

Cardiac Surgery Mcq With Answers Online PDF

Cardiac Surgery MCQ with Answers

Cardiac surgery is a specialized field within cardiology that involves the operative management of heart diseases. For medical students, residents, and practicing clinicians, mastering the concepts through multiple-choice questions (MCQs) is an effective way to prepare for exams and enhance understanding. In this comprehensive guide, we present a wide array of cardiac surgery MCQs along with detailed answers to aid your learning process. Whether you are reviewing basic concepts or tackling complex surgical procedures, this resource aims to provide clarity and confidence.

Introduction to Cardiac Surgery MCQs

Understanding the types of questions typically encountered and their correct responses is crucial for effective exam preparation. This section discusses the importance of MCQs in cardiac surgery education, common topics covered, and tips for approaching these questions.

Importance of MCQs in Cardiac Surgery Education

- Assess knowledge of surgical procedures and indications
- Improve problem-solving and clinical decision-making skills
- Prepare for board exams and certification assessments
- Identify knowledge gaps for further study

Common Topics Covered in Cardiac Surgery MCQs

- Preoperative assessment and risk stratification
- Types of cardiac surgeries (e.g., coronary artery bypass grafting, valve surgeries)
- Postoperative management and complications
- Specialized procedures (e.g., congenital heart defect repairs)
- Imaging and diagnostic tools used in cardiac surgery

Sample Cardiac Surgery MCQs with Answers

1. Which of the following is the most common indication for coronary artery

bypass grafting (CABG)?

- Severe aortic stenosis
- Multi-vessel coronary artery disease
- Atrial fibrillation
- Mitral regurgitation

Answer: 2. Multi-vessel coronary artery disease

Explanation: CABG is primarily indicated in patients with multi-vessel coronary artery disease, especially when significant stenosis affects the left main coronary artery or when medical therapy fails.

2. Which valve is most commonly replaced during cardiac surgery?

- Mitral valve
- Aortic valve
- Tricuspid valve
- Pulmonary valve

Answer: 2. Aortic valve

Explanation: The aortic valve is the most frequently replaced valve, often due to calcific aortic stenosis or aortic regurgitation.

3. In which scenario is cardiopulmonary bypass typically used?

- During minimally invasive procedures
- In all open heart surgeries requiring cardiac arrest
- For diagnosis only
- Only in emergencies

Answer: 2. In all open heart surgeries requiring cardiac arrest

Explanation: Cardiopulmonary bypass (CPB) provides a bloodless and motionless field during open heart surgeries, allowing the surgeon to operate on a still and bloodless heart.

4. Which of the following is a contraindication for mechanical heart valve

replacement?

- History of bleeding disorders
- Young age
- Presence of atrial fibrillation
- Coronary artery disease

Answer: 1. History of bleeding disorders

Explanation: Mechanical valves require lifelong anticoagulation, which can pose bleeding risks in patients with bleeding disorders, making them a contraindication.

5. What is the primary purpose of an aortic cross-clamp during cardiac surgery?

- To control bleeding from the aorta
- To isolate the heart from systemic circulation
- To stop blood flow through the aorta temporarily
- To prevent embolism

Answer: 3. To stop blood flow through the aorta temporarily

Explanation: The aortic cross-clamp is applied to halt blood flow through the aorta, allowing the surgeon to operate on a still and bloodless heart while cardioplegia solutions protect the myocardium.

Key Topics and Concepts in Cardiac Surgery MCQs

1. Coronary Artery Bypass Grafting (CABG)

- Indications: multi-vessel disease, left main disease, failed PCI
- Graft options: saphenous vein, internal mammary artery, radial artery
- Postoperative care: antiplatelet therapy, lipid management

2. Valve Surgery

- Types of valves: mechanical vs. bioprosthetic

- Indications for replacement vs. repair
- Complications: thrombosis, endocarditis

3. Congenital Heart Disease Surgery

- Common procedures: atrial septal defect closure, ventricular septal defect repair
- Timing of surgery based on severity and symptoms

4. Postoperative Management and Complications

- Monitoring for arrhythmias, bleeding, and myocardial infarction
- Management of infections and wound healing
- Understanding cerebrovascular risks

Tips for Approaching Cardiac Surgery MCQs

- Read each question carefully, noting keywords
- Eliminate obviously incorrect options to improve chances
- Relate clinical scenarios to surgical principles
- Review recent guidelines and standard protocols
- Practice regularly with varied question banks to enhance familiarity

Conclusion

Mastering cardiac surgery MCQs with answers is an essential step in medical education and clinical practice. This resource provides a broad overview and detailed explanations to help you understand complex concepts, improve decision-making skills, and excel in examinations. Continuous practice, staying updated with current guidelines, and understanding the underlying principles will significantly enhance your competence in cardiac surgical management.

Remember, understanding the rationale behind each answer is key to applying knowledge effectively in real-world clinical settings. Use this guide as a foundation to deepen your understanding and prepare confidently for your assessments in cardiac surgery.

If you need further elaboration on specific topics or additional MCQs, feel free to ask!

Cardiac Surgery MCQ with Answers: An Essential Resource for Medical Students and Practitioners

Cardiac surgery multiple-choice questions (MCQs) with answers are an indispensable tool for medical students, residents, and practicing cardiothoracic surgeons aiming to master the complexities of cardiac procedures. These MCQs serve as a comprehensive means to assess knowledge, reinforce learning, and prepare for examinations or clinical decision-making. In this article, we delve into the significance of cardiac surgery MCQs, explore their structure, discuss key topics covered, and evaluate their features, pros, and cons to help learners utilize these resources effectively.

Understanding the Role of Cardiac Surgery MCQs

Cardiac surgery is a highly specialized field that encompasses a broad spectrum of procedures ranging from coronary artery bypass grafting (CABG) to complex congenital defect repairs. Given the intricacy of these interventions, MCQs are designed to test a variety of competencies including anatomy, pathophysiology, surgical techniques, postoperative management, and complication handling.

Why are MCQs important in cardiac surgery?

- **Assessment of Knowledge:** They provide a structured way to evaluate understanding of core concepts.
- **Exam Preparation:** MCQs mimic the format of many certification and licensing exams, making them valuable practice tools.
- **Self-Directed Learning:** They enable learners to identify gaps in knowledge and focus on weak areas.
- **Clinical Decision-Making:** Well-designed MCQs challenge critical thinking and application of knowledge to real-world scenarios.

Features of Cardiac Surgery MCQs

Effective MCQ resources typically share several features that enhance their educational value:

Clear Question Stem

- Presents a clinical scenario or theoretical question.
- Includes relevant data while avoiding extraneous information.

Well-Constructed Options

- Usually four or five options.
- One correct (best) answer with plausible distractors.
- Distractors are based on common misconceptions or errors.

Explanatory Answers

- Rationales provided for correct and incorrect options.
- Clarify underlying principles, aiding deeper understanding.

Coverage of Core Topics

- Anatomy and physiology of the heart.
- Pathology of cardiac conditions.
- Surgical techniques and procedures.
- Preoperative, intraoperative, and postoperative management.
- Complications and their management.

Key Topics Covered in Cardiac Surgery MCQs

A comprehensive MCQ bank covers a wide array of topics. Here, we outline the major areas essential for mastering cardiac surgery.

1. Coronary Artery Disease and Bypass Surgery

- Indications for CABG.
- Graft choices and techniques.
- Complications and graft patency.
- Postoperative care.

2. Valvular Heart Disease

- Surgical indications for mitral, aortic, tricuspid, and pulmonary valves.
- Valve repair versus replacement.
- Prosthetic valve types and their pros/cons.
- Management of prosthetic valve complications.

3. Congenital Heart Defects

- Common congenital anomalies (e.g., atrial septal defect, ventricular septal defect).
- Surgical correction techniques.
- Timing of intervention.

4. Cardiac Tumors and Masses

- Diagnosis and surgical management.
- Common types like myxomas.

5. Surgical Management of Heart Failure

- Ventricular assist devices.
- Transplantation criteria.
- Innovations like stem cell therapy.

6. Preoperative and Postoperative Care

- Hemodynamic monitoring.
- Anticoagulation management.
- Infection prevention.
- Complication management.

7. Special Procedures

- Aortic aneurysm repair.
- Maze procedure for atrial fibrillation.
- Minimally invasive techniques.

Sample MCQs with Answers and Explanations

To illustrate the utility of these MCQ resources, below are some sample questions spanning different topics.

Question 1: Coronary Artery Bypass Grafting (CABG)

Which of the following grafts is most commonly used for CABG?

- A) Saphenous vein
- B) Internal mammary artery
- C) Radial artery
- D) Femoral artery

Correct Answer: B) Internal mammary artery

Explanation:

The internal mammary (thoracic) artery is preferred due to its superior long-term patency rates and resistance to atherosclerosis. While saphenous veins are commonly used, they have lower long-term success. Radial arteries are also used but less frequently as a primary graft. Femoral arteries are typically not used as grafts in coronary bypass surgery.

Question 2: Valve Replacement

Which type of prosthetic valve is associated with the highest risk of thromboembolism if anticoagulation is not maintained?

- A) Mechanical valve
- B) Bioprosthetic valve
- C) Homograft valve
- D) Autograft valve

Correct Answer: A) Mechanical valve

Explanation:

Mechanical valves are durable but require lifelong anticoagulation due to their thrombogenic nature. Without proper anticoagulation, they pose a high risk of thromboembolism. Bioprosthetic valves have lower thrombogenicity but tend to degenerate faster.

Question 3: Congenital Heart Disease

In which congenital defect is a "hole in the atrial septum" most characteristic?

- A) Ventricular septal defect
- B) Atrial septal defect
- C) Patent ductus arteriosus
- D) Tetralogy of Fallot

Correct Answer: B) Atrial septal defect

Explanation:

An atrial septal defect (ASD) involves an abnormal opening in the atrial septum, leading to left-to-right shunting of blood. VSD involves a ventricular septal opening, PDA involves abnormal ductus arteriosus, and Tetralogy of Fallot is characterized by multiple defects including VSD and pulmonary stenosis.

Advantages and Limitations of Cardiac Surgery MCQ Resources

Advantages

- Structured Learning: Organized questions covering all aspects of cardiac surgery.
- Immediate Feedback: Explanations help reinforce correct understanding.
- Exam Simulation: Mimic real exam conditions, boosting confidence.
- Self-Assessment: Identify weak points for targeted study.

Limitations

- Question Quality Variability: Not all MCQs are equally well-constructed.
- Context Limitations: MCQs may oversimplify complex clinical scenarios.
- Potential for Guessing: Multiple-choice format may encourage guessing over deep understanding.
- Need for Complementary Resources: Must be used alongside textbooks, journals, and clinical experience for comprehensive learning.

Conclusion: Maximizing the Utility of Cardiac Surgery MCQs

Cardiac surgery MCQs with answers are invaluable for both educational and clinical purposes. They facilitate active recall, critical thinking, and exam readiness. To maximize their benefits, learners

should focus on high-quality question banks, seek thorough explanations, and regularly review topics to build a solid foundation. Combining MCQ practice with clinical exposure, reading current guidelines, and engaging in discussions will produce the most competent and confident cardiac surgeons and cardiologists.

By integrating these questions into a structured study plan, aspiring cardiac surgeons can enhance their understanding, stay updated with evolving techniques, and ultimately improve patient outcomes. Whether preparing for licensing exams or honing surgical decision-making skills, cardiac surgery MCQs remain a cornerstone of effective medical education.

Question Which of the following is the most common indication for coronary artery bypass grafting (CABG)? Severe multi-vessel coronary artery disease causing significant ischemia and angina refractory to medical therapy. **What is the primary goal of cardiac surgery in patients with valvular heart disease?** To restore normal valve function, relieve symptoms, and prevent heart failure or other complications. **Which graft is most commonly used in coronary artery bypass surgery?** The saphenous vein is most commonly used, followed by the internal thoracic (mammmary) artery. **What is a common complication following cardiac surgery?** Postoperative atrial fibrillation is a common complication, occurring in up to 30% of patients. **Which imaging modality is typically used intraoperatively to assess cardiac structures during surgery?** Transesophageal echocardiography (TEE) is commonly used intraoperatively for real-time assessment. **What is the purpose of a cardiopulmonary bypass machine during cardiac surgery?** It temporarily takes over the function of the heart and lungs, maintaining circulation and oxygenation during the procedure. **Which postoperative management is crucial to reduce the risk of graft failure in CABG patients?** Aggressive management of risk factors such as hypertension, hyperlipidemia, and smoking cessation, along with antiplatelet therapy. **In which scenario is minimally invasive cardiac surgery typically preferred?** In patients requiring isolated mitral or atrial septal defect repairs, especially when aiming to reduce recovery time and surgical trauma.

Related keywords: cardiac surgery, multiple choice questions, MCQ, heart surgery, cardiology, surgical procedures, medical exam prep, cardiac operations, surgical techniques, heart disease quiz

Cardiac muscle labeled diagram

Cardiac Muscle Labeled Diagram: An In-Depth Guide to the Heart's Myocardial Structure

Cardiac muscle labeled diagram serves as an essential visual tool for students, healthcare professionals, and anatomy enthusiasts aiming to understand the intricate architecture of the

myocardium?the muscular tissue of the heart. The heart's ability to pump blood efficiently relies on the unique structure and function of cardiac muscle tissue. This detailed guide explores the anatomy of cardiac muscle, highlighting key components through a labeled diagram, and discusses its vital role in cardiovascular health.

Understanding Cardiac Muscle: An Overview

The cardiac muscle, also known as myocardium, is a specialized type of involuntary striated muscle tissue found exclusively in the heart. It possesses unique features that distinguish it from skeletal and smooth muscles, including its ability to contract rhythmically and continuously without fatigue. The structure of cardiac muscle is designed to facilitate synchronized contractions, ensuring effective blood circulation throughout the body.

Components of a Cardiac Muscle Labeled Diagram

A typical **cardiac muscle labeled diagram** highlights several key anatomical features. These components work together to enable the heart's function. Below are the primary parts featured in the diagram:

1. Cardiac Muscle Fibers

- Long, cylindrical, and branched cells
- Contain striations due to organized myofilaments (actin and myosin)
- Connected by intercalated discs for synchronized contraction

2. Intercalated Discs

- Specialized junctions between cardiac cells
- Facilitate electrical and mechanical coupling
- Contain gap junctions and desmosomes

3. Nucleus

- Typically one centrally located nucleus per cell, sometimes two
- Controls cellular activities and protein synthesis

4. Sarcolemma

- Cell membrane of cardiac muscle fibers
- Involved in conducting electrical impulses

5. Myofibrils

- Bundle of myofilaments within muscle fibers
- Responsible for contraction

6. Myofilaments (Actin and Myosin)

- Thin (actin) and thick (myosin) filaments arranged in sarcomeres
- Responsible for the contractile function

7. Sarcoplasmic Reticulum

- Specialized smooth endoplasmic reticulum storing calcium ions
- Plays a key role in muscle contraction

8. T-Tubules

- Transverse tubules that extend into the muscle fiber
- Transmit electrical signals from the sarcolemma to the sarcoplasmic reticulum

Visualizing the Cardiac Muscle: Importance of a Labeled Diagram

A **cardiac muscle labeled diagram** provides a clear visual understanding of the heart's microstructure, which is crucial for grasping how the myocardium functions. It helps in:

- Identifying cellular components and their arrangement
- Understanding the structural basis for electrical conduction
- Learning the mechanism of muscle contraction
- Recognizing pathological changes in cardiac tissue

Detailed Explanation of Cardiac Muscle Structure

Microstructure of Cardiac Muscle Cells

Cardiac muscle cells, or cardiomyocytes, are unique in their architecture. They are shorter than skeletal muscle fibers, branched, and interconnected, forming a network that allows for coordinated contractions. The key features include:

- **Striations:** Alternating light and dark bands formed by organized sarcomeres, essential for contraction.
- **Intercalated Discs:** Complex junctions that facilitate rapid electrical impulses and mechanical cohesion.
- **Single or Double Nuclei:** Usually centrally located, aiding in cellular metabolism and function.

Role of Intercalated Discs in Cardiac Function

The intercalated discs are critical for maintaining the integrity of cardiac tissue. They contain:

- **Gap Junctions:** Allow ions and small molecules to pass directly between cells, enabling synchronized depolarization.
- **Desmosomes:** Provide mechanical strength, preventing cells from separating during contraction.

Functionality of Cardiac Muscle Components

Myofibrils and Sarcomeres

Myofibrils are the contractile elements within cardiomyocytes, composed of repeating units called sarcomeres. Sarcomeres contain actin and myosin filaments whose interactions produce contraction. The coordinated shortening of sarcomeres leads to myocardial contraction.

Calcium's Role in Cardiac Contraction

Calcium ions released from the sarcoplasmic reticulum bind to troponin on actin filaments, initiating cross-bridge cycling with myosin. This process is pivotal for cardiac muscle contraction and is tightly regulated by electrical signals transmitted via T-tubules.

Importance of the Cardiac Muscle Labeled Diagram in Medical Education

A comprehensive **cardiac muscle labeled diagram** is indispensable in medical training. It aids in:

- Understanding cardiac physiology and pathophysiology
- Learning about cardiac diseases such as cardiomyopathies and myocarditis
- Grasping the basis for diagnostic techniques like histology and electrocardiography

Conclusion

In summary, the **cardiac muscle labeled diagram** is a vital educational resource that provides insight into the complex microstructure of the heart's myocardium. Recognizing its components—from muscle fibers and sarcomeres to intercalated discs and T-tubules—enhances understanding of cardiac function and disease. Whether for academic purposes, clinical practice, or general knowledge, a detailed diagram serves as an effective visual aid to comprehend the elegant design of the heart's muscular tissue and its critical role in sustaining life.

Cardiac Muscle Labeled Diagram: An Expert Overview

Understanding the intricate structure of cardiac muscle is pivotal for appreciating how our heart functions seamlessly to sustain life. A cardiac muscle labeled diagram serves as an invaluable visual tool, providing clarity on the specialized features that distinguish cardiac tissue from other muscle types. In this comprehensive review, we will delve deep into the anatomy, structure, and unique features of cardiac muscle, supported by detailed diagrams and expert insights that make the learning process engaging and thorough.

Introduction to Cardiac Muscle

The human heart is a marvel of biological engineering, capable of rhythmic contractions that pump blood throughout the body. Central to this function is cardiac muscle, a specialized involuntary striated muscle tissue uniquely adapted for continuous, rhythmic activity. Unlike skeletal muscles, which are under voluntary control, cardiac muscles maintain an autonomous rhythm, thanks to their unique cellular and structural features.

A labeled diagram of cardiac muscle is instrumental in understanding these features, highlighting the key components that contribute to the heart's contractile and conductive functions. Such diagrams are widely used in medical education, research, and clinical diagnosis to facilitate recognition and comprehension.

Structural Overview of Cardiac Muscle

At its core, cardiac muscle shares some similarities with skeletal muscle but exhibits distinctive structural elements that enable its specialized function. Let's explore these features systematically:

1. Cardiac Muscle Cells (Cardiomyocytes)

- **Shape and Size:** Cardiomyocytes are generally short, branched, and cylindrical cells measuring approximately 50-100 micrometers in length.
- **Striations:** Like skeletal muscle, they display striations owing to organized sarcomeres, which are the fundamental contractile units.
- **Nucleus:** Most cardiomyocytes are uninucleated or binucleated, with nuclei centrally located within the cell.
- **Intercalated Discs:** Specialized junctions that connect neighboring cells, enabling synchronized contractions.

2. Intercalated Discs

Intercalated discs are complex structures crucial for effective cardiac function. They contain:

- **Desmosomes:** Provide mechanical strength, anchoring cells together to withstand the force of contractions.
- **Gap Junctions:** Facilitate rapid electrical conduction between cells, allowing synchronized depolarization.

A labeled diagram prominently displays these discs at the cell junctions, emphasizing their role in conduction and mechanical integrity.

3. Sarcolemma and T-Tubules

- **Sarcolemma:** The cell membrane of cardiomyocytes, integral for conducting electrical impulses.
- **T-Tubules (Transverse Tubules):** Invaginations of the sarcolemma that penetrate into the cell interior, allowing swift transmission of action potentials and calcium ions necessary for contraction.

The Structural Components in a Labeled Diagram

A detailed cardiac muscle labeled diagram typically highlights the following components:

1. Sarcomeres

- The basic contractile units, composed of actin and myosin filaments arranged in a highly organized pattern.
- Exhibits alternating dark (A bands) and light (I bands) that give the muscle its striated appearance.
- The diagram labels key features such as Z-lines, M-line, H-zone, and I-band, each critical to

contraction mechanics.

2. Myofibrils

- Bundles of sarcomeres running longitudinally within each cell.
- Responsible for the contractile force; their density determines the strength of contraction.

3. Mitochondria

- Cardiac muscle has an abundance of mitochondria (~25-35% of cell volume), reflecting its high energy demands.
- Labeled diagrams often show mitochondria interspersed between myofibrils.

4. Nucleus

- Usually centrally located within the cell.
- The diagram marks nuclei with clear labels to distinguish between cardiac and skeletal muscle.

5. Capillaries and Blood Supply

- Embedded within the tissue, reflecting the rich vascularization necessary for oxygen and nutrient delivery.
- Diagrams may include capillaries running close to cardiomyocytes.

Unique Features of Cardiac Muscle in Labeled Diagrams

A comprehensive diagram not only identifies components but also emphasizes the unique adaptations of cardiac muscle:

1. Branching Fibers

- Cardiac fibers are branched, allowing for a dense network that facilitates coordinated contractions.
- Labeled diagrams indicate the branching points and orientation.

2. Intercalated Discs

- The junctions are often magnified in diagrams to show desmosomes and gap junctions.
- These features are essential for the synchronized depolarization and mechanical strength.

3. Autorhythmicity

- Specialized pacemaker cells (e.g., sinoatrial node) are marked in diagrams to explain how cardiac rhythm originates.

4. Conductive System Components

- Structures such as the atrioventricular (AV) node, bundle of His, and Purkinje fibers are labeled to demonstrate the conduction pathway.

Applications of Cardiac Muscle Labeled Diagrams

A well-constructed diagram serves multiple purposes:

- Educational Tool: Helps students visualize and memorize complex structures.
- Diagnostic Aid: Assists clinicians in understanding pathological changes.
- Research Reference: Guides researchers in understanding cellular interactions and functions.
- Surgical Planning: Visualizes anatomical relationships for interventions.

Creating an Effective Cardiac Muscle Labeled Diagram

To maximize educational value, a diagram should:

- Clearly label all major components.
- Use color coding to differentiate structures (e.g., nuclei, sarcomeres, intercalated discs).
- Include magnified insets for complex junctions like intercalated discs.
- Provide a legend for symbols and labels.
- Incorporate cross-sectional and longitudinal views for comprehensive understanding.

Conclusion

The cardiac muscle labeled diagram is more than just a visual aid; it is a window into the heart's microscopic machinery that sustains life. By meticulously highlighting the structure and specialized features of cardiac tissue, such diagrams enable a deeper understanding of cardiac physiology and

pathology. Whether for students beginning their journey into cardiovascular anatomy or seasoned clinicians seeking a refresher, an accurate, detailed diagram is an indispensable resource.

In essence, mastering the labeled components of cardiac muscle equips learners and professionals alike with the knowledge necessary to appreciate the heart's complex yet elegant design. It underscores the importance of structural specialization in biological function, reinforcing the intricate harmony that sustains our vitality.

Note: For optimal learning, it is recommended to review high-quality, color-coded diagrams accompanied by detailed legends. Visualizing these structures in three dimensions or through interactive models can further enhance comprehension of cardiac muscle anatomy and function.

Question What are the main components labeled in a cardiac muscle diagram? The main components include the striations, intercalated discs, nuclei, sarcoplasmic reticulum, T-tubules, and myofibrils, which are all essential for the contraction and function of cardiac muscle. **Answer** How do intercalated discs contribute to the function of cardiac muscle? Intercalated discs contain gap junctions and desmosomes that facilitate synchronized contraction and mechanical stability by allowing rapid electrical communication between cardiac cells. Why are striations visible in a labeled diagram of cardiac muscle? Striations are visible due to the organized arrangement of actin and myosin filaments within the myofibrils, which are characteristic of cardiac muscle and facilitate contraction. What is the significance of labeled nuclei in the cardiac muscle diagram? The nuclei, typically centrally located, control cellular activities and are essential for gene expression and protein synthesis necessary for muscle contraction and repair. How does the structure of a cardiac muscle cell differ from skeletal muscle, as shown in the diagram? Cardiac muscle cells are shorter, branched, and interconnected via intercalated discs, whereas skeletal muscle fibers are longer, unbranched, and multinucleated; these features are highlighted in the labeled diagram to distinguish their functions.

Related keywords: heart muscle, myocardium, cardiac tissue, heart anatomy, muscle fibers, cardiac cell structure, labeled heart diagram, muscle tissue diagram, cardiac muscle function, heart diagram labels

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