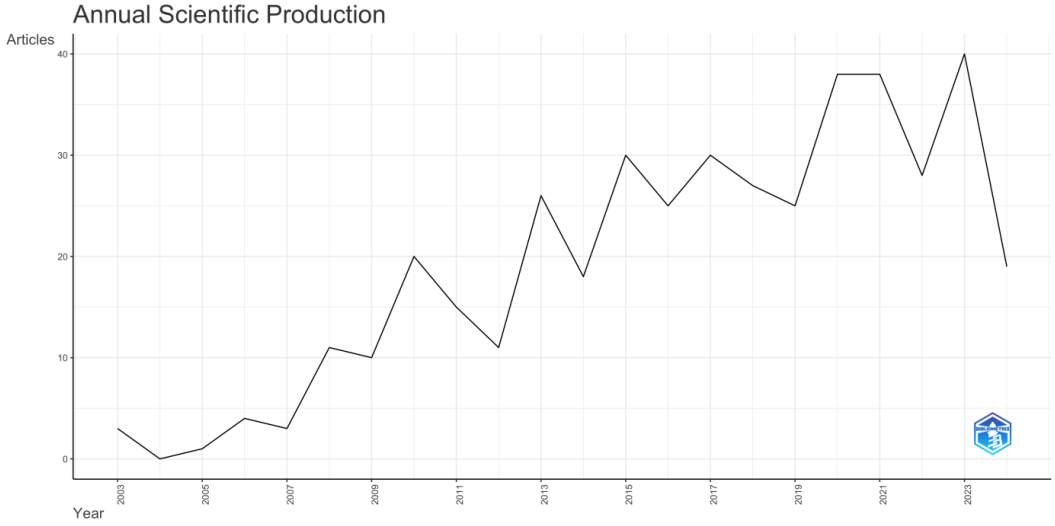

Figure 1. Publications related to learning curve according to years

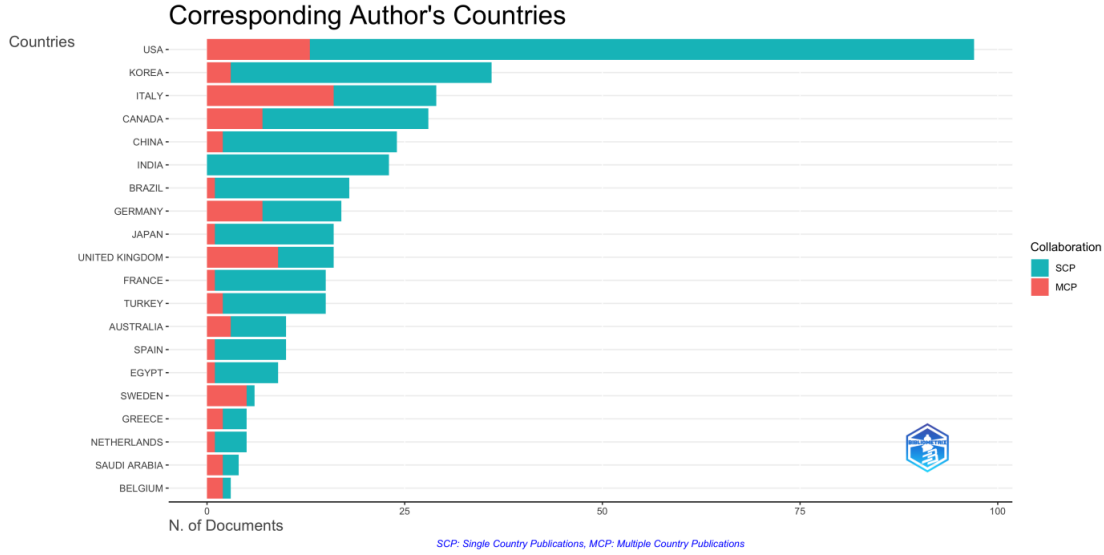

Figure 2. Number and distribution of single-centre and multicentre studies on the learning curve of urological surgeries by country

impact on this subject's literature, Memorial Sloan Kettering Cancer Centre ranked first with 48 publications, followed by the University of Toronto with 17 articles, and Gothenburg University with 14 articles (Figure 3).

Journal and Citation Trends

The top 10 journals on the learning curve in urologic surgery are listed in Figure 4. The International Brazilian Journal of Urology was the journal that published the most articles on this topic with 34 articles, followed by the British Journal of Urology (BJU) International (n=31) and the Canadian Urological Association Journal (n=30). As for the most frequently cited journals, the Journal of Urology ranked first with 1545 citations, despite publishing 17 articles. European Urology was the journal with the highest impact factor, and published seven articles in this field, but it was the 2nd most frequently cited journal (n=1196). The most cited articles and those with the most publications are shown in Figure 5.

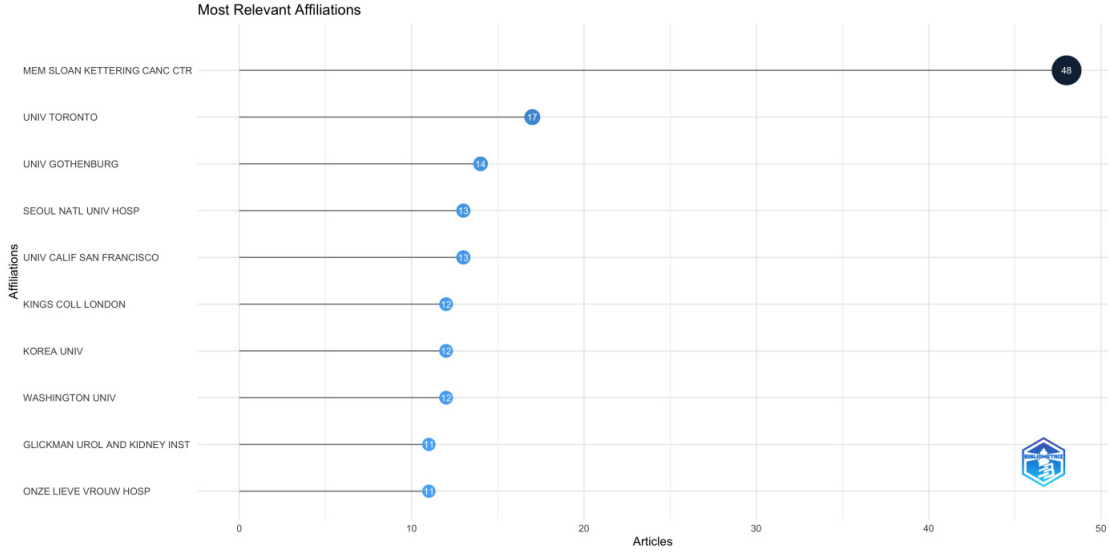

Figure 3. Affliations that publish the most articles with the learning curve of urological surgeries

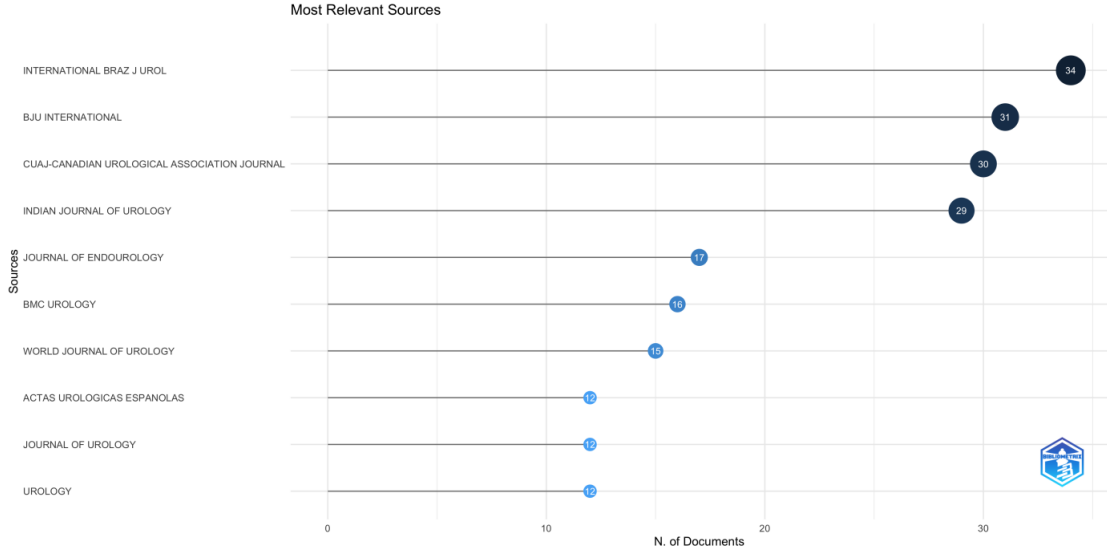

Figure 4. Top 10 journals on the learning curve in urologic surgery

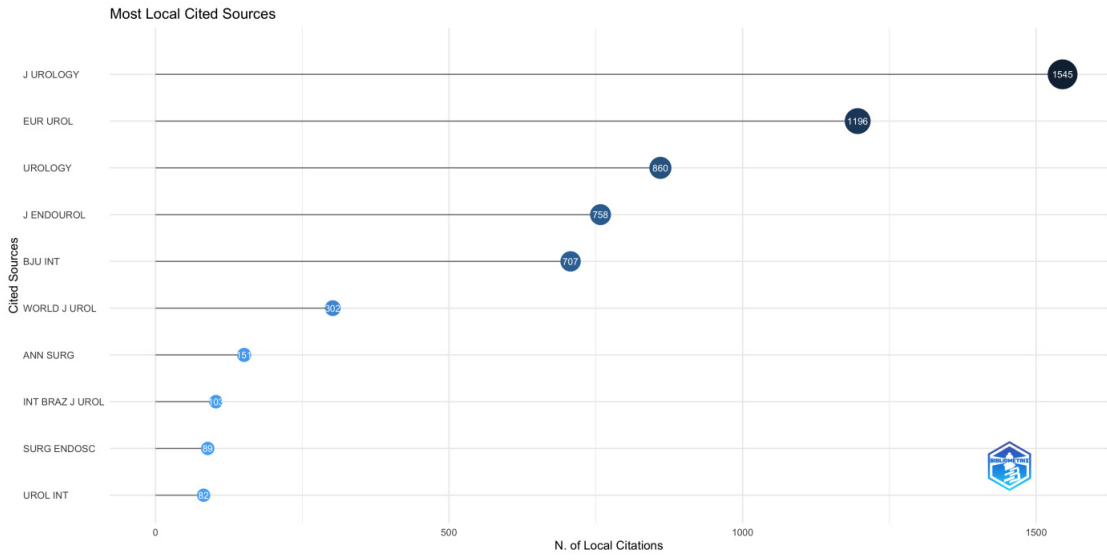

Figure 5. Top 10 most cited journals on the learning curve in urologic surgery

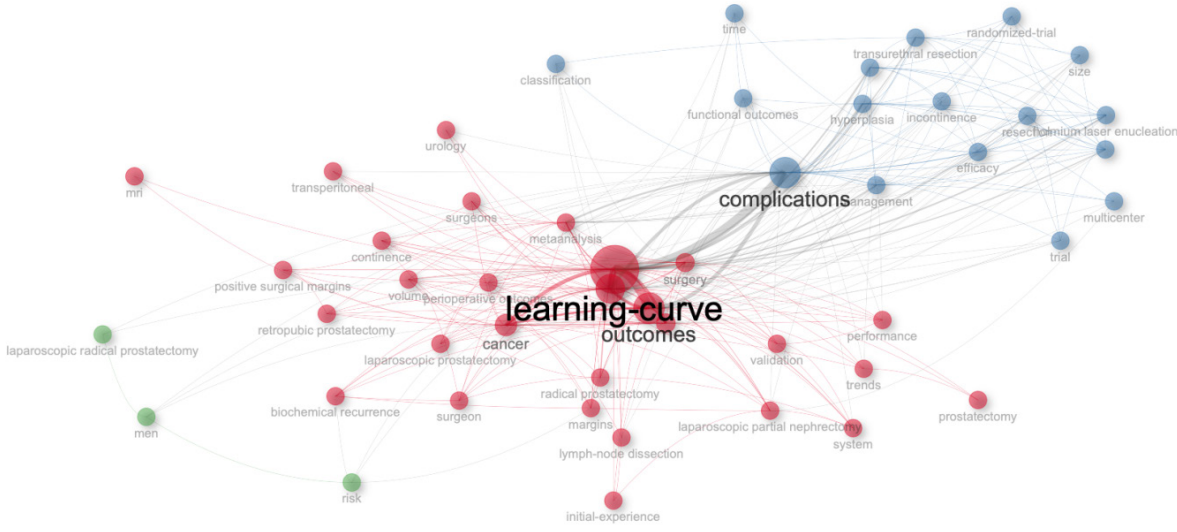

Figure 6. Most searched keywords related to learning curve in urologic surgery

Trends of Learning Curve-Related Keywords

The most common keywords are listed in Figure 6. Among the articles analyzed, the keyword "learning curve" was the most common. This was followed by "outcomes", "complications" and "experience". It is seen that the most frequently used keywords are related to prostate diseases. This indicates that learning curve studies are mostly performed on prostate surgery.

Trend Topics in Learning Curve

When trending topics related to learning curves are examined, it is seen that more endoscopic procedures are the subject of research rather than open surgeries. The most common research topic pertains to prostate surgeries. Trend topics related to the learning curve of urological surgeries are shown in Figure 7.

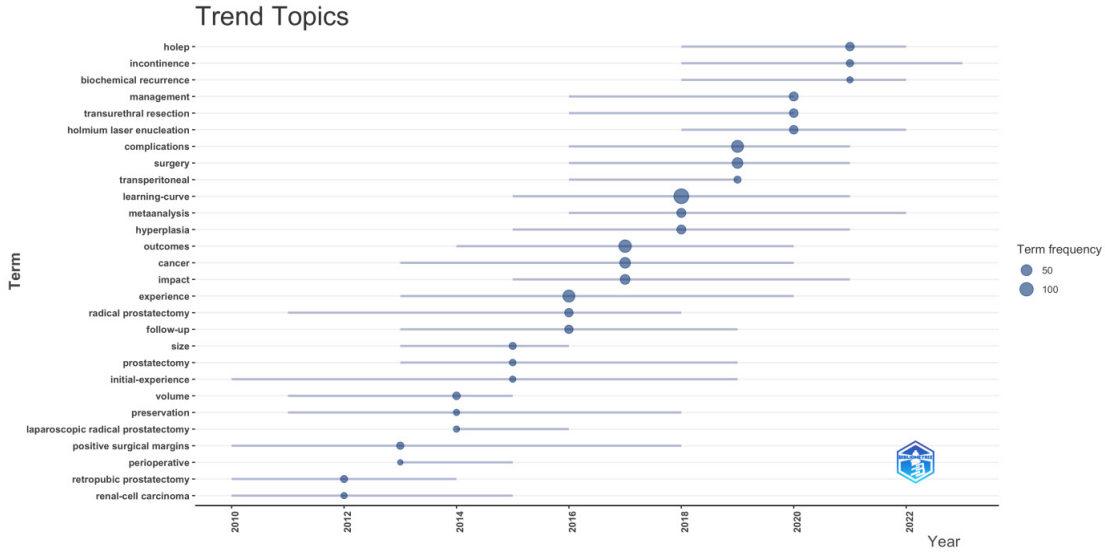

Figure 7. Trend topics related to the learning curve of urologic surgeries

Discussion

Urologic surgeries encompass a wide range of procedures aimed at treating conditions affecting the urinary tract and male reproductive system[8]. As medical science has advanced, the complexity and variety of these surgeries have increased significantly, leading to a greater need for competent surgical skills and knowledge[9]. Understanding the learning curve associated with urologic surgeries is crucial not only for surgical residents but also for experienced surgeons seeking to refine their techniques and improve patient outcomes. The concept of the learning curve in this context refers to the progression of a surgeon's skill and effectiveness in performing urologic procedures over time. This progression is influenced by various factors such as the complexity of the surgery, faculty mentorship, simulation training, and accumulation of procedural experience[10]. Each surgical technique, whether simple or difficult, presents its own unique challenges and subtleties that contribute to the surgeon's learning curve[11]. When assessing somewhat crude outcomes such as safety, efficacy, and operative time, it has been recognized that 15 to 40 cases are probably required to learn procedures to reach basic competence[12-15]. However, technical difficulties will be overcome with more cases to improve surgical success. For this, it is important to follow the learning curve and current knowledge[7].

When we examined the literature on the learning curve over the years, we found that while there were only 41 articles on the learning curve until 2003, there were 422 articles on the learning curve between 2003 and 2024. We attribute this to the variability of surgical operation methods, which are influenced by technological advances, performed on a specific organ. Especially in the 2000s, endoscopic advances and the use of new technology in clinical practice have brought many scientific articles. Considering all these factors, publications on the learning curve of each procedure have increased over time. The countries where the literature is published reveal that research centers in this field are mainly located in developed countries and developing countries with higher economic levels. The United States has published the most on the learning curve, but in terms of collaboration, Italy has contributed the most to the literature, followed by the United Kingdom. MSP rates are highest in the United Kingdom, Italy, and Germany, and European countries show closer cooperation in collaborating on the learning curve of urological procedures.

The most frequently searched keywords in the literature with learning curve were learning curve, outcomes, complications, and experience. The most common articles about the learning curve in medical literature are related to prostate cancer and prostate surgery. Vickers Andrew J is the author who published the highest number of articles on the learning curve, and all of these articles are related to prostate cancer surgery[16-20]. Dell'Oglio P is the author with the second highest number of articles on this subject after Vickers Andrew J[21,22].

This bibliometric analysis was performed using the WoS database. The search strategy was as comprehensive as possible and the data were analyzed thoroughly. However,

results may differ from other databases (e.g., Scopus) or due to the inclusion of different search terms. Given the importance of the topic and the current upward trend in the number of publications on the learning curve due to technological advances, the significance of the quantitative results provided by this analysis will increase in the future.

Study Limitations

This study acknowledges that the search was limited to the WoS database and articles published in English, which may have resulted in the exclusion of relevant studies published in other databases or languages. Additionally, while efforts were made to expand the search terms, some relevant articles may still have been missed due to the specificity of keywords.

Conclusion

Our study provides insights into the learning curve of urological surgeries, the evolution of surgical skills over time, the importance of ongoing research, and the need for effective training mechanisms in this field. Such analyses may ultimately contribute to advancing surgical practice and improving the quality of care for patients undergoing urological procedures.

Ethics

Ethics Committee Approval: Ethics committee approval was received for this study from the Non-Interventional Ethics Committee of University of Health Sciences Türkiye, İzmir Tepecik Education and Research Hospital (decision no.: 2024/07-25, date: 19.08.2024).

Informed Consent: Informed consent was not required.

Footnotes

Authorship Contributions

Surgical and Medical Practices: Y.A., Concept: Y.A., B.E., Design: Y.A., B.E., Data Collection or Processing: Y.A., B.E., Analysis or Interpretation: B.E., Literature Search: Y.A., B.E., Writing: Y.A., B.E.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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