Volume 2 Issue 2, 2024

NEWSLETTER

Pakistan Association of Cardiothoracic Anaesthesiologists

VIGILANCE ENSURE SAFETY

Inside This Issue:

EDITORIAL

Assalam Alaikum,

this is the second issue of the Newsletter published this year under the banner of the Pakistan Association of Cardiothoracic Anaesthesiologists (PACTA).

I received several excellent suggestions regarding previous Newsletters and incorporated them into this edition. Two excellent suggestions were to include case reports and educational quizzes for young readers.

You will find both in the present edition. This year, we launched the long-awaited PACTA website, a significant milestone for our Society. The website will update recent events and activities planned. All the Newsletters are also available on the PACTA website (www.pacta.pk).

This Newsletter's theme is Ischemic Heart Disease and cardiac anaesthesia, and we have included important topics related to this theme. I am grateful to all who contributed, including the writers, reviewers, and editors.

Please keep sending your feedback to improve the quality of this Newsletter.

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Axillary IABP: Enhancing Recovery after CABG Surgery

(Prof. Syed Aqeel Hussain, AFIC/NIHD, Rawalpindi)

Introduction:

At our advanced Cardiac Care Hospital (AFIC), we have observed a rise in cardiac surgery patients with compromised left ventricular function. The absence of a national heart transplant program necessitates complex coronary revascularization procedures. Postoperatively, some patients may require mechanical circulatory assistance. The intra-aortic balloon pump (IABP) is a common initial intervention due to its cost-effectiveness and ease of use. However, traditional femoral insertion limits mobility and hinders rehabilitation. The axillary artery offers an alternative approach for IABP placement, particularly beneficial for patients requiring prolonged support. This method facilitates ambulation and participation in rehabilitation programs, improving functional recovery. While our institution lacks experience with this technique, we present a successful case.

Please send your comments and feedback to the editor's desk
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Case Report:

A 58-year-old male with hypertension, COPD, and documented multivessel coronary artery disease (TVCAD) underwent CABG surgery. Preoperative echocardiography revealed a depressed left ventricular ejection fraction (LVEF) of 30%. Considering the potential need for prolonged support, a percutaneous axillary IABP was placed via the left axillary artery to facilitate early mobilization and respiratory therapy.

The procedure was performed in a hybrid catheterization laboratory. Following standard antibiotic prophylaxis, the patient was positioned supine with the left arm abducted. Ultrasound guidance was used to locate and access the left axillary artery. A small introducer sheath was inserted, followed by a J-shaped guidewire advanced into the descending aorta. The IABP sheath was positioned just below the diaphragm, and the IABP catheter was deployed. Proper positioning was confirmed with fluoroscopy. The IABP was secured, and a sterile dressing was applied.

The patient underwent off-pump CABG surgery with three bypass grafts. Postoperatively, he required moderate inotropic support initially but was successfully extubated the following morning. Unlike patients with a femoral IABP, early mobilization was facilitated. He ambulated out of bed and sat in a chair on postoperative day 1, followed by supervised ambulation and respiratory therapy on day 2. Due to his favourable clinical course, the IABP was removed on day 3. The patient's postoperative course remained stable, permitting ICU discharge on day five and hospital discharge on day 8. A three-week follow-up revealed sustained clinical improvement with no complications.

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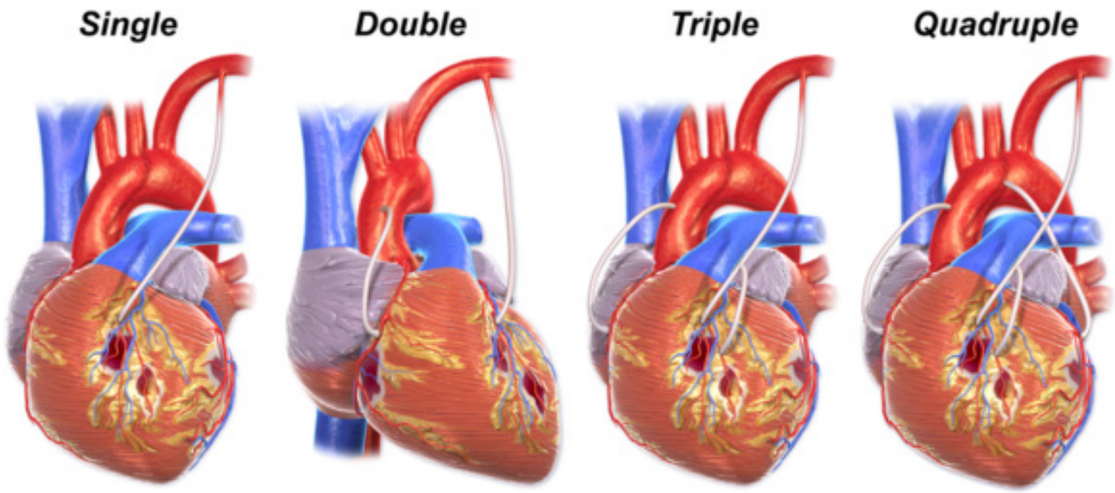
Discussion:

Preoperative IABP use in high-risk CABG patients has been associated with improved outcomes. While femoral IABP is standard, it restricts mobility. Axillary IABP offers a percutaneous approach that facilitates early ambulation and potentially improves physical recovery. Our case demonstrates the successful implementation of this technique.

Conclusion:

Percutaneous axillary IABP placement appears valuable for high-risk CABG patients requiring IABP support. This approach promotes earlier patient mobilization and may contribute to a more robust recovery than the traditional femoral approach. Further experience with this technique at our institution is recommended.



Coronary Artery Bypass Graft (CABG)

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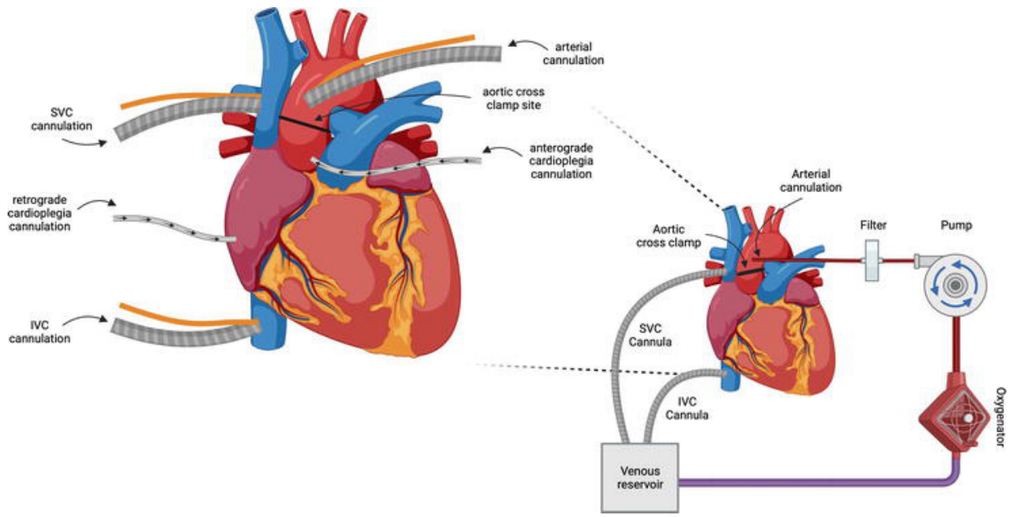

Interpretation of cardiac catheterization finding what the Anesthesiologist must know

Cardiac catheterization findings provide a wealth of information about the heart's structure and function. Interpreting these findings goes beyond anaesthesia implications and plays a crucial role in diagnosing and managing various heart conditions.

Clinical Context: The interpretation hinges on the patient's medical history, symptoms, and prior investigations. It is crucial to know if the catheterization is diagnostic (evaluating a suspected issue) or interventional (treating a blockage). Additionally, factors like age, comorbidities, and risk factors for coronary artery disease influence the results evaluation.

Hemodynamic Data: Cardiac catheterization measures pressures within different heart chambers and major vessels. Normal values exist for each pressure, and deviations can indicate specific problems. For instance, elevated right atrial pressure might suggest heart failure or valvular stenosis. Similarly, high pulmonary artery pressure could point towards pulmonary hypertension.

Coronary Anatomy: Coronary angiography, a part of cardiac catheterization, visualizes the coronary arteries that supply blood to the heart muscle. This helps identify blockages (stenosis) or narrowing, which can cause angina or even heart attacks. The severity of the blockage and the number of arteries involved determine treatment approaches.

Ventricular Function: Cardiac catheterization can assess the pumping efficiency of the heart ventricles. This involves measuring volumes of blood ejected with each heartbeat (ejection fraction). A low ejection fraction indicates a weak heart and can be a marker for heart failure.

Valvular Function: The catheterization procedure can evaluate the function of heart valves. This might involve assessing pressure gradients across valves, which can indicate stenosis (narrowing) or regurgitation (leakage).

Shunts: Cardiac catheterization can detect abnormal connections between heart chambers or blood vessels (shunts). These shunts can allow blood to flow abnormally, reducing oxygen delivery to the body or causing excessive blood flow to the lungs.

In conclusion, comprehensive analysis guides treatment decisions, which might involve medications, balloon angioplasty, stent placement, valve replacement, or bypass. Understanding these core aspects of cardiac catheterization findings improves patient outcomes.

● Paul Callan, et al. Right heart catheterization: indications and interpretation: Heart 2016; 102 87-88 Published Online First: 04 Jan 2016. doi: 10.1136/heartjnl-2015-309115
• Catherine M Otto et al. 2020 ACC/AHA Guideline for the Management of Patients with Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines: Circulation. 2021 Feb 2; 143(5):e72-e227.

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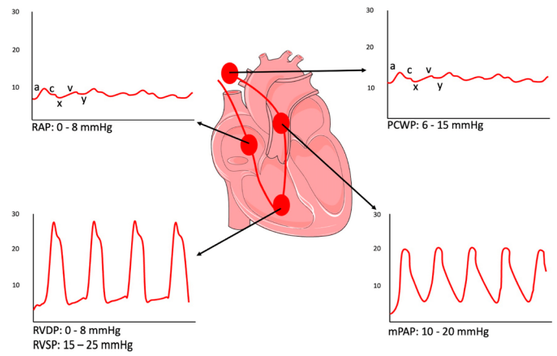


WHAT IS MYOCARDIAL NUCLEAR SCINTIGRAPHY:

Myocardial Nuclear Scintigraphy, also known as Myocardial perfusion imaging or scanning (MPI or MPS), is a non-invasive nuclear medicine imaging procedure that illustrates the function of the myocardium. There are two types of MPI: single photon emission computed tomography (SPECT) and positron emission tomography (PET).SPECT, more commonly used and available in clinical practice today, uses planar images to reconstruct a three-dimensional representation of myocardial perfusion.PET imaging, although less available than SPECT, can help overcome some of the limitations of SPECT use, provide better spatial resolution, and allow for attenuation correction with more accuracy than SPECT.PET scanning also quantifies myocardial blood flow and myocardial flow reserve and can significantly benefit risk stratification.

Myocardial Perfusion Scan to Assess Myocardial Ischemia:
Stress MPS assesses the physiological significance of coronary stenosis by inducing heterogeneity in coronary flow. Resting coronary flow is maintained until there is an approximately 90% reduction of coronary arterial flow. However, the ability to maintain the maximum flow (termed coronary flow reserve) is impaired with approximately 50% coronary stenosis. An increase in coronary flow can be achieved by increased oxygen demand with exercise (treadmill), a b-adrenergic agonist (dobutamine), or a direct vasodilator (adenosine, dipyridamole).

SPECT MPS is used in the diagnosis and risk stratification of ischemic heart disease in patients with intermediate risk for CAD. It is used To identify the extent, severity, and location of myocardial ischemia.
• Assess the functional significance of intermediate coronary artery stenosis.

• Abnormal, non-diagnostic resting EKG or non-diagnostic treadmill stress test.
• Intermediate Duke Treadmill score (score between 4 and -11) on exercise stress test (ETT).
• Repeat testing in patients with a change in their ischemic symptoms.
• Severe coronary calcification on CT angiogram with unpredictable ECG.
• Asymptomatic patients but with high-risk occupations (such as firefighters and pilots).
• Assessment of Interventions and risk stratification in Ischemic Heart Disease patients, 2 to 5 years after revascularization (either CABG or Coronary angioplasty) in high-risk asymptomatic patients.
• Repeat testing to evaluate the therapeutic efficacy in patients with ischemic heart disease.
• Before Non-cardiac Surgery, inpatients undergoing Intermediate-risk surgery or vascular surgery and risk factors with poor functional capacity (<4 METS)

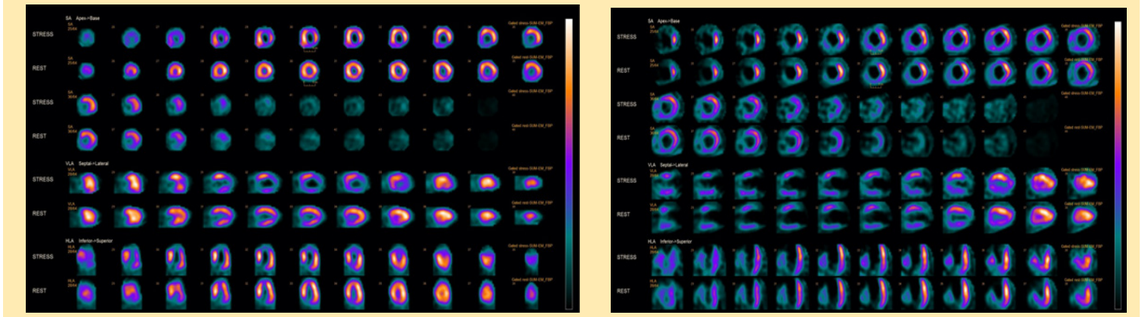
Myocardial Perfusion Scan Techniques:
Several stress techniques are available, but the Graded exercise stress test is the preferred method for patients who can exercise adequately because it is more physiological and provides several important prognostic data in addition to increasing coronary blood flow. Maximum exercise results in a 3-4 fold increase in coronary blood flow secondary to an increase in myocardial oxygen consumption due to an increase in heart rate and contractility and flow-mediated vasodilatation from the release of endothelial-derived factor from normal endothelial cells in response to stress from increased flow. Pharmacological stress must be considered in case of contraindication to exercise stress testing.

99mTc-labeled radionuclides (99mTc sestamibi and 99mTc-tetrofosmin) are the most commonly used radio-pharmaceuticals in SPECT MPS.

The interpretation of MPS SPECT images should be performed systematically and consistently. This includes evaluating the raw images in cine mode to determine the presence of potential sources of image artefact and the distribution of extracardiac tracer activity.

Normal myocardial perfusion study: There is homogenous radiotracer distribution in both stress and rest images, and hence, there is no clinically significant infarction or coronary stenosis.
Reversible Perfusion defect A defect in the stress images that normalises in the rest of the images indicates an inducible perfusion abnormality and normally corresponds to a significant coronary stenosis.

Fixed Perfusion defect: A defect that remains the same in both stress and rest images indicates an area with loss of viable myocardium, such as after myocardial infarction. A severe fixed defect most likely represents scarring or fibrosis from prior MI, but a mild or moderate fixed defect may indicate hibernating myocardium or prior nontransmural MI.



High-risk scintigraphic findings:

• Multiple ischemic perfusion defects in more than one coronary artery territory.
• Low LV ejection (LVEF) of less than 40%
• Increased end-diastolic and end-systolic volumes.
• Increased lung uptake with TL 201.
• Right ventricular uptake.
• Transient ischemic dilatation.

CONCLUSION:
A myocardial perfusion scan (MPS) is a non-invasive, readily available, and reliable imaging test to assess myocardial ischemia. Its high diagnostic accuracy allows reliable risk stratification and guides the selection of patients for further interventions, such as revascularisation. On the other hand, a normal MPS indicates a low-risk group with less than 1% cardiovascular death or non-fatal myocardial infarction per year.

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Myocardial protection during cardiopulmonary bypass period Recent trends/ Current options and challenges

Myocardial protection during cardiopulmonary bypass period is an essential component of cardiac surgery to prevent postoperative ventricular dysfunction. Currently available techniques are still evolving, and further improvement needed particularly in high-risk clinical settings.

The cornerstone of myocardial preservation has been the combination of hypothermia to reduce myocardial oxygen demand and electromechanical cardiac arrest in diastole using potassium containing cardioplegia. Other established strategies are to avoid hyperglycaemia, hyperthermia, hyperoxia and extreme swings in intracellular calcium. (warm blood cardioplegia Ahmed). Few centres still used GIK solution (20 IU insulin and 10 mEq potassium in 50 ml glucose 40%) to prevent low cardiac output syndrome in high-risk patients undergoing on pump cardiac surgery. Ellenberger C. Anesth Analg. 2018;126(4):1133.

The various types of cardioplegia solutions available in terms of composition, delivery method, temperature, and additives. Composition common in all the cardioplegia solutions are Potassium (15-35 mEq/L), Low dose Calcium, Sodium, Chloride, Magnesium, and buffers to counteract ischaemia induced acidosis. Myocardial edema is minimized by monitoring pressure of cardioplegia infusion and administering moderately hyperosmolar solution. Single dose cardioplegia are more common nowadays.
Two commonly used crystalloid cardioplegia are St Thomas (Extracellular require repeated dosing after 20 minutes) and Del Nido cardioplegia (provides longer myocardial protection). Del Nido cardioplegia for infants and children is dosed at 20 mL/kg at a temperature of 8 to 12 degrees Celsius in an anterograde fashion.
Cardioplegia composition can be pure crystalloid or commonly used blood containing cardioplegia. Blood cardioplegia provide energy and substrate to myocardium leading to better myocardial protection. Several surveys mentioned blood cardioplegia is the favoured technique in USA and UK. Typically, ratio of 4:1 (4 parts blood and one part crystalloid) is used at regular interval. Alternatively, Del Nido formula administered at a ratio of 1:4 (1 part blood to 4 parts crystalloids) as a single dose cardioplegia solution, the effect may last for 90 minutes.

There is a debate about cold Vs warm cardioplegia and most of the surgeons still prefer cold blood cardioplegia despite several disadvantages including reduced energy substrate, cellular edema, calcium sequestration and acidosis. Cold cardioplegia seems to be more effective in protecting myocardial function particularly with prolonged cross clamp time. Warm blood cardioplegia is associated with higher perioperative stroke rates and vasodilation. Still there is no consensus regarding temperature of cardioplegia solution. A recent meta-analysis showed no significant difference in major postoperative outcomes. (JTCV open)

Intermittent cardioplegia is typically used but there are advantages of continuous cardioplegia in certain surgeries like aortic root surgery and complex paediatric surgeries. Despite its several disadvantages the retrograde method is still preferred in certain surgeries like critical coronary stenosis, aortic regurgitation, heavily calcified coronary ostia, aortic root replacement with coronaries reimplantation and where continuous cardioplegia is required. Target maximum pressure is typically 40 mmHg.

Myocardial ischaemic preconditioning is supposed to be a protective adoptive response to prolong ischaemia which requires brief period of sublethal ischaemia. Temporary cessation of coronary flow is difficult to perform in many clinical situations. Preconditioning can be simulated by certain pharmacological agents like adenosine. Studies have shown that the use of volatile anaesthethetic agents may also provide cardioprotection by same mechanism.

Vasoplegia, also known as vasoplegic shock or distributive shock, is a syndrome characterized by pathologically low systemic vascular resistance (SVR). The dominant clinical feature of vasoplegia is reduced blood pressure despite having a normal or raised cardiac output. This condition can occur in various clinical scenarios, including septic shock, post-cardiac bypass surgery, burns, and trauma.
Here are some key points about vasoplegia

1. Definition and Criteria
•Vasoplegia is encountered in situations where the SVR is abnormally low, leading to hypotension or the need for therapies to prevent it.
• The criteria for diagnosing vasoplegia include:
• Mean arterial pressure (MAP) < 65 mmHg with resistance to fluid challenge.
• SVR < 800 dynes.s/cm5.
• Cardiac index (CI) ≥ 2.2 L/min/m2.
• In patients with severe cardiac dysfunction, a CI < 2.2 L/min/m2 may still indicate a mixed form of shock.

2. Incidence
• The occurrence of vasoplegic syndrome after cardiopulmonary bypass (CPB) varies from 5% to 44% and constitutes 4.6% of all forms of circulatory shock.

3. Predisposing Factors
• Patient-related factors: Advanced age, anaemia, low left ventricular ejection fraction (LVEF), and renal failure.
• Pre-/perioperative drugs: Diuretics, sympatho-adrenergic inotropes and angiotensin-converting enzyme inhibitors (ACEIs) (controversial).
• Operative factors: CPB/aortic cross-clamping time, redo surgery, combined surgery, left ventricular assist device (LVAD) surgery, and heart transplantation.

4. Pathophysiology
• Initiating events leading to vasoplegia include systemic inflammatory responses triggered by exposure to artificial surfaces during CPB, surgical trauma, ischemia/reperfusion injury, oxidative stress, endotoxin release from the gut, haemolysis, and reinfusion of cell-saver blood.
• Mechanisms of pathological vasodilation involve desensitization of adrenergic receptors, increased nitric oxide (NO) biosynthesis, low plasma vasopressin, vascular smooth muscle cell (VSMC) hyperpolarization due to K+ ATP channel opening, renin-angiotensin system (RAS) dysfunction with low angiotensin II, excess hydrogen sulfide (H2S) generation, and alterations in endothelial glycocalyx.

5. Outcomes
• Vasoplegia is associated with more frequent postoperative bleeding, increased incidence of organ dysfunction (renal, liver, and respiratory failure), prolonged mechanical ventilation and more extended ICU/hospital stays. Mortality rates are also higher.

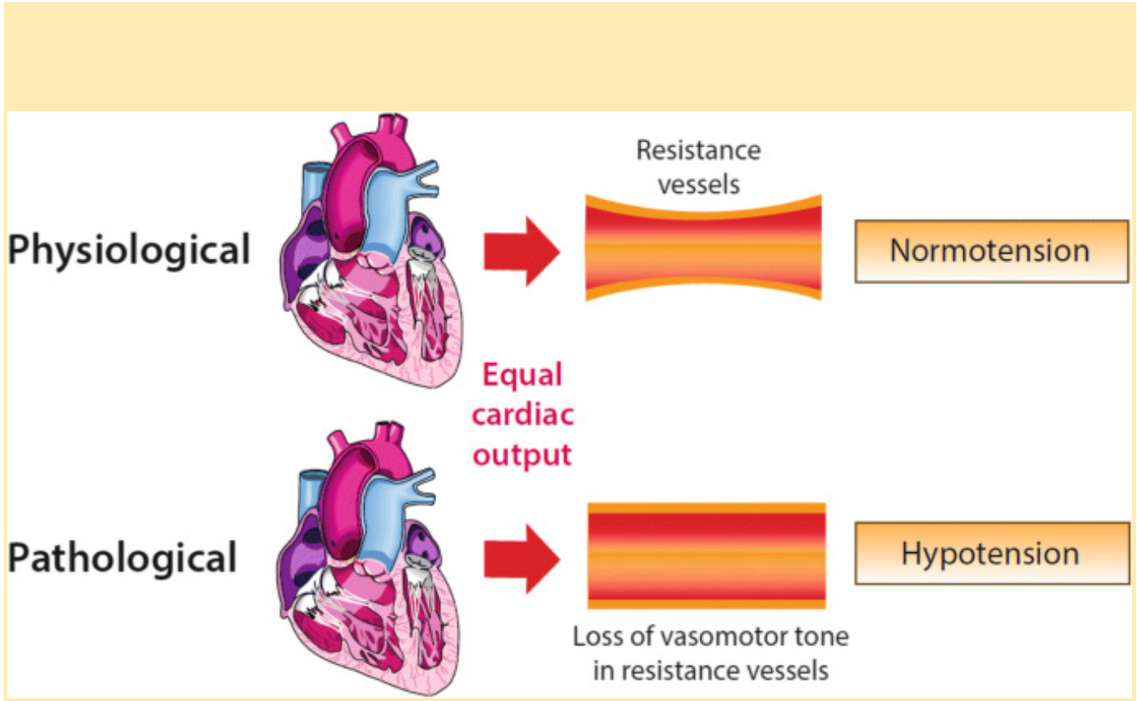
6. Management
Preoperative optimization of renal functions, anaemia and haemodynamics can be beneficial in reducing the risk of postoperative vasoplegic shock. However, there is no consensus regarding management of preoperative medication (ACEi, diuretics and ca2+ channel blockers).

Reducing CPB and cross-clamp time during surgery and using a short, heparin-coated circuit can limit inflammation.

The main goal of resuscitation is to maintain adequate cardiac output and perfusion pressures to ensure tissue perfusion and oxygen delivery to meet the metabolic requirement.
• Ensure adequate cardiac preload and output:
• Evaluate tissue perfusion using capillary refill time, mottling score, arterial lactate, and venoarterial PCO2 gap.
• Use dynamic indices of volume responsiveness.
• Vasoactive drugs:
• Conventional vasopressors: Norepinephrine and vasopressin.
• Non-conventional vasopressors (in refractory vasoplegia): Methylene blue, hydroxocobalamin, and angiotensin II.
• Consider low doses of hydrocortisone.

7.Conclusion

Vasoplegia is a multifactorial condition with a significant impact on clinical outcomes. Understanding its pathophysiology can guide better patient care. The main goal of resuscitation is to maintain end-organ perfusion with hemodynamic indices-guided fluid therapy and conventional and non-conventional vasopressors.



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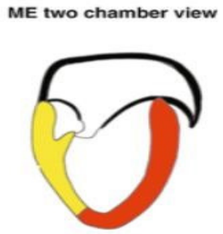
(PACTA) Newsletter Volume 2 issue 2, 2024 Pg - 08

Quize Corner

Q. 1. Name the LV walls seen in ME2ch view.

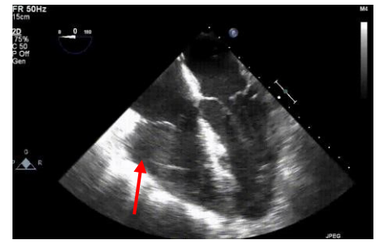


a) Inferior and anterior
b) Inferolateral and inferoseptal
c) Inferolateral and anteroseptal
d) Septal and lateral

Q. 2. What are you looking for when you are eyeballing the LV to assess EF?

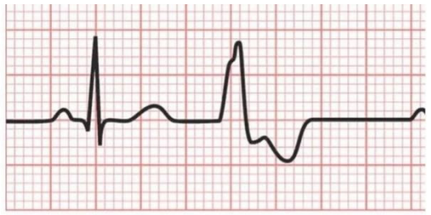
a) Inward motion of endocardium
b) Thickening of myocardium
c) Longitudinal motion of the mitral annulus
d) Inward motion of the endocardium, the thickening of myocardium, the longitudinal motion of the mitral annulus, and the geometry of the ventricle.

Q.3. Identify the structure shown in following tee views?



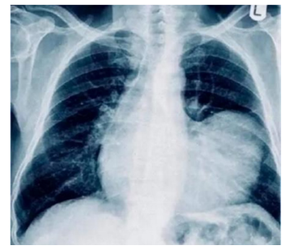
a) Septal leaflet of tricuspid valve
b) Anterior leaflet of tricuspid valve
c) Posterior leaflet of tricuspid valve
d) Tricuspid valve annulus

Q. 4. identifiy the ECG shown in below strip



a) Premature atrial complex
b) Premature ventricular complex
c) Junctional escape beat
d) Atrial escaep beat

Q. 5. which of the following pathology match with the diagnosis shown in X



a) Tetrology of fallot
b) Mttral stenosis
c) Bulging of LV border (LV aneurysm)
d) Calcified sclerotic aortic stenosis

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