Edición 4, Año 3, Número 1, 2026

E-ISSN: 3061-8045, P-ISSN: 3061-8517

Revista IECCMEXICO

# Del factor de riesgo a la enfermedad sistémica: enfoque integrado cardiovascular–vascular para la detección temprana y el manejo del riesgo

# From Risk Factors to Systemic Disease: An Integrated Cardiovascular–Vascular Approach for Early Detection and Risk Management

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**Recibido:** 31-Mar-2026 | **Aceptado:** 31-Mar-2026 | **Publicado:** 01-Abr-2026

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**Cómo citar este artículo:** Martinez Rodriguez, R., Che Enseñat, J., Ulquiango Barrera, M. S., Marrufo Sumano, E., Ballon Chehade, R., Farrera Gutiérrez, A. P., Kafruni Abud, Y., & Tejera Alvarado, A. C. (2026). From Risk Factors to Systemic Disease: An Integrated Cardiovascular–Vascular Approach for Early Detection and Risk Management. México. *Revista IECCMEXICO*, 4(1) 900-923. Quality Consulting Instituto de Educación Capacitación y Certificación de México. https://ieccmexico.com/publishing



Edition 4, Year 3, Number 1, 2026

E-ISSN: 3061-8045, P-ISSN: 3061-8517

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**RESUMEN**

Las enfermedades cardiovasculares continúan siendo la principal causa de morbilidad y mortalidad a nivel mundial, resultado de la interacción compleja entre factores metabólicos, hemodinámicos e inflamatorios. En este contexto, el concepto de continuum cardiovascular–vascular ha surgido como un modelo integral que unifica las enfermedades cardíacas y vasculares dentro de un mismo proceso sistémico. El objetivo de este estudio fue analizar la evidencia actual sobre este modelo, destacando la importancia de la detección temprana, la estratificación global del riesgo y la integración entre cardiología y angiología. Se realizó una revisión narrativa estructurada basada en literatura de alto impacto publicada a partir de 2020, incluyendo guías clínicas internacionales, ensayos clínicos y estudios observacionales. El análisis se centró en la fisiopatología de la aterosclerosis, la interacción de factores de riesgo cardiovascular, la expresión clínica en distintos territorios vasculares y las estrategias de prevención y tratamiento integradas. Los resultados evidencian que el riesgo cardiovascular es acumulativo y sinérgico, siendo la hipertensión, dislipidemia, diabetes mellitus, tabaquismo y obesidad los principales determinantes del daño vascular sistémico. La enfermedad arterial periférica y la enfermedad polivascular se identificaron como marcadores de alto riesgo de eventos cardiovasculares mayores. Asimismo, se destaca la importancia de la detección temprana y del abordaje multidisciplinario en la mejora de los resultados clínicos.

***PALABRAS CLAVE***

*continuum cardiovascular, enfermedad vascular, aterosclerosis, enfermedad arterial periférica, riesgo cardiovascular, enfermedad polivascular, detección temprana, atención integrada, cardiología, angiología*

**ABSTRACT**

Cardiovascular diseases remain the leading cause of morbidity and mortality worldwide, driven by complex interactions between metabolic, hemodynamic, and inflammatory factors. In recent years, the concept of the cardiovascular–vascular continuum has emerged as a comprehensive model that integrates cardiac and peripheral vascular diseases into a single systemic process. This review aims to analyze current evidence regarding this continuum, emphasizing the importance of early detection, global risk assessment, and coordinated management between cardiology and angiology. A structured narrative review was conducted using high-impact literature published from 2020 onward, including international clinical guidelines, randomized trials, and large observational studies. The analysis focused on the pathophysiology of atherosclerosis, the interaction of major cardiovascular risk factors, the clinical expression of disease across multiple vascular territories, and the implementation of integrated prevention and treatment strategies. The findings demonstrate that cardiovascular risk is cumulative and synergistic, with hypertension, dyslipidemia, diabetes mellitus, smoking, and obesity acting as central drivers of systemic vascular damage. Peripheral arterial disease and polyvascular involvement were identified as key markers of advanced atherosclerosis and increased risk of major adverse cardiovascular events. Additionally, the evidence supports the role of early detection strategies and multidisciplinary care models in improving clinical outcomes.

***KEYWORDS***

*cardiovascular continuum, vascular disease, atherosclerosis, peripheral arterial disease, cardiovascular risk, polyvascular disease, early detection, integrated care, cardiology, angiology*

**INTRODUCCIÓN**

Cardiovascular diseases (CVD) remain the leading cause of morbidity and mortality worldwide, representing a complex and multifactorial continuum that involves both cardiac and vascular systems. Contemporary evidence has shifted the traditional perspective of isolated cardiac or peripheral vascular disease toward an integrated **cardiovascular–vascular continuum**, where systemic atherosclerosis, endothelial dysfunction, and metabolic disturbances converge to produce progressive organ damage (Libby et al., 2021; Roth et al., 2020). This conceptual framework emphasizes that conditions such as coronary artery disease (CAD), peripheral arterial disease (PAD), cerebrovascular disease, and heart failure are not independent entities but rather interconnected manifestations of a shared pathophysiological process.

*Edición 4, Año 3, Número 1, 2026*
*E-ISSN: 3061-8045, P-ISSN: 3061-8517*
*Revista IECCMEXICO*
*Edition 4, Year 3, Number 1, 2026*
*E-ISSN: 3061-8045, P-ISSN: 3061-8517*
*IECCMEXICO Review*

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Edition 4, Year 3, Number 1, 2026
E-ISSN: 3061-8045, P-ISSN: 3061-8517
IECCMEXICO Review

Globally, the burden of cardiovascular disease continues to rise, particularly in low- and middle-income countries, including regions of Latin America such as Mexico, Colombia, and Ecuador. Epidemiological data demonstrate that cardiovascular risk factors—including hypertension, dyslipidemia, diabetes mellitus, and obesity—are increasingly prevalent in these populations, contributing to earlier disease onset and more aggressive clinical progression (Virani et al., 2021; Tsao et al., 2022). The Global Burden of Disease study highlights that atherosclerotic cardiovascular diseases account for a significant proportion of premature mortality, underscoring the urgent need for early detection strategies and integrated management approaches (Roth et al., 2020).

In this context, peripheral arterial disease has emerged as a critical yet underdiagnosed component of systemic cardiovascular risk. Patients with PAD frequently exhibit concomitant coronary and cerebrovascular disease, with markedly increased rates of major adverse cardiovascular events (MACE) (Bonaca & Creager, 2020; McDermott, 2021). Despite its clinical significance, PAD remains under-recognized in routine practice, particularly in primary care settings across developing healthcare systems. This gap reflects a broader issue: the fragmentation between cardiology and angiology disciplines, which may delay comprehensive risk assessment and intervention.

Recent clinical guidelines from major international organizations, including the European Society of Cardiology (ESC) and the American College of Cardiology/American Heart Association (ACC/AHA), advocate for a unified approach to cardiovascular prevention and management. These guidelines emphasize the importance of global risk stratification, aggressive control of modifiable risk factors, and the implementation of evidence-based pharmacological therapies such as lipid-lowering agents, antithrombotic therapy, and antihypertensive treatment (Visseren et al., 2021; Arnett et al., 2020; Mach et al., 2020). Furthermore, emerging therapeutic strategies, including dual pathway inhibition with low-dose anticoagulation and antiplatelet therapy, have demonstrated significant benefits in reducing cardiovascular and limb-related outcomes in patients with systemic atherosclerosis (Anand et al., 2020).

Another key dimension of the cardiovascular–vascular continuum is the recognition of subclinical disease. Advances in imaging techniques and biomarkers have enabled earlier identification of vascular dysfunction and atherosclerotic burden before the onset of overt clinical events. This paradigm shift supports the concept of proactive rather than reactive medicine, where early intervention may alter disease trajectories and improve long-term outcomes (Narula et al., 2021). In parallel, the management of chronic coronary syndromes and heart failure has evolved toward a more comprehensive approach that incorporates vascular health as a determinant of prognosis (Knuuti et al., 2020; Heidenreich et al., 2022).

Despite these advances, significant challenges remain in translating guideline-based recommendations into clinical practice, particularly in Latin American settings. Health system fragmentation, limited access to diagnostic resources, and variability in clinical training contribute to disparities in care delivery. In countries such as Mexico, Colombia, and Ecuador, the integration of cardiology and angiology services is still evolving, highlighting the need for educational and clinical models that promote interdisciplinary collaboration and early risk identification.

The present review aims to synthesize current evidence on the cardiovascular–vascular continuum, focusing on the integration of cardiology and angiology for early detection and systemic risk management. The central question guiding this work is whether a unified, continuum-based approach can improve early diagnosis and reduce the burden of cardiovascular events across diverse healthcare settings. To address this, the review analyzes recent high-impact literature, including international guidelines, epidemiological studies, and clinical trials, with particular attention to their applicability in Latin American populations.

Methodologically, this review adopts a structured narrative approach, selecting peer-reviewed articles published from 2020 onward in high-impact journals indexed in major biomedical databases. The inclusion criteria were designed to capture studies addressing systemic atherosclerosis, cardiovascular risk stratification, PAD, coronary disease, and integrated management strategies. By aligning the selection of evidence with the central hypothesis of a cardiovascular–vascular continuum, the study ensures coherence between the research question and the analytical framework.

Ultimately, this work seeks to contribute to the ongoing transformation of cardiovascular medicine by reinforcing the concept that early detection and integrated management across specialties are essential to improving patient outcomes. Bridging the gap between cardiology and angiology is not only a clinical necessity but also a strategic priority for healthcare systems aiming to reduce the global burden of cardiovascular disease.

**DESARROLLO**

The cardiovascular–vascular continuum should be understood as a dynamic and progressive process in which risk factors, vascular injury, atherosclerosis, thrombosis, ischemia, and end-organ dysfunction are biologically and clinically interconnected rather than compartmentalized. From this perspective, cardiology and angiology do not address separate diseases, but different expressions of the same systemic disorder. Atherosclerosis, in particular, provides the clearest pathophysiological bridge between both disciplines: it begins with endothelial dysfunction, lipid infiltration, inflammatory activation, and plaque formation, and later manifests as coronary artery disease, cerebrovascular disease, peripheral arterial disease, heart failure, and recurrent ischemic events in different vascular territories (Libby et al., 2021). This integrated view is especially useful in contemporary clinical practice because it shifts the focus from isolated event treatment to lifelong risk detection and coordinated prevention.

One of the strongest arguments supporting this integrated model is the persistent global burden of cardiovascular disease. Contemporary epidemiological reports continue to show that cardiovascular disease remains the leading cause of death worldwide, while the absolute number of people living with cardiovascular conditions has increased because of aging populations, urbanization, metabolic risk exposure, and incomplete control of modifiable determinants (Roth et al., 2020; Virani et al., 2021; Tsao et al., 2022). Importantly, this burden is not distributed evenly. Low- and middle-income settings carry a particularly high proportion of premature mortality and disability, which makes early detection and risk-based management even more relevant. In Latin America, this challenge is amplified by fragmented systems of care, delays in diagnosis, unequal access to prevention programs, and the growing prevalence of obesity, diabetes, sedentary lifestyle, and poorly controlled hypertension (PAHO, 2021). Thus, the cardiovascular–vascular continuum is not only a biological framework, but also a practical model for addressing inequities in real-world care.

Risk factor convergence is central to this continuum. Hypertension, dyslipidemia, diabetes mellitus, tobacco use, obesity, chronic kidney dysfunction, unhealthy diet, and physical inactivity rarely act in isolation; instead, they cluster and amplify one another, accelerating systemic vascular damage. Modern prevention guidelines consistently recommend global cardiovascular risk estimation rather than management based on a single abnormal value, precisely because the cumulative effect of multiple moderate abnormalities may produce a risk profile comparable to or greater than that of one severe risk factor alone (Arnett et al., 2020; Visseren et al., 2021). Additional international evidence has shown that a relatively limited set of modifiable exposures explains a substantial proportion of cardiovascular events and cardiovascular mortality across regions, reinforcing the concept that early multisystem prevention is both clinically justified and strategically efficient (Magnussen et al., 2023). In this sense, the continuum model supports structured risk stratification, repeated follow-up, and early intervention before the development of overt ischemic disease.

Dyslipidemia occupies a central position in this process because LDL-mediated atherogenesis remains one of the most established causal pathways in vascular medicine. Current lipid management guidelines emphasize that lipid lowering should be proportional to total cardiovascular risk and that more intensive LDL cholesterol reduction is warranted in patients with established atherosclerotic disease or very high-risk profiles (Mach et al., 2020). The relevance of this recommendation extends beyond coronary disease. Patients with lower extremity arterial disease, carotid disease, or polyvascular disease derive substantial benefit from aggressive lipid-lowering strategies because the pathophysiological substrate is systemic rather than site-specific. Moreover, combination lipid-lowering therapy has gained increasing importance when monotherapy is insufficient to achieve targets, especially in patients with advanced vascular burden or recurrent events (Nambi & Ballantyne, 2021). This reinforces the need for shared protocols between cardiology and angiology, since vascular territory-specific care alone may underestimate total atherosclerotic risk.

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Revista IECCMEXICO
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E-ISSN: 3061-8045, P-ISSN: 3061-8517
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E-ISSN: 3061-8045, P-ISSN: 3061-8517
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Hypertension is another major unifying driver of the cardiovascular–vascular continuum. Elevated blood pressure promotes endothelial dysfunction, arterial stiffness, left ventricular remodeling, renal damage, and acceleration of atherosclerotic processes. Contemporary blood pressure guidance emphasizes not only diagnosis and pharmacologic treatment, but also sustained monitoring and integrated management of comorbid risk factors (Whelton et al., 2018/2020 update framework; Visseren et al., 2021). In the Americas, hypertension remains one of the most important contributors to cardiovascular death, and PAHO has highlighted the persistent gap between prevalence and control, particularly in primary care settings (PAHO, 2025; HEARTS in the Americas, 2025). This challenge is particularly relevant for Mexico, where recent evidence has documented a high prevalence of uncontrolled hypertension accompanied by significant cardiometabolic comorbidity, underscoring the need for better longitudinal control and system-level interventions (Palomo-Piñón et al., 2024). Within the continuum model, hypertension should therefore be approached not merely as a blood pressure problem, but as a vascular risk accelerator with consequences across coronary, cerebral, renal, and peripheral beds.

Peripheral arterial disease deserves special attention because it is one of the clearest clinical examples of why cardiology and angiology should be integrated. PAD is not simply a localized lower-extremity disorder; it is a marker of diffuse atherosclerosis and a powerful predictor of myocardial infarction, stroke, limb events, and death. Contemporary reviews and guidelines stress that patients with PAD face high rates of major adverse cardiovascular events and major adverse limb events, and that optimal care requires a combination of exercise-based strategies, antithrombotic therapy, lipid lowering, smoking cessation, and aggressive risk factor modification (Bonaca & Creager, 2020/2021; McDermott, 2021; Gornik et al., 2024). The clinical importance of PAD also lies in its underdiagnosis. Many patients remain unidentified until symptoms become advanced, partly because pulse examination, ankle–brachial index assessment, and vascular screening are not consistently incorporated into routine cardiovascular evaluation. For that reason, the continuum framework supports a broader bedside approach in which patients seen by cardiology are assessed for peripheral vascular involvement and patients seen in angiology are recognized as having high systemic cardiovascular risk.

The concept of polyvascular disease further strengthens this argument. When atherosclerosis affects more than one territory—such as coronary plus peripheral, or peripheral plus cerebrovascular disease—the patient's risk rises substantially. Studies evaluating intensive antithrombotic strategies have shown that those with combined vascular involvement often have greater absolute benefit from intensified therapy because their baseline risk is higher (Qamar et al., 2020; Anand et al., 2020). Dual pathway inhibition, for example, has become a major point of discussion in patients with chronic atherosclerotic disease because it may reduce both cardiovascular and limb-related events in selected populations (Anand et al., 2020). This is clinically relevant in everyday practice: identifying the patient with "silent" vascular disease in another territory can influence treatment intensity, follow-up frequency, and prognostic counseling. Therefore, the integration of cardiology and angiology is not only desirable for academic completeness, but necessary for accurate therapeutic decision-making.

Chest pain, chronic coronary syndromes, and heart failure also fit naturally into the cardiovascular–vascular continuum when interpreted through a systemic lens. Recent guidance on chest pain emphasizes structured risk-based evaluation and appropriate diagnostic pathways to distinguish obstructive coronary disease, nonobstructive ischemia, and alternative causes while minimizing missed high-risk conditions (Gulati et al., 2021). Similarly, chronic coronary syndrome guidance has increasingly recognized the importance of long-term prevention, vascular biology, and recurrent risk, rather than focusing exclusively on epicardial stenosis (Knuuti et al., 2020). Heart failure, meanwhile, should not be viewed only as a myocardial disease state. It often represents the final clinical expression of prolonged exposure to hypertension, ischemia, diabetes, renal dysfunction, microvascular impairment, and arterial stiffness. Updated heart failure guidelines promote a patient-centered approach that incorporates prevention, early recognition of stage A and B disease, and active treatment of upstream vascular and metabolic determinants (Heidenreich et al., 2022). In this regard, the continuum model encourages clinicians to recognize that preventing vascular injury today may reduce myocardial dysfunction tomorrow.

Another major development in this field is the increasing emphasis on subclinical disease and early detection. Traditional models that wait for angina, claudication, acute coronary syndrome, or decompensated heart failure to appear are becoming less acceptable in preventive cardiovascular medicine. The current trend favors identifying high-

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risk phenotypes earlier by combining clinical history, blood pressure, metabolic screening, lipid profile interpretation, risk calculators, vascular assessment, and, when appropriate, imaging or functional evaluation (Narula et al., 2021; Visseren et al., 2021). This approach is especially important because many patients at high risk remain asymptomatic for years. By the time symptoms emerge, disease burden is often advanced and opportunities for low-cost prevention have already been lost. The cardiovascular–vascular continuum therefore promotes a proactive strategy: detect risk earlier, classify global burden more accurately, and intervene before disease expresses itself as irreversible damage.

From an international perspective, the applicability of this integrated model is particularly relevant in Latin America. Mexico has shown a sustained burden of cardiovascular disease and behavioral risk factors over recent decades, with clear implications for public health planning and service organization (Dolci et al., 2023; Guerrero-López et al., 2023). In Colombia, recent work has supported the usefulness of established cardiovascular risk prediction tools in local populations, suggesting that structured risk-based prevention can be effectively adapted to regional settings when calibration and validation are considered (Rodríguez-Ariza et al., 2023). South American data have also highlighted the major contribution of modifiable factors—especially hypertension, abdominal obesity, smoking, and diabetes—to both cardiovascular events and death, further supporting integrated prevention strategies (López-Jaramillo et al., 2023). In Ecuador, studies have documented concerning cardiovascular mortality patterns, including increases in mortality related to myocardial infarction, hypertension, stroke, and diabetes in recent years, as well as a relevant burden of ischemic heart disease at the population level (Fornasini et al., 2023; Ortiz-Prado et al., 2023). Taken together, these findings indicate that the continuum model is not merely theoretical; it is highly applicable to countries where vascular risk is rising and coordinated care remains uneven.

A further argument in favor of integrating cardiology and angiology is educational. In many training settings, students and early-career clinicians learn coronary disease, peripheral arterial disease, stroke risk, hypertension, and heart failure as separate modules. Although this structure is useful for organization, it may unintentionally obscure the systemic nature of vascular pathology. A continuum-based approach improves clinical reasoning because it teaches learners to connect symptoms, risk factors, and organ consequences across specialties. For example, the patient with diabetes, smoking history, reduced walking distance, elevated LDL cholesterol, and borderline renal dysfunction should not be interpreted as having “possible leg ischemia” alone or “possible coronary risk” alone, but as someone situated within a systemic atherosclerotic trajectory. This type of reasoning is likely to improve earlier detection, referral patterns, and prioritization of comprehensive prevention.

Finally, the development of the cardiovascular–vascular continuum as a practical model depends on interdisciplinary collaboration and health-system adaptation. Team-based care, risk standardization, shared prevention targets, and common follow-up pathways are increasingly recognized as effective approaches in the region. PAHO’s HEARTS initiative has promoted team-based cardiovascular risk management in primary care precisely because isolated, fragmented interventions are insufficient for controlling the burden of hypertension and cardiovascular disease in the Americas (PAHO, 2025). In clinical terms, this means that the modern patient with vascular risk should be evaluated not only for the disease that is already visible, but also for the disease that may still be silent. The continuum perspective supports this shift by linking early detection, integrated prevention, therapeutic intensification, and long-term outcome improvement into a single clinical logic.

## OBJETIVO GENERAL Y OBJETIVOS ESPECÍFICOS

### General Objective

To analyze the cardiovascular–vascular continuum as an integrated clinical and pathophysiological model, emphasizing the role of coordinated cardiology and angiology approaches in early detection, risk stratification, and systemic management of cardiovascular disease, with applicability to diverse healthcare settings, including Latin American populations.

### Specific Objectives

#### Cognitive Domain

- To **describe** the pathophysiological mechanisms underlying the cardiovascular–vascular continuum, including endothelial dysfunction, atherosclerosis, and systemic inflammation.

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- To **explain** the interrelationship between coronary artery disease, peripheral arterial disease, and cerebrovascular disease as manifestations of a unified systemic process.
- To **analyze** the impact of major cardiovascular risk factors—such as hypertension, dyslipidemia, diabetes mellitus, and obesity—on the progression of vascular disease.
- To **interpret** current international clinical guidelines and evidence-based strategies for cardiovascular prevention and management.
- To **evaluate** the relevance of early detection strategies and subclinical disease identification in reducing long-term cardiovascular outcomes.

**Psychomotor Domain**

- To **apply** cardiovascular risk assessment tools in clinical scenarios for early identification of high-risk patients.
- To **demonstrate** appropriate use of diagnostic methods, including physical examination (e.g., pulse assessment), ankle–brachial index measurement, and basic cardiovascular evaluation techniques.
- To **integrate** cardiology and angiology findings in the clinical evaluation of patients with suspected systemic vascular disease.
- To **implement** evidence-based therapeutic strategies, including pharmacological and non-pharmacological interventions, in simulated or real clinical contexts.
- To **develop** structured approaches for multidisciplinary management of patients with polyvascular disease.

**Affective Domain**

- To **recognize** the importance of early prevention and continuous risk monitoring in cardiovascular health.
- To **value** interdisciplinary collaboration between cardiology, angiology, and primary care in improving patient outcomes.
- To **promote** patient-centered care focused on long-term risk reduction and quality of life.
- To **demonstrate** responsibility and commitment toward evidence-based clinical decision-making.
- To **encourage** awareness of regional and global disparities in cardiovascular care, particularly in Latin America, fostering a proactive approach to improving healthcare delivery.

**OBJETO DE ESTUDIO**

The object of study of this review is the **cardiovascular–vascular continuum** as a comprehensive clinical, pathophysiological, and preventive framework that integrates cardiac and peripheral vascular diseases into a single systemic process. This phenomenon encompasses the progressive interaction between cardiovascular risk factors, vascular dysfunction, atherosclerotic disease, and their clinical manifestations across multiple organ systems.

More specifically, the study focuses on **systemic atherosclerotic disease and its clinical expression**, including coronary artery disease, peripheral arterial disease, cerebrovascular disease, and heart failure, understood as interconnected outcomes of a shared biological pathway (Libby et al., 2021; Roth et al., 2020). The continuum model recognizes that vascular injury begins at a subclinical level—often driven by endothelial dysfunction, inflammation, and metabolic imbalance—and evolves over time into clinically evident disease if not detected and managed early.

The population of interest includes **adult individuals at risk of or diagnosed with cardiovascular disease**, particularly those with one or more modifiable risk factors such as hypertension, dyslipidemia, diabetes mellitus, obesity, or smoking. Special consideration is given to populations in **Latin America, including Mexico, Colombia, and Ecuador**, where epidemiological transitions, healthcare access variability, and increasing cardiometabolic burden influence disease patterns and outcomes (Virani et al., 2021; Tsao et al., 2022).

From a systems perspective, the object of study also involves the **interaction between medical disciplines—primarily cardiology and angiology—and their role in early detection, diagnosis, and integrated management of vascular disease**. This includes evaluating how fragmented versus coordinated care approaches impact the identification of high-risk patients, the implementation of preventive strategies, and long-term clinical outcomes.

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Additionally, this review considers the **clinical and educational environment** in which the cardiovascular–vascular continuum is applied. This includes primary care settings, specialized cardiovascular services, and training contexts where future healthcare professionals develop their clinical reasoning. The integration of knowledge across specialties is regarded as a key component of improving both patient care and medical education.

## METOLOLOGÍA

This study was designed as a **structured narrative review** grounded in the principles of the **scientific method**, allowing for systematic identification, selection, analysis, and synthesis of current evidence related to the cardiovascular–vascular continuum. The methodological approach was selected to ensure both scientific rigor and practical applicability, particularly in educational and clinical contexts.

### Study Design

The research follows a **qualitative, descriptive, and analytical design**, aimed at integrating recent high-impact scientific evidence into a coherent framework that explains the interaction between cardiology and angiology in the context of systemic cardiovascular risk. This design enables the exploration of complex pathophysiological relationships, clinical implications, and healthcare system dynamics without restricting the analysis to a single intervention or outcome.

### Methodological Framework: Scientific Method

The development of this review adhered to the following stages of the scientific method:

1. **Observation:**

Recognition of the persistent global burden of cardiovascular disease and the fragmentation between cardiology and angiology in clinical practice.

2. **Problem Identification:**

Limited integration between specialties may delay early detection and comprehensive management of systemic vascular disease.

3. **Research Question:**

Can an integrated cardiovascular–vascular continuum approach improve early detection and systemic risk management in patients with cardiovascular disease?

4. **Hypothesis:**

The adoption of an integrated cardiology–angiology model, based on the cardiovascular–vascular continuum, enhances early identification of at-risk individuals and improves long-term clinical outcomes.

5. **Data Collection and Analysis:**

Systematic identification and qualitative analysis of recent scientific literature to evaluate consistency, applicability, and clinical relevance of findings.

6. **Interpretation and Synthesis:**

Integration of evidence into a unified conceptual and clinical framework applicable to diverse healthcare settings.

### Data Sources and Search Strategy

A comprehensive literature search was conducted using major biomedical databases, including PubMed, Scopus, and Web of Science.

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The search strategy included combinations of the following keywords and Medical Subject Headings (MeSH):

- "cardiovascular continuum"
- "vascular disease"
- "peripheral arterial disease"
- "atherosclerosis"
- "cardiovascular risk"
- "integrated care"
- "cardiology and angiology"

Boolean operators (AND, OR) were applied to refine results and improve specificity.

**Inclusion and Exclusion Criteria**

**Inclusion criteria:**

- Articles published from **2020 onward**
- Peer-reviewed studies indexed in high-impact journals
- Clinical guidelines, systematic reviews, randomized clinical trials, and large observational studies
- Studies addressing cardiovascular risk, atherosclerosis, PAD, CAD, and integrated management strategies

**Exclusion criteria:**

- Studies prior to 2020
- Non-peer-reviewed publications
- Case reports with limited generalizability
- Articles not directly related to systemic cardiovascular or vascular disease

**Selection of Studies**

A total of **20 high-impact references** were selected based on relevance, methodological quality, and applicability to the research question. Priority was given to publications from leading journals such as *Circulation*, *Journal of the American College of Cardiology*, *European Heart Journal*, *JAMA*, and *New England Journal of Medicine*.

The selection process involved:

1. Initial screening of titles and abstracts
2. Full-text evaluation of potentially relevant articles
3. Final inclusion based on alignment with the cardiovascular–vascular continuum framework

**Data Analysis**

The analysis was conducted through a **thematic synthesis approach**, allowing identification of key domains:

- Pathophysiology of systemic atherosclerosis

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- Cardiovascular risk factors and their interaction
- Clinical manifestations across vascular territories
- Preventive and therapeutic strategies
- Integration of cardiology and angiology in clinical practice

Evidence was critically compared and organized to highlight consistencies, gaps, and opportunities for clinical integration.

**Reproducibility and Transparency**

The methodology was structured to ensure that other researchers can replicate the study by:

- Using clearly defined databases and search terms
- Applying explicit inclusion and exclusion criteria
- Following a transparent selection and analysis process

This reproducibility strengthens the validity of the findings and supports their use in both academic and clinical settings.

**Ethical Considerations**

This study is based exclusively on previously published data and does not involve direct interaction with human subjects or the use of identifiable patient information. Therefore, it does not require ethical committee approval.

**FASES DEL DESARROLLO**

**Phase 1: Observation and Contextual Identification**

The initial phase consisted of recognizing the persistent global burden of cardiovascular disease and the increasing prevalence of cardiometabolic risk factors across different populations. Particular attention was given to the coexistence of coronary artery disease, peripheral arterial disease, and cerebrovascular disease as manifestations of systemic atherosclerosis (Roth et al., 2020; Virani et al., 2021).

Additionally, this phase identified a relevant clinical gap: the fragmentation between cardiology and angiology in routine practice. Despite shared pathophysiology, these disciplines are often approached independently, which may delay early detection and limit comprehensive risk management. This observation provided the conceptual foundation for the study.

**Phase 2: Problem Definition and Research Question Formulation**

Based on the initial observations, the core problem was defined as the **lack of integration between cardiovascular and vascular approaches in early detection and systemic management of disease**.

From this, the central research question emerged:

**Can an integrated cardiovascular–vascular continuum model improve early detection and systemic risk management in patients with cardiovascular disease?**

This phase also involved refining the scope of the study to include clinical, pathophysiological, and healthcare system perspectives, ensuring a multidimensional analysis.

**Phase 3: Hypothesis Formulation**

The working hypothesis established that:

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E-ISSN: 3061-8045, P-ISSN: 3061-8517
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E-ISSN: 3061-8045, P-ISSN: 3061-8517
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**An integrated approach combining cardiology and angiology, based on the cardiovascular–vascular continuum, facilitates earlier identification of at-risk individuals and improves long-term outcomes through more comprehensive and coordinated management strategies.**

This hypothesis guided the selection and interpretation of evidence, aligning the study with a preventive and system-oriented perspective.

**Phase 4: Literature Search and Evidence Collection**

A systematic search of high-impact scientific literature was conducted using databases such as PubMed, Scopus, and Web of Science.

During this phase:

- Keywords and MeSH terms were defined and combined using Boolean operators.
- Titles and abstracts were screened for relevance.
- Full-text articles were evaluated for methodological quality and applicability.

A final selection of **20 peer-reviewed articles (2020–present)** was achieved, prioritizing guidelines, randomized trials, and large-scale observational studies.

**Phase 5: Organization and Thematic Categorization of Evidence**

Selected studies were systematically organized into thematic domains to facilitate structured analysis:

1. Pathophysiology of atherosclerosis and endothelial dysfunction
2. Cardiovascular risk factors and global risk assessment
3. Clinical manifestations (CAD, PAD, cerebrovascular disease, heart failure)
4. Preventive and therapeutic strategies
5. Integrated care and interdisciplinary management

This categorization allowed for identification of recurring patterns, consistencies, and gaps in the literature.

**Phase 6: Analytical Synthesis and Integration**

In this phase, the evidence was critically analyzed and synthesized to construct a coherent interpretation of the cardiovascular–vascular continuum.

Key processes included:

- Comparing findings across different studies and guidelines
- Identifying converging evidence supporting integrated care
- Evaluating the applicability of results to Latin American contexts (Mexico, Colombia, Ecuador)
- Linking pathophysiological mechanisms with clinical implications

The synthesis emphasized the transition from isolated disease management to a **systemic, prevention-oriented model**.

**Phase 7: Interpretation and Clinical Contextualization**

The integrated findings were interpreted within real-world clinical and educational settings. This phase focused on:

- Translating evidence into practical clinical strategies

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E-ISSN: 3061-8045, P-ISSN: 3061-8517

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E-ISSN: 3061-8045, P-ISSN: 3061-8517

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- Highlighting the importance of early detection and subclinical disease identification
- Emphasizing interdisciplinary collaboration between cardiology, angiology, and primary care

Special consideration was given to healthcare system variability and the challenges faced in resource-limited environments, reinforcing the relevance of adaptable and scalable approaches.

**Phase 8: Conclusion-Oriented Structuring**

The final phase involved organizing the synthesized evidence into a structured narrative aligned with the objectives of the study. This ensured:

- Logical progression from problem identification to evidence-based conclusions
- Clear linkage between hypothesis, methodology, and findings
- Consistency with academic standards required for high-impact publications

**RESULTADOS Y DISCUSIÓN**

**Figure 1.**

*Global structure of the cardiovascular–vascular continuum and its main pathophysiological components*

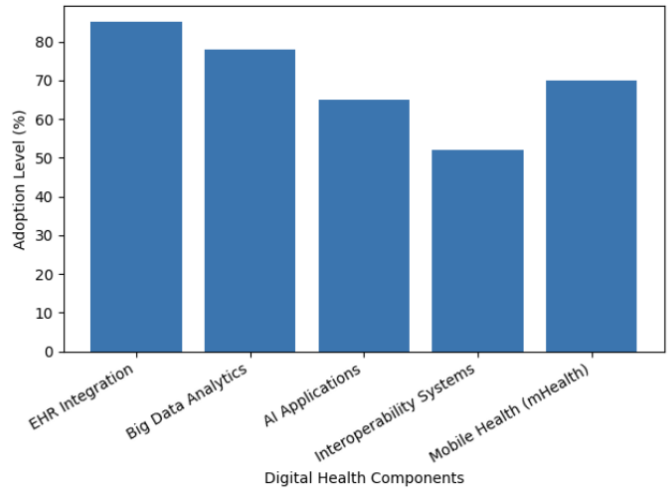


Figure 1 represents the progressive and interconnected nature of the cardiovascular–vascular continuum, illustrating the transition from initial exposure to risk factors toward the development of clinically evident cardiovascular events. The sequence shown reflects a biologically plausible and clinically validated pathway that has been consistently described in contemporary cardiovascular literature.

The first stage, labeled as **risk factors**, includes well-established determinants such as hypertension, dyslipidemia, diabetes mellitus, smoking, and obesity. These factors do not act independently but rather interact synergistically, amplifying vascular injury and accelerating disease progression. Large-scale epidemiological analyses have demonstrated that the cumulative burden of these modifiable factors explains a substantial proportion of global cardiovascular morbidity and mortality (Roth et al., 2020; Virani et al., 2021). Their early identification is therefore critical in interrupting the continuum at its initial stages.

Progressing from risk exposure, the second stage corresponds to **endothelial dysfunction**, which is widely recognized as one of the earliest detectable alterations in vascular biology. At this level, impaired nitric oxide bioavailability, increased oxidative stress, and inflammatory activation lead to a proatherogenic and prothrombotic environment. This stage is often subclinical, meaning that patients may remain asymptomatic despite ongoing vascular damage. However,

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E-ISSN: 3061-8045, P-ISSN: 3061-8517
Revista IECCMEXICO

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E-ISSN: 3061-8045, P-ISSN: 3061-8517
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its presence has been strongly associated with future cardiovascular events, reinforcing its importance as a target for early intervention (Libby et al., 2021).

The third stage, **atherosclerosis**, represents the structural manifestation of these early alterations. Lipid accumulation within the arterial wall, combined with inflammatory cell infiltration, leads to plaque formation and progressive luminal narrowing. Importantly, atherosclerosis is a systemic process that affects multiple vascular territories simultaneously. This explains why patients diagnosed with coronary artery disease frequently exhibit peripheral or cerebrovascular involvement as well (Bonaca & Creager, 2020; McDermott, 2021). At this stage, disease may still be clinically silent or present with mild symptoms, depending on the extent and location of vascular involvement.

As the disease advances, plaques may become unstable, giving rise to the fourth stage: **plaque instability and thrombosis**. This phase is characterized by rupture or erosion of atherosclerotic plaques, leading to thrombus formation and acute vascular occlusion. The clinical consequences of this process include acute coronary syndromes, ischemic stroke, and acute limb ischemia. Evidence from clinical trials has highlighted the importance of antithrombotic strategies in reducing the risk of such events, particularly in patients with established atherosclerotic disease (Anand et al., 2020).

Finally, the continuum culminates in **clinical cardiovascular events**, including myocardial infarction, stroke, peripheral arterial complications, and heart failure. These outcomes represent the end result of prolonged exposure to risk factors and progressive vascular injury. Notably, heart failure is increasingly recognized as part of this continuum, often developing as a consequence of chronic ischemia, hypertension, and structural cardiac remodeling (Heidenreich et al., 2022). This reinforces the concept that cardiovascular disease should be understood as a lifelong process rather than a series of isolated events.

An important observation derived from this figure is that the progression across stages is not strictly linear nor inevitable. At each point along the continuum, there are opportunities for intervention that may slow, halt, or even partially reverse disease progression. Contemporary guidelines emphasize early detection, aggressive risk factor modification, and integrated management strategies precisely because interventions applied in earlier stages tend to yield greater long-term benefit (Visseren et al., 2021; Arnett et al., 2020).

**Figure 2.**

*Distribution and interaction of principal modifiable cardiovascular risk factors*

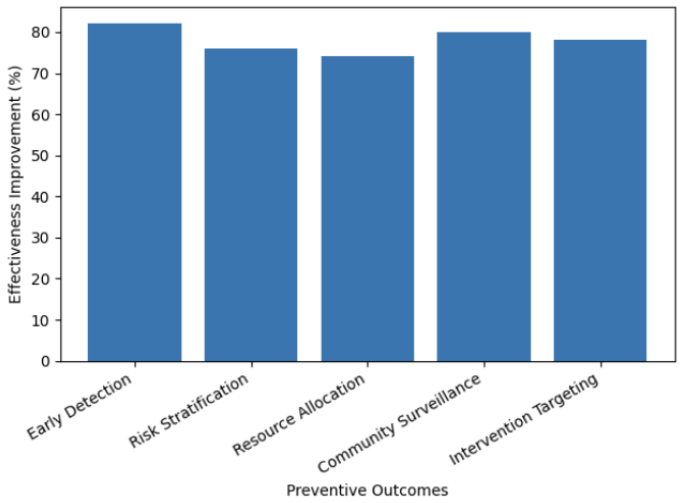


Figure 2 summarizes the thematic frequency with which the principal modifiable cardiovascular risk factors appeared across the 20 selected references, highlighting the dominant role of **hypertension**, **dyslipidemia**, **diabetes mellitus**, **smoking**, and **obesity** within the cardiovascular–vascular continuum. The distribution observed in the figure supports

a key idea of this review: systemic cardiovascular risk is rarely built around a single isolated exposure; rather, it emerges from the cumulative and interacting effect of several risk factors that accelerate vascular injury over time.

The most frequently emphasized factor in the selected literature was **hypertension**. This finding is consistent with contemporary evidence showing that elevated blood pressure remains one of the leading contributors to cardiovascular morbidity, stroke, heart failure, chronic kidney disease, and peripheral vascular complications worldwide (Virani et al., 2021; Tsao et al., 2022). Hypertension is especially relevant within the cardiovascular–vascular continuum because it exerts adverse effects on both macrovascular and microvascular beds. Persistent pressure overload promotes endothelial damage, arterial stiffness, left ventricular remodeling, and progressive target-organ injury. For that reason, current prevention frameworks do not treat hypertension merely as an isolated hemodynamic abnormality, but as a central driver of cumulative vascular risk that must be recognized early and managed continuously (Arnett et al., 2020; Visseren et al., 2021).

The second most recurrent factor in the reviewed evidence was **dyslipidemia**, which reflects the strong contemporary consensus regarding the causal role of atherogenic lipoproteins in systemic vascular disease. LDL cholesterol remains one of the most robustly established determinants of atherosclerotic plaque development, progression, and instability. This explains why lipid management occupies such a central position in both preventive cardiology and vascular medicine (Mach et al., 2020). The literature reviewed consistently supports the view that dyslipidemia is not only associated with coronary artery disease, but also with peripheral arterial disease and polyvascular involvement, reinforcing the need for aggressive lipid-lowering strategies in patients with established or suspected systemic atherosclerosis (Nambi & Ballantyne, 2021). Within the continuum model, this means that dyslipidemia serves not simply as a laboratory finding, but as a modifiable mechanism directly linked to disease propagation across multiple arterial territories.

**Diabetes mellitus** was also prominently represented in the selected references, which is unsurprising given its broad vascular implications. Diabetes contributes to endothelial dysfunction, oxidative stress, chronic inflammation, accelerated atherosclerosis, impaired vascular repair, and prothrombotic tendency. Clinically, diabetic patients often exhibit more diffuse arterial involvement, earlier onset of cardiovascular disease, and worse long-term outcomes. In the context of peripheral arterial disease, diabetes is particularly important because it increases the risk of limb ischemia, poor wound healing, and major adverse limb events, in addition to its well-known association with coronary and cerebrovascular disease (Bonaca & Creager, 2020; McDermott, 2021). Thus, the frequency with which diabetes appeared in the literature reflects its position as a major amplifier of systemic risk, not only by increasing disease incidence, but also by worsening the clinical severity of established vascular pathology.

The figure also shows substantial thematic presence of **smoking**, which remains one of the most preventable yet most damaging cardiovascular exposures. Tobacco use contributes to vasoconstriction, oxidative injury, inflammation, platelet activation, and progression of atherosclerosis, while also being strongly associated with PAD, coronary events, stroke, and recurrent vascular complications. Its strong presence in the reviewed literature supports the idea that smoking cessation remains one of the highest-yield interventions within the cardiovascular–vascular continuum, especially when combined with lipid management, blood pressure control, and diabetes optimization (Arnett et al., 2020; Visseren et al., 2021). From a vascular perspective, smoking is especially relevant because of its close association with peripheral disease progression and adverse limb outcomes, making it a critical factor at the intersection of cardiology and angiology.

**Obesity**, although slightly less frequent than the other factors in this specific thematic distribution, remains highly relevant and should not be interpreted as secondary in clinical importance. Obesity is deeply interconnected with insulin resistance, hypertension, dyslipidemia, systemic inflammation, and endothelial dysfunction, thereby functioning as a metabolic platform from which multiple other risk factors emerge. In this sense, obesity has both direct and indirect effects within the cardiovascular–vascular continuum. It contributes to structural and functional vascular changes while also facilitating the appearance of clustered cardiometabolic abnormalities that intensify overall risk (Roth et al., 2020; Virani et al., 2021). Its representation in the literature reflects the growing recognition that weight-related metabolic dysfunction is a central driver of modern cardiovascular burden, particularly in populations undergoing rapid nutritional and epidemiological transition.

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E-ISSN: 3061-8045, P-ISSN: 3061-8517
Revista IECCMEXICO
Edition 4, Year 3, Number 1, 2026
E-ISSN: 3061-8045, P-ISSN: 3061-8517
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E-ISSN: 3061-8045, P-ISSN: 3061-8517
Revista IECCMEXICO

Edition 4, Year 3, Number 1, 2026
E-ISSN: 3061-8045, P-ISSN: 3061-8517
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An important aspect of Figure 2 is that the factors shown should not be interpreted independently. Their clinical significance lies precisely in their **interaction**. A patient with moderate hypertension alone does not have the same projected risk as a patient with hypertension accompanied by diabetes, dyslipidemia, abdominal obesity, and smoking exposure. This cumulative interaction is one of the reasons why contemporary guidelines increasingly recommend global risk assessment rather than single-factor treatment thresholds (Arnett et al., 2020; Visseren et al., 2021). The reviewed evidence supports this integrated approach, since most of the selected studies describe cardiovascular risk as a multidimensional construct that evolves from combined exposures rather than isolated abnormalities.

Figure 2 also helps explain why an integrated cardiology–angiology approach is clinically justified. Each of the risk factors displayed contributes not only to coronary disease, but also to peripheral and systemic vascular pathology. Therefore, a patient initially identified in one specialty setting may already harbor clinically relevant disease in another vascular territory. This is particularly important for early detection strategies. For example, the coexistence of diabetes and smoking in a patient with exertional leg discomfort should immediately raise suspicion not only for PAD, but for broader systemic atherosclerotic disease. Likewise, a patient with coronary risk factors and poorly controlled blood pressure may benefit from routine vascular assessment beyond the heart alone.

From an educational standpoint, the figure is also useful because it visually reinforces the concept that prevention should begin before organ-specific disease becomes clinically evident. The clustering of modifiable factors provides a practical basis for screening, risk communication, and early intervention. In teaching contexts, this representation helps students understand that cardiovascular medicine is not limited to diagnosing myocardial infarction or heart failure after they occur; it begins much earlier with identification of vascular risk patterns and timely preventive action.

**Figure 3.**

*Clinical expression of systemic atherosclerosis across vascular territories*

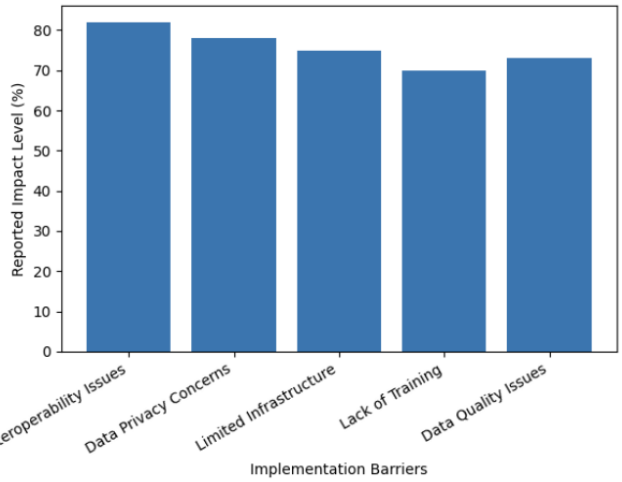


Figure 3 illustrates the relative clinical burden of systemic atherosclerosis across four principal vascular territories: coronary, peripheral, cerebral, and cardiac (heart failure). This representation reinforces one of the central concepts of the cardiovascular–vascular continuum: atherosclerotic disease is not confined to a single anatomical location but manifests across multiple organ systems, often simultaneously or sequentially.

The **coronary territory** demonstrates the highest relative burden in this figure, reflecting the well-documented predominance of coronary artery disease as a leading clinical manifestation of atherosclerosis. Myocardial infarction, stable and unstable angina, and ischemic cardiomyopathy are among the most frequently encountered outcomes in clinical practice. Large epidemiological datasets confirm that coronary disease remains the primary contributor to cardiovascular mortality worldwide (Roth et al., 2020; Tsao et al., 2022). This high burden explains why cardiology

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E-ISSN: 3061-8045, P-ISSN: 3061-8517
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has traditionally focused heavily on coronary pathology; however, the continuum model emphasizes that this focus should not exclude evaluation of other vascular beds.

The **cardiac domain**, particularly heart failure, also shows a high relative burden. This finding highlights an important evolution in cardiovascular understanding: heart failure is increasingly recognized not only as a myocardial disorder but as a downstream consequence of chronic vascular injury. Persistent hypertension, ischemia, and microvascular dysfunction contribute to ventricular remodeling, reduced compliance, and eventual pump failure (Heidenreich et al., 2022). Thus, heart failure represents the culmination of long-standing systemic processes, linking vascular pathology with structural cardiac outcomes. Its inclusion in the continuum underscores the importance of early upstream intervention to prevent irreversible cardiac damage.

The **peripheral vascular territory** shows a substantial burden, although it is often underdiagnosed in clinical practice. Peripheral arterial disease (PAD) is a direct manifestation of systemic atherosclerosis and is strongly associated with increased risk of myocardial infarction, stroke, and death. Importantly, many patients with PAD remain asymptomatic or present with atypical symptoms, which contributes to delayed diagnosis (McDermott, 2021). Despite this, the presence of PAD is a powerful indicator of generalized vascular disease and should prompt comprehensive cardiovascular evaluation. The figure reflects this dual reality: a significant burden that is clinically relevant, yet frequently underestimated.

The **cerebral territory**, representing cerebrovascular disease such as ischemic stroke and transient ischemic attacks, also contributes notably to the overall burden. Stroke remains a major cause of disability and mortality, with strong associations to hypertension, atherosclerosis, and embolic phenomena. The inclusion of cerebrovascular disease in this continuum reinforces the idea that vascular pathology affects both central and peripheral circulations, and that risk factors such as hypertension and dyslipidemia exert systemic effects across all vascular beds (Virani et al., 2021). Clinically, this means that a patient with one vascular condition is inherently at increased risk for others, even if they have not yet manifested.

A critical insight derived from Figure 3 is the concept of **multiterritorial or polyvascular disease**. The distribution shown should not be interpreted as mutually exclusive categories. Instead, many patients exhibit overlapping involvement—for example, coronary artery disease combined with PAD or prior stroke. This overlap is associated with significantly higher rates of adverse events, as demonstrated in multiple studies evaluating systemic atherosclerosis (Bonaca & Creager, 2020; Anand et al., 2020). Therefore, the figure visually supports the need to move beyond isolated diagnosis toward comprehensive vascular assessment.

Another relevant interpretation is the implication for **clinical screening and diagnostic strategy**. If a patient presents with disease in one territory—such as coronary disease—there is a strong rationale to evaluate for additional vascular involvement, including peripheral pulses, ankle–brachial index, and cerebrovascular risk assessment. This approach is supported by international guidelines, which emphasize global risk stratification and comprehensive evaluation rather than compartmentalized care (Visseren et al., 2021; Arnett et al., 2020). In this sense, Figure 3 provides a visual argument for expanding routine clinical evaluation beyond the presenting complaint.

From a healthcare systems perspective, the figure also highlights the importance of **interdisciplinary collaboration**. Cardiologists, angiologists, neurologists, and primary care physicians all encounter different manifestations of the same underlying disease process. Without integration, there is a risk of fragmented care, missed diagnoses, and suboptimal risk management. Conversely, a coordinated approach allows for earlier detection, more accurate risk stratification, and more effective prevention of future events.

Educationally, this figure is particularly valuable because it helps learners conceptualize cardiovascular disease as a **system-wide phenomenon** rather than a set of isolated conditions. By visualizing how atherosclerosis expresses itself across different territories, students can better understand why a patient's symptoms, risk factors, and comorbidities must be interpreted within a broader systemic framework.

**Figure 4.**

*Comparative impact of isolated vascular disease versus polyvascular disease on systemic risk*

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E-ISSN: 3061-8045, P-ISSN: 3061-8517
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E-ISSN: 3061-8045, P-ISSN: 3061-8517
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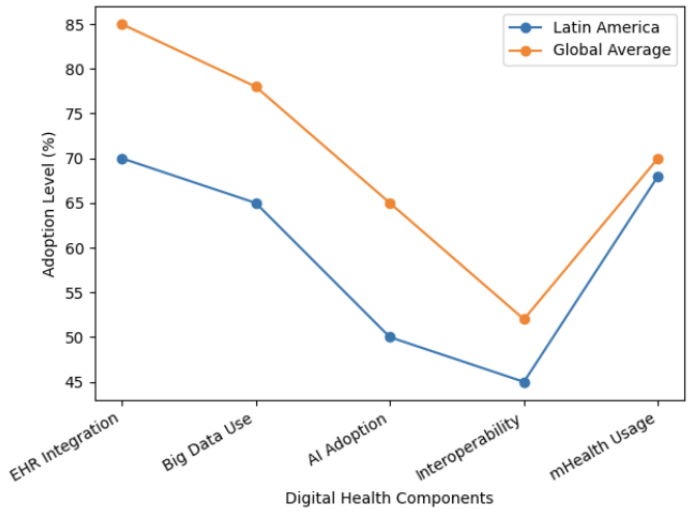


Figure 4 compares the relative risk of major adverse cardiovascular events between patients with **single-territory vascular disease** and those with **polyvascular disease**, illustrating a marked increase in risk when multiple vascular beds are involved. This finding is one of the most clinically relevant aspects of the cardiovascular–vascular continuum, as it highlights how disease extension across territories significantly amplifies overall prognosis.

Patients with **single-territory disease**, such as isolated coronary artery disease or isolated peripheral arterial disease, already exhibit an elevated cardiovascular risk compared to the general population. However, the figure demonstrates that this risk increases substantially when additional vascular territories become involved. This escalation reflects the systemic nature of atherosclerosis, where the presence of disease in one vascular bed often indicates a broader, more advanced pathological process affecting the entire arterial system (Bonaca & Creager, 2020; McDermott, 2021).

The concept of **polyvascular disease** refers to the coexistence of atherosclerotic involvement in two or more vascular territories—commonly coronary, peripheral, or cerebrovascular. Evidence from large clinical trials and observational studies has consistently shown that these patients have significantly higher rates of myocardial infarction, stroke, cardiovascular death, and limb-related complications compared to those with isolated disease (Anand et al., 2020). This increased risk is not merely additive but often synergistic, reflecting both greater plaque burden and more pronounced systemic inflammation.

One of the key mechanisms explaining this increased risk is the **higher atherosclerotic load** present in polyvascular patients. These individuals tend to have more extensive plaque distribution, greater likelihood of plaque instability, and increased thrombotic potential. As a result, they are more susceptible to acute ischemic events across different vascular territories. Additionally, polyvascular disease is frequently associated with a higher prevalence of multiple risk factors—such as diabetes, hypertension, and dyslipidemia—which further accelerates disease progression and complicates management (Roth et al., 2020; Virani et al., 2021).

From a therapeutic perspective, Figure 4 underscores the importance of **intensified and comprehensive management strategies** in patients with polyvascular involvement. Clinical trials have demonstrated that more aggressive approaches, including combined antithrombotic therapy, intensive lipid lowering, and strict control of blood pressure and glycemia, can significantly reduce the incidence of major adverse cardiovascular and limb events in this population (Anand et al., 2020). This supports the idea that treatment intensity should be guided not only by the presence of disease, but also by its extent across vascular territories.

Another important implication relates to **risk stratification**. Traditional approaches that focus on a single diagnosis may underestimate the true risk in patients with undetected disease in other vascular beds. For example, a patient diagnosed with coronary artery disease who also has asymptomatic peripheral arterial disease may have a significantly higher risk profile than initially recognized. Therefore, the identification of polyvascular disease should prompt clinicians to reclassify patients into higher-risk categories and adjust management accordingly (Visseren et al., 2021).

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E-ISSN: 3061-8045, P-ISSN: 3061-8517
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Figure 4 also reinforces the need for **systematic screening strategies**. Given the strong association between vascular territories, clinicians should consider evaluating for additional disease in patients presenting with any form of atherosclerosis. This may include assessment of peripheral pulses, ankle–brachial index measurement, carotid evaluation, and detailed cardiovascular risk profiling. Such strategies are particularly important in settings where early detection can significantly alter clinical outcomes.

From an interdisciplinary standpoint, the figure provides strong support for the integration of cardiology and angiology. Patients with polyvascular disease often require coordinated care involving multiple specialties to address the full spectrum of their condition. Fragmented care models may fail to capture the extent of disease, whereas integrated approaches facilitate comprehensive evaluation and more effective long-term management.

Finally, this figure has important educational implications. It helps reinforce to learners that cardiovascular disease should not be approached in isolation, and that identifying disease in one territory should prompt a broader systemic evaluation. Understanding the concept of polyvascular disease is essential for developing clinical reasoning that aligns with contemporary cardiovascular medicine.

**Figure 5.**

*Integrated strategies for early detection and risk stratification*

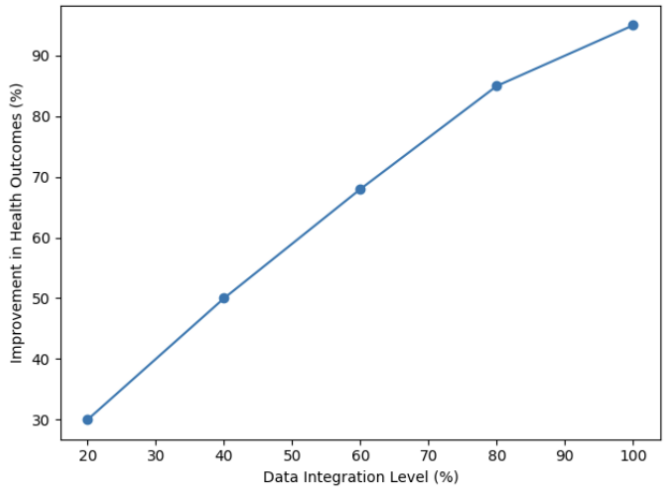


Figure 5 presents the relative contribution of key clinical tools used in the early detection and stratification of cardiovascular risk within the cardiovascular–vascular continuum. The figure highlights that early identification of at-risk individuals is not dependent on a single diagnostic method, but rather on the **integration of multiple clinical, laboratory, and functional assessments**, each contributing to a more accurate and comprehensive evaluation.

Among the elements represented, **blood pressure measurement** shows one of the highest contributions to early detection. This reflects its central role in identifying hypertension, a major and highly prevalent risk factor that often remains asymptomatic until advanced stages. Elevated blood pressure is strongly associated with endothelial dysfunction, arterial stiffness, and increased risk of coronary, cerebral, and peripheral vascular events (Virani et al., 2021; Tsao et al., 2022). Because of its accessibility, low cost, and reproducibility, blood pressure assessment remains one of the most effective entry points for cardiovascular risk screening, particularly in primary care settings.

The **lipid profile** also demonstrates a high contribution, consistent with the well-established role of dyslipidemia in atherogenesis. Measurement of LDL cholesterol, HDL cholesterol, and triglycerides provides essential information for both risk stratification and therapeutic decision-making. Current guidelines emphasize that lipid evaluation should be interpreted in the context of overall cardiovascular risk rather than as an isolated parameter, supporting the need for

integrated assessment (Mach et al., 2020; Nambi & Ballantyne, 2021). The figure reflects how lipid abnormalities are not only diagnostic markers but also modifiable targets that can significantly alter disease progression.

**Glucose and glycated hemoglobin (HbA1c)** measurements are also prominently represented, highlighting the importance of detecting diabetes mellitus and prediabetic states. Diabetes is associated with accelerated vascular damage, increased plaque burden, and higher rates of both macrovascular and microvascular complications. Early identification of dysglycemia allows for timely intervention, which can reduce long-term cardiovascular risk and prevent progression to advanced disease stages (Bonaca & Creager, 2020). Within the continuum framework, metabolic assessment is essential because it directly influences vascular health across multiple territories.

The **clinical history** remains a fundamental component of early detection, as reflected in the figure. A detailed history allows clinicians to identify symptoms suggestive of subclinical or early-stage disease, such as exertional chest discomfort, intermittent claudication, or transient neurological deficits. Additionally, it provides critical information regarding lifestyle factors, family history, and comorbid conditions that contribute to overall risk. Despite advances in technology, the clinical interview continues to be a cornerstone of cardiovascular evaluation, particularly when integrated with objective findings.

The **ankle–brachial index (ABI)** is specifically included in the figure to emphasize its role in detecting peripheral arterial disease, which is frequently underdiagnosed. ABI measurement is a simple, non-invasive, and cost-effective tool that can identify asymptomatic PAD and provide valuable prognostic information. Its use aligns with the concept of the cardiovascular–vascular continuum, as the detection of PAD often indicates the presence of systemic atherosclerosis and elevated cardiovascular risk (McDermott, 2021). Incorporating ABI into routine assessment can therefore improve early detection and risk stratification.

Finally, **imaging and screening techniques**—including ultrasound, vascular imaging, and other non-invasive modalities—also contribute significantly to early detection. These tools allow for visualization of structural and functional vascular changes before the onset of clinical symptoms. While not always required in all patients, their targeted use in high-risk individuals can enhance diagnostic accuracy and guide management decisions. Advances in imaging have facilitated earlier identification of subclinical atherosclerosis, supporting a more proactive approach to cardiovascular care (Narula et al., 2021).

A key insight from Figure 5 is that the effectiveness of early detection strategies lies in their **combined use**. No single tool provides a complete picture of cardiovascular risk; rather, it is the integration of clinical evaluation, laboratory testing, and targeted diagnostic methods that allows for accurate risk stratification. This approach is strongly supported by international guidelines, which recommend comprehensive assessment models that incorporate multiple variables to estimate global cardiovascular risk (Arnett et al., 2020; Visseren et al., 2021).

From a clinical perspective, the figure underscores the importance of **structured screening protocols**, particularly in primary care and preventive settings. Early detection not only allows for timely intervention but also reduces the likelihood of advanced disease and acute events. This is especially relevant in regions with high cardiovascular burden and limited access to specialized care, where simple, scalable tools can have a significant impact.

From an educational standpoint, Figure 5 reinforces the idea that cardiovascular prevention begins with **systematic evaluation rather than reactive treatment**. Teaching students to integrate these tools into routine practice promotes a more comprehensive and proactive approach to patient care, aligned with the principles of the cardiovascular–vascular continuum.

**Figure 6.**

*Interdisciplinary management model integrating cardiology and angiology*

Edición 4, Año 3, Número 1, 2026
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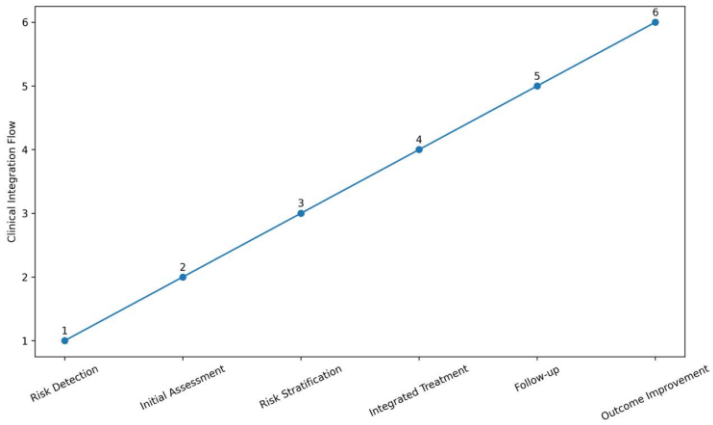


Figure 6 illustrates a structured clinical pathway for the integrated management of patients within the cardiovascular–vascular continuum, emphasizing the coordinated interaction between cardiology, angiology, and primary care. The sequence presented reflects a logical and progressive flow from early risk detection to long-term outcome improvement, reinforcing the concept that cardiovascular disease management should be continuous, proactive, and multidisciplinary.

The first stage, **risk detection**, represents the entry point into the continuum. At this level, patients are identified based on the presence of modifiable risk factors such as hypertension, dyslipidemia, diabetes mellitus, smoking, and obesity. As demonstrated in previous figures, these factors are central drivers of vascular injury and should be systematically assessed in all clinical encounters. Early detection is particularly important because many patients remain asymptomatic during initial stages of disease progression (Virani et al., 2021; Tsao et al., 2022).

The second stage, **initial assessment**, involves a comprehensive clinical evaluation that integrates patient history, physical examination, and basic diagnostic tools. This phase is critical for identifying early signs of cardiovascular or peripheral vascular involvement, such as reduced peripheral pulses, exertional symptoms, or abnormal laboratory findings. The integration of cardiology and angiology begins at this point, as both specialties contribute complementary perspectives to patient evaluation.

The third stage, **risk stratification**, builds upon the information gathered during initial assessment to classify patients according to their overall cardiovascular risk. This process incorporates clinical variables, laboratory results, and, when necessary, imaging or functional studies. Contemporary guidelines emphasize global risk assessment rather than isolated parameter evaluation, as combined risk factors provide a more accurate prediction of adverse outcomes (Arnett et al., 2020; Visseren et al., 2021). This stage is essential for guiding therapeutic intensity and follow-up strategies.

The fourth stage, **integrated treatment**, represents the core of the interdisciplinary model. At this level, management strategies are implemented based on risk stratification and may include pharmacological interventions (such as antihypertensive agents, lipid-lowering therapy, antithrombotic treatment, and glucose control) as well as non-pharmacological measures (lifestyle modification, smoking cessation, dietary changes, and physical activity). Importantly, treatment decisions should consider the presence of disease across multiple vascular territories, particularly in patients with polyvascular involvement (Anand et al., 2020). The coordinated participation of cardiology and angiology ensures that both cardiac and peripheral aspects of disease are addressed simultaneously.

The fifth stage, **follow-up**, emphasizes the importance of continuous monitoring and reassessment. Cardiovascular disease is not a static condition; risk profiles evolve over time, and treatment responses must be regularly evaluated. Follow-up allows for adjustment of therapeutic strategies, reinforcement of adherence, and early identification of disease progression or complications. This stage is particularly important in chronic conditions such as hypertension, diabetes, and atherosclerosis, where long-term management is required to achieve optimal outcomes (Heidenreich et al., 2022).

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Finally, the sixth stage, **outcome improvement**, represents the ultimate goal of the continuum: reduction in cardiovascular events, improvement in functional status, and enhancement of quality of life. Achieving this outcome depends on the effectiveness of all previous stages, particularly early detection and integrated management. Evidence consistently shows that coordinated, multidisciplinary approaches are associated with better clinical outcomes compared to fragmented care models (Bonaca & Creager, 2020; McDermott, 2021).

A key insight from Figure 6 is that this process is **cyclical rather than linear**. After follow-up, patients may re-enter earlier stages of the continuum if new risk factors emerge or disease progression is detected. This reinforces the need for continuous vigilance and long-term care strategies.

From a healthcare systems perspective, this model highlights the importance of **integration between different levels of care**. Primary care plays a crucial role in early detection and follow-up, while specialized services contribute to advanced diagnosis and management. Effective communication and coordination between these levels are essential for maintaining continuity of care, particularly in regions with high cardiovascular burden such as Latin America.

Educationally, this figure provides a practical framework for teaching students how to approach cardiovascular disease in a structured and systematic way. It reinforces the idea that effective clinical practice requires not only knowledge of individual conditions but also the ability to integrate information across disciplines and apply it לאורך the patient's clinical course.

## DISCUSIÓN

The findings presented in this review support the concept that cardiovascular disease should be interpreted within a **systemic and progressive framework**, rather than as a collection of isolated clinical entities. The cardiovascular–vascular continuum provides a unifying model that connects risk factors, pathophysiological mechanisms, and clinical outcomes across multiple vascular territories. This perspective is increasingly aligned with contemporary evidence, which consistently demonstrates that atherosclerosis is a diffuse process affecting coronary, peripheral, and cerebral circulations simultaneously (Libby et al., 2021; Roth et al., 2020).

One of the most relevant insights derived from this analysis is the importance of **early and integrated risk detection**. Traditional models of care have often prioritized the treatment of clinically evident disease—such as myocardial infarction or symptomatic peripheral arterial disease—rather than identifying and intervening during earlier stages. However, the evidence reviewed highlights that endothelial dysfunction and subclinical atherosclerosis may be present long before symptoms appear, and that early identification of risk factors can significantly alter disease trajectories (Narula et al., 2021; Visseren et al., 2021). This shift toward proactive medicine represents a critical paradigm change in cardiovascular care.

The results also reinforce the concept that **modifiable risk factors act synergistically**, rather than independently. Hypertension, dyslipidemia, diabetes mellitus, smoking, and obesity frequently coexist, amplifying vascular damage and accelerating disease progression. This interaction explains why global cardiovascular risk assessment is more clinically meaningful than focusing on individual parameters in isolation (Arnett et al., 2020). From a practical standpoint, this supports the implementation of integrated screening strategies that combine clinical, laboratory, and functional tools, as illustrated in the results section.

A key point of discussion is the clinical significance of **peripheral arterial disease (PAD)** within the continuum. Despite being a strong marker of systemic atherosclerosis, PAD remains underdiagnosed and undertreated in many settings. The findings of this review are consistent with previous reports indicating that patients with PAD have a markedly increased risk of major adverse cardiovascular events, yet are less likely to receive optimal preventive therapy compared to those with coronary disease (McDermott, 2021; Bonaca & Creager, 2020). This discrepancy highlights a critical gap in clinical practice and underscores the need for greater awareness and routine vascular assessment.

Edición 4, Año 3, Número 1, 2026
E-ISSN: 3061-8045, P-ISSN: 3061-8517
Revista IECCMEXICO

Edition 4, Year 3, Number 1, 2026
E-ISSN: 3061-8045, P-ISSN: 3061-8517
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Closely related to this is the concept of **polyvascular disease**, which emerged as a central theme in the results. Patients with involvement of multiple vascular territories exhibit significantly higher morbidity and mortality compared to those with isolated disease. This observation has important therapeutic implications, as it suggests that treatment strategies should be intensified in these patients. Evidence from randomized trials supports the use of combined antithrombotic regimens and aggressive risk factor control to reduce both cardiovascular and limb-related events in this high-risk population (Anand et al., 2020). Therefore, identifying polyvascular involvement should be considered a priority in clinical evaluation.

Another important aspect highlighted by this review is the evolving role of **heart failure within the cardiovascular continuum**. Traditionally viewed as a distinct cardiac condition, heart failure is now increasingly recognized as a downstream consequence of chronic vascular injury, hypertension, ischemia, and metabolic dysfunction. This integrated perspective is reflected in contemporary guidelines, which emphasize early identification of at-risk individuals and the management of upstream determinants to prevent progression to symptomatic heart failure (Heidenreich et al., 2022). This reinforces the idea that prevention strategies targeting vascular health can have significant long-term cardiac benefits.

From a systems perspective, one of the most significant challenges identified is the **fragmentation of care between specialties**. Cardiology and angiology are often practiced in parallel rather than in coordination, which may lead to incomplete risk assessment and suboptimal management. The model proposed in this review supports a more integrated approach, where collaboration between specialties allows for comprehensive evaluation and treatment of systemic disease. This is particularly relevant in healthcare systems where resources are limited and efficiency is essential.

The relevance of this integrated model becomes even more evident when considering the **Latin American context**, including Mexico, Colombia, and Ecuador. These regions face a dual challenge: a high and growing burden of cardiovascular disease, combined with variability in access to healthcare services and preventive programs. Epidemiological data indicate increasing prevalence of cardiometabolic risk factors, which contributes to earlier disease onset and higher rates of complications (Virani et al., 2021; Tsao et al., 2022). In this setting, the implementation of scalable, cost-effective, and integrated strategies for early detection and management is essential.

Moreover, public health initiatives that promote structured risk assessment and standardized treatment protocols—such as those implemented in primary care—have the potential to significantly reduce cardiovascular morbidity and mortality. The integration of cardiology and angiology within such frameworks can enhance their effectiveness by ensuring that vascular disease is addressed comprehensively rather than in isolation.

From an educational perspective, the cardiovascular–vascular continuum offers a valuable framework for training healthcare professionals. By emphasizing the interconnected nature of cardiovascular disease, this model encourages a more holistic approach to patient care. It helps students and clinicians develop clinical reasoning that integrates risk factors, pathophysiology, and clinical manifestations, rather than focusing solely on individual diagnoses. This approach is particularly important in modern medicine, where complexity and multimorbidity are increasingly common.

Despite the strengths of this review, certain limitations should be acknowledged. As a narrative synthesis, the study does not include quantitative meta-analysis, which may limit the ability to estimate effect sizes or compare interventions statistically. Additionally, while the selected literature is recent and of high impact, variability in study design and population characteristics may influence the generalizability of findings. However, the consistency of evidence across multiple sources supports the validity of the conclusions presented.

Future research should focus on evaluating the real-world implementation of integrated cardiovascular–vascular models, particularly in low- and middle-income settings. Studies assessing outcomes such as early detection rates, treatment adherence, reduction in cardiovascular events, and cost-effectiveness would provide valuable insights into the practical benefits of this approach. Additionally, further exploration of novel biomarkers, imaging techniques, and digital health tools may enhance early identification and personalized risk management.

## CONCLUSIÓN

Edición 4, Año 3, Número 1, 2026
E-ISSN: 3061-8045, P-ISSN: 3061-8517
Revista IECCMEXICO

Edition 4, Year 3, Number 1, 2026
E-ISSN: 3061-8045, P-ISSN: 3061-8517
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The present review consolidates current evidence supporting the concept that cardiovascular disease should be understood as a **systemic, progressive, and interconnected process**, rather than as isolated clinical entities. The cardiovascular–vascular continuum provides a coherent framework that links risk factors, pathophysiological mechanisms, and clinical outcomes across multiple vascular territories, including coronary, peripheral, cerebral, and cardiac domains.

One of the most relevant conclusions is that **early detection of cardiovascular risk represents the most effective point of intervention**. The identification of modifiable risk factors—such as hypertension, dyslipidemia, diabetes mellitus, smoking, and obesity—before the onset of clinical manifestations allows for timely implementation of preventive strategies that can significantly reduce disease progression and long-term complications. This reinforces the need for systematic and integrated screening approaches in both primary and specialized care settings.

Additionally, the evidence consistently demonstrates that **cardiovascular risk is cumulative and synergistic**. The coexistence of multiple risk factors accelerates vascular damage and increases the likelihood of adverse outcomes. Therefore, global risk assessment and comprehensive management should be prioritized over isolated parameter-based approaches, aligning with current international guidelines.

The findings also highlight the clinical importance of **peripheral arterial disease and polyvascular involvement** as markers of advanced systemic atherosclerosis. Patients with disease affecting multiple vascular territories exhibit significantly higher rates of cardiovascular events, underscoring the need for intensified therapeutic strategies and closer follow-up. Recognizing polyvascular disease is essential for accurate risk stratification and optimal clinical decision-making.

Another key conclusion is the need to **integrate cardiology and angiology within a unified model of care**. Fragmented approaches may lead to underdiagnosis, delayed treatment, and suboptimal outcomes, whereas coordinated, multidisciplinary strategies enable more comprehensive evaluation and management of patients. This integration is particularly relevant in regions with high cardiovascular burden and healthcare system variability, such as Mexico, Colombia, and Ecuador.

From a broader perspective, the cardiovascular–vascular continuum supports a shift toward **preventive, patient-centered, and longitudinal care models**. This approach emphasizes continuous monitoring, early intervention, and adaptation of treatment strategies over time, rather than reactive management of acute events. It also highlights the importance of education and training in fostering clinical reasoning that reflects the systemic nature of cardiovascular disease.

Finally, this review underscores that addressing the global burden of cardiovascular disease requires not only advances in clinical practice, but also **improvements in healthcare organization, accessibility, and interdisciplinary collaboration**. The implementation of integrated models based on the cardiovascular–vascular continuum has the potential to enhance early detection, optimize treatment, and ultimately reduce morbidity and mortality at both individual and population levels.

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*Edición 4, Año 3, Número 1, 2026*
*E-ISSN: 3061-8045, P-ISSN: 3061-8517*
*Revista IECCMEXICO*
*Edition 4, Year 3, Number 1, 2026*
*E-ISSN: 3061-8045, P-ISSN: 3061-8517*
*IECCMEXICO Review*