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The 100 Most-cited Articles in Autologous Breast Reconstruction: A Bibliometric Analysis

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Background: Autologous breast reconstruction has continued to increase in popularity and witnessed significant advancements in aesthetic outcomes, patient satisfaction, and improved quality of life. We performed the first bibliometric analysis focused only on the 100 most-cited autologous breast reconstruction articles to characterize any emerging trends and assess the methodological quality of these studies.
Methods: The 100 most-cited articles in autologous breast reconstruction were identified on Web of Science, across all available journals and years. Study details, including the citation count, main subject, and outcome measures, were extracted from each article, and the level of evidence was also assessed.
Results: The 100 most-cited articles in autologous breast reconstruction were cited by a total of 21,194 articles. Citation per article ranged significantly from 112 to 1123 (mean, 211.9). Overall, most of the top-cited articles are case reports/series (n = 32, mean citations = 243.2) and cohort studies (n = 30, mean citations = 211.2). This is closely followed by case-control studies (n = 29, mean citations = 183.6). Only four studies achieved level 1 status, underscoring a lack of high-quality methodological research in the field. Most studies (n = 72) highlighted autologous breast reconstruction outcomes, whereas 12 focused on its indications. There were nine studies exploring surgical techniques, and seven studies addressing the autologous breast reconstruction surgical anatomy.
Conclusions: Overall, most of the influential articles in autologous breast reconstruction literature are of lower-level evidence. Contemporary research should focus on enhancing the study designs and measure clinical and patient-reported outcomes with validated tools, such as BREAST-Q. *(Plast Reconstr Surg Glob Open 2024; 12:e6033; doi: 10.1097/GOX.0000000000006033; Published online 12 August 2024.)*

INTRODUCTION

Breast surgery, encompassing various reconstructive techniques and procedures, has undergone significant advancements in recent years. These developments have not only improved aesthetic outcomes but have also addressed patient-reported outcomes, safety, and postoperative complications.[1–5]

Autologous breast reconstruction (ABR) has continued to increase in popularity due to numerous factors, including improved cosmetic outcomes, patient satisfaction, and quality of life.[1,6–11] As the field has transformed over the past 50 years, the number of peer-reviewed publications in breast reconstruction has drastically increased to reflect new insights and trends.

Bibliometric analyses provide perspective on growth, impact, trends, and gaps in scientific literature.[12,13] Article citations serve as a relevant proxy to gauge an article's impact and relevance to clinical practice. Citation totals also affect the reputations of the authors, their institutions, and even the journal's impact factor, calculated as the number of citations received over the preceding year divided by the number of published articles over the last

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2 years. Published articles are also designated a level of evidence to assess the quality of the study design.

In breast reconstruction, although previous bibliometric analyses have been published, encompassing both autologous and implant-based reconstruction, there is no published bibliometric analysis focusing on the 100 top-cited papers published on ABR only.[14–19] In this article, we performed the first bibliometric analysis focused on the 100 most-cited ABR articles, with the aim of providing an overview of the developments in the surgical techniques, oncological safety and patient-reported outcomes. The aim of the analysis was also to identify trends, gaps in the literature and provide direction for future research.

Takeaways

Question: What are the emerging trends and methodological quality of the highest impact studies in autologous breast reconstruction (ABR)?

Findings: The 100 most-cited articles in ABR were identified on Web of Science. These studies amassed a total of 21,194 references. Case reports/series (n = 32) and cohort studies (n = 30) predominated the 100 most-cited articles. There is a lack of high-quality study design within the field, with only four studies achieving level 1 status. Most studies investigated (n = 72) highlighted the outcomes of ABR.

Meaning: Most of the top-cited articles in ABR literature seem to be of lower-level evidence.

METHODS

A literature review to identify the 100 most-cited articles on ABR was performed, based on a priori determined methodology, as previously described by our group.[20–22] All available journals through Web of Science online database were searched using the following search strategy: "breast reconstruction" OR "breast reconstructive surgery" AND "autologous" OR "abdominal flap" OR "thigh flap" OR "DIEP" OR "deep inferior epigastric artery perforator" OR "breast-Q" as a "topic" on August 24, 2023. No publication date restriction was applied.

The search yielded a total of 21,478 articles. A descending order of "times cited" was used to assemble the 100 most-cited articles. Those with same number of citations were separated based on the mean number of citations yearly, with the more recent articles ranking higher. Two authors (M.A. and Z.B.) independently screened titles and abstracts until 100 articles were identified to ensure the direct relevance to the topic of ABR. Any discrepancies were resolved by a discussion with the senior author (A.K.) and reviewing the publication's full text. Summary of the methodology with the reasons of exclusion are specified in Figure 1.

Data extraction of the full-text articles was performed by five independent authors (M.A., Z.B., F.R., K.D., I.T.) and analyzed via Jamovi statistical software (version 2.3.2). A similar methodology to our group's previously published work was used to record the following information: article title; authors; publication year; source journal; total citations; mean number of citations yearly; study setting;

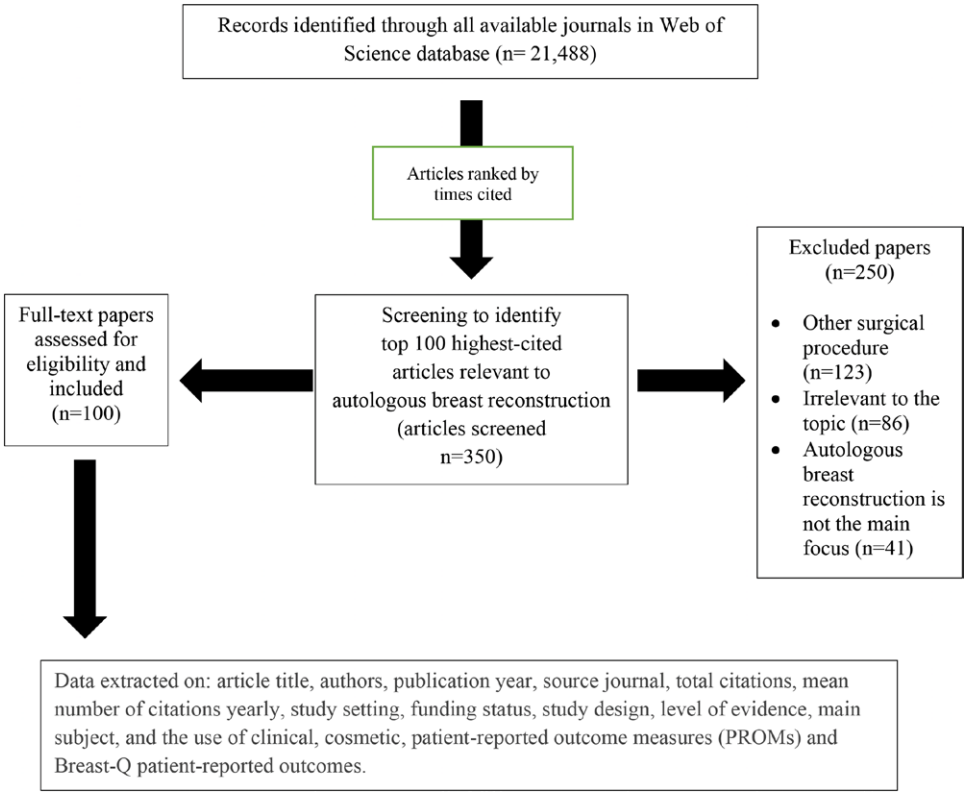

Fig. 1. Flow chart summarizing methodology.

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funding status; study design; level of evidence; main subject; and the use of clinical, cosmetic patient-reported outcome measures and BREAST-Q patient-reported outcomes.[20–22] The level of evidence was assessed using the Oxford Centre for Evidence-Based Medicine (2011).[23]

RESULTS

Distribution of Citations

The 100 top-cited articles on ABR amassed a total of 21,194 references, with a mean citation count of 211.9 per article. (**See table, Supplemental Digital Content 1,** which displays the 100 highest-cited papers relevant to autologous breast reconstruction ranked in descending order of total citation count. **http://links.lww.com/PRSGO/D403**.) The range of citations per article varied significantly, spanning from 112 to 1123. (**See table, Supplemental Digital Content 2,** which displays the 100 most-cited articles on autologous breast reconstruction. **http://links.lww.com/PRSGO/D404**). Additionally, the mean number of citations per article per year exhibited variability, ranging from 7.47 to 74.87. Within this dataset, 72 studies covered ABR outcomes, whereas 12 focused on the indications of ABR. Moreover, nine studies explored surgical techniques, and seven studies addressed the surgical anatomy of ABR. Notably, the most highly cited article within this collection, authored by Pusic et al, brought attention to the seminal development of the BREAST-Q patient-reported outcomes survey tool, which has become a standard tool for patient-reported outcomes in breast reconstruction.[1]

Publishing Journals and Timestamps

The top-cited ABR studies were distributed across 15 different journals, categorized into four plastic surgery journals, three breast journals, five cancer/oncology journals, and three surgery journals, as outlined in Table 1. Notably, *Plastic and Reconstructive Surgery* journal emerged as the primary contributor with 60 articles, followed by the *British Journal of Plastic Surgery* (currently *Journal of Plastic, Reconstructive, and Aesthetic Surgery*) with 15 articles. The remaining journals each contributed five articles or fewer. In terms of cumulative citations per decade, the highest figures were observed in the 1980s, followed by the 2000s, as depicted in Figures 2 and 3.

Table 1. Journals Contributing to the 100 Most-cited Articles

Journal	No. Articles (%)
Plastic and Reconstructive Surgery	60 (59.0%)
Journal of Plastic, Reconstructive, and Aesthetic Surgery	15 (15.0%)
Annals of Surgery	5 (5.0%)
Annals of Plastic Surgery	4 (4.0%)
Journal of Clinical Oncology	2 (2.0%)
JAMA Surgery	2 (2.0%)
Journal of Reconstructive Microsurgery	2 (2.0%)
Annals of Surgical Oncology	2 (2.0%)
The Breast Journal	2 (2.0%)
International Journal of Radiation Oncology - Biology - Physics	2 (2.0%)
Breast Cancer Research and Treatment	1 (1.0%)
Cancer	1 (1.0%)
Journal of The National Cancer Institute	1 (1.0%)
ANZ Journal of Surgery	1 (1.0%)

Level of Evidence and Study Designs

Upon classification of the articles based on their level of evidence, it was observed that level 5 studies garnered the highest average number of citations, closely followed by level 4 studies, as detailed in Table 2 and illustrated in

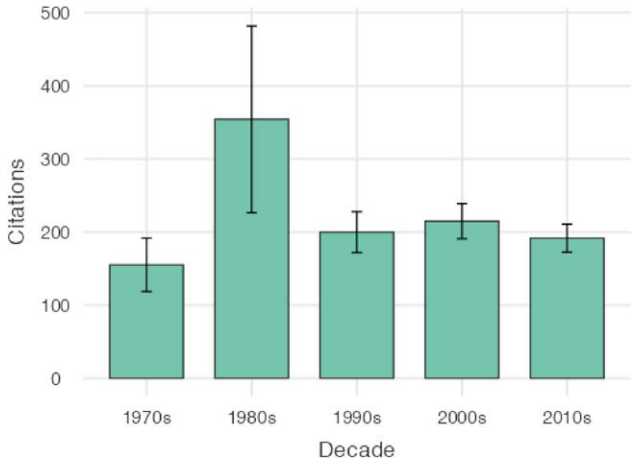

Fig. 2. The 100 most-cited articles—decade analysis.

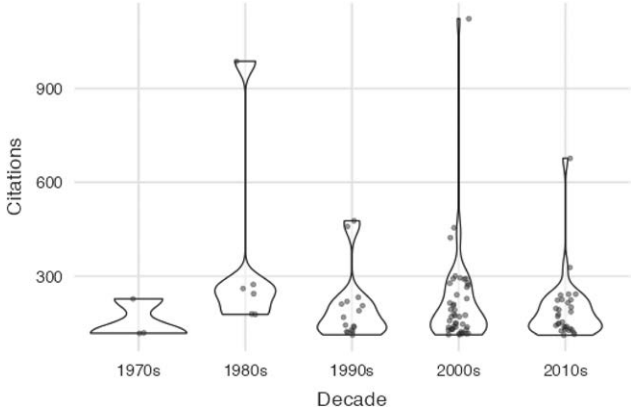

Fig. 3. Violin and box plots of citations in relation to decades. The violins depict kernel density estimation of distribution of citations in relation to different decades (ie, violin width at each level corresponds to the density of data points, wider violin sections indicate higher data densities).

Table 2. Citations by Level of Evidence

Level of Evidence	Citations, Mean (SD)
Level 1	153.8 (30.1)
Level 2	204.9 (110.6)
Level 3	197.5 (89.7)
Level 4	223.3 (196.6)
Level 5	295.0 (309.1)

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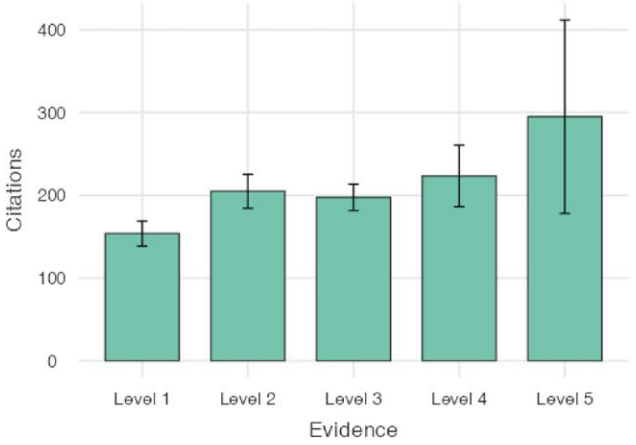

Fig. 4. The 100 most-cited articles—levels of evidence.

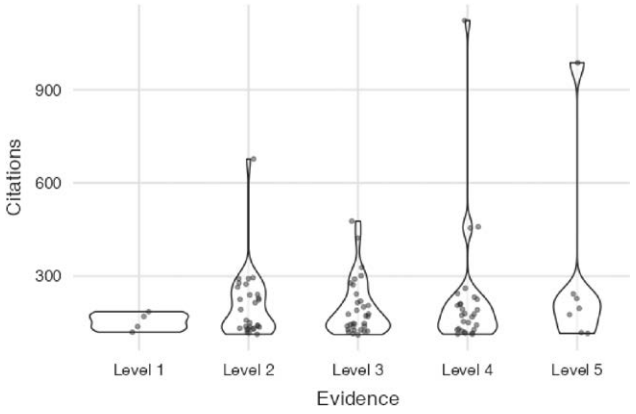

Fig. 5. Violin and box plots of citations in relation to level of evidence. The violins depict kernel density estimation of distribution of citations in relation to different levels of evidence (ie, violin width at each level corresponds to the density of data points, wider violin sections indicate higher data densities).

Table 3. Citations by Study Design

Study Design	N	Citations, Mean (SD)
Case reports or series	32	243.2 (229.0)
Narrative review	5	226.2 (50.0)
Cohort	30	211.2 (117.6)
Case-control	29	183.6 (79.5)
Systematic review and meta-analysis	2	182.0 (15.6)
Randomized control trial	2	129.0 (12.7)

Figures 4 and 5. Further examination of the study designs revealed that the majority of the top-cited articles belonged to the categories of case reports/series (n = 32, mean citations = 243.2) and cohort studies (n = 30, mean citations = 211.2), followed by case-control studies (n = 29, mean citations = 183.6), as presented in Table 3 and Figure 6.

Country and Author Trends

The United States emerges as the most prolific contributor to the literature on ABR, with 59 publications. Following behind, Belgium exhibits a notable presence with seven

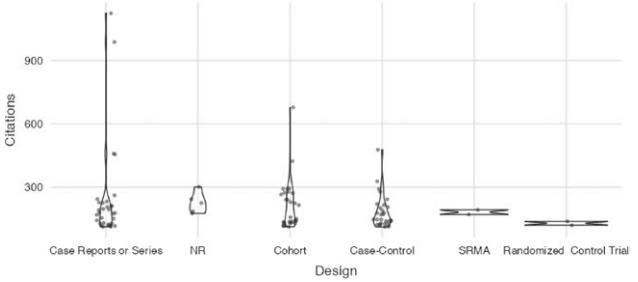

Fig. 6. Violin and box plots of citations in relation to different study designs. The violins depict kernel density estimation of distribution of citations in relation to different study designs (ie, violin width at each level corresponds to the density of data points, wider violin sections indicate higher data densities).

publications, while multicenter studies collectively contribute to another seven publications. The United Kingdom, France, Germany, and Spain each contribute four, three, three, and three publications, respectively. Slovenia, Australia, the Netherlands, Austria, and Canada each have two publications to their credit. Additionally, Ireland, Georgia, Sweden, and Japan contribute one publication each to the ABR literature. Among the authors contributing significantly to the literature of ABR, Kroll emerged as the most prolific, boasting six first-author papers featured on the list. Following closely behind, Blondeel contributed with four first-authorships and three co-authorships. Similarly, Chang's work was highlighted with three first authorships and three co-authorships. Subsequently, Jagsi and Nahabedian both showcased substantial contributions, each with three first-author papers (**Supplemental Digital Content 1, http://links.lww.com/PRSGO/D403**).

DISCUSSION

This is the first bibliometric analysis to review and classify the 100 highest cited ABR articles according to Oxford Centre for Evidence-Based Medicine methodological quality. It provides valuable insights into the impact, trends, and gaps in the existing literature. The distribution of citations emphasizes the significant attention the field has gained, with 21,194 references amassed by the 100 top-cited articles. The wide range of citations per article denotes the diverse impact of individual studies within the literature. Notably, the mean citation count per article (198) and the mean number of citations per year (5–75) suggest varying degrees of influence and persistent relevance among the top-cited articles.

Most studies focused on ABR outcomes, underlining the emphasis on evaluating effectiveness and patient-reported outcomes of ABR. The increased focus and implementation of patient-reported outcomes, with evaluation of physical, psychosexual and social outcomes, has been a pivotal addition to the ABR literature, underscoring the importance of tools like the BREAST-Q.[1] A smaller proportion of articles addressed surgical techniques, indications, and anatomy. The identification of these themes reflects the field's priorities, providing valuable guidance for future research directions.

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The distribution of articles across different journals sheds light on the publication landscape. *Plastic and Reconstructive Surgery*, followed by the *British Journal of Plastic Surgery*, emerged as the main contributors. The diversity in journals from plastic surgery, breast, cancer/oncology, and other surgery journals underscores the interdisciplinary nature of ABR research. The peaks in cumulative citations per decade, particularly in the 1980s and 2000s, suggest pivotal periods of accelerated research and development in ABR, with the shift in abdominal-based flap reconstruction, from pedicled transverse rectus abdominis myocutaneous to the deep inferior epigastric perforator flap.[3,24]

In terms of level of evidence, level 5 studies garnered the highest average number of citations, indicating a prominent impact of lower-level evidence in the ABR literature. Observational studies dominated the study designs, with case-series studies exhibiting the highest citation count. This predominance of lower-level evidence prompts a critical reflection on the methodological quality of the top-cited ABR literature. Future research should incorporate higher-level evidence and diverse study designs to enhance the robustness of findings in the ABR literature.

From the authorship perspective, Kroll, Blondeel, and Chang emerged as the most prolific contributors. The prevalence of multi-center studies highlight the collaborative nature of ABR research. The dominance of the United States in terms of geographical distribution, and limited representation from some other parts of the world, highlights potential opportunities for international collaboration to focus on diverse patient populations and clinical practices.

The study has certain limitations, as the analysis acknowledges the potential presence of inherent biases in bibliometric analyses.[25] This study is susceptible to in-house review and author self-citation biases, alongside English language and national biases.[26] Unconscious biases, such as bandwagon bias, powerful person bias, and bias by omission, may influence efforts to gain a competitive publication advantage. Relying solely on the assumption that highly cited articles inherently hold greater significance may lead to inaccurate conclusions. Instead, it is advisable to individually assess each article to critically evaluate the robustness of the study methodology and the formulation of article conclusions. Moreover, as foundational articles become widely accepted and consequently receive fewer citations, they may face potential exclusion, offering a plausible explanation for the absence of certain papers in this analysis.[27,28]

In recent years, ABR has advanced significantly, promising patients improved aesthetics and quality of life. These advancements are attributed to progress in microsurgical techniques and technologies, resulting in better surgical outcomes and reduced donor site morbidity. Despite these achievements, ABR research currently faces several challenges. One significant limitation is the scarcity of long-term follow-up data in many studies, complicating the evaluation of surgical outcomes and patient satisfaction. Additionally, there is inconsistency in reporting outcomes and complications across studies, impeding comparability and meta-analysis efforts. Disparities in access to care and variations in surgical techniques further contribute to research inconsistencies. Addressing these deficits necessitates standardized reporting guidelines, longer-term follow-up studies, and efforts to mitigate healthcare disparities.

CONCLUSIONS

In conclusion, we provide a comprehensive analysis of the 100 top-cited articles on ABR, offering valuable insights, trends, themes, and authorship patterns. These serve as the basis for future research, emphasizing the need for higher-level evidence, evaluating clinical and patient-reported outcomes with robust tools, such as BREAST-Q. Interdisciplinary and global collaboration is needed to advance the field, focus on diverse patient backgrounds, and optimize clinician-patient shared decision-making.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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