Historical Evolution of the Terminology for the Human Cardiac Septomarginal Trabecula

Evolución Histórica De La Terminología De La Trabécula Septomarginal Del Corazón Humano

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Abstract

The septomarginal trabecula is an intracavitary structure of the right ventricle that contains part of the cardiac conduction system and whose terminology has varied throughout history. This study analyzes the evolution of its nomenclature, from the earliest descriptions to its current designation in the Terminology Anatomic. Several names have been identified, including eponyms such as "Leonardo's band" and "Reil's band," functional terms like "moderator band," and morphological descriptors such as "arcuate fasciculus." However, these terms are either inaccurate or based on unproven physiological hypotheses. Contemporary anatomical and histological evidence demonstrates that the septomarginal trabecula plays an active role in right ventricular electrical conduction, which refutes its supposed mechanical "moderator" function. Moreover, it has clinical relevance for cardiac imaging interpretation and surgical procedures involving the conduction system. In this context, the exclusive use of the term "septomarginal trabecula" emerges as the most appropriate designation, as it accurately reflects its morphology, location, and function, ensuring precision and consistency in teaching, research, and modern clinical practice.

Keywords: Septomarginal trabecula; moderator band; anatomical terminology; history of medicine; cardiac conduction.

Resumen

La trabécula septomarginal es una estructura intracavitaria del ventrículo derecho que contiene parte del sistema de conducción cardíaco y cuya terminología ha variado a lo largo de la historia. Este estudio analiza la evolución de su nomenclatura, desde las primeras descripciones hasta su denominación actual en la Terminología Anatómica. Se han identificado varios nombres, incluidos epónimos como "banda de Leonardo" y "banda de Reil", términos funcionales como "banda moderadora" y descriptores morfológicos como "fascículo arcuato". Sin embargo, estos términos son inexactos o se basan en hipótesis fisiológicas no comprobadas. La evidencia anatómica e histológica contemporánea demuestra que la trabécula septomarginal desempeña un papel activo en la conducción eléctrica del ventrículo derecho, lo que refuta su supuesta función mecánica de "moderador". Además, tiene relevancia clínica para la interpretación de imágenes cardíacas y los procedimientos quirúrgicos que involucran el sistema de conducción. En este contexto, el uso exclusivo del término "trabécula septomarginal" surge como la designación más apropiada, ya que refleja con precisión su morfología, ubicación y función, garantizando exactitud y coherencia en la enseñanza, la investigación y la práctica clínica moderna.

Palabras Clave: Trabécula septomarginal; banda moderadora; terminología anatómica; historia de la medicina; conducción cardíaca.

INTRODUCTION

The septomarginal trabecula, derived from the Latin term trabecula ("small beam" or "little joist") [1], [2], is an intracavitary structure of the right ventricle that contains the right branch of the atrioventricular bundle, an essential component of the cardiac conduction system [3]. For centuries, it was referred to as the "moderator band" in anatomical literature until the Paris Anatomical Nomenclature of 1955 officially adopted the term "septomarginal trabecula" [4].

Anatomically, this structure connects the interventricular septum to the base of the anterior papillary muscle, providing structural reinforcement to the right ventricle and, more importantly, ensuring the coordinated activation of this papillary muscle for proper tricuspid valve function [5], [6]. It is classified as a specialized second-order muscular trabecula with a characteristic "Y" shape, branching into anterosuperior and infer posterior limbs [5].

Historically, Renaissance anatomists such as Leonardo da Vinci were the first to observe and describe this structure, depicting it as an internal architectural reinforcement of the ventricular cavity [7], [8]. Only with the advent of microscopic anatomy and modern electrophysiology was its true role in cardiac electrical conduction fully recognized [9], [10].

The use of multiple designations, including eponyms, functional terms, and purely morphological descriptions, has generated ambiguity and hindered both teaching and clinical communication. Therefore, the aim of this study is to analyze the historical and anatomical evolution of the terminology applied to the septomarginal trabecula, emphasizing the urgent need for standardized nomenclature as a cornerstone for clear scientific communication and safe clinical practice.

METHODS

A comprehensive integrative review of the literature [11] was conducted on the terminology historically used to describe the human cardiac septomarginal trabecula. The process included classical anatomical texts as well as contemporary sources, ensuring a broad historical and scientific perspective.

The search strategy focused on scientific databases such as PubMed, Scopus, and Google Scholar, using the keywords trabecula septomarginalis, moderator ban, cardiac anatomy, anatomical terminology, and historical nomenclature, both in English and Spanish. The selection included original articles, review paper historical anatomical treatises, and the official Terminologia Anatomica issued by the Federative International Programme for Anatomical Terminology (FIPAT) [4].

Articles were included if they addressed the anatomical description, function, or historical evolution of the terminology related to the septomarginal trabecula. Sources that were redundant, lacked anatomical relevance, or did not specifically address the structure were excluded.

The historical texts reviewed included works from the Renaissance, such as the drawings and notes of Leonardo da Vinci [7], [8], as well as classical anatomical treatises by authors like Testut and Latarjet [12]. Contemporary literature was also considered, including histological and electrophysiological studies that clarify the functional role of the septomarginal trabecula within the cardiac conduction system [10], [13].

The information gathered was synthesized chronologically, highlighting the progressive evolution of terminology from the earliest anatomical descriptions to the standardized nomenclature currently recommended by international organizations. This integrative approach allowed for the identification of patterns in the historical use of eponyms, functional terms, and structural descriptors, facilitating the discussion of their implications for teaching, clinical practice, and scientific communication.

RESULTS

The review of historical and contemporary sources revealed a progressive evolution in the terminology used to describe the septomarginal trabecula. Initially, during the Renaissance, anatomists such as Leonardo da Vinci referred to this structure descriptively in their drawings

and manuscripts, without using a formal name [7], [8]. Over time, as anatomical knowledge expanded, the use of eponyms emerged, highlighting the contributions of prominent figures such as Leonardo and Reil. These designations were widely disseminated in anatomical literature, particularly in European [2], [14].

In the 19th century, the term "moderator band" became common in English-language literature, reflecting a functional interpretation of the structure as a mechanical limiter of right ventricular dilation [15]. This interpretation, while influential at the time, lacked histological and experimental evidence, which later challenged its validity [16], [17]. Despite this, "moderator band" persisted in textbooks and clinical practice for several decades, creating ambiguity regarding its true anatomical and physiological role.

The official recognition of "septomarginal trabecula" as the standardized term occurred with the Paris Anatomical Nomenclature of 1955, which sought to eliminate eponyms and imprecise terms [4]. This marked a significant shift toward precise and descriptive terminology that accurately reflects the structure's morphology and position.

Recent histological and electrophysiological studies have confirmed that the septomarginal trabecula plays an essential role in the conduction of electrical impulses within the right ventricle, rather than serving a purely mechanical function [10], [13]. Clinically, its identification has become relevant in imaging techniques such as echocardiography, where it serves as a key anatomical marker for differentiating normal structures from pathological intracavitary masses [6], [18]. Additionally, its proximity to the conduction system has implications in cardiac surgery, where unintentional damage may result in postoperative atrioventricular blocks [19].

Table 1 summarizes the chronological evolution of the various terms used to refer to this structure, illustrating the transition from descriptive and functional terms to the internationally accepted nomenclature. This progression highlights the dynamic nature of anatomical language and the influence of scientific advancements on the way structures are named and understood.

TABLE 1. CHRONOLOGICAL EVOLUTION OF TERMINOLOGY USED TO DESCRIBE THE SEPTOMARGINAL TRABECULA

Year/Period	Term Used	Language/ Origin	Author(s)	Notes/ Interpretation
Renaissance (16th century)	No formal name	Italian/Latin	Leonardo da Vinci (Dobson, 1962; Shoja et al., 2013) [7,8].	Initial descriptive drawings without a defined term.
1808	Leonardo's band	German/Latin	Reil (Mascaró & Porcar, 1983; Schochow et al., 2014; Finlayson, 1895) [2,14].	Eponym honoring Leonardo da Vinci.
1837	Moderator band	English	Ring (1837) [12].	Interpreted as a mechanical limiter of right ventricular dilation.
19th – early 20th century	Arcuate fasciculus	Latin	Various authors	Based on its curved morphology.
Mid-20th century (1955)	Trabecula septomarginalis (Septomarginal trabecula)	Latin	Federative International Programme for Anatomical Terminology (2019) [4].	Official standardized term adopted by the Paris Anatomical Nomenclature.

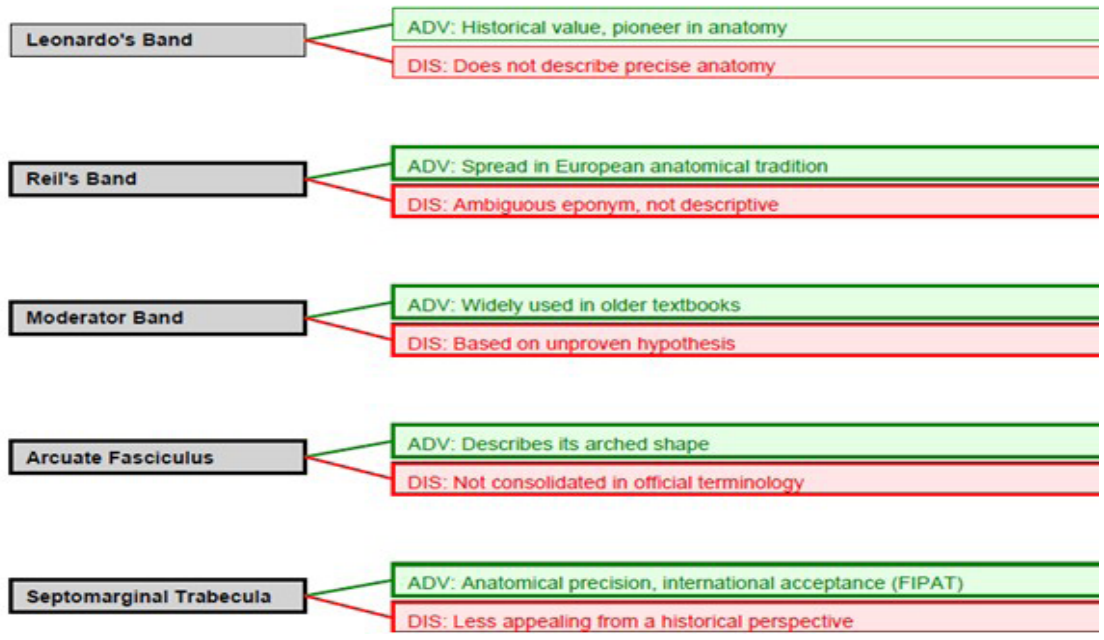

Figure 1. Comparative analysis of historical and current names for septomarginal trabecula. Green boxes show advantages of each term, while the red boxes indicate disadvantages. The most precise term is septomarginal trabecula according to FIPAT. Source authors

DISCUSSION

The historical and terminological analysis of the septomarginal trabecula highlights how anatomical and physiological interpretations have shaped the evolution of its nomenclature. The persistence of eponyms such as “Leonardo’s band” [7], [8], [20], or “Reil’s band” [2], [14], reflects the cultural influence of certain anatomists. However, these designations lack anatomical precision and provide little clinical utility in modern contexts. Similarly, the term “moderator band,” introduced by Ring in 1837 and widely adopted in English-language literature [12], [15], emerged from 19th-century functional interpretations that were never supported by solid experimental evidence. This underscores the need to critically revise medical terminology considering contemporary scientific knowledge.

Current evidence clearly demonstrates that septomarginal trabecula does not act as a mechanical limiter of right ventricular dilation [16], [17]. Instead, it constitutes a key component of the cardiac conduction system. Histological and electrophysiological studies have shown that this structure contains specialized myocardial fibers with differential expression of ion channels and connexins, facilitating rapid impulse transmission [10], [13]. This new interpretation provides a comprehensive understanding of its role in synchronizing the contraction of the right ventricle.

From a clinical perspective, the septomarginal trabecula is a relevant anatomical landmark in echocardiography for identifying the right ventricle, particularly in patients with congenital heart defects [18]. Nevertheless, its appearance can sometimes be mistaken for an intracavitary thrombus, leading to potential diagnostic errors [6]. In cardiac surgery, its proximity to the conduction system has been associated with postoperative atrioventricular blocks following procedures involving the interventricular septum [19]. This highlights the importance of detailed anatomical knowledge for preventing iatrogenic complications during corrective interventions.

The terminological debate thus goes beyond linguistic considerations: retaining imprecise terms like “moderator band” perpetuates conceptual errors in anatomy teaching and fosters ambiguity in clinical practice. Conversely, the term “septomarginal trabecula” adheres to objective anatomical criteria and aligns with the guidelines established by the Federative International Programme for Anatomical Terminology [4]. Standardization not only enhances scientific communication but also improves patient safety by minimizing misinterpretation in educational and clinical contexts.

The morphological variability of the septomarginal trabecula, including its thickness, branching patterns, and connections with the trabeculae of the right ventricle, may influence intracardiac dynamics and the interpretation of advanced imaging studies. The integration of new tools such as 3D echocardiography and cardiac magnetic resonance imaging has allowed better characterization of this structure, demonstrating that it is not merely a support cable, but a functionally active component of ventricular architecture. These advances support the

need for continued research into its physiological and pathological implications to optimize diagnostic and therapeutic processes [21].

Beyond its anatomical and historical significance, the evolution of the terminology for the septomarginal trabecula also illustrates a broader meta-research phenomenon: how scientific language both shapes and reflects conceptual understanding [22], [23], [24]. The persistence of eponyms and functional misinterpretations in anatomy mirrors similar epistemological inertia observed in other biomedical disciplines, including neuroscience, where terminological ambiguities have long influenced the interpretation of structural-functional relationships [25], [26], [27].

In this sense, the standardization of "septomarginal trabecula" represents not only a terminological correction but also an epistemic refinement that aligns anatomy with the principles of contemporary scientific reasoning. It underscores the need for a continuous, reflective revision of biomedical nomenclature as part of a broader meta-research effort to ensure coherence between language, evidence, and conceptual models, bridging morphology, physiology, and cognitive interpretation within the human sciences [22]

CONCLUSIONS

Throughout history, the septomarginal trabecula has been referred to by multiple names, many of them imprecise or based on unverified functional interpretations. Current anatomical and clinical evidence demonstrates that the most accurate and descriptive term is *septomarginal trabecula*, as it precisely reflects the morphology and location of this structure.

Adopting this term exclusively is essential to promote clarity and uniformity in teaching, research, and clinical practice. The standardized nomenclature endorsed by the Federative International Programme for Anatomical Terminology represents a critical step toward improving scientific communication and ensuring safer patient care by eliminating terminological ambiguity.

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CRediT AUTHORSHIP CONTRIBUTION STATEMENT

Jorge Eduardo Duque Parra: conceptualization, research, methodology, writing-original draft, writing-revision and editing. Jhony Alejandro Díaz Vallejo: conceptualization, research, methodology, writing-original draft, writing-revision and editing. Clara Helena Gonzalez Correa: conceptualization, research, methodology, writing-original draft, writing-revision and editing. Jhonatan Duque Colorado: research, methodology, data analysis, writing-original draft, writing-revision and editing.

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