

NEET SS 2024 DrNB Cardiology Paper3 Question Paper with Solution

Time Allowed :3 Hours | Maximum Marks :100 | Total Questions :10

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 10 questions. The maximum marks are 100.
3. Each Question is of 10 marks.

1. Recent advances in the management of atrial fibrillation.

Solution:

Step 1: Understanding the topic.

Atrial fibrillation (AF) is a common arrhythmia, and recent advances in its management focus on improving patient outcomes and reducing the risk of stroke. These advances include better drug therapies, improved rate and rhythm control strategies, and enhanced procedures like catheter ablation.

Step 2: Recent advancements.

Recent research has highlighted several advances in the treatment of atrial fibrillation:

- Antiarrhythmic drugs: New medications are available to restore normal rhythm or control the rate effectively. For example, drugs like flecainide and dronedarone have shown improved efficacy with fewer side effects.
- Catheter ablation: This procedure is now more effective with advances in imaging and mapping technologies, offering better long-term outcomes for patients.
- Stroke prevention: Newer anticoagulants, such as direct oral anticoagulants (DOACs), have made stroke prevention more accessible and safer, especially for patients who cannot tolerate warfarin.
- Lifestyle and risk management: Advances in identifying risk factors like obesity, hypertension, and sleep apnea, as well as the importance of lifestyle interventions, are key to managing atrial fibrillation long-term.

Step 3: Conclusion.

The management of atrial fibrillation has seen significant improvements, focusing on both pharmaceutical and non-pharmaceutical treatments. A personalized approach based on the patient's risk factors and type of AF remains critical.

Quick Tip

When discussing the management of atrial fibrillation, it is important to address both rate and rhythm control, as well as stroke prevention strategies.

2. (a) CLEAR Outcomes trial

Solution:

Step 1: Understanding the CLEAR Outcomes trial.

The **CLEAR Outcomes trial** is a study that focuses on cardiovascular disease outcomes, including patients with heart failure. It is a significant clinical trial designed to evaluate treatment options for heart failure patients.

Step 2: Analysis of the options.

(1) **CLEAR Outcomes trial:** Correct, as this trial investigates heart failure outcomes and treatment.

Step 3: Conclusion.

The CLEAR Outcomes trial is related to heart failure and thus the correct answer for this part.

Quick Tip

In clinical trials, it's important to understand the type of heart failure (e.g., HFpEF, HFrEF) studied to assess the treatment options accurately.

2. (b) STEP-HFpEF trial

Solution:

Step 1: Understanding the STEP-HFpEF trial.

The **STEP-HFpEF trial** focuses on heart failure with preserved ejection fraction (HFpEF), a specific subgroup of heart failure. This trial examines treatment options for patients with this condition, which is characterized by a normal ejection fraction but with heart failure symptoms.

Step 2: Analysis of the options.

(2) **STEP-HFpEF trial:** Correct, as this trial specifically addresses heart failure with preserved ejection fraction (HFpEF).

Step 3: Conclusion.

The STEP-HFpEF trial is focused on HFpEF and is a major trial in treating this specific type of heart failure. Therefore, the correct answer for this part is the STEP-HFpEF trial.

Quick Tip

HFpEF (Heart Failure with Preserved Ejection Fraction) is a challenging condition, and trials like STEP-HFpEF aim to find effective treatments for this subgroup.

3. Role of intra-cardiac echocardiogram in Interventional Cardiology.

Solution:

Step 1: Understanding the intra-cardiac echocardiogram (ICE).

An intra-cardiac echocardiogram (ICE) is a specialized imaging technique used in interventional cardiology. It involves placing a small catheter with an ultrasound probe into the heart to provide real-time imaging during procedures. This technique allows cardiologists to visualize the heart's structure and function from within, offering more detailed information compared to traditional echocardiograms.

Step 2: Role in interventional cardiology.

In interventional cardiology, ICE is essential for guiding procedures such as catheter placements, balloon angioplasty, and stent insertion. It provides critical information on heart chamber sizes, valve function, and the presence of blood clots or plaques, helping to guide the treatment process accurately and safely.

Step 3: Advantages of ICE.

ICE offers several advantages, including better visualization of cardiac structures, real-time imaging during procedures, and improved safety and accuracy. It reduces the need for fluoroscopy, decreasing radiation exposure, and allows for more precise interventions in complex cases.

Step 4: Conclusion.

The intra-cardiac echocardiogram plays a crucial role in interventional cardiology by enhancing procedural guidance, improving patient outcomes, and reducing procedural risks. It is an invaluable tool for cardiologists performing complex heart procedures.

Quick Tip

ICE is particularly useful in complex heart procedures where real-time visualization of cardiac structures is essential for successful outcomes.

4. Current indications and advances in transcatheter tricuspid valve therapies.

Solution:

Step 1: Understanding Transcatheter Tricuspid Valve Therapies.

Transcatheter tricuspid valve therapies refer to minimally invasive procedures used to treat tricuspid valve diseases, primarily tricuspid regurgitation (TR). These therapies involve the use of a catheter to repair or replace the tricuspid valve without the need for open-heart surgery. They are a part of a broader category of transcatheter heart valve therapies that have revolutionized the management of valvular heart diseases.

Step 2: Current Indications for Transcatheter Tricuspid Valve Therapies.

The primary indication for these therapies is symptomatic severe tricuspid regurgitation, which often results from primary valve disease or secondary enlargement due to left-sided heart disease. Other indications include patients who are not candidates for traditional surgery due to advanced age or comorbidities, as well as those with recurrent tricuspid regurgitation after surgery. These therapies are also considered for patients with progressive heart failure symptoms and poor quality of life.

Step 3: Advances in Transcatheter Tricuspid Valve Therapies.

Recent advances in transcatheter tricuspid valve therapies include novel catheter-based devices for valve repair and replacement, such as the transcatheter tricuspid valve replacement (TTVR) and edge-to-edge repair devices. These advancements allow for more precise and less invasive procedures, with improved patient outcomes. Additionally, the development of transcatheter technologies that enable valve repair has expanded the treatment options for high-risk patients.

Step 4: Conclusion.

Transcatheter tricuspid valve therapies have become a cornerstone in the treatment of tricuspid valve diseases, offering a promising solution for patients who are not candidates for conventional surgery. Advances in this field continue to improve patient outcomes and provide less invasive alternatives for managing tricuspid valve diseases.

Quick Tip

Transcatheter valve therapies are crucial for high-risk patients and those with severe comorbidities, offering them an opportunity for treatment without the need for open-heart surgery.

5. ECMO: indications, technique and limitations in Cardiology practice.

Solution:

Step 1: Understanding ECMO (Extracorporeal Membrane Oxygenation).

ECMO is a life-support technique used for patients with severe cardiac and/or respiratory failure. It involves the use of a machine to oxygenate the blood outside the body, providing

heart and lung support when the heart and lungs are not functioning adequately. The process involves two primary types: veno-arterial (VA) ECMO, which provides support for both heart and lungs, and veno-venous (VV) ECMO, which supports the lungs only.

Step 2: Indications for ECMO in Cardiology.

ECMO is indicated in cases of severe, refractory cardiogenic shock, which may occur due to conditions like acute myocardial infarction, myocarditis, or severe heart failure. It is also used in cases of severe respiratory failure due to conditions such as acute respiratory distress syndrome (ARDS), pneumonia, or post-cardiac surgery complications. Additionally, ECMO can be considered as a bridge to recovery or transplantation in patients awaiting a heart or lung transplant.

Step 3: Technique of ECMO.

The ECMO procedure involves cannulation of blood vessels, through which blood is withdrawn, oxygenated, and then returned to the patient. The veno-venous configuration is used for respiratory support, while veno-arterial ECMO supports both the heart and lungs. The blood is pumped through a circuit that includes a pump, oxygenator, and heat exchanger. This allows for gas exchange and circulatory support outside the body.

Step 4: Limitations of ECMO.

Despite its life-saving capabilities, ECMO has limitations. It requires specialized expertise and resources, and is not suitable for all patients, particularly those with multiple organ failure or irreversible damage. ECMO is associated with significant risks, including bleeding, infection, thromboembolism, and mechanical complications. Additionally, prolonged ECMO support can lead to complications such as renal failure and limb ischemia.

Step 5: Conclusion.

ECMO is a valuable tool in critical care cardiology, especially for patients with severe heart and lung failure. However, its use is associated with risks and limitations, and it should be considered carefully in conjunction with other treatment options.

Quick Tip

ECMO should be considered as a life-saving support mechanism in critically ill patients with reversible heart or lung failure. Early initiation and careful management are key to minimizing complications.

6. Subcutaneous ICD: indications, limitations and technique of implantation.

Solution:

Step 1: Understanding Subcutaneous ICD (S-ICD).

A Subcutaneous Implantable Cardioverter Defibrillator (S-ICD) is a device designed to treat

life-threatening arrhythmias, such as ventricular fibrillation and ventricular tachycardia, without the need for transvenous leads. Unlike traditional ICDs, which use transvenous leads that pass through blood vessels, the S-ICD is implanted under the skin, typically on the left side of the chest. It uses an external electrode placed subcutaneously to deliver shocks for rhythm disturbances.

Step 2: Indications for S-ICD.

The primary indication for an S-ICD is the prevention of sudden cardiac death in patients with high-risk arrhythmias, especially those with a history of ventricular arrhythmias or those at risk of developing such conditions. Patients with an intact heart and no need for pacing, such as those with idiopathic or genetic arrhythmias (e.g., long QT syndrome or Brugada syndrome), are often suitable candidates. It is particularly advantageous in patients who have contraindications for transvenous devices, such as those with venous occlusion or those who have had a history of infection related to transvenous leads.

Step 3: Technique of Implantation.

The implantation of an S-ICD is a minimally invasive procedure typically performed under local anesthesia and sedation. The device is placed just below the skin, usually on the left side of the chest, while the subcutaneous electrode is tunneled under the skin and positioned along the left chest wall. The system is then tested to ensure correct sensing and shock delivery. The procedure involves careful planning to avoid the breastbone, ribs, and muscles, with post-operative monitoring for device function and complications.

Step 4: Limitations of S-ICD.

Despite its benefits, the S-ICD has certain limitations. It cannot provide pacing therapy, which means it is not suitable for patients who require pacing for bradycardia or other conduction abnormalities. Additionally, there may be challenges in sensing arrhythmias in certain patients, and the device's shock delivery can be more painful compared to transvenous ICDs. Furthermore, the implantation procedure, while minimally invasive, can be technically challenging, especially in patients with obesity or those with a high body mass index (BMI).

Step 5: Conclusion.

The Subcutaneous ICD is an important innovation in the prevention of sudden cardiac death, particularly for patients with arrhythmias who do not need pacing. While the procedure is minimally invasive and associated with fewer complications than traditional ICDs, it does have limitations that must be considered during patient selection.

Quick Tip

S-ICDs are ideal for patients requiring defibrillation but not pacing, and they are especially useful in those with venous access issues or a high risk of device infections.

7. Left atrial appendage closure: technique, device, indications and contraindications.

Solution:

Step 1: Understanding Left Atrial Appendage Closure (LAAC).

Left atrial appendage closure (LAAC) is a procedure used to prevent stroke in patients with atrial fibrillation (AF) who are at high risk of thromboembolism. The left atrial appendage is a pouch-like structure in the left atrium where blood clots can form in patients with AF. Closing this appendage reduces the risk of stroke by preventing clot formation and embolization.

Step 2: Technique of LAAC.

LAAC can be performed percutaneously or surgically. The percutaneous approach is the most common and involves the use of a catheter to insert a device into the left atrial appendage through a vein. A common device used for LAAC is the WATCHMAN device, which is a self-expanding plug that occludes the appendage. The procedure is typically performed under general anesthesia and requires the use of fluoroscopy and echocardiography to guide device placement. After implantation, the device permanently seals the appendage, and the patient can begin anticoagulation therapy.

Step 3: Indications for LAAC.

The main indication for LAAC is stroke prevention in patients with non-valvular atrial fibrillation who are not candidates for long-term anticoagulation therapy due to bleeding risks. It is also considered for patients with persistent AF who are at high risk for stroke and have failed or are not candidates for other forms of rhythm control, including ablation or medication therapy. Other indications may include patients with mechanical heart valves or those with recurrent thromboembolic events despite anticoagulation therapy.

Step 4: Contraindications for LAAC.

LAAC is not recommended for patients with significant left atrial thrombus, as the device may dislodge existing clots, leading to a stroke. It is also contraindicated in patients with active infection or endocarditis, severe mitral stenosis, or those with other significant valvular diseases. In addition, patients who are unable to comply with post-procedure anticoagulation therapy or who have contraindications to anticoagulants should not undergo LAAC.

Step 5: Conclusion.

LAAC is a safe and effective procedure for reducing stroke risk in high-risk AF patients who cannot tolerate long-term anticoagulation. It offers a permanent solution to reduce the risk of stroke without the need for lifelong anticoagulant therapy. However, careful patient selection is essential to ensure optimal outcomes.

Quick Tip

Left atrial appendage closure is particularly useful for stroke prevention in patients with atrial fibrillation who are at high risk for bleeding or unable to take anticoagulants long-term.

8. Remote monitoring devices for arrhythmia: types, indications and limitations.

Solution:

Step 1: Understanding Remote Monitoring Devices for Arrhythmia.

Remote monitoring devices for arrhythmia are used to continuously monitor and track a patient's heart rhythm outside of a clinical setting. These devices provide real-time data to healthcare providers, allowing for timely interventions in case of arrhythmic events. They are particularly useful for patients with conditions like atrial fibrillation, ventricular arrhythmias, or those who have implanted cardiac devices like pacemakers or defibrillators.

Step 2: Types of Remote Monitoring Devices.

Several types of remote monitoring devices are used for arrhythmia management:

- Wearable ECG Monitors: These devices record continuous electrocardiogram (ECG) data, which can be transmitted to healthcare providers. They are typically worn as patches, wristbands, or chest straps.
- Implantable Cardiac Devices (ICDs and Pacemakers): Modern ICDs and pacemakers come with built-in remote monitoring features, allowing healthcare providers to track device function and arrhythmia events remotely.
- Mobile Health Applications: These apps allow patients to monitor their heart rate and rhythm using their smartphones, often paired with external sensors or patches.
- Patch-based Monitors: A small adhesive patch with embedded electrodes that continuously records ECG and transmits the data to the healthcare provider.

Step 3: Indications for Remote Monitoring.

Remote monitoring is particularly useful in the following situations:

- Patients with Atrial Fibrillation (AF): AF patients benefit from remote monitoring as it helps track episodes of arrhythmia, ensuring timely interventions, especially for those on anticoagulation therapy.
- Post-surgery or after device implantation: Patients with pacemakers or ICDs can benefit from continuous monitoring to track device performance and identify potential arrhythmias.
- High-risk patients: Those at high risk for sudden cardiac death or other arrhythmias can benefit from constant monitoring to detect dangerous rhythms early.
- Management of chronic arrhythmias: Patients with chronic arrhythmias, such as ventricular tachycardia, can use remote monitoring to assess treatment efficacy and manage their condition more effectively.

Step 4: Limitations of Remote Monitoring.

While remote monitoring offers significant advantages, there are some limitations:

- Technology barriers: Not all patients are comfortable or capable of using advanced technology, particularly elderly patients or those with limited access to mobile devices.
- Data overload: Continuous monitoring can lead to an overwhelming amount of data, which may make it difficult for healthcare providers to prioritize urgent issues.
- Connectivity issues: Remote monitoring depends on the availability of a stable internet connection for data transmission. In areas with poor connectivity, the efficacy of these devices can be compromised.
- False alarms: Some remote monitoring devices may trigger false alarms, leading to unnecessary anxiety and additional tests.
- Limited diagnostic capability: While remote monitoring devices are excellent for tracking arrhythmia events, they may not provide comprehensive diagnostic information compared to in-hospital tests.

Step 5: Conclusion.

Remote monitoring devices for arrhythmia offer a valuable tool for managing heart conditions, improving patient outcomes by enabling early intervention and ongoing assessment. However, careful patient selection and the integration of these devices into clinical workflows are crucial to overcoming the limitations and ensuring their effectiveness.

Quick Tip

Remote monitoring devices can enhance patient care, but healthcare providers should balance the benefits with the potential for data overload and ensure adequate support for patients.

9. Discuss the various options of surgical management of heart failure.

Solution:

Step 1: Understanding Surgical Management of Heart Failure.

Surgical management of heart failure is considered when medical therapy is not sufficient, and the patient continues to experience symptoms of heart failure. The goal of surgery is to improve cardiac function, alleviate symptoms, and improve survival. Surgical interventions may be necessary for patients with advanced heart failure or those who are not responsive to medical treatments.

Step 2: Surgical Options for Heart Failure.

The main surgical options for managing heart failure include:

- Coronary Artery Bypass Grafting (CABG): CABG is performed in patients with heart failure caused by coronary artery disease (CAD). In this procedure, blocked coronary arteries are bypassed with healthy vessels, improving blood flow to the heart and reducing symptoms of heart failure. CABG is typically recommended when heart failure is secondary to CAD.
- Valve Repair or Replacement: In cases of heart failure caused by valvular heart disease, valve repair or replacement may be necessary. This procedure is performed to treat conditions such as mitral regurgitation or aortic stenosis, where the valve function is compromised, leading to inefficient heart pumping. Valve repair or replacement improves cardiac output and reduces heart failure symptoms.
- Left Ventricular Assist Device (LVAD): An LVAD is a mechanical pump implanted to help the left ventricle pump blood in patients with severe heart failure. LVADs are often used as a bridge to heart transplantation for patients awaiting a donor heart, or as a long-term therapy for patients who are not candidates for a heart transplant.

- Heart Transplantation: Heart transplantation is considered the definitive surgical treatment for end-stage heart failure in patients who are not responsive to other treatments. The procedure involves the removal of the patient's diseased heart and the implantation of a donor heart. This is usually reserved for patients with advanced heart failure and no other viable treatment options.
- Cardiac Resynchronization Therapy (CRT): Also known as biventricular pacing, CRT involves the implantation of a specialized pacemaker that coordinates the contraction of the left and right ventricles to improve heart function. CRT is typically used in patients with heart failure and a wide QRS complex, a sign of poor electrical conduction in the heart.
- Endoventricular Circular Patch Plasty (Dor Procedure): This is a surgical technique used to treat patients with dilated cardiomyopathy by repairing the ventricular wall to improve heart function. It is sometimes performed in combination with other procedures like LVAD implantation or valve surgery.

Step 3: Limitations and Considerations.

Each of the surgical options has its own limitations and indications:

- CABG is limited to patients with heart failure due to CAD and may not be effective in those with non-ischemic cardiomyopathies.

- Valve surgery is indicated for patients with significant valvular disease but may not be beneficial for those with advanced heart failure or poor ventricular function.
- LVADs require lifelong anticoagulation and may lead to complications such as bleeding, infection, or device failure. They are also not a cure but serve as a bridge to heart transplantation or long-term therapy.
- Heart transplantation is limited by the availability of donor hearts and requires lifelong immunosuppressive therapy to prevent organ rejection.
- CRT requires appropriate patient selection and may not be effective in all patients with heart failure.

Step 4: Conclusion.

Surgical management of heart failure provides important treatment options for patients with advanced or refractory heart failure. The choice of procedure depends on the underlying cause of heart failure, the severity of symptoms, and the patient's overall health. Multidisciplinary management and careful patient selection are essential to achieving the best outcomes for patients undergoing surgical interventions.

Quick Tip

Surgical options for heart failure should be individualized based on the patient's specific condition, and the risks and benefits of each procedure should be carefully considered.

10. Non-conventional risk markers of ASCVD and associated interventions.

Solution:

Step 1: Understanding ASCVD and its Risk Factors.

Atherosclerotic cardiovascular disease (ASCVD) encompasses a group of conditions that involve the buildup of atherosclerotic plaques in the arteries, leading to cardiovascular events like heart attacks, strokes, and peripheral artery disease. Traditional risk factors for ASCVD include hypertension, high cholesterol, smoking, diabetes, and family history. However, non-conventional or emerging risk markers are increasingly being studied to further predict and manage ASCVD risk.

Step 2: Non-Conventional Risk Markers for ASCVD.

Some non-conventional risk markers that have been linked to ASCVD include:

- High-Sensitivity C-Reactive Protein (hs-CRP): A marker of inflammation, hs-CRP has been shown to be an independent predictor of cardiovascular events. Elevated levels indicate systemic inflammation, which plays a key role in the development of atherosclerosis.
- Lipoprotein(a) [Lp(a)]: Lp(a) is a genetic variant of LDL cholesterol that has been associated with an increased risk of ASCVD. Elevated Lp(a) levels are considered a non-modifiable risk factor, making it a valuable marker for individuals with a family history of cardiovascular disease.
- Coronary Artery Calcium (CAC) Score: The CAC score is a measure of calcified plaque in the coronary arteries, detected via CT scanning. Higher scores are associated with a greater risk of cardiovascular events, and the CAC score is often used to refine risk assessment in patients at intermediate risk.
- Ankle-Brachial Index (ABI): This simple test measures the ratio of blood pressure in the ankle to the blood pressure in the arm. A low ABI suggests peripheral artery disease and an increased risk of ASCVD.
- Endothelial Dysfunction: Dysfunction of the endothelial cells lining blood vessels is an early marker of atherosclerosis. It can be assessed non-invasively through techniques like flow-mediated dilation (FMD), which measures the ability of blood vessels to dilate in response to stress.
- Fibrinogen: Fibrinogen is a blood protein involved in clotting. Higher fibrinogen levels are associated with an increased risk of thrombosis and cardiovascular events, as it contributes to the formation of blood clots in the arteries.
- Apolipoproteins (ApoB and ApoA1): Apolipoproteins are proteins that bind lipids to form lipoproteins. ApoB, which is found in atherogenic lipoproteins like LDL, is a key marker of atherosclerotic risk. The ApoB/ApoA1 ratio is a more accurate predictor of ASCVD than traditional lipid measures like total cholesterol or LDL.
- Homocysteine: Elevated homocysteine levels have been implicated in endothelial damage and an increased risk of ASCVD. Homocysteine can be lowered through folate and B-vitamin sup-

plementation.

Step 3: Associated Interventions.

The identification of non-conventional risk markers can lead to more targeted interventions to reduce ASCVD risk:

- Statins: These are the cornerstone of therapy for reducing cholesterol levels and managing ASCVD risk. Statins have been shown to reduce both LDL levels and inflammation, especially in patients with elevated hs-CRP.
- Aspirin: For high-risk individuals, aspirin therapy may be used to reduce thrombotic risk by inhibiting platelet aggregation. However, its use should be individualized due to bleeding risks.
- Lifestyle Modifications: Diet, exercise, smoking cessation, and weight management remain critical interventions for both conventional and non-conventional risk factors.
- PCSK9 Inhibitors: These newer agents, which lower LDL cholesterol, can be considered for individuals with elevated Lp(a) or those who have familial hypercholesterolemia.
- Vitamin Supplementation: In cases of elevated homocysteine, B-vitamin supplementation (folate, B6, B12) may help lower levels and reduce ASCVD risk.
- Ablation of Endothelial Dysfunction: In patients with proven endothelial dysfunction, treatments like statins, ACE inhibitors, and lifestyle changes can help improve endothelial function and reduce the risk of ASCVD.

Step 4: Conclusion.

Non-conventional risk markers play an important role in identifying individuals at higher risk for ASCVD, especially in those who may not have traditional risk factors. Understanding and monitoring these markers, along with appropriate interventions, can help prevent cardiovascular events and improve overall heart health.

Quick Tip

Emerging risk markers such as hs-CRP and Lp(a) provide valuable information for refining ASCVD risk assessment, helping healthcare providers to personalize treatment strategies.