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INSTITUTE OF SCIENCE & TECHNOLOGY
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CARDIAC ASSIST DEVICES

Course Code: XECO2

**Prepared by
Mr.S.Arunmurugan,
AP/ECE**

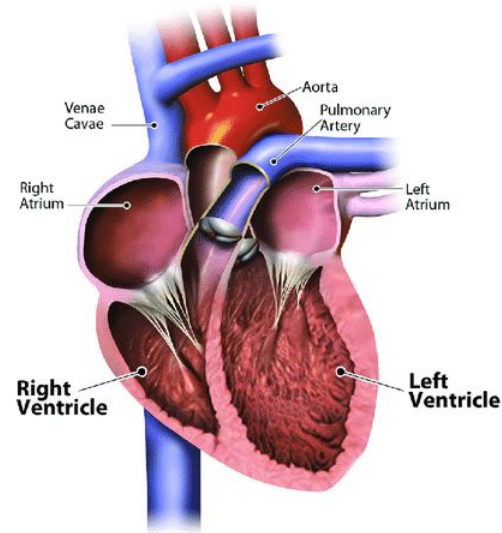
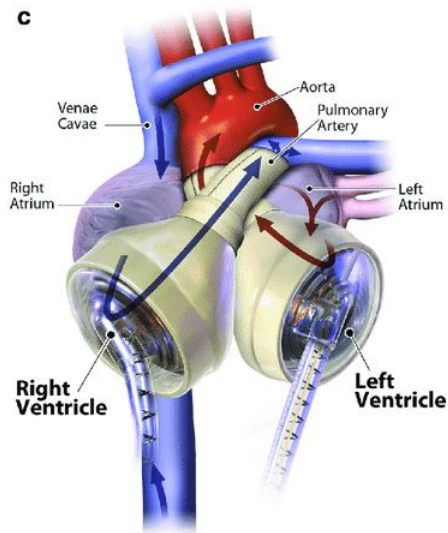
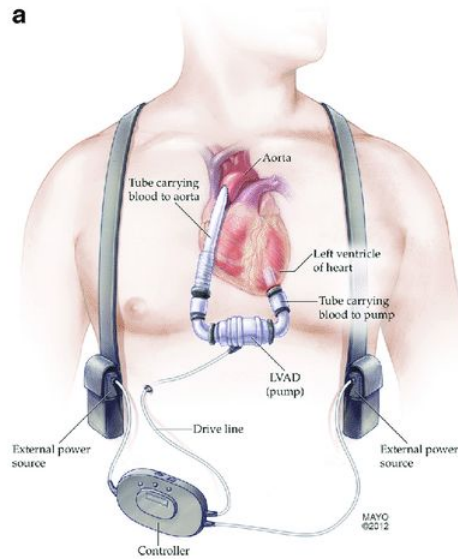
CARDIAC ASSIST DEVICES

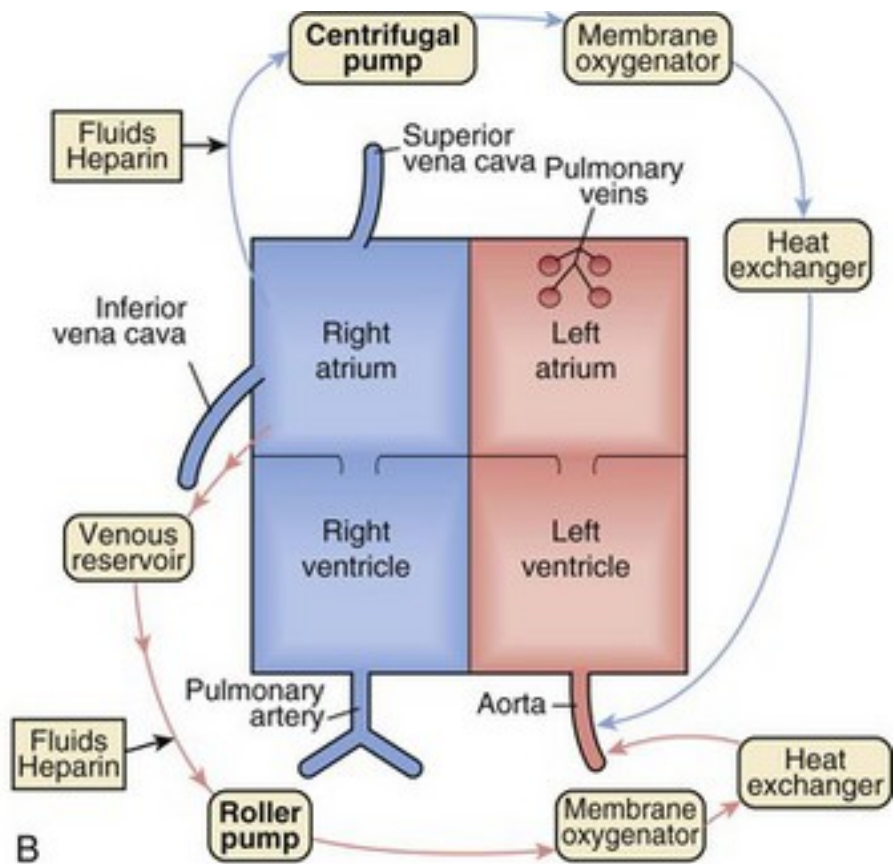
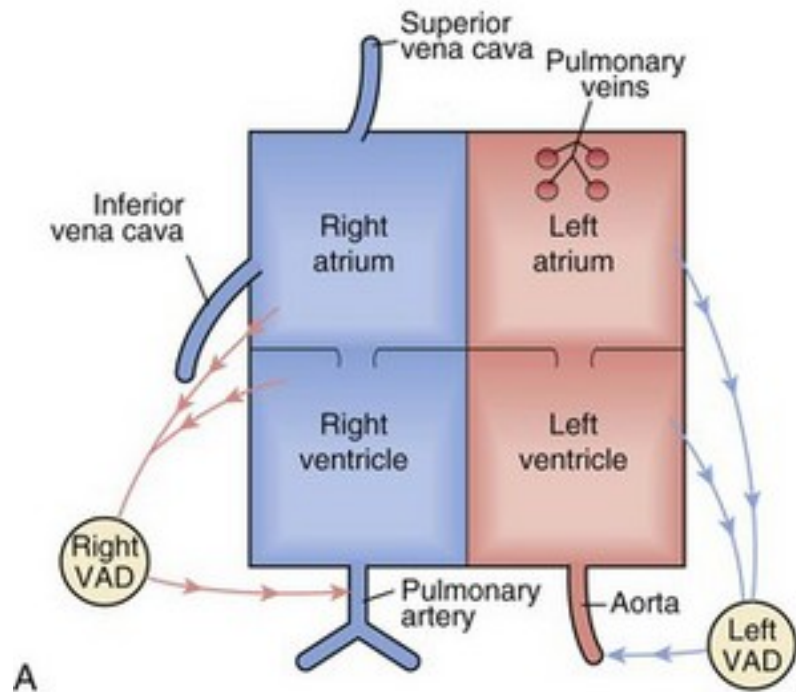
It is a ventricular assist devices (VADs)/Heart pumps

Medical devices

Support to function of a person's heart

CARDIAC ASSIST DEVICES





Types of cardiac assist devices

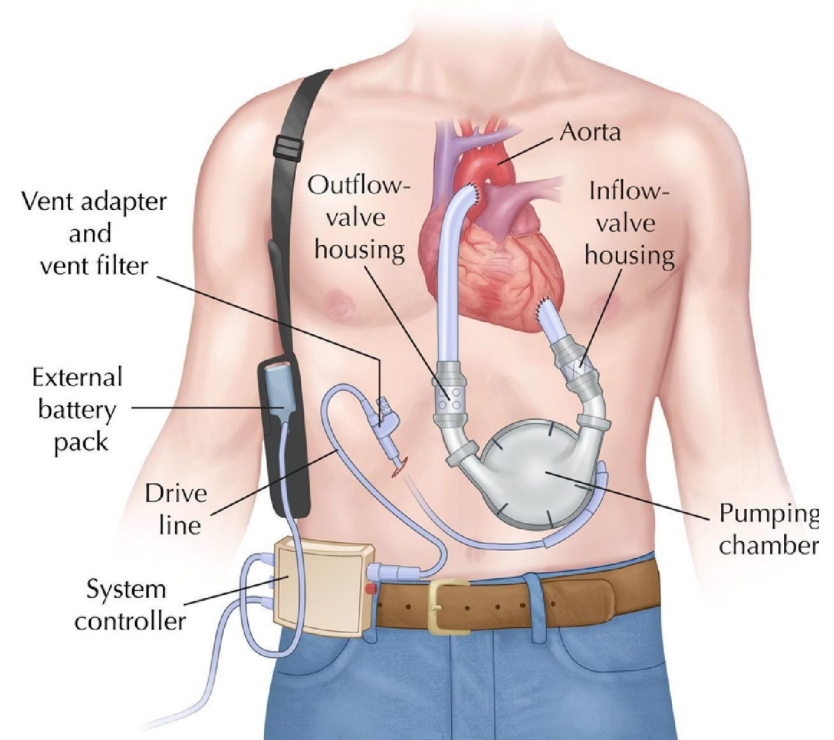
Left Ventricular Assist Device (LVAD)

Right Ventricular Assist Device (RVAD)

Biventricular Assist Device (BiVAD)

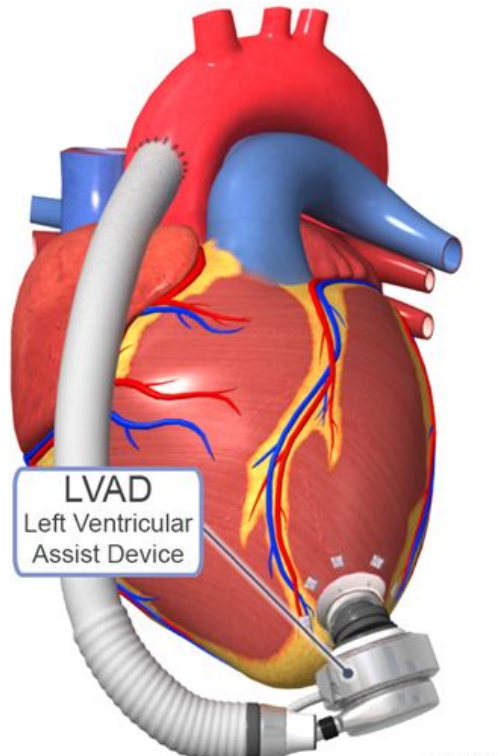
Total Artificial Heart (TAH)

Temporary Assist Devices



Left Ventricular Assist Device (LVAD)

It helps pump blood from the left ventricle



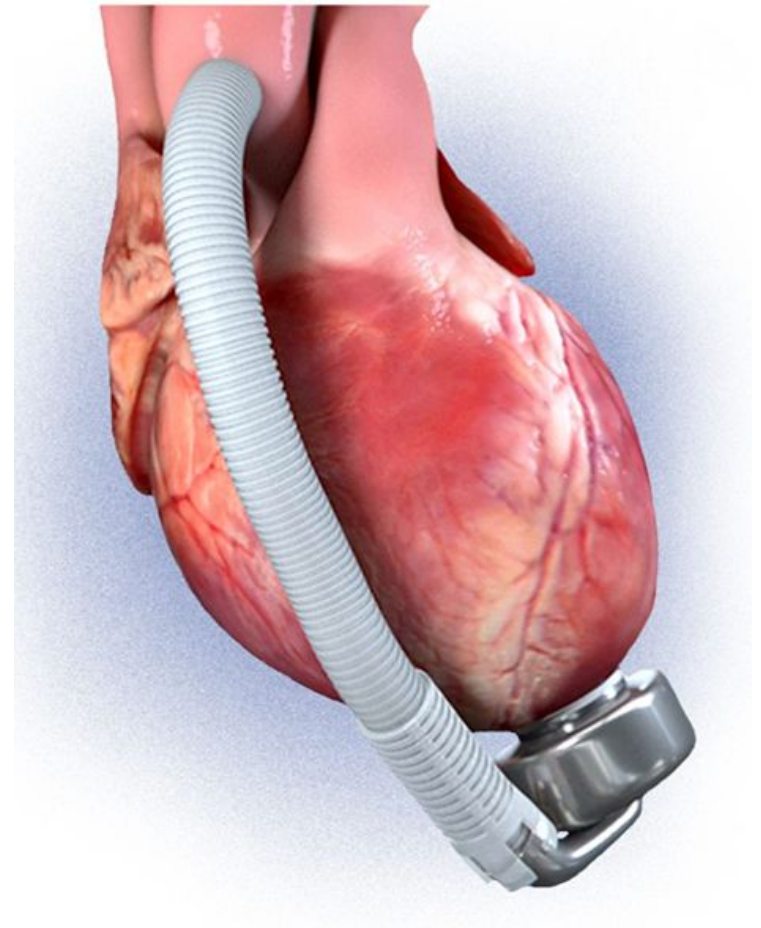
Donor heart is not immediately available

Right Ventricular Assist Device (RVAD)

Similar to an LVAD

RVAD is designed to support the right ventricle's function

Used to right side of the heart is failing

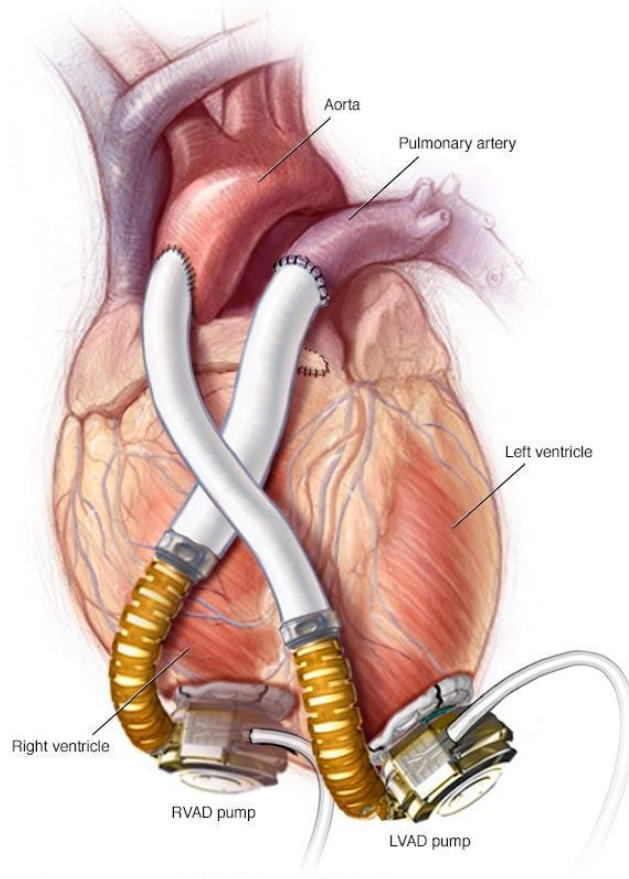


Biventricular Assist Device (BiVAD)

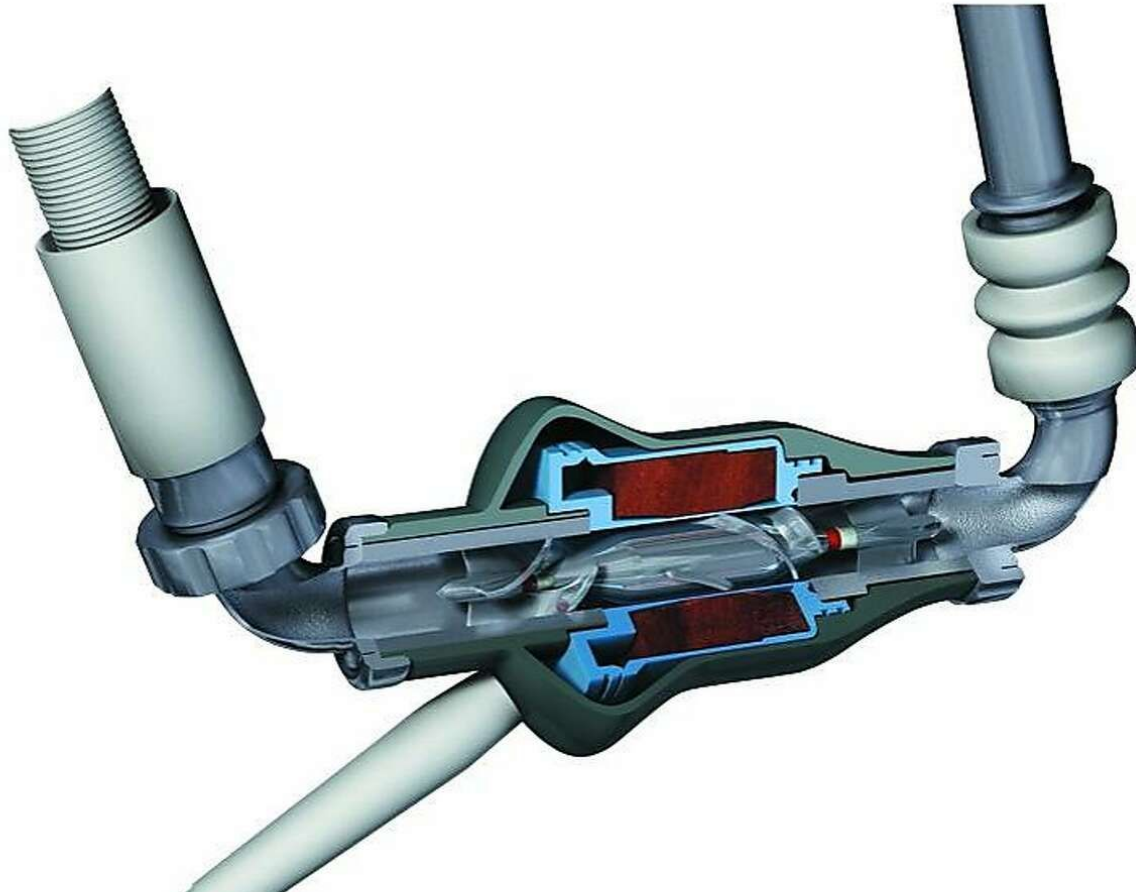
Use of both an LVAD and an RVAD

To support both sides of the heart when both ventricles are failing

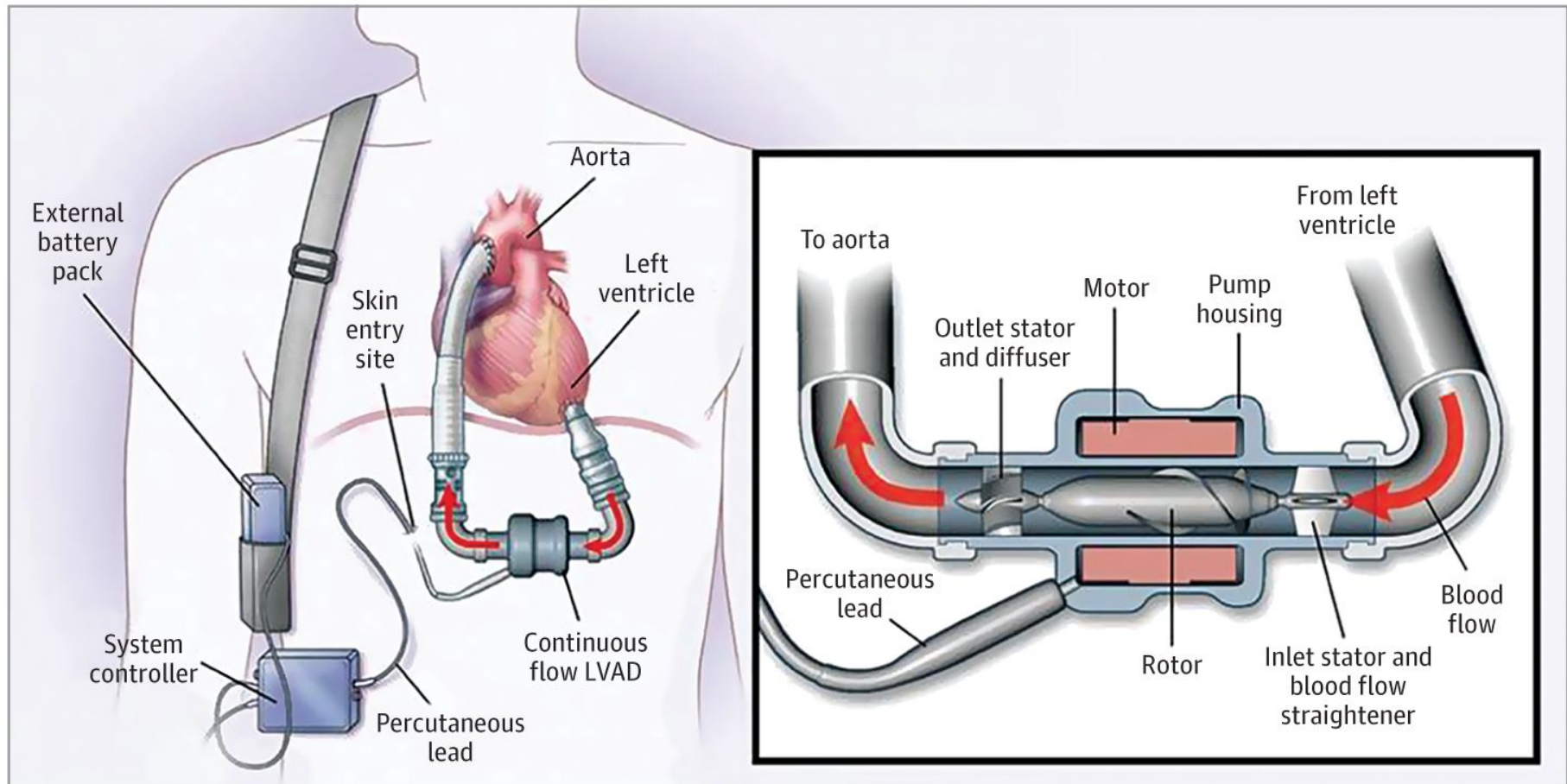
Applied in the most severe cases of heart failure

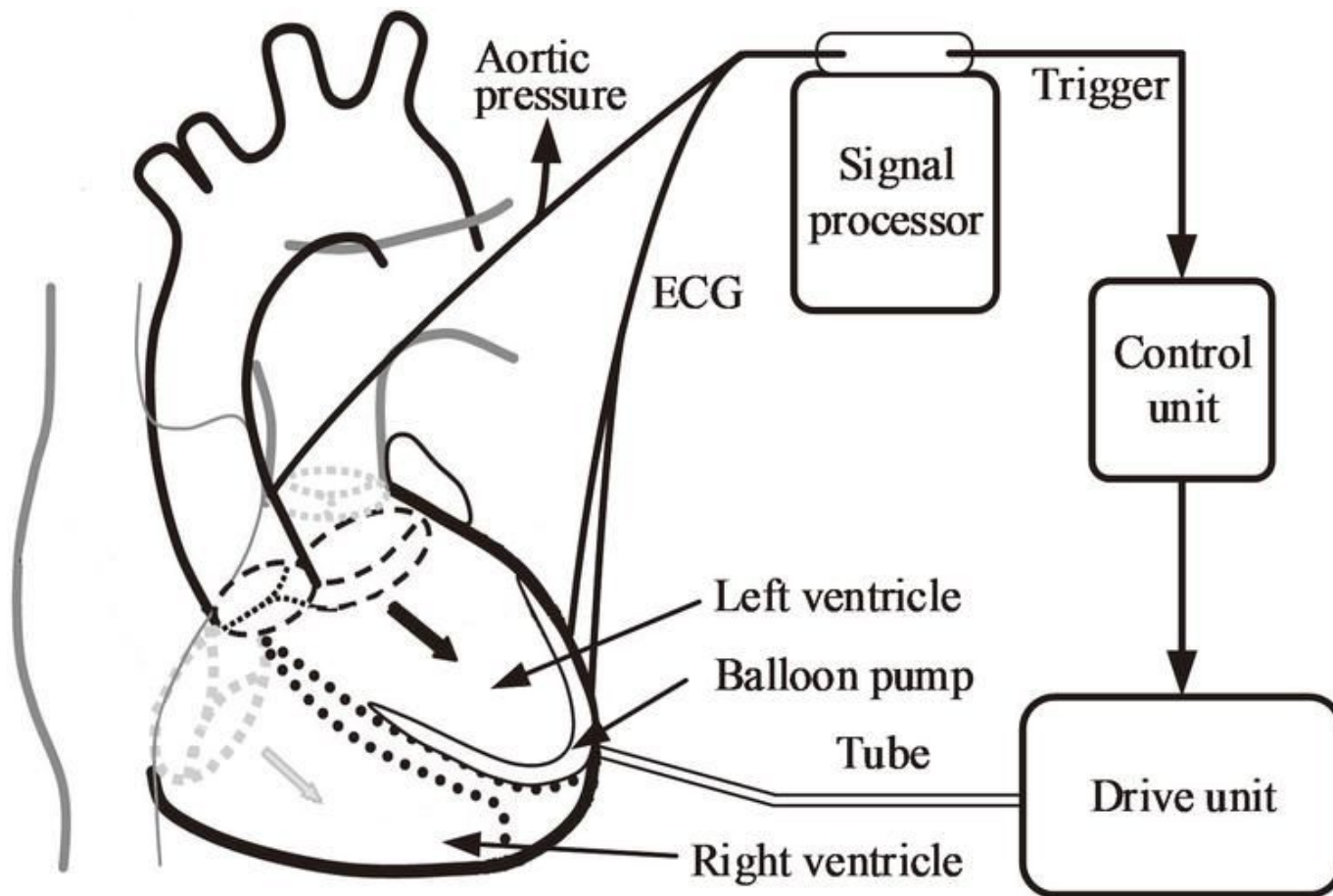


Mechanical Cardiac Assist Devices



Mechanical Cardiac Assist Devices





Total Artificial Heart (TAH)

Completely replaces the patient's native heart and requires the removal of the patient's own heart.

To transplantation for patients awaiting a suitable donor heart.

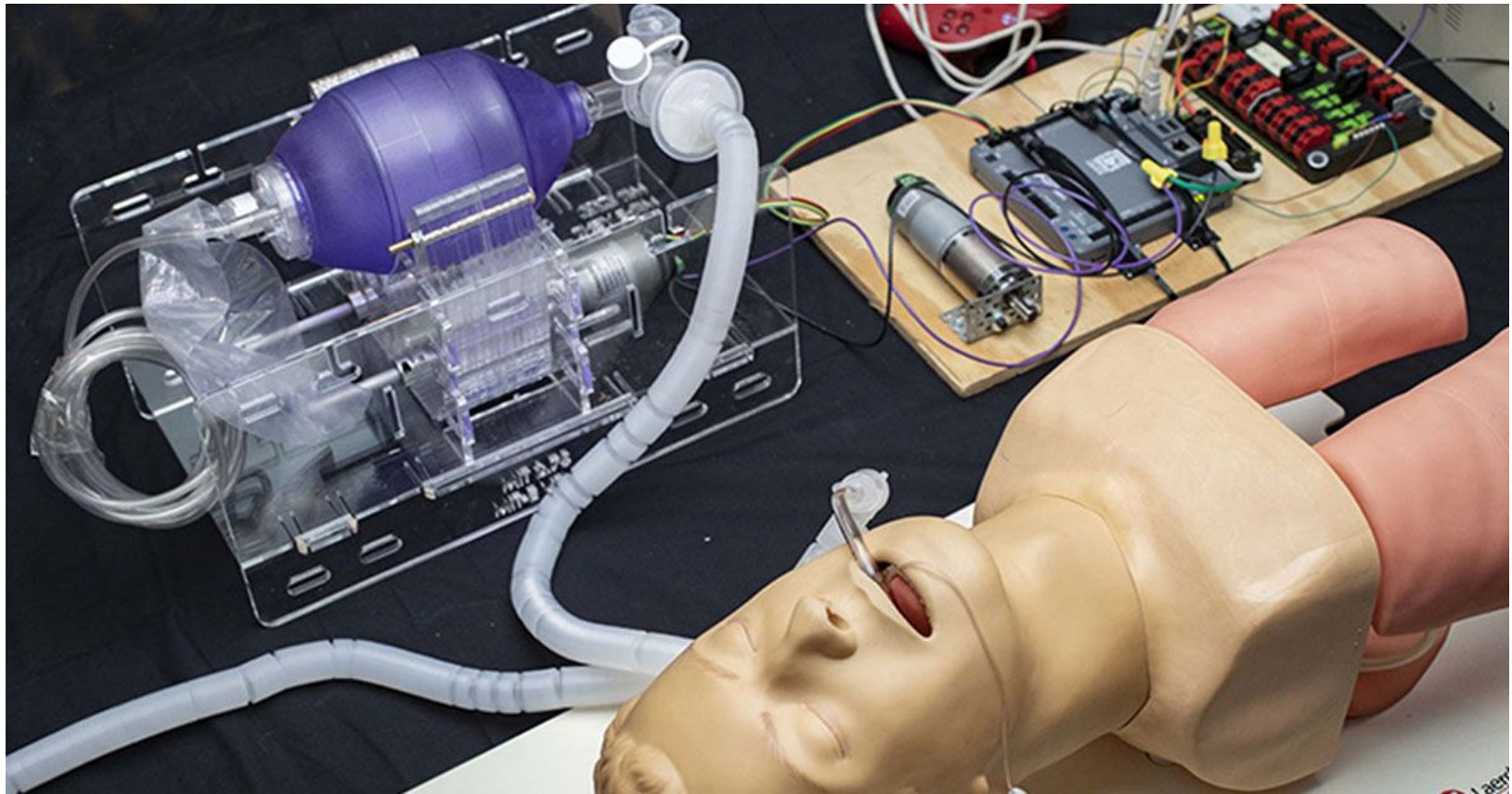
Temporary Assist Devices

Temporary devices can be used during the recovery process until the patient's heart function improves.

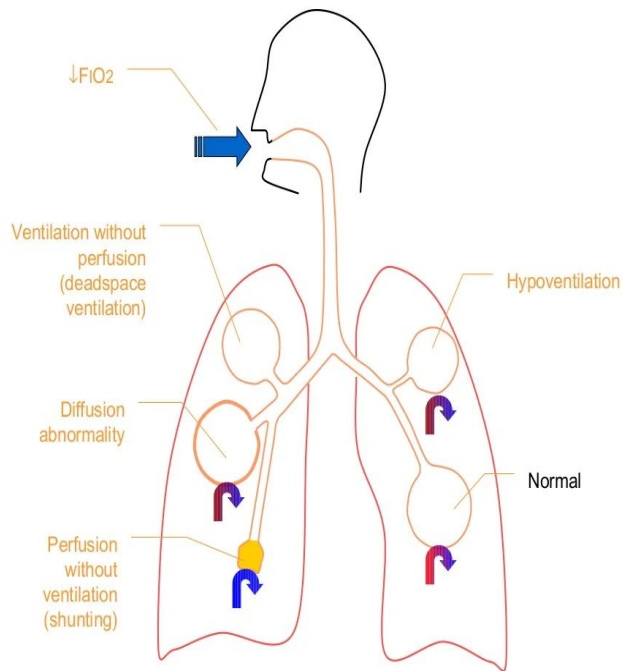
Implanted via open-heart surgery / minimally invasive procedures, depending on the device type and the patient's condition.

Devices are powered by external battery packs or through a wired connection to an external power source.

Assisted Respiration



Assisted Respiration



Assisted respiration is a mechanical ventilation

Support a patient's breathing
Severe heart failure or other conditions

Provide controlled and regulated airflow to ensure the patient

To receives adequate oxygen and expels carbon dioxide.

Mechanical ventilation is commonly used in...

Critical Illness

Surgery

Neurological Conditions

Trauma

Muscle Weakness

Colours associated with gases

Medical Gas	Colour
Oxygen	White
Nitrous oxide	Blue
Medical air	White and Black stripes
Carbon dioxide	Grey
Nitrogen	Black
Medical vacuum	Yellow

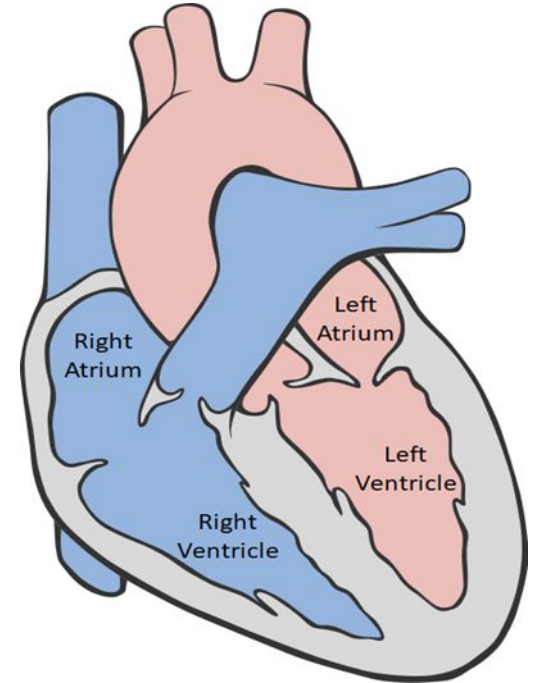
<https://air-source.com/blog/types-of-gases-used-in-hospitals/>

Right and Left Ventricular Bypass Pump

- Medical device
- In the devices that can provide temporary circulatory support by diverting blood from either the right or left ventricle of the heart.
- Used to assist a failing ventricle while allowing the heart to rest and recover.
- Temporarily assist the heart's pumping function in cases of severe heart failure/surgical procedures.

Applications of Right and Left Ventricular Bypass Pump

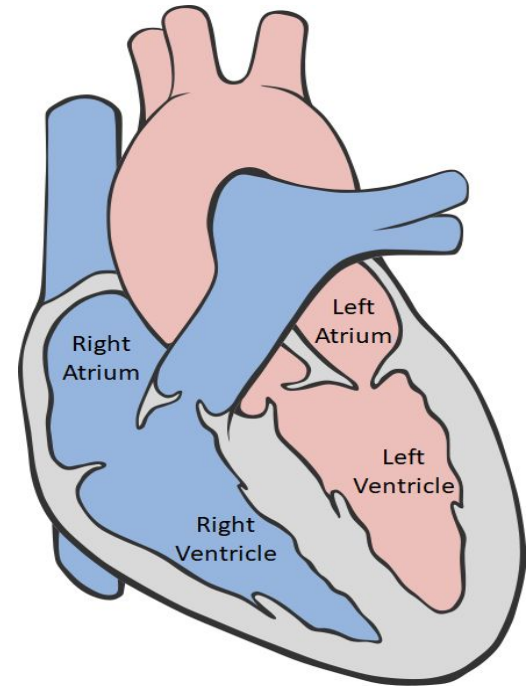
- **Cardiopulmonary Bypass During Surgery**
- **Heart Transplantation**
- **Temporary Support for Failing Ventricles**



Used in critical and high-risk situations to support patients with severely compromised cardiac function

Auxiliary Ventricle

- Assisting to ventricle
- Supplementing ventricle
- To help the heart pump blood more effectively
- Severe heart failure - ventricles are not functioning well
- To provide additional pumping support to the heart



Open Chest and Closed Chest Type Cardiac Assist Device

Surgical approach used to access the heart during cardiac procedures

"Open chest" refers to procedures where the chest cavity is surgically opened, providing direct access to the heart.

"Closed chest" procedures are performed without opening the chest, often using minimally invasive techniques such as catheter-based procedures.

Open Chest Approach:

In the open chest approach, a traditional surgical incision is made to access the heart and surrounding structures.

Advantages:

Offers optimal visualization and access to the heart.

Suitable for complex procedures and device implantation.

Enables thorough assessment of the heart's condition.

Disadvantages:

Invasive surgery with a larger incision.

Longer recovery time.

Increased risk of infection and other complications associated with open surgery.

Closed Chest Approach:

The closed chest approach involves using minimally invasive techniques to access the heart without making a large incision in the chest.

Advantages:

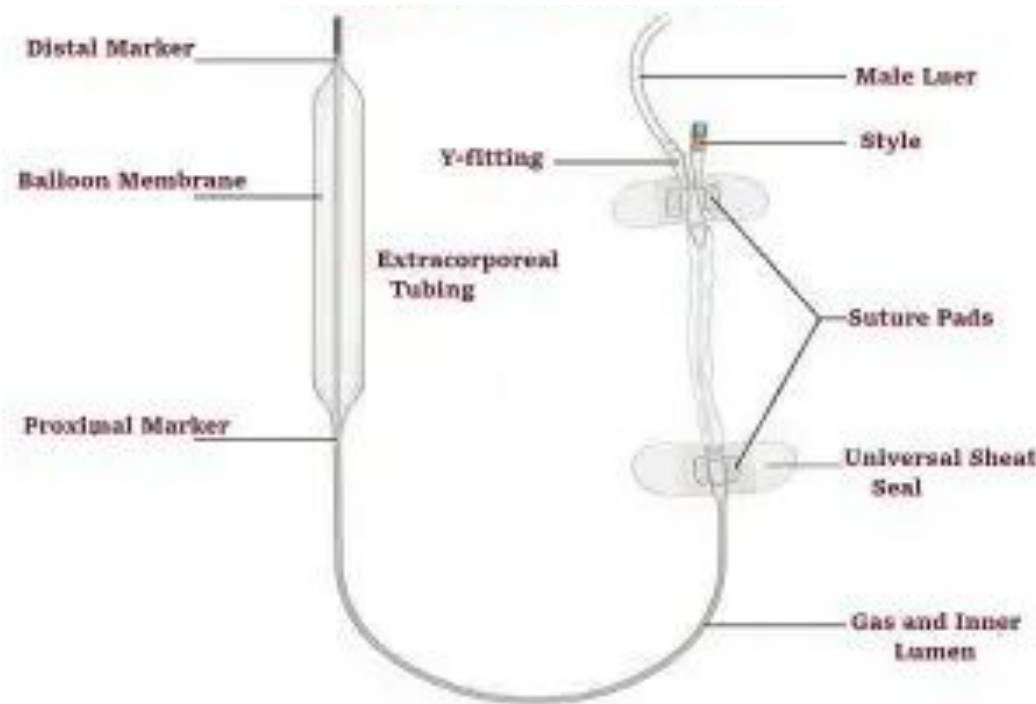
- Smaller incisions or punctures, resulting in less tissue damage.
- Shorter hospital stays and quicker recovery.
- Reduced risk of infection and post-operative complications.

Disadvantages:

- Limited access and visualization compared to open chest surgery.
- May not be suitable for all types of cardiac procedures or devices.
- Requires specialized training and equipment.

Intra-Aortic Balloon Pump (IABP)

An intra-aortic balloon pump is a **mechanical device**, to provide **temporary circulatory assistance**.



Assist in improving coronary blood flow and reducing the heart's workload.



It helps improve coronary artery blood flow and overall cardiac function.

Carries oxygenated blood from the heart to the rest of the body.

Applications of Intra-Aortic Balloon Pump (IABP)

Acute Myocardial Infarction (Heart Attack)

IABP can help increase blood supply to the heart muscle

Cardiogenic Shock

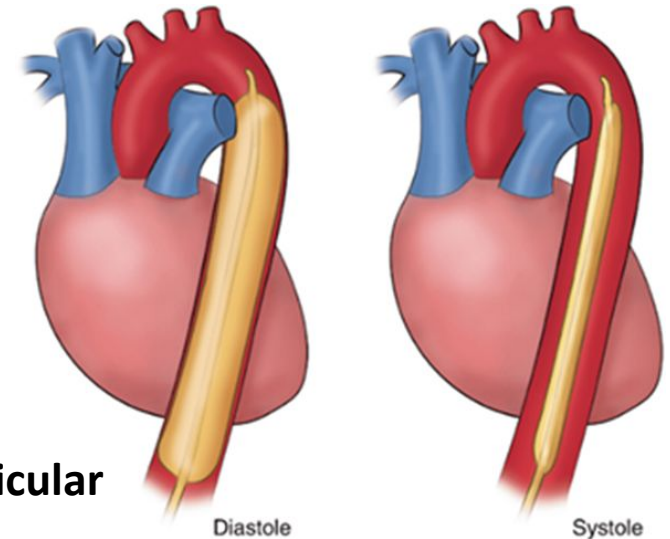
IABP can provide temporary circulatory support in these critically

High-Risk Cardiac Procedures

IABP can stabilize the patient's hemodynamics and improve coronary blood flow.

Bridge to Further Interventions

Heart transplantation or the implantation of a ventricular assist device



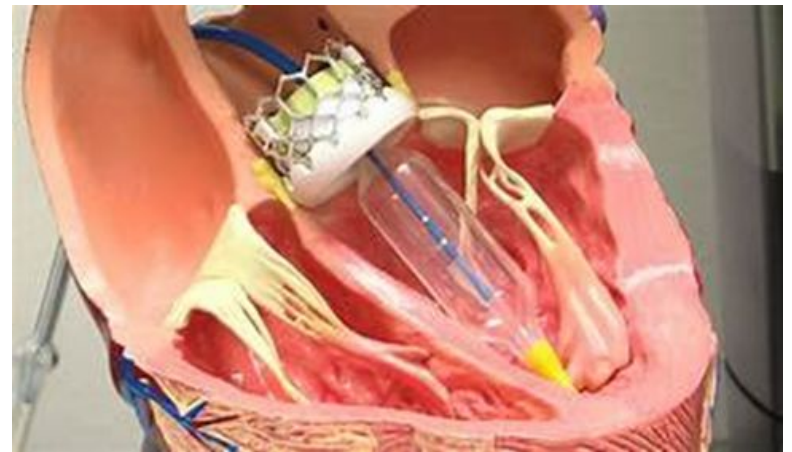
Prosthetic Cardiac Valves

Prosthetic cardiac valves are artificial valves used to replace damaged or diseased heart valves.

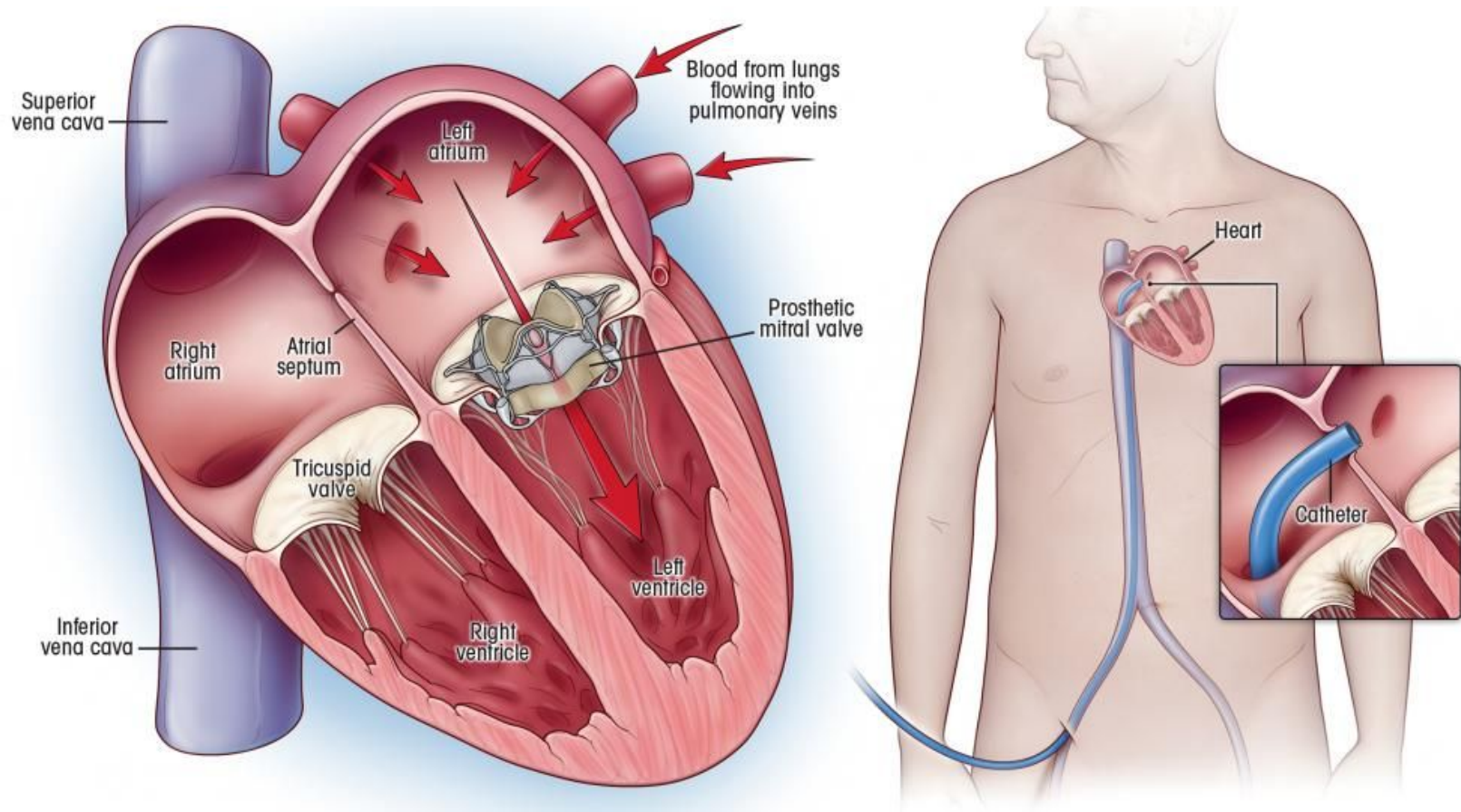
Prosthetic cardiac valves are not exactly cardiac assist devices

Closely related as they play a crucial role in restoring proper blood flow through the heart

Assisting in cardiac function.



Prosthetic Cardiac Valves



Prosthetic Heart Valves



Biologic

- Lasts 8-10 years
- No anticoagulation
- No Click



Mechanical

- Lasts > 20 years
- Lifelong anticoagulation
- Click

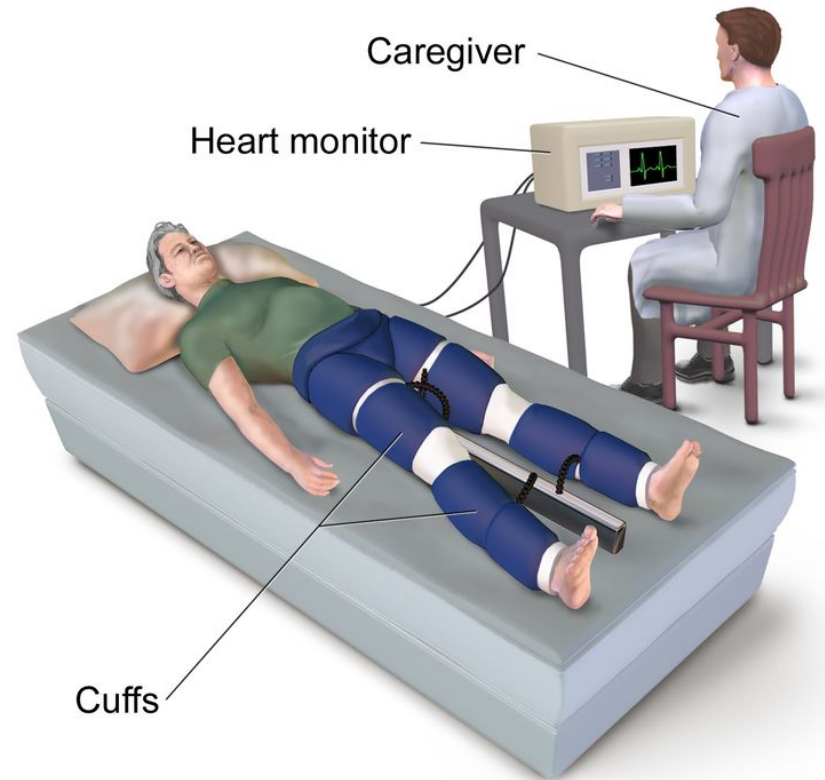
External Counter pulsation (ECP) Technique

Non-invasive medical technique used to improve blood flow to the heart muscle.

It is not a traditional cardiac assist device

It aims to enhance cardiac function by increasing coronary perfusion and oxygen supply to the heart.

ECP involves the use of external cuffs that are wrapped around the patient's legs and connected to a computerized control system



Applications of External Counter pulsation

Typically used for patients with angina (chest pain) or heart failure. By increasing blood flow to the heart muscle, ECP can:

- Reduce the frequency and severity of angina episodes.
- Enhance oxygen delivery to the heart, which may alleviate symptoms and improve exercise tolerance.
- Stimulate the formation of collateral blood vessels (collaterals) that can bypass blocked or narrowed coronary arteries.

Limitations of External Counter pulsation:

It may not be suitable for all patients

It is not a cardiac assist device in the traditional sense, it aims to enhance cardiac function and alleviate symptoms by improving blood flow to the heart muscle.

Thank You