

## NEET SS 2024 DrNB Vascular Surgery Paper 3 Question Paper and Solutions

|                       |                    |                     |
|-----------------------|--------------------|---------------------|
| Time Allowed :3 Hours | Maximum Marks :100 | Total questions :10 |
|-----------------------|--------------------|---------------------|

**1. A patient underwent right side above knee femoro-popliteal graft using ePTFE graft for acute on chronic limb ischemia as an emergency procedure 6 months ago. He now reports with functioning graft and a discharging groin sinus. Discuss the various options of management.**

**Solution:**

### **Step 1: Introduction**

This patient has a history of right side above-knee femoro-popliteal graft using an ePTFE graft for acute on chronic limb ischemia. Six months post-surgery, the patient presents with a functioning graft but also has a discharging groin sinus. A groin sinus may suggest an infection or graft-related complication, requiring a systematic approach to diagnosis and management.

### **Step 2: Differential Diagnosis**

The possible causes for the discharging groin sinus include:

- **Infection of the graft:** This could be an infection at the anastomotic site or within the graft itself.
- **Graft failure or thrombosis:** Even though the graft is functioning, the groin sinus may indicate a developing issue such as thrombosis or poor blood flow.
- **Groin sinus due to foreign body response:** The synthetic ePTFE graft material may induce a chronic inflammatory response leading to sinus formation.
- **Non-healing wound or fistula formation:** A fistula or non-healing wound may form after surgery, leading to a discharge.

### **Step 3: Investigation and Diagnosis**

To confirm the diagnosis and guide treatment, the following investigations are essential: 1.

**Ultrasound Doppler:** This will assess graft patency and detect signs of thrombosis or stenosis at the anastomotic sites.

2. **CT Angiography or MRI Angiography:** Imaging can help visualize the graft and surrounding tissues to detect infection or anatomical issues.

3. **Blood cultures and wound swab:** To identify the pathogen and initiate appropriate antibiotic therapy.

4. **Serum inflammatory markers:** Such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), to assess for infection.

#### **Step 4: Management Options**

The management of this patient will depend on the findings from the investigations. The following management strategies are considered:

##### **1. Antibiotic Therapy:**

- If an infection is confirmed, broad-spectrum intravenous antibiotics should be started empirically, with adjustments based on culture results.
- Common antibiotics for vascular graft infections include cephalosporins or vancomycin for Gram-positive infections.

##### **2. Surgical Intervention:**

- **Debridement:** If the infection is localized to the graft or surrounding tissue, surgical debridement of the infected tissue may be necessary.
- **Graft Replacement or Revision:** If the graft is infected or thrombosed, it may need to be removed and replaced with either a new synthetic graft or a biological graft. Autologous vein grafts may also be considered.

##### **3. Wound Care:**

- The discharging groin sinus should be properly managed with regular dressing changes to prevent further contamination and promote healing.
- If the sinus is due to non-healing tissue or drainage, compressive dressings or negative pressure wound therapy (NPWT) may be beneficial.

##### **4. Follow-Up:**

- **Doppler Ultrasound:** To monitor graft patency and ensure there is no further infection or occlusion.
- **Blood Pressure and Lipid Management:** Ensuring that the patient maintains good control of cardiovascular risk factors is essential to prevent graft failure.

## 5. Lifestyle Modifications:

- **Smoking Cessation:** Smoking is a major risk factor for vascular complications, so advising the patient to stop smoking is critical.
- **Diet and Exercise:** To reduce further cardiovascular risk factors and improve overall health.

### Step 5: Conclusion

Timely diagnosis and prompt treatment are essential in preventing further complications and ensuring the longevity of the graft. A comprehensive approach that includes antibiotics, surgical intervention if necessary, and long-term monitoring will lead to better outcomes for this patient.

#### Quick Tip

In cases of groin sinus formation after graft surgery, early identification and management of infections, along with regular monitoring of graft patency, are key to preventing severe complications.

---

## 2(a). What is a guide wire?

### Solution:

A guide wire is a thin, flexible wire used in medical procedures, particularly in catheter-based surgeries, to guide the placement of other instruments or devices. It serves as a track or a rail for other devices, ensuring accurate placement and reducing the risk of damage to blood vessels or other structures. The guide wire helps in maneuvering through narrow or blocked vessels during procedures like angioplasty, stent placement, and catheterization.

#### Quick Tip

A guide wire is crucial for the successful navigation of medical instruments, ensuring safe and precise placement during minimally invasive procedures.

**(b). What are the various characteristics of a guide wire?**

**Solution:**

**Step 1: Flexibility:**

Guide wires are designed to be highly flexible, allowing them to navigate through curved or narrow vessels while maintaining their shape. Flexibility helps in the smooth advancement of the wire.

**Step 2: Torqueability:**

The ability of a guide wire to transmit rotational force to the tip without causing damage is known as torqueability. This is critical when precise placement of the wire is required.

**Step 3: Stiffness:**

Guide wires vary in stiffness depending on the procedure. A stiffer wire provides better support and control, while a softer wire minimizes trauma to the blood vessels.

**Step 4: Trackability:**

Trackability refers to how easily the guide wire moves through the vessel without resistance. A wire with good trackability makes it easier to navigate complex vessels.

**Step 5: Biocompatibility:**

Guide wires are made from materials that are compatible with the human body to prevent adverse reactions during the procedure. Materials like stainless steel, nitinol, and polymer coatings are commonly used.

**Quick Tip**

The flexibility, stiffness, and trackability of a guide wire should be carefully chosen depending on the complexity of the procedure and the type of vessel.

---

**(c). What are the different types of guide wires?**

**Solution:**

**Step 1: J-Tip Guide Wire:**

This wire has a curved tip that facilitates smooth navigation around curves in the vessel. It is often used for catheter insertion in difficult or tortuous vessels.

**Step 2: Straight Guide Wire:**

A straight guide wire is used when a more direct path is available, offering less flexibility but better control during the procedure. It is ideal for procedures requiring precision in straight vessels.

**Step 3: Hydrophilic Guide Wire:**

Coated with a hydrophilic material, this guide wire becomes slippery when wet, which reduces friction during the procedure. It is helpful in navigating difficult or narrow pathways.

**Step 4: Supportive Guide Wire:**

These wires are stiffer and provide greater support to the catheter or other medical instruments, often used in more challenging cases where high support is needed.

**Quick Tip**

When selecting a guide wire, consider the vessel's shape and size, as well as the specific medical procedure, to choose the most appropriate wire type for the task.

---

**3.(a). Define an aneurysm.****Solution:**

An aneurysm is a localized abnormal dilation or bulging of a blood vessel, typically caused by a weakness in the vessel wall. It can occur in arteries or veins and may lead to serious complications such as rupture or thrombosis. Aneurysms are most commonly found in arteries, including the aorta and cerebral arteries.

**Quick Tip**

Aneurysms can be life-threatening if they rupture, leading to severe hemorrhage and other complications. Early detection is essential for effective management.

---

**(b). What are the various etiologies for formation of aneurysm?****Solution:**

**Step 1: Atherosclerosis:**

Atherosclerosis is the most common cause of aneurysms, particularly in the aorta. The accumulation of fatty deposits in the walls of arteries weakens the vessel, leading to the formation of an aneurysm.

**Step 2: Genetic Factors:**

Inherited conditions like Marfan syndrome or Ehlers-Danlos syndrome can cause weakened vessel walls, making them prone to aneurysm formation.

**Step 3: Hypertension:**

Chronic high blood pressure can increase the stress on arterial walls, leading to weakening and the development of aneurysms.

**Step 4: Trauma:**

Trauma, such as from a car accident or surgical injury, can cause direct damage to blood vessels, resulting in an aneurysm.

**Step 5: Infection:**

Certain infections, particularly bacterial infections like syphilis or endocarditis, can weaken blood vessel walls and contribute to aneurysm formation.

**Quick Tip**

Management of aneurysms often involves controlling risk factors such as blood pressure, cholesterol, and smoking to prevent further enlargement and rupture.

---

**(c). What are the general indications for intervention in an aneurysm?****Solution:****Step 1: Size of the Aneurysm:**

When an aneurysm exceeds a certain size, typically 5-6 cm in the aorta, intervention is considered to prevent rupture.

**Step 2: Symptomatic Aneurysm:**

If the aneurysm causes symptoms such as pain, swelling, or embolization, it may require intervention regardless of its size.

**Step 3: Rapid Growth:**

If an aneurysm shows rapid expansion or growth, it is often treated to prevent rupture or other complications.

**Step 4: Ruptured Aneurysm:**

A ruptured aneurysm is a medical emergency that requires immediate surgical intervention to repair the damaged vessel and control hemorrhage.

**Quick Tip**

The decision for surgical intervention in aneurysms is based on the size, growth rate, and symptoms, with the aim of preventing rupture.

---

**(d). How would you manage a case of popliteal artery aneurysm?****Solution:****Step 1: Diagnosis and Imaging:**

The first step in managing a popliteal artery aneurysm is confirming the diagnosis through imaging techniques such as ultrasound, CT angiography, or MRI to assess the size and location of the aneurysm.

**Step 2: Risk Assessment:**

Assess the patient's overall cardiovascular health, including any history of peripheral artery disease, diabetes, or hypertension, which may influence treatment decisions.

**Step 3: Surgical Repair:**

For aneurysms greater than 2 cm in diameter, surgical repair is typically indicated. This may involve bypass grafting or endovascular repair, depending on the location and size of the aneurysm.

**Step 4: Conservative Management:**

In smaller, asymptomatic aneurysms, conservative management with regular monitoring may be considered, especially if the patient has other significant medical conditions that complicate surgery.

**Step 5: Postoperative Care:**

After surgical repair, follow-up care includes monitoring for graft patency, managing anticoagulation if required, and addressing any risk factors such as smoking or hypertension to prevent recurrence.

#### Quick Tip

Surgical intervention is often recommended for larger or symptomatic popliteal artery aneurysms, as they carry a higher risk of rupture and embolization.

---

#### **4(a). Describe various complications of endovascular aneurysm repair of aorta (EVAR) pertaining to the procedure and graft deployment.**

##### **Solution:**

##### **Step 1: Introduction:**

Endovascular aneurysm repair (EVAR) is a minimally invasive procedure used to treat abdominal aortic aneurysms (AAA) and other aortic pathologies. While generally considered safe, EVAR can be associated with several complications related to the procedure and graft deployment.

##### **Step 2: Procedure-related Complications:**

- **Endoleak:** A condition where blood continues to flow into the aneurysm sac despite the presence of the graft, potentially leading to aneurysm expansion. - **Migration:** The graft may move from its original position, compromising the sealing of the aneurysm and increasing the risk of rupture. - **Infection:** As with any surgical procedure, there is a risk of infection at the graft or incision site. - **Perforation:** The catheter or guide wire can cause vessel damage during placement, leading to vessel perforation and hemorrhage. -

**Contrast-induced nephropathy:** The use of contrast agents during the procedure may lead to kidney damage in susceptible patients.

##### **Step 3: Graft-related Complications:**

- **Graft thrombosis:** Blood clot formation inside the graft can obstruct blood flow, leading to graft failure. - **Graft rupture:** In rare cases, the graft may fail and rupture, requiring emergency surgical intervention.



### Quick Tip

Close monitoring after EVAR is essential to detect complications like endoleaks or graft migration, which can compromise the success of the procedure.

## (b). What are the endovascular options for less than adequate neck length for an infrarenal abdominal aortic aneurysm?

### Solution:

#### Step 1: Introduction:

In some patients with infrarenal abdominal aortic aneurysms (AAA), the aortic neck (the area where the graft attaches) may be too short or inadequately shaped for standard endovascular graft deployment. In these cases, special techniques and grafts are needed to ensure the procedure's success.

#### Step 2: Endovascular Options:

1. **Bilateral Iliac Artery Grafts:** These can be used when the aortic neck is too short to secure a standard graft, allowing for better anchoring to the iliac arteries. 2. **Chimney or Sandwich Technique:** Involves placing a stent graft in the aorta and a secondary stent graft in the renal or iliac arteries to secure the graft and provide adequate flow. 3. **Fenestrated Grafts:** These grafts have holes (fenestrations) that allow the graft to be deployed around branch vessels such as the renal arteries, improving fit and stability in patients with short necks. 4. **Endograft with Extension Sleeves:** Extension sleeves can be used to provide additional support and length to the aortic neck, making the graft more stable.

#### Step 3: Considerations:

Choosing the right approach depends on the patient's anatomy, and a careful preoperative assessment using imaging techniques like CT angiography is critical to planning the appropriate procedure.

### Quick Tip

In patients with short aortic necks, fenestrated and branched endografts offer a viable solution to secure a proper fit and reduce the risk of complications.

---

*A 68-year-old male had failed bypass (common femoral artery to below knee popliteal artery) and was doing well with ABI of 0.6 over the past 4 years. For the past two months, his sleep gets disturbed by the feeling of coldness in the foot. Current ABI is 0.4. There is no tissue loss or ulcer. CDFI reveals no significant stenosis in iliac and common femoral artery but has significant stenosis in the origin of profunda femoris artery.*

**5(a). How will you evaluate him further?**

**Solution:**

**Step 1: Assessment of Symptoms:**

The patient has a feeling of coldness in the foot and disturbed sleep. This suggests the possibility of worsening peripheral artery disease (PAD) or a new vascular issue. A detailed symptom assessment will help guide the evaluation.

**Step 2: Re-evaluate Ankle-Brachial Index (ABI):**

Given that the patient's ABI has decreased to 0.4, a lower ABI indicates severe arterial occlusion and ischemia. The ABI should be reassessed and compared with previous values to determine any significant worsening.

**Step 3: Advanced Imaging:**

Since there is significant stenosis in the origin of the profunda femoris artery, advanced imaging techniques such as CT angiography (CTA), Magnetic Resonance Angiography (MRA), or contrast angiography should be used to further evaluate the extent of the stenosis and vascular occlusion.

**Quick Tip**

In PAD, a decreasing ABI, especially below 0.5, is associated with critical ischemia, which necessitates urgent intervention to prevent tissue damage.

---

**(b). What are the various options available for him with reasoning?**

**Solution:**

**Step 1: Medical Management:**

Given the patient's current ABI of 0.4 and the presence of stenosis in the profunda femoris artery, the first line of management includes optimizing medical therapy. This may involve antiplatelet agents (e.g., aspirin or clopidogrel), statins to lower cholesterol, and medications to manage hypertension. These can help slow the progression of the disease and reduce the risk of thrombosis.

### **Step 2: Revascularization:**

For this patient, revascularization is a critical option. If surgery is considered, either bypass surgery or angioplasty with stent placement may be appropriate, depending on the extent and location of the stenosis. Since the stenosis is in the origin of the profunda femoris artery, a surgical bypass or endovascular intervention can help restore blood flow.

### **Step 3: Monitoring and Lifestyle Changes:**

Close follow-up with regular ABI measurements and lifestyle changes (e.g., smoking cessation, exercise, dietary modifications) is important. These changes help improve blood circulation and prevent further progression of the disease.

#### **Quick Tip**

Revascularization can significantly improve the quality of life and reduce the risk of limb loss in patients with critical limb ischemia.

---

**6. A 45-year-old male patient has non-salvageable foot despite multiple revascularization attempts, which had failed. He has agreed for amputation. How will you decide on the level of amputation, and what are the local and systemic complications of major amputation?**

### **Solution:**

#### **Step 1: Introduction:**

The decision to perform amputation and select the level of amputation is made when the foot is non-salvageable due to failed revascularization attempts. This decision involves assessing the patient's overall health, the viability of the remaining limb, and the extent of damage or necrosis in the foot.

## Step 2: Deciding on the Level of Amputation:

The level of amputation depends on several factors, including:

- **Vascular Supply:** The amputation should be at a level where the remaining tissue has a sufficient blood supply to promote healing.
- **Necrosis and Infection:** The extent of gangrene or infection determines the need for more proximal amputations.
- **Functionality:** The decision also takes into account the remaining functional potential of the limb, aiming to preserve as much function as possible.
- **Patient's Preferences and Quality of Life:** The patient's lifestyle needs and preferences are crucial in determining the level of amputation.

## Step 3: Local and Systemic Complications of Major Amputation:

1. **Local Complications:**
  - **Infection:** The amputation site is at risk for infection, especially if there is inadequate blood supply or poor wound care.
  - **Wound Healing Problems:** In some cases, the wound may not heal properly due to poor circulation or other underlying conditions.
  - **Neuroma Formation:** Nerve endings at the amputation site can form a painful neuroma.
2. **Systemic Complications:**
  - **Cardiovascular Complications:** Major amputations can lead to changes in cardiovascular status, especially in patients with underlying heart disease.
  - **Respiratory Complications:** Post-operative complications such as pneumonia can arise, especially if the patient is immobilized or has pre-existing lung conditions.
  - **Psychosocial Impact:** Major amputation can lead to emotional distress, depression, and a reduced quality of life. Rehabilitation and psychological support are essential.

### Quick Tip

Early mobilization and rehabilitation post-amputation are crucial in minimizing complications and improving the patient's recovery and quality of life.

---

## 7(a). Classify different treatment modalities for varicose veins.

### Solution:

#### Step 1: Conservative Management:

For mild cases of varicose veins, conservative management includes lifestyle changes such

as weight management, leg elevation, and compression stockings to improve blood circulation and relieve symptoms.

**Step 2: Sclerotherapy:**

Sclerotherapy involves injecting a solution into the affected vein, which causes it to collapse and eventually be absorbed by the body. It is commonly used for smaller varicose veins and spider veins.

**Step 3: Endovenous Laser Therapy (EVLT):**

EVLT is a minimally invasive procedure where a laser fiber is inserted into the vein, and heat is applied to close the vein. This method is used for larger varicose veins.

**Step 4: Surgery:**

For severe cases, surgical interventions such as vein stripping or ligation may be required. This involves the removal of the affected veins to alleviate symptoms and prevent complications.

**Step 5: Foam Sclerotherapy:**

Foam sclerotherapy is an advanced form of sclerotherapy that uses foam rather than a liquid solution to treat larger veins. It improves the contact with the vein wall and can treat larger veins more effectively.

**Quick Tip**

Early intervention with less invasive treatments such as compression stockings or sclerotherapy can prevent the progression of varicose veins and reduce the need for more invasive procedures.

---

**(b). Discuss sclerotherapy in detail.**

**Solution:**

**Step 1: Definition:**

Sclerotherapy is a medical procedure used to treat varicose veins and spider veins. It involves injecting a sclerosing agent (typically a chemical solution) into the affected vein, causing the vein to collapse, scar, and eventually be absorbed by the body.

**Step 2: Technique:**

The procedure is performed in an outpatient setting. The patient is positioned to allow easy access to the vein. A small needle is used to inject the sclerosing agent directly into the vein. The procedure usually takes around 15-30 minutes.

**Step 3: Types of Sclerotherapy:**

There are two main types of sclerotherapy: liquid sclerotherapy and foam sclerotherapy. Liquid sclerotherapy is used for smaller veins, while foam sclerotherapy is used for larger veins. Foam is more effective as it occupies more space inside the vein and comes in contact with more of the vein wall.

**Step 4: Post-Procedure Care:**

After the procedure, patients are advised to wear compression stockings to help compress the treated veins and reduce swelling. Most patients can resume normal activities immediately but should avoid strenuous exercise for a few days.

**Step 5: Side Effects and Risks:**

The procedure is generally safe but may cause side effects such as temporary redness, swelling, or bruising at the injection site. Rarely, complications like allergic reactions, blood clots, or skin discoloration may occur.

**Quick Tip**

Sclerotherapy is most effective for smaller varicose veins and spider veins, with minimal downtime and a high success rate in reducing the appearance of veins.

---

**8(a). A 45 year old lady with acute ileofemoral DVT:**

**Mention treatment options for acute ileofemoral DVT.**

**Solution:**

For a 45-year-old lady with acute ileofemoral deep vein thrombosis (DVT), the following treatment options are available:

**Step 1: Anticoagulation Therapy:**

Initial treatment includes anticoagulation to prevent further clot formation and reduce the risk of pulmonary embolism. This may involve:

- **Heparin (IV or subcutaneous):** To prevent clot extension.
- **Direct oral anticoagulants (DOACs):** Such as rivaroxaban or apixaban, as alternatives for long-term therapy.

### **Step 2: Thrombolysis:**

For patients with significant symptoms or extensive thrombus burden, thrombolytic therapy may be considered to break down the clot and restore normal blood flow. Medications like alteplase are often used in catheter-directed thrombolysis (CDT).

### **Step 3: Compression Therapy:**

Graduated compression stockings can be used to reduce swelling, prevent post-thrombotic syndrome, and improve venous return.

#### **Quick Tip**

Early anticoagulation therapy is essential in preventing complications such as pulmonary embolism and long-term complications like post-thrombotic syndrome.

---

### **(b). A 45 year old lady with acute ileofemoral DVT:**

**Discuss catheter directed thrombolysis (CDT) - Technique, indication, complications and studies on CDT.**

#### **Solution:**

##### **Step 1: Technique:**

Catheter-directed thrombolysis (CDT) is a minimally invasive procedure used to treat acute DVT, particularly in the ileofemoral veins. The technique involves the insertion of a catheter directly into the thrombus, allowing for localized delivery of thrombolytic agents (such as alteplase or urokinase). The catheter may be placed using fluoroscopic guidance, and sometimes, mechanical thrombectomy devices are used in combination with thrombolytic therapy.

##### **Step 2: Indications:**

CDT is indicated in patients with: - **Severe Symptoms:** Including swelling, pain, and risk of post-thrombotic syndrome.

- **Extensive Thrombosis:** Involving the iliofemoral veins or patients who are at high risk for complications such as pulmonary embolism.

- **Failure of Anticoagulation:** In cases where standard anticoagulation therapy fails to provide adequate symptom relief.

### Step 3: Complications:

Complications of CDT can include: - **Bleeding:** From either the catheter insertion site or from systemic anticoagulation.

- **Infection:** At the catheter site or within the vein.

- **Recurrent thrombosis:** In cases where thrombus is not adequately cleared.

- **Pulmonary Embolism:** If thrombolysis or thrombectomy dislodges clot fragments.

### Step 4: Studies on CDT:

Several studies have shown that CDT improves symptoms and quality of life in patients with acute iliofemoral DVT. The most notable studies include: - **The CAVENT Trial:** Which demonstrated improved outcomes with CDT compared to anticoagulation alone in patients with acute DVT.

- **The ATTRACT Trial:** Focused on the long-term benefits of CDT in terms of reducing post-thrombotic syndrome, though some studies have raised concerns about the risk-benefit profile.

#### Quick Tip

CDT is effective for restoring venous flow and preventing long-term complications in patients with severe DVT, but its risks, especially bleeding, must be carefully managed.

---

## 9(a). Classify acute limb ischemia.

### Solution:

Acute limb ischemia (ALI) is a sudden decrease in limb perfusion, which threatens the viability of the affected limb. It is classified into several types based on its etiology and the



severity of ischemia:

**Step 1: Classification Based on Etiology:**

1. **Arterial Occlusion:** This occurs due to embolism or thrombosis, causing a sudden blockage of the artery. 2. **Traumatic Injury:** Severe trauma, such as fractures or dislocations, can lead to vascular injury and subsequent ischemia. 3. **Aortic Dissection:** Dissecting aortic aneurysms can also obstruct blood flow, leading to ischemia in the limbs. 4. **Vasculitis:** Inflammatory vascular diseases, such as Buerger's disease, can cause progressive ischemia in the limbs.

**Step 2: Classification Based on Severity (Surgical or Clinical Classification):**

1. **Stage I: Viable Limb** - The limb is salvageable, with no tissue death. 2. **Stage II: Marginally Threatened Limb** - Tissue death is imminent without timely intervention. 3. **Stage III: Irreversibly Damaged Limb** - The limb has undergone severe ischemia, and tissue is no longer viable.

**Quick Tip**

Early detection and classification of acute limb ischemia are crucial for choosing the correct treatment approach and preventing irreversible limb damage.

---

**(b). Discuss ischemia reperfusion injury in detail.**

**Solution:**

**Step 1: Introduction:**

Ischemia-reperfusion injury (IRI) refers to the tissue damage caused when blood supply returns to the tissue after a period of ischemia. Despite the restoration of blood flow, this process can paradoxically result in further injury due to the inflammatory response and the generation of harmful molecules.

**Step 2: Pathophysiology:**

- **Oxidative Stress:** The return of oxygenated blood leads to the generation of reactive oxygen species (ROS), which damage cell membranes and proteins.
- **Inflammation:** Reperfusion activates the immune system, causing neutrophils to infiltrate

the tissue, releasing inflammatory mediators like cytokines and proteases.

- **Endothelial Dysfunction:** Endothelial cells, which line blood vessels, become damaged during reperfusion, leading to increased vascular permeability and edema.

- **Mitochondrial Dysfunction:** Mitochondria are severely affected, leading to cellular energy depletion, further aggravating injury.

### Step 3: Clinical Manifestations:

- **Tissue Edema:** The return of blood flow leads to fluid accumulation in the affected tissue.

- **Pain:** Due to inflammation and cellular injury, severe pain is often reported post-reperfusion.

- **Cellular Necrosis:** Prolonged ischemia followed by reperfusion can cause irreversible tissue damage.

### Step 4: Management Strategies:

1. **Antioxidant Therapy:** Agents like vitamin E or N-acetylcysteine may help reduce oxidative damage. 2. **Anti-inflammatory Agents:** Steroids or other anti-inflammatory drugs can help modulate the inflammatory response. 3. **Ischemic Preconditioning:** Brief episodes of ischemia may reduce the severity of subsequent reperfusion injury.

### Step 5: Studies on IRI:

Numerous studies have shown that IRI contributes significantly to the morbidity and mortality of organ transplantation, especially in the heart, liver, and kidneys. Research into therapeutic strategies continues to evolve.

#### Quick Tip

Preventing ischemia reperfusion injury through early intervention, antioxidant therapy, and anti-inflammatory treatment can significantly improve recovery outcomes after ischemic events.

---

## 10(a). What is a carotid body tumour (CBT)?

### Solution:

A carotid body tumour (CBT), also known as a chemodectoma, is a rare, typically benign,

vascular tumour that originates from the carotid body. The carotid body is a small cluster of chemoreceptor cells located at the bifurcation of the common carotid artery. Its primary role is to monitor blood oxygen levels and help regulate respiratory rate. CBTs occur in about 1-2% of head and neck tumours and are generally asymptomatic until they reach a significant size.

### **Step 1: Pathophysiology:**

CBTs develop due to hyperplasia of the chemoreceptor cells, leading to tumour formation. These tumours are highly vascular, and as they grow, they can compress adjacent structures such as the cranial nerves (IX, X, and XII), the jugular vein, and the carotid artery.

### **Step 2: Symptoms:**

Most CBTs are asymptomatic, but they may present with a painless neck mass, hoarseness (due to recurrent laryngeal nerve involvement), difficulty swallowing (due to glossopharyngeal or vagus nerve compression), or a pulsatile mass due to its proximity to the carotid artery. In rare cases, they can cause a bruit in the neck.

#### **Quick Tip**

The majority of CBTs are benign, but because of their location, they can present challenges in diagnosis and management. Early identification is crucial to avoid complications.

---

## **(b). How will you evaluate a person suspected of CBT?**

### **Solution:**

#### **Step 1: Clinical Examination:**

The first step in evaluation is a thorough history and physical examination. Patients may present with a palpable mass in the neck, hoarseness, difficulty swallowing, or a pulsatile mass. A careful examination of the neck should be performed to assess the size, consistency, and mobility of the mass.

#### **Step 2: Imaging Studies:**

Imaging plays a pivotal role in the diagnosis of CBT. The following imaging techniques are

essential:

- **Ultrasound:** A Doppler ultrasound is commonly the first imaging modality used. It helps assess the vascular nature of the mass and can detect characteristic features such as a hypervascular tumour. - **CT Angiography (CTA):** CTA provides detailed images of the carotid artery and surrounding structures. It helps assess the size of the tumour and its relationship with the carotid artery, jugular vein, and cranial nerves. - **MRI:** MRI is helpful for detailed soft tissue imaging and can provide additional information on tumour location and its relationship to adjacent structures.

### **Step 3: Angiography:**

In some cases, conventional angiography is performed to visualize the tumour's blood supply and assess its vascularity. This is particularly helpful when planning surgical resection.

### **Step 4: Biopsy:**

If the imaging findings are inconclusive, a biopsy may be performed to confirm the diagnosis. Fine needle aspiration (FNA) is often used, but care must be taken to avoid complications such as bleeding or tumour spillage.

#### **Quick Tip**

Imaging, particularly CT or MRI angiography, is essential for determining the exact location and vascularity of the CBT, which guides treatment planning.

---

### **(c). How will you manage a 42-year-old male with CBT?**

#### **Solution:**

#### **Step 1: Surgical Management:**

The mainstay of treatment for CBT is surgical resection. Given the proximity of the tumour to the carotid artery and important cranial nerves, surgical management requires careful planning and expertise. The goal of surgery is to remove the tumour while preserving the carotid artery and surrounding nerves as much as possible. Preoperative imaging is essential to assess the tumour's size, relationship to surrounding structures, and vascular supply.

- **Surgical Approach:** The approach is typically through a lateral cervical incision to access

the carotid bifurcation. The tumour is carefully dissected from the carotid artery and surrounding structures. In some cases, the carotid artery may require temporary clamping during tumour removal.

**Step 2: Preoperative Considerations:**

Before surgery, the patient should undergo a full preoperative evaluation. This includes controlling comorbidities such as hypertension and diabetes, as well as ensuring that any anticoagulant therapy is appropriately managed. Blood pressure control is particularly important to minimize the risk of intraoperative bleeding.

**Step 3: Postoperative Care:**

Postoperatively, patients should be closely monitored for complications such as bleeding, infection, or nerve injury. Carotid artery patency should be assessed, and patients should be monitored for any signs of cranial nerve deficits. The use of compression stockings or anticoagulation may also be indicated depending on the patient's risk profile.

**Quick Tip**

Surgical resection is the preferred treatment for CBTs, but it requires meticulous planning to avoid damage to the carotid artery and nerves. In some cases, radiation therapy may be used as an adjunct or alternative.

---

**(d). What are the complications involved in CBT surgery?**

**Solution:**

**Step 1: Vascular Complications:**

One of the most significant risks of CBT surgery is injury to the carotid artery. This can result in severe bleeding or the need for carotid artery repair. There is also a risk of thromboembolism due to dislodgement of clots during surgery, which can lead to stroke.

**Step 2: Nerve Injury:**

Since the CBT is located near several cranial nerves (vagus, glossopharyngeal, hypoglossal), there is a risk of nerve damage during surgery. This may result in hoarseness (due to recurrent laryngeal nerve injury), difficulty swallowing (due to glossopharyngeal nerve

damage), or tongue weakness (due to hypoglossal nerve injury).

### **Step 3: Bleeding:**

Intraoperative bleeding is another significant risk, particularly because of the tumour's vascular nature. The surgeon must be cautious to control bleeding from the carotid artery and surrounding vessels during resection.

### **Step 4: Infection:**

Infections are a possible complication, particularly after major surgeries involving the neck and carotid artery. Postoperative care includes monitoring for signs of infection such as fever or redness at the incision site.

#### **Quick Tip**

Close monitoring and careful surgical technique are essential to minimize the risk of complications, particularly vascular injury and nerve damage.