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Morphological variations, morphometry and microstructure of adult human mitral valve

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We use this protocol and it's working

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Keywords: mitral valve, mitral valve morphometry, mitral annulus circumference, mitral valve area, leaflet length, mitral valve variations, histology, embryology, reported mitral valve morphometry, mitral valve morphometry, embryological development of the human mitral valve, mitral valve anatomy, mitral valve dimensions across population, reporting mitral valve anatomy, human mitral valve, human mitral valve background, mitral valve, mitral valve dimension, posterior mitral leaflet, anatomical variation, many observed anatomical variant, echocardiography, complex component of the heart, histological feature, literature on the morphometric parameter, morphometry, microstructure of adult, embryological development, embryological evidence, embryology, annular circumference, data on annular circumference

Abstract

Background:

The mitral valve is a structurally complex component of the heart, and precise knowledge of its anatomy is essential for understanding valvular function, disease mechanisms, and surgical or transcatheter interventions. Although numerous studies have reported mitral valve morphometry, anatomical variations, histology, and embryology, the findings are dispersed across different methodologies and populations.

Objective:

This review aims to comprehensively synthesise published literature on the morphometric parameters, anatomical variations, histological organisation, and embryological development of the human mitral valve, and to highlight their clinical significance.

Methods:

A systematic literature search was conducted using PubMed, Google Scholar, Scopus, ScienceDirect, and Embase. Original studies reporting mitral valve anatomy based on cadaveric dissection, autopsy, echocardiography, and computed tomography were included. Data on annular circumference and area, leaflet length, height, diameter, leaflet variations, histological features, and developmental aspects were extracted and synthesised narratively and descriptively.

Results:

Considerable variability was observed in mitral valve dimensions across populations and measurement techniques, with consistently larger values reported in imaging-based studies compared to cadaveric studies. Anatomical variations were predominantly noted in the posterior mitral leaflet. Histological studies demonstrated a layered leaflet structure, while embryological evidence explained many observed anatomical variants.

Guidelines

****Background****

The mitral valve is a complex anatomical structure essential for normal cardiac function. Accurate knowledge of mitral valve morphometry, anatomical variations, histological organisation, and embryological development is critical for understanding valvular diseases and for planning surgical and transcatheter interventions. Existing data are derived from cadaveric, autopsy, echocardiographic, and computed tomographic studies, with considerable variation in methods and reported measurements. A consolidated review of these findings is lacking.

****Objectives****

- To review published data on mitral valve morphometry, including annular circumference, area, leaflet length, diameter, and height.
- To document anatomical variations of mitral valve leaflets and scallops.
- To summarise histological architecture and embryological development of the mitral valve.
- To highlight clinical and surgical relevance of mitral valve anatomy.

****Review Question****

What are the normal morphometric parameters, anatomical variations, histological features, and developmental aspects of the human mitral valve reported in the literature?

****Methods****

****Study Design:****

Systematic review and meta analysis

****Data Sources:****

Electronic databases including PubMed, Google Scholar, Scopus, ScienceDirect, and Embase were searched. Reference lists of relevant articles were also reviewed.

****Search Strategy:****

Search terms included "mitral valve," "mitral valve morphometry," "mitral annulus circumference," "mitral valve area," "leaflet length," "mitral valve variations," "histology," and "embryology," used in various combinations with Boolean operators.

****Eligibility Criteria:****

Included studies were original research articles in English reporting anatomical, morphometric, histological, or developmental data on the human mitral valve using cadaveric, autopsy, echocardiographic, or imaging-based methods. Case reports, editorials, animal-only studies, and studies lacking anatomical measurements were excluded.

****Study Selection:****

Titles and abstracts were screened for relevance, followed by full-text assessment of eligible articles. Relevant data were extracted independently and verified.

- 1 Objectives Primary Objective To systematically review published literature on morphometric parameters of the human mitral valve. Secondary Objectives To evaluate anatomical variations of mitral valve leaflets and scallops To summarize histological characteristics of the mitral valve To review embryological development and its clinical relevance To compare morphometric findings based on sex, population, and study modality
- 2 Review Question What are the morphometric characteristics, anatomical variations, histological features, and developmental aspects of the human mitral valve as reported in published studies?
- 3 Methodology
 - 3.1 Study Design This study is designed as a systematic review, conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.
 - 3.2 Data Sources
 - 3.3 comprehensive literature search will be conducted using the following electronic databases: PubMed Google Scholar Scopus ScienceDirect Embase Manual searching of reference lists of included articles will also be performed to identify additional relevant studies.
 - 3.4 Search Strategy The search strategy will include Medical Subject Headings (MeSH) terms and keywords such as: Mitral valve, mitral annulus, mitral leaflet, morphometry, dimensions, circumference, area, height, anatomical variations, scallops, histology, and embryology. Boolean operators (AND/OR) will be applied to refine the search.
 - 3.5 Eligibility Criteria Inclusion Criteria Original research articles Human studies (cadaveric, autopsy, echocardiographic, CT/CTA-based) Studies reporting morphometric, anatomical, histological, or developmental data of the mitral valve Articles published in English Exclusion Criteria Case reports, reviews, editorials, and conference abstracts Animal studies Studies focusing solely on pathological mitral valves without baseline anatomical data Incomplete or inaccessible full-text articles
 - 3.6 Study Selection Two independent reviewers will screen titles and abstracts for eligibility. Full-text articles will be assessed for inclusion. Disagreements will be resolved through discussion or consultation with a third reviewer.
 - 3.7 Data Extraction Data will be extracted using a standardized data extraction form, including: Author and year of publication Study population and sample size Study

methodology Mitral valve morphometric parameters Anatomical variations Histological and embryological findings

- 3.8 Data Synthesis Due to heterogeneity in study design and measurement techniques, a qualitative synthesis will be performed. Results will be presented using comparative tables and descriptive analysis.
- 4 Risk of Bias Assessment Risk of bias will be assessed using appropriate quality assessment tools depending on study design (e.g., adapted anatomical study appraisal checklists).
- 5 Ethical Considerations Ethical approval is not required as this study involves analysis of previously published data.
- 6 Expected Outcomes and Significance This systematic review will provide consolidated and comparative data on mitral valve anatomy, offering valuable insights for cardiac surgeons, cardiologists, anatomists, and biomedical engineers involved in valve repair and prosthesis development.
- 7 Dissemination Plan Findings will be submitted to a peer-reviewed journal and presented at relevant scientific conferences.