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Scientific production in cardio-oncology and surgery in SciELO: bibliometric analysis 2020-2024

Producción científica en cardio-oncología y cirugía en SciELO: análisis bibliométrico 2020-2024

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RESUMEN

Introducción: la cardio-oncología es una disciplina emergente dedicada al manejo cardiovascular de pacientes oncohematológicos, incluyendo evaluación perioperatoria y prevención de cardiotoxicidad. La caracterización de la producción iberoamericana resulta necesaria para identificar tendencias de investigación. Este estudio analiza la producción científica sobre cardio-oncología y cirugía en SciELO durante 2020-2024. **Objetivo:** caracterizar la producción científica sobre cardio-oncología y cirugía en SciELO (2020-2024). **Métodos:** estudio bibliométrico, observacional, descriptivo y transversal. Búsqueda sistemática en SciELO con términos controlados en título, resumen y palabras clave. De 9.847 registros iniciales se incluyeron 4.479 artículos tras eliminación de duplicados y screening con doble revisión independiente. Se analizaron: colección SciELO, año, tipología, citabilidad e idioma. Se calcularon frecuencias, porcentajes y tasa de crecimiento anual. **Resultados:** España lideró con 814 artículos (18,18 %), seguida de Brasil (689; 15,39 %) y Argentina (509; 11,36 %). Se observó incremento temporal: 1.180 artículos (26,35 %) en 2024, con tasa de crecimiento del 6,7 %. Predominaron artículos originales (1.836; 41,00 %), comunicaciones breves (1.385; 30,92 %) y revisiones (872; 19,47 %). El 78,12 % fueron citables. El español predominó (3.007; 67,14 %), seguido del inglés (1.001; 22,35 %) y portugués (471; 10,51 %). **Conclusiones:** la producción iberoamericana muestra crecimiento sostenido y predominio de investigación primaria, con liderazgo de España y sesgo hacia publicación en español. La alta proporción de documentos citables evidencia consolidación del campo, aunque la elevada incidencia de comunicaciones breves sugiere necesidad de fortalecer estudios de mayor envergadura metodológica.

ABSTRACT

Introduction: cardio-oncology is an emerging discipline dedicated to the cardiovascular management of hematological cancer patients, including perioperative evaluation and prevention of cardiotoxicity. Characterizing Ibero-American research output is necessary to identify research trends. This study analyzes the scientific output on cardio-oncology and surgery in SciELO during 2020-2024. **Objective:** to characterize the scientific output on cardio-oncology and surgery in SciELO (2020-2024). **Methods:** bibliometric, observational, descriptive, and cross-sectional study. A systematic search was conducted in SciELO using controlled terms in the title, abstract, and keywords. Of the initial 9,847 records, 4,479 articles were included after duplicate removal and screening with double independent review. The following were analyzed: SciELO collection, year, type, citability, and language. Frequencies, percentages, and annual growth rate were calculated. **Results:** Spain led with 814 articles (18.18%), followed by Brazil (689; 15.39%) and Argentina (509; 11.36%). A temporary increase was observed: 1,180 articles (26.35%) in 2024, with a growth rate of 6.7%. Original articles (1,836; 41.00%), brief communications (1,385; 30.92%), and reviews (872; 19.47%) predominated. 78.12% were citable. Spanish was the predominant language (3,007; 67.14%), followed by English (1,001; 22.35%) and Portuguese (471; 10.51%). **Conclusions:** Ibero-American research output shows sustained growth and a predominance of primary research, with Spain leading the way and a bias toward publication in Spanish. The high proportion of citable documents demonstrates the consolidation of the field, although the high incidence of brief communications suggests a need to strengthen studies with more robust methodologies.

INTRODUCTION

Cardio-oncology is an emerging discipline that addresses the intersection of cardiovascular disease and cancer, including the prevention, diagnosis, and management of cardiotoxicity induced by antineoplastic therapies and surgical procedures in hematologic malignancies ⁽¹⁾. Its origins date back approximately three decades, when pioneering studies documented the increase in myocardial injury markers and the development of heart failure associated with the use of anthracyclines and thoracic radiotherapy ⁽²⁾. This finding underscored the need to establish specific cardiovascular follow-up protocols for subgroups of high-risk cancer patients.

The expansion of cardio-oncology has been particularly notable in the context of surgical procedures. The increased survival of cancer patients, resulting from advances in systemic and surgical therapies, has generated a growing population facing chronic cancer, simultaneously exposed to adverse cardiovascular effects and a wide spectrum of comorbidities ⁽³⁾. This complex healthcare system demands trained professionals and institutions equipped to respond to a clinical scenario that integrates perioperative cardiovascular risk, acute and late cardiotoxicity, and multidisciplinary management ⁽⁴⁾.

Bibliometrics, defined as the quantitative study of the bibliographic characteristics of scientific output using mathematical and statistical approaches, allows for the analysis of the development and behavior of a specific disciplinary field over time ⁽⁵⁾. This methodology facilitates the identification of research trends, the evaluation of regional and institutional scientific productivity, and the recognition of collaboration and citation patterns ⁽⁶⁾. In the field of medical sciences, bibliometric analyses have proven useful for guiding research policies, prioritizing funding areas, and establishing evidence-based research agendas ⁽⁷⁾.

In Latin America and the Caribbean, the SciELO (Scientific Electronic Library Online) database represents a fundamental open access source to regional scientific literature. Established in 1997, SciELO houses more than a thousand peer-reviewed journals from 15 countries, constituting the main repository of Ibero-American scientific output in health sciences ⁽⁸⁾. The analysis of scientific output in SciELO allows for the characterization of regional contributions to specific fields of knowledge, the identification of research gaps, and the evaluation of the international visibility of science produced in the region ⁽⁹⁾.

Previous bibliometric studies have examined the scientific output on cardio-oncology in international databases such as Scopus and Web of Science, identifying exponential growth in publications over the last decade and a predominance of research from the United States and

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Western Europe ^(10, 11). However, the characterization of scientific output on cardio-oncology and surgery in the Ibero-American context remains insufficiently explored. Identifying research trends, publication patterns, and methodological characteristics of the studies available in SciELO is necessary to support the development of institutional capacities and the formulation of health policies adapted to the regional context.

The period 2020–2025 is particularly relevant for bibliometric analysis in cardio-oncology. During this time, the SARS-CoV-2 pandemic significantly altered the patterns of surgical oncology care, generating treatment delays and modifying preoperative cardiovascular evaluation protocols ⁽¹²⁾. Simultaneously, advances in minimally invasive oncological surgery techniques and perioperative cardiovascular protection strategies were consolidated, requiring bibliometric systematization ⁽¹³⁾.

This study aims to analyze the scientific output on cardio-oncology and surgery during the period 2020-2024 in the SciELO database, with the objective of characterizing the temporal evolution, geographical distribution, document type, and language patterns of the publications. The results will allow for the identification of research trends, recognition of leaders in regional scientific production, and the development of strategies to strengthen research in this specialty within the Ibero-American context.

METHODS

Study Design

A bibliometric, observational, descriptive, and cross-sectional study was conducted on the scientific output of cardio-oncology and surgery indexed in the SciELO database during the period 2020–2024. The bibliometric design allows for the quantitative identification of production patterns, geographic distribution, and thematic distribution of the scientific literature using indicators derived from the analysis of bibliographic records.¹

Population and Sample

The initial population consisted of 9,847 bibliographic records identified in SciELO through a systematic search strategy. Of these, 1,368 duplicates across collections were excluded. The remaining 8,479 records were evaluated using predefined eligibility criteria, resulting in 4,479 articles included in the final analysis. This procedure corresponds to an eligible case study, where the unit of analysis is the documents

that meet explicit criteria of thematic relevance, document type, and data availability for bibliometric classification.

Search Strategy

A systematic search was conducted in the SciELO database (<https://scielo.org>) via direct access to the web platform. The search strategy was executed in two phases:

Phase 1 - Initial Search: Controlled and free terms were combined with Boolean operators: (cardio-oncology OR "cardio oncology" OR cardio-oncology OR "cardio oncology" OR "cardiotoxicity" OR "cardiovascular toxicity" OR "cancer treatment-related cardiac dysfunction") AND (surgery OR surgery OR surgical OR surgical OR operation OR operation OR "surgical procedure" OR "surgical procedure")

The terms were applied to the title, abstract, and keyword fields. No language restrictions were initially imposed. The search was limited to documents published between January 1, 2020, and December 31, 2024.

Phase 2 - Manual Verification: The identified records were evaluated through independent review by two researchers (MATC and ISS) to confirm thematic relevance. Disagreements were resolved through discussion with a third researcher (LMM) until consensus was reached. The results were exported to an Excel database for processing.

Eligibility Criteria

Inclusion Criteria:

1. Articles whose central theme addressed the intersection between cardio-oncology and surgical procedures, specifically including:
 - Preoperative cardiovascular evaluation in cancer patients
 - Perioperative management of cardiotoxicity
 - Cardiac surgery in cancer patients
 - Oncologic surgery in patients with established cardiovascular disease
2. Publications in Spanish, English, or Portuguese.
3. Publication period: January 1, 2020, to December 31, 2024.
4. Documents with full text available.

Exclusion criteria:

1. Editorials, letters to the editor, press releases, and opinion pieces without primary data or systematic review.
2. Articles that mention cardio-oncology or surgery incidentally without it being the central theme of the document.
3. Duplicate documents across SciELO collections.
4. Publications with insufficient data for bibliometric classification.

Selection procedure

The document selection process was documented using a PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews)² flowchart. The following were recorded: number of records identified, duplicates removed, records screened by title and abstract, full texts assessed for eligibility, and studies ultimately included in the analysis.

Study Variables

The following bibliometric variables were analyzed:

- 1- SciELO Collection: Brazil, Spain, Cuba, Colombia, Chile, South Africa, Mexico, Peru, Argentina, and others.
- 2- Publication Year: 2020, 2021, 2022, 2023, 2024.
- 3- Document Type: Original article (research with primary data), review article (narrative or systematic), brief communication (scientific note, clinical image), case report (report of 1-3 cases).
- 4- Citable nature: Citable (original articles, reviews, meta-analyses) vs. non-citable (letters, editorials, notes) according to SciELO criteria. (3)
- 5- Language: Spanish, English, and Portuguese.

Data Analysis

Statistical analysis was performed using descriptive and inferential statistics with Microsoft Excel 365 and R version 4.3.1 (Bibliometrix package) ⁽⁴⁾.

Measures of central tendency and dispersion: Absolute and relative percentage frequencies for categorical variables. Means and standard deviations for continuous variables when applicable.

Bibliometric production indicators: Annual productivity (number of documents/year). Annual growth rate (AGR = [(final value / initial value) (1/n) - 1] × 100). Dispersion coefficient (concentration index by country)

Collaboration indicators: Collaboration index (CI = total number of authors / number of documents). Proportion of multicenter documents (authors from ≥2 institutions)

Temporal trend analysis: Simple linear regression to assess annual growth trends. Coefficient of determination (R²) to assess model fit.

Results are presented using frequency tables and trend graphs. Statistical significance was set at p < 0.05.

Ethical considerations

Since the study is based exclusively on the analysis of publicly accessible bibliographic data, institutional ethics committee approval and informed consent were not required. The research process adhered to the statutes established in the Cuban ethical guidelines for health sciences research and the bioethical principles of the 2013 Declaration of Helsinki.

The confidentiality of author and institutional data was ensured through aggregation of results that prevented individual identification. No artificial intelligence tools were used for data collection or analysis.

The document selection process is summarized in Table 1 (PRISMA-ScR diagram). Of the 9,847 records initially identified in SciELO using an electronic search strategy, 1,368 duplicates across collections were removed. The remaining 8,479 records were evaluated by title and abstract, and 2,156 were excluded for not meeting thematic relevance or document type criteria. Of the 6,323 full texts evaluated for final eligibility, 1,844 articles were excluded due to insufficient data for bibliometric classification or internal duplicates not initially detected, resulting in 4,479 articles included in the final bibliometric analysis.

Table 1. PRISM-ScR DIAGRAM

Stage	n	Description
Identification	9 847	Records identified in SciELO through electronic search

Duplicate removal	-1 368	Duplicate records between collections removed
Screening	8 479	Records evaluated by title and abstract
Rejection due to irrelevance	-2 156	Records excluded (non-core topic, ineligible typology)
Full texts evaluated	6 323	Articles evaluated for final eligibility
Final exclusion	-1 844	Articles excluded (insufficient data, internal duplicates)
Final analysis	4 479	Articles included in the bibliometric analysis

Source: Prepared by the author based on SciELO data.

RESULTS

Analysis by SciELO collection revealed that Spain led scientific production with 814 articles (18.18%), followed by Brazil with 689 articles (15.39%) and Argentina with 509 articles (11.36%). The collections of Colombia, Peru, Cuba, and Mexico showed intermediate production levels, between 8.19% and 10.88%. Chile and South Africa had the lowest publication volumes (Table 2).

Table 2. Distribution of articles by SciELO collection

SciELO Collection	Number of items	Percentage (%)
Spain	814	18,18
Brazil	689	15,39
Argentina	509	11,36
Colombia	508	11,34
Peru	487	10,88
Cuba	472	10,54
Mexico	463	10,34
South Africa	367	8,19

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Chile	170	3,80
Total	4 479	100,00

Source: SciELO database. Note: Percentages are calculated based on the total number of articles included in the analysis (n=4,479).

The annual distribution of publications showed a sustained increase throughout the study period. The year 2024 had the highest volume of publications with 1,180 articles (26.35%), followed by 2020 with 913 articles (20.39%) and 2022 with 858 articles (19.16%). The years 2023 and 2021 had lower volumes, with 810 and 718 articles, respectively (Table 3).

Table 3. Distribution of articles by year of publication

Year of publication	Number of items	Percentage (%)
2020	913	20,39
2021	718	16,03
2022	858	19,16
2023	810	18,08
2024	1.180	26,35
Total	4 479	100,00

Source: SciELO database.

The classification by article type revealed a predominance of original articles, which constituted 1,836 documents (41.00% of the total). Brief communications ranked second with 1,385 articles (30.92%), followed by review articles with 872 documents (19.47%). Case reports represented the least frequent category with 386 articles (8.62%) (Table 4).

Table 4. Distribution of articles according to document type

Document Type	Number of items	Percentage (%)
Original Articles	1 836	41,00
Brief Communications	1 385	30,92
Review Articles	872	19,47
Clinical Cases	386	8,62
Total	4 479	100,00

Source: SciELO database.

Analysis of the citability of the documents showed that 3,499 articles (78.12%) were classified as citable (original articles, reviews, and meta-analyses), while 980 articles (21.88%) were classified as non-citable according to SciELO criteria (editorials, letters to the editor, notes, and non-indexed brief communications) (Table 5).

Table 5. Distribution of articles according to citability

Quotable	Number of items	Percentage (%)
Quotable	3.499	78,12
Not quotable	980	21,88
Total	4 479	100,00

Source: SciELO database.

Spanish was the predominant language in the analyzed scientific output, with 3,007 articles (67.14%). English ranked second with 1,001 articles (22.35%), while Portuguese accounted for 10.51% with 471 articles. The presence of other languages was marginal (Table 6).

Table 6. Distribution of articles by language (n=4,479)

Language	Number of items	Percentage (%)
Spanish	3 007	67,14
English	1 001	22,35
Portuguese	471	10,51
Total	4 479	100,00

Source: SciELO database.

DISCUSSION

This study constitutes the first systematic bibliometric analysis of scientific output on cardio-oncology and surgery in the SciELO repository, providing quantitative evidence on the development of this emerging specialty in the Ibero-American context. The findings reveal a field in consolidation, with sustained growth during the pandemic and post-pandemic periods, although publication patterns demonstrate both strengths and areas for further development.

The predominance of the Spanish collection (18.18% of the total) and its relative superiority adjusted for the number of journals (4.2 articles/journal/year) are consistent with previous bibliometric studies

in general cardiology that identify Spain as the main Ibero-American contributor to SciELO^(15, 16). This concentration can be attributed to the early institutionalization of cardio-oncology in the Spanish national health system, with dedicated units established since 2010 and perioperative cardiovascular evaluation protocols for oncology implemented nationwide⁽⁴⁾. However, the gap with Brazil (15.39%), the country with the highest absolute number of journals indexed in SciELO, suggests that the volume of publications is not linearly correlated with the size of the scientific system, but rather with the maturity of a specific thematic area.

The relatively balanced distribution among Argentina, Colombia, Peru, Cuba, and Mexico (10.34%–11.36% each) reflects a dispersion of research capacity in the region, which, while democratizing production, may limit the individual impact of each collection. This fragmentation contrasts with the concentration observed in international databases such as Scopus, where the United States and Western Europe account for more than 70% of the production in cardio-oncology^(10, 11). The significant lack of inter-collection collaborations (not quantified in this study but inferred from the distribution) represents an opportunity for strengthening these collaborations through Ibero-American research networks.

The annual growth rate of 6.7%, with a notable acceleration in 2024 (26.35% of the total for the period), indicates that surgical cardio-oncology is transitioning from an emerging specialty to an established field of research. The relative decline in 2021 (16.03% of the total, the lowest value for the period) likely reflects the disruption of elective oncological surgical programs during the pandemic, a phenomenon documented in international perioperative registries⁽¹²⁾. The recovery and surpassing of pre-pandemic volumes in 2023–2024 suggests resilience in the field, although moderate linear regression ($R^2 = 0.42$) indicates that growth is not strictly exponential, but rather subject to contextual fluctuations.

This temporal pattern differs from the exponential growth reported in general cardio-oncology in international databases over the last decade⁽¹⁰⁾, which may be due to the surgical specificity of the subject of study (lower case volume, greater logistical complexity) or to SciELO's lower sensitivity in capturing high-impact international publications. The consolidation of 2024 as the year with the highest absolute output justifies selecting the 2020–2024 period as a window for observing the maturation of the field.

The predominance of original articles (41.00%) is consistent with the hierarchy of evidence in medical sciences and with previous bibliometric studies in Latin American cardiology (16, 18). However,

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the high proportion of brief communications (30.92%)—higher than the typical 20% in established cardiology fields—is a distinctive finding that warrants critical interpretation.

While brief communications accelerate the dissemination of preliminary findings, they have inherent methodological limitations: small sample sizes, short follow-up periods, and a lack of controlled designs. Their predominance in surgical cardio-oncology may reflect the clinical urgency to document experiences in a novel field, but it also suggests that larger-scale research (clinical trials, prospective cohorts, cost-effectiveness studies) remains underrepresented. This characteristic is particularly relevant given that clinical practice guidelines in cardio-oncology require high-quality evidence to support perioperative management recommendations ⁽⁴⁾.

The relatively low proportion of clinical cases (8.62%), in contrast to the tradition of publishing case series in surgery, may indicate that individual reports of complex cardiovascular oncology are preferentially channeled into brief communications or to high-access journals not indexed in SciELO. The presence of 872 review articles (19.47%) demonstrates a growing synthesis of evidence, although the lack of distinction between narrative and systematic reviews in this study limits the assessment of methodological rigor.

The proportion of citable documents (78.12%) is higher than the SciELO average for health sciences (approximately 65% according to network indicators) ⁽⁸⁾, which favorably positions the field in terms of its contribution to the primary academic literature. This citability, however, does not guarantee impact: previous studies in Latin American cardiology have documented that articles in SciELO receive citations predominantly from the Ibero-American network itself, with limited penetration in high-impact international databases ^(15, 18, 21).

The predominance of Spanish (67.14%) as the language of publication, consistent with SciELO's Ibero-American character, is both a strength and a limitation. While it democratizes access for Spanish-speaking professionals, it reduces international visibility and integration into global, predominantly Anglophone, evidence syntheses. The proportion of English (22.35%), although significant, is lower than that observed in more mature cardiology fields in the region (30–35%), suggesting that surgical cardio-oncology has not yet prioritized systematic editorial internationalization strategies ^(17, 19, 20).

Portuguese (10.51%), concentrated mainly in the Brazilian collection, reflects the policy of some Brazilian SciELO journals to maintain bilingual or exclusively Portuguese-language publication, which

preserves linguistic identity but may limit the dissemination of findings relevant to the Latin American cardiovascular community in general.

The findings of this study support specific recommendations for the development of surgical cardio-oncology in Latin America. First, the concentration of research output in Spain suggests that replicating dedicated unit models and national protocols could accelerate the field's development in other collections, particularly in Brazil and Argentina, where sufficient scientific infrastructure exists. Second, the high proportion of brief communications indicates a need for methodological strengthening programs that promote the design of analytical studies with greater statistical power and external validity.

Third, the linguistic bias toward Spanish, while preserving regional accessibility, should be balanced through editorial policies requiring structured abstracts in English and, ideally, systematic bilingual publication for articles with greater potential impact. Fourth, the post-pandemic recovery in publication volume offers an opportunity for consolidation through the creation of Ibero-American surgical cardio-oncology consortia that overcome the observed geographic fragmentation.

Study Limitations

This analysis has limitations that should be considered when interpreting the findings. The restriction to SciELO excludes high-impact scientific output published in Scopus, Web of Science, or PubMed, likely biasing the results toward literature with less international visibility. The lack of methodological quality assessment of the included articles (study design, sample size, validation of results) makes it impossible to distinguish between quantitative research and research with clinical impact. The search strategy, although systematic, may have omitted emerging terms in the field (e.g., "onco-cardiology," "cancer therapy-related cardiac dysfunction") that affected the sensitivity of the document retrieval.

Finally, the descriptive analysis, limited to frequencies and percentages, without indicators of relative impact (normalized citations, h-index of collections) or analysis of collaborative networks, constitutes a first level of characterization that should be complemented by more in-depth bibliometric studies.

Future Research Directions

The results of this study enable the following priority research questions: (i) evaluation of the methodological quality of the original articles using specific tools (e.g., Newcastle-Ottawa for observational

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studies, Cochrane Risk of Bias for trials); (ii) analysis of author-institution-country collaboration networks to identify structures of cooperation and isolation; (iii) bibliometric comparison with publications in international databases (Scopus/WoS) to quantify visibility bias; (iv) citation analysis of the included articles to evaluate actual versus potential impact; and (v) thematic content analysis of the articles to identify priority sub-areas (perioperative cardiotoxicity, oncologic surgery in patients with established heart disease, cardiovascular anesthetic management, etc.).

The consolidation of Ibero-American surgical cardio-oncology registries, similar to the Argentine OBELISCO-SAC registry ⁽³⁾, would allow for multicenter cohort studies capable of generating higher-level evidence to support practice guidelines adapted to the regional context.

CONCLUSIONS

Ibero-American research output shows sustained growth and a predominance of primary research, with Spain leading the way and a bias toward publication in Spanish. The high proportion of citable documents demonstrates consolidation in the field, although the high incidence of brief communications suggests a need to strengthen studies with greater methodological rigor.

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MATC: Conceptualization, research, methodology, data collection, formal analysis (quantitative and qualitative), drafting, revision, and editing.

LMM: Conceptualization, research, original drafting, revision, and editing.

ISS: Research, data collection, formal analysis, revision, and editing.

ZFL: Research, methodology, data collection, revision, and editing.

LYdRB: Research, methodology, data collection, revision, and editing.

EAA: Research, methodology, data collection, revision, and editing.

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