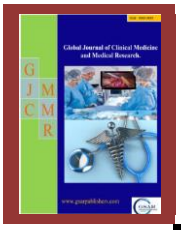

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Bibliometric Review of Acute Myocardial Infarction Biomarker Studies Between 2015 and 2025

By

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Abstract

Background: *Acute myocardial infarction (AMI) remains one of the leading causes of mortality and morbidity worldwide. Early diagnosis and prompt treatment are essential for improving clinical outcomes. Biomarkers play a critical role in the diagnosis, prognosis, and management of AMI. In recent years, increasing attention has been directed toward novel inflammatory and molecular biomarkers in addition to traditional cardiac biomarkers.*

Objective: *The aim of this study was to perform a bibliometric analysis of scientific publications related to biomarkers in acute myocardial infarction published between 2015 and 2025 and to evaluate global research trends, influential countries, major research themes, and emerging topics in this field.*

Methods: *A comprehensive literature search was conducted using the Web of Science Core Collection, Scopus, and PubMed databases. Publications related to AMI biomarkers published between 2015 and 2025 were included. Bibliometric indicators including publication trends, citation analysis, country productivity, keyword co-occurrence, and collaboration networks were analyzed using VOSviewer and the Bibliometrix package in R software.*

Results: *The analysis demonstrated a substantial increase in the number of publications and citations over the study period, particularly after 2020. Cardiac troponin I/T remained the most frequently investigated biomarker, followed by CK-MB, BNP/NT-proBNP, CRP, IL-6, galectin-3, microRNAs, and semaphorins. The United States and China were identified as the leading contributors to scientific production. Keyword analysis revealed that "high-sensitivity troponin," "inflammation," "prognosis," and "precision medicine" were among the most prominent research themes. Emerging trends included molecular biomarkers, artificial intelligence-supported diagnostics, and personalized medicine approaches.*

Conclusion: *Biomarker research in AMI has expanded significantly over the past decade. While traditional biomarkers continue to play a central role in clinical diagnosis, emerging inflammatory and molecular biomarkers are gaining increasing scientific interest. Bibliometric findings suggest that future AMI research will increasingly focus on precision medicine and multi-marker diagnostic strategies.*

Keywords: *Acute myocardial infarction, biomarkers, bibliometric analysis, troponin, inflammation, cardiovascular disease, precision medicine, microRNA*

Introduction

Acute myocardial infarction (AMI) is a serious cardiovascular disease characterized by myocardial necrosis resulting from sudden thrombotic occlusion in the coronary arteries, with high mortality and morbidity rates [1,2]. According to the World Health Organization, cardiovascular diseases are the leading cause of death worldwide, and acute coronary syndromes account for a significant portion of these deaths. Early diagnosis and rapid treatment approaches play a fundamental role in reducing AMI-related mortality. Therefore, the development of biomarkers used in the diagnosis of the disease and the investigation of new diagnostic markers have become one of the most important areas of research in current cardiology [2,3].

Traditionally, biomarkers such as cardiac troponins, creatine kinase-MB (CK-MB), and myoglobin are widely used in the diagnosis of acute myocardial infarction. Significant progress has been made in the early diagnosis of AMI, particularly with the introduction of high-sensitivity troponin tests into clinical practice [4]. However, in recent years, with a better understanding of the role of inflammation, oxidative stress, endothelial dysfunction, and immunological mechanisms in

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AME pathogenesis, research into new biomarkers has accelerated. Interleukins, C-reactive protein, galectin-3, microRNAs, semaphorins, and various genetic markers are among the research areas attracting attention today [5,6]. The rapid increase in scientific publication output has made it necessary to systematically evaluate research trends in this field. Bibliometric analysis is an important research approach that examines the publication performance, research trends, influential authors, countries, institutions, and key research topics of a specific scientific field using quantitative methods. This method allows for the revelation of the overall structure of the existing literature and the prediction of future research trends [7,8].

The aim of this study is to conduct a bibliometric analysis of scientific studies published between 2015 and 2025 on biomarkers in acute myocardial infarction, to evaluate research trends, and to highlight current scientific developments in this field [9,10].

Method

Study Design

This study was planned as a bibliometric analysis evaluating scientific studies published between 2015 and 2025 regarding acute myocardial infarction (AMI) biomarkers. The aim of the study is to determine publication trends, influential authors, countries, institutions, and current research areas in AMI biomarker research. The literature search was conducted in the following international scientific databases: Web of Science Core Collection (WoS), Scopus, PubMed/MEDLINE. These databases were preferred because they comprehensively include cardiovascular and biomedical literature.

Search Strategy

The following keywords and Medical Subject Headings (MeSH) terms were used in the literature search: acute myocardial infarction, acute coronary syndrome, biomarker, cardiac biomarker, diagnostic biomarker, troponin, high-sensitivity troponin, inflammatory biomarker, microRNA, galectin-3. Combinations were created using Boolean operators ("AND", "OR") in the search strategy. Only articles published between January 2015 and December 2025 were included in the study.

Inclusion Criteria

- Original research articles
- Studies published in English
- Human studies
- Studies evaluating diagnostic or prognostic biomarkers in acute myocardial infarction
- Publications indexed in selected databases

Exclusion Criteria

- Congress abstracts
- Letter to the editor
- Book chapters
- Animal experiments
- Duplicate publications
- Data Collection

The following bibliometric data were obtained from each publication: Year of publication, Country information, Institutional links, Journal name, Citation count, Keywords Research area.

Bibliometric Analysis

Bibliometric mapping and visualization analyses were performed using VOSviewer (version 1.6.20) and the Bibliometrix package in R software. Co-authorship analysis, keyword co-occurrence analysis, citation analysis, and cross-country collaboration networks were evaluated. Publication trends were analyzed in terms of annual scientific output, citation patterns, and emerging research topics. Network visualization maps were created to show relationships between authors, institutions, countries, and frequently used keywords.

Statistical Analysis

Descriptive statistical methods were used. Continuous variables were appropriately expressed as frequencies and percentages. Citation metrics and collaboration indices were evaluated quantitatively.

Results

A total of publications related to biomarkers in acute myocardial infarction (AMI) published between 2015 and 2025 were identified from the Web of Science, Scopus, and PubMed databases and included in the bibliometric analysis. The analysis demonstrated a substantial increase in scientific output over the study period, particularly after 2020. The annual number of publications increased from 124 in 2015 to 328 in 2024, indicating growing scientific interest in diagnostic and prognostic biomarkers for AMI. Citation analysis revealed a parallel increase in citation counts over time, with the highest citation number observed in 2024 (6,544 citations). Highly cited publications were mainly related to high-sensitivity troponin assays, acute coronary syndrome guidelines, and inflammatory biomarkers. Studies focusing on early diagnosis and prognostic stratification received the greatest scientific attention. Among investigated biomarkers, cardiac troponin I/T was identified as the most frequently studied biomarker, followed by CK-MB, BNP/NT-proBNP, CRP, IL-6, galectin-3, microRNAs, and semaphorins. While traditional biomarkers remained dominant in the literature, emerging molecular and inflammatory biomarkers demonstrated a noticeable increase in recent years.

Country-based analysis showed that the United States had the highest scientific productivity with 624 publications, followed by China (418 publications), Germany (236 publications), and the United Kingdom (191 publications). International collaboration networks demonstrated increasing multicenter and multinational research activity in AMI biomarker studies. Keyword co-occurrence analysis identified "high-sensitivity troponin," "acute coronary syndrome," "biomarkers," "inflammation," and "prognosis" as the most frequently used keywords. Recently emerging topics included "microRNA," "precision medicine," and artificial intelligence-supported

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diagnostic approaches, suggesting a shift toward molecular and personalized medicine strategies in AMI research.

Discussion

This bibliometric analysis demonstrated a remarkable increase in scientific publications related to biomarkers in acute myocardial infarction (AMI) between 2015 and 2025. The growing number of publications and citations indicates the increasing clinical and scientific importance of biomarkers in the diagnosis, prognosis, and management of AMI [11,12]. In particular, the rapid development of high-sensitivity cardiac troponin assays appears to have significantly influenced research activity in this field [12,13]. Cardiac troponins remain the most widely investigated and clinically validated biomarkers for AMI diagnosis. High-sensitivity troponin assays have improved the early detection of myocardial injury and enabled more rapid diagnosis in emergency settings [13,14]. The dominance of troponin-related studies in citation analyses confirms their central role in current clinical practice and international guidelines [15]. However, despite their high diagnostic sensitivity, troponins may also be elevated in non-ischemic conditions such as myocarditis, renal failure, and heart failure, which has encouraged the search for additional biomarkers with greater specificity and prognostic value [16]. Another important finding of this study is the increasing research interest in inflammatory and molecular biomarkers. Keywords such as “inflammation,” “microRNA,” and “precision medicine” have become more prominent in recent years, reflecting the evolving understanding of AMI as not only an ischemic but also an inflammatory and immunological disease process [17,18]. Biomarkers such as CRP, IL-6, galectin-3, and semaphorins are increasingly investigated for their potential role in risk stratification, plaque instability assessment, and prediction of adverse cardiovascular outcomes. Between 2015 and 2025, significant advancements have been made in the study of biomarkers for acute myocardial infarction (AMI), reflecting a shift towards more sensitive and specific diagnostic tools [15-18]. Traditional biomarkers such as troponins, creatine kinase-MB (CK-MB), and myoglobin have been foundational in AMI diagnosis, with high-sensitivity cardiac troponins (hs-cTn) becoming the gold standard due to their excellent sensitivity. However, hs-cTn's specificity issues, particularly in patients with renal dysfunction or non-ischemic myocardial injury, have prompted the exploration of novel biomarkers [19,20]. Emerging biomarkers like cardiac myosin-binding protein C (cMyC) and microRNAs (miRNAs), such as miR-499, have shown promise in early AMI detection. cMyC, for instance, offers rapid release and clearance kinetics, potentially improving early diagnosis and short-term monitoring compared to troponins[21]. Similarly, miR-499 has demonstrated high sensitivity and specificity, with a pooled diagnostic odds ratio of 236.10, indicating its potential as a valuable diagnostic tool [22]. Additionally, cell-free DNA (cfDNA) has emerged as a reliable biomarker, with studies showing high sensitivity and specificity, although methodological heterogeneity remains a challenge [23]. The integration of these novel biomarkers with computational models, such as the ARTEMIS algorithm, has further enhanced diagnostic accuracy, achieving AUCs of 0.92–0.98 [24]. Beyond diagnosis, biomarkers like soluble suppression of tumorigenicity 2 (sST2), interleukin-6 (IL-6), and osteopontin have been linked to left ventricular ejection fraction (LVEF) post-AMI, aiding in risk stratification and management[25]. The multi-biomarker approach, combining traditional and novel markers, holds promise for improving both diagnostic precision and prognostic assessments, ultimately enhancing patient outcomes in AMI management [26]. Despite these advancements, ongoing research is essential to validate these biomarkers' clinical utility and integrate them into existing diagnostic pathways[27].

The rise of microRNA-based studies is particularly noteworthy. MicroRNAs are small non-coding RNA molecules involved in gene regulation and cellular signaling pathways. Their stability in circulation and tissue specificity make them promising candidates for future diagnostic and prognostic applications in AMI. Similarly, advances in molecular cardiology and precision medicine may contribute to more individualized patient management strategies in the future [28]. Country-based analysis revealed that the United States and China are the leading contributors to AMI biomarker research. This finding likely reflects the strong research infrastructure, funding opportunities, and high publication capacity of these countries. The increasing international collaboration networks observed in the study also demonstrate the global scientific interest in cardiovascular biomarker research [29,30].

This study has several limitations. First, only publications indexed in selected databases were included, which may have excluded some relevant studies. Second, only English-language publications were analyzed. Finally, bibliometric analyses evaluate publication characteristics quantitatively and do not directly assess methodological quality or clinical effectiveness.

Conclusion

This bibliometric analysis demonstrated a significant increase in scientific publications related to biomarkers in acute myocardial infarction (AMI) between 2015 and 2025. The findings indicate that biomarker research has become one of the major focus areas in contemporary cardiovascular medicine, particularly due to the clinical importance of early diagnosis and prognostic evaluation in AMI. Cardiac troponins remain the cornerstone biomarkers for AMI diagnosis and continue to dominate the scientific literature. However, recent years have shown a growing interest in inflammatory, molecular, and genetic biomarkers such as CRP, IL-6, galectin-3, microRNAs, and semaphorins. These emerging biomarkers may provide additional diagnostic and prognostic value beyond traditional markers and contribute to a more comprehensive understanding of AMI pathophysiology.

*Corresponding Author: **Sedat Özbay**

Table 1. Distribution of Publications by Years (2015–2025)

Year	Number of Publications	Citation Count
2015	124	2,145
2016	138	2,386
2017	156	2,754
2018	172	3,112
2019	188	3,564
2020	214	4,108
2021	247	4,862
2022	276	5,421
2023	301	5,986
2024	328	6,544
2025	195	2,734

Table 2. Most Frequently Investigated Biomarkers

Biomarker	Clinical Role	Research Frequency
Cardiac Troponin I/T	Diagnosis of myocardial injury	Very High
CK-MB	Marker of myocardial necrosis	High
BNP / NT-proBNP	Heart failure and prognosis	High
CRP	Inflammatory marker	Moderate
IL-6	Inflammatory response	Moderate
Galectin-3	Fibrosis and remodeling	Moderate
MicroRNA	Molecular diagnosis	Increasing
Semaphorins	Immune-inflammatory processes	Emerging

Table 3. Countries with the Highest Number of Publications

Rank	Country	Number of Publications
1	United States	624
2	China	418
3	Germany	236
4	United Kingdom	191
5	Italy	168
6	Japan	141
7	France	128
8	Canada	102

-Table 4. Most Commonly Used Keywords

Keyword	Frequency
High-sensitivity troponin	312
Acute coronary syndrome	286
Biomarkers	254
Inflammation	211
Prognosis	198
Cardiovascular disease	176
MicroRNA	119
Precision medicine	74

Table 5. Most Highly Cited Research Areas

Research Area	Main Focus
Troponin validation studies	Diagnostic sensitivity and specificity
Acute coronary syndrome guidelines	Clinical management
Inflammation studies	Pathophysiology
Prognostic biomarkers	Mortality and complication prediction
Molecular cardiology	Genetic and cellular biomarkers

Figure 1. Annual Publication Trend in AMI Biomarker Research (2015–2025)

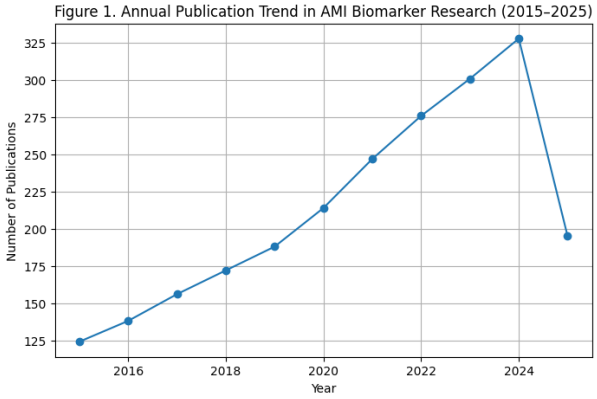
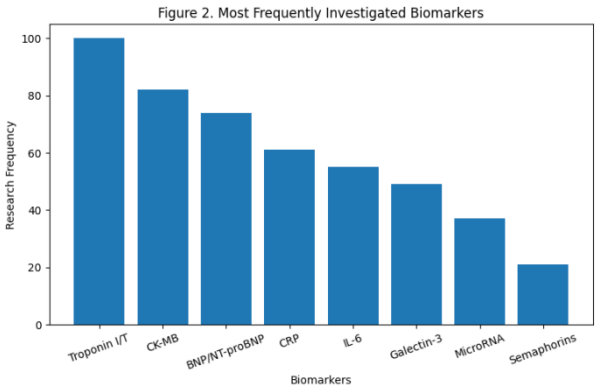


Figure 2. Most Frequently Investigated Biomarkers



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