



SNS COLLEGE OF ALLIED HEALTH SCIENCES
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DEPARTMENT OF CARDIO PULMONARY PERFUSION CARE
TECHNOLOGY

COURSE NAME : PRINCIPLES OF PERFUSION TECHNOLOGY

II YEAR

TOPIC : BLOOD PUMPS - OTHERS



IDEAL CHARACTERISTICS OF BLOOD PUMP



- An ideal blood pump should be able to move large volumes of blood a flow rate of 7l/min at pressure 500mmhg
- The handling of blood by the pump should minimize the flow velocity so that damage to the blood is minimized.
- Pump components in contact with blood should not damage the blood cells and should not activate either the inflammatory or the coagulation cascades.
- Calibration- maintaining proper occlusion and revolution [for maintaining accurate flow]
- The pump should be automatically controlled and operated for routine use but it should be designed for possible manual operation in case of power failure.



Diagonal pump



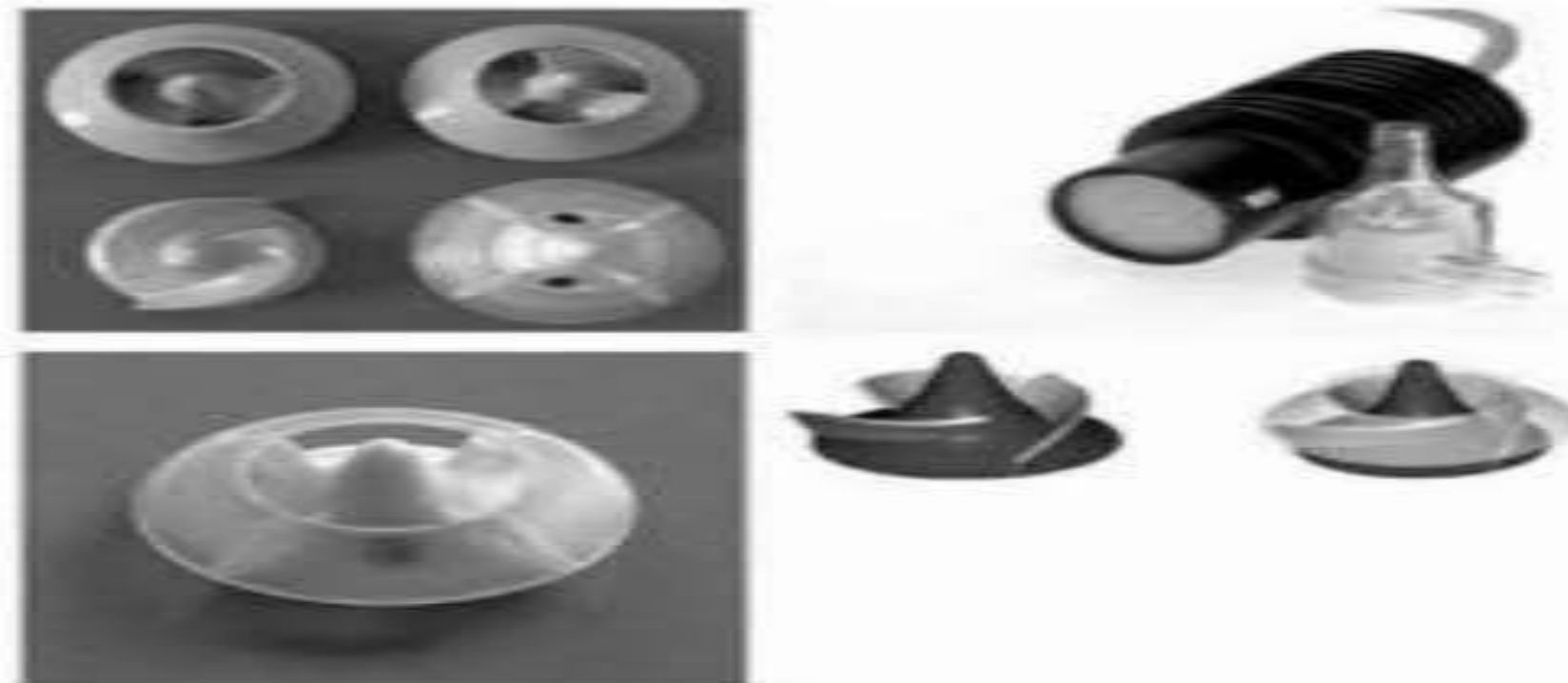
- There is currently only one diagonal pump available (the Delta Stream)
- This pump was developed by the Helmholtz Institute in Aachen to provide a **highly integrated blood pump** for use not only in cpb procedures but also for longer duration support , such as ECMO and ventricular assist.
- Two systems were developed , one with a built in electric motor for ventricular assist and ECMO procedures and the other with a disposable pump head and an external motor for short term procedures.
- Major advantages of this pump are its capability of **generating pulsatile flow**, small size , and simple design

Working principle

- The basic design has a hydraulic efficiency and a priming volume between that of an axial pump and centrifugal pump
- The pump consists of a cylindrical electric motor integrated into the pump and an annular blood flow path that surrounds the motor for cooling purposes.



- The impeller is positioned between the pump inlet and the motor.
- The motor cylinder and the impeller have a diameter of approximately 25mm.
- Colour Flow Doppler was used to optimize the blood path in the pump head.
- As could be expected from a diagonal design the RPM necessary to achieve a certain flow against a given resistance will be higher than that in impeller centrifugal pumps.





Axial pump



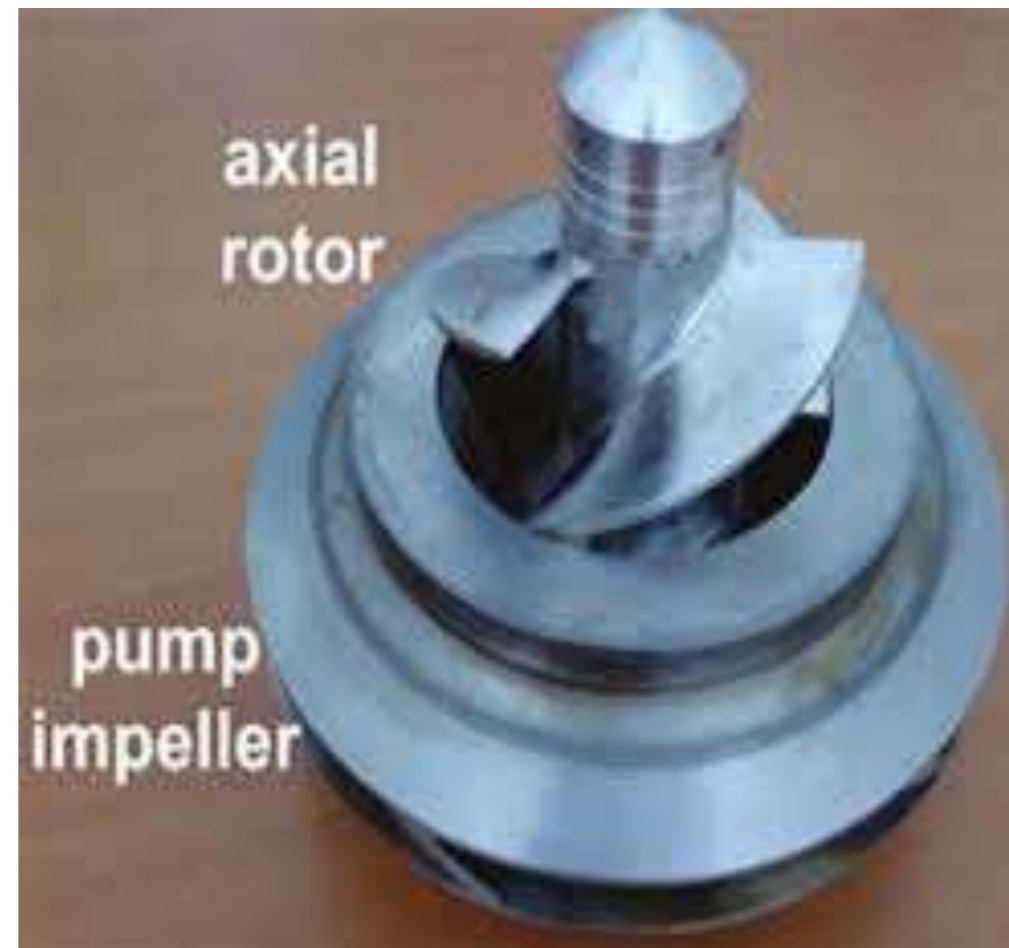
- The axial blood pump is a new generation of rotary pump , it consists of axial or diagonal impeller driven by an electric motor to generates an axial flow by rotating the blood internal impeller.
- Impeller is an important component in axial pump , and its structure mostly determines the heart pump performance , thus a marked improvements in impeller design ensures a high flow rate and little blood damage.
- Axial pump motivated by electric motor to provide high speed rotation.



- In some generation both continuous flow and pulsatile operation are possible(eg.DP3 from medos)
- When comparing between centrifugal and axial pump design theory , centrifugal pumps are capable of producing higher pressures at lower flows ,where as axial pumps typically generate higher flows at lower pressure rises.
- The priming volume of axial pumps is smaller than that of centrifugal pumps, so it usually utilized in pediatrics ECMO and ventricular assist device.



- Axial flow pumps operate at much higher rotational speeds (up to 15000 rpm), than centrifugal pumps (up to 5500rpm) to produce the desired head pressure and flow.
- In addition axial flow pumps have a lower energy consumption, which allows lighter power supply components and eventually implantable batteries

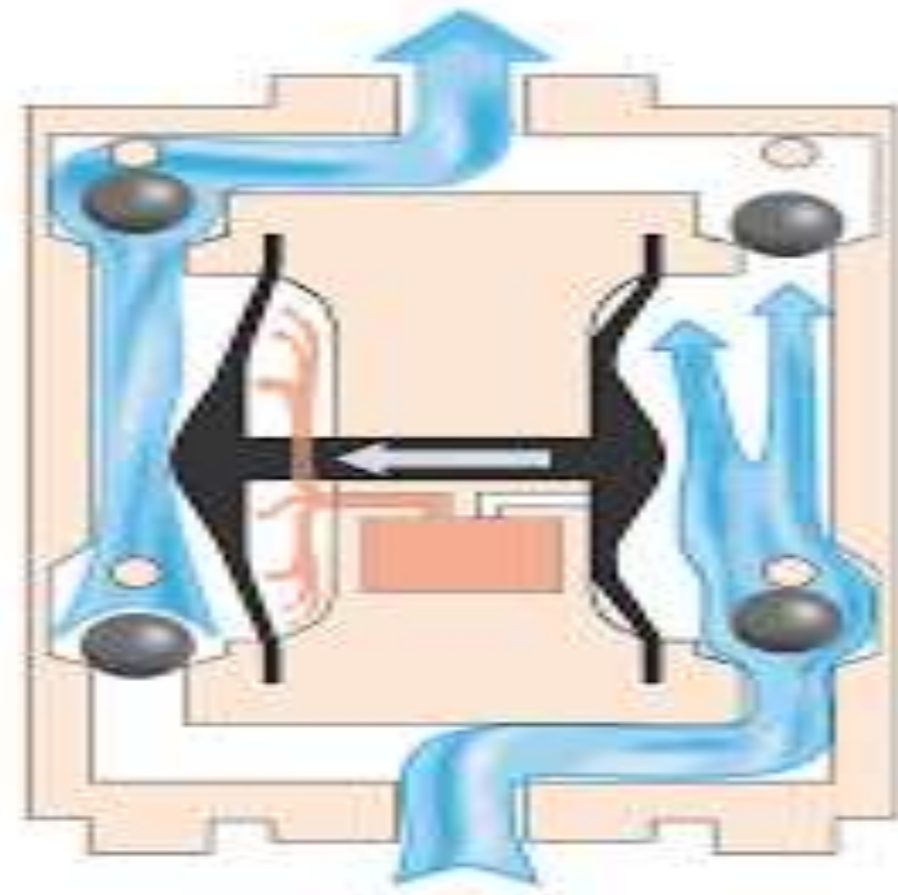




DIAPHRAGM PUMP



- It is also known as membrane pump.
- It is a positive displacement pump that uses a combination of the reciprocating action of a rubber, thermoplastic or Teflon diaphragm and suitable valves on either side of the diaphragm to pump a fluid





Characteristics

- Have good suction lift
- Suitable for discharge pressure upto 1200 bar
- Have good dry running characteristics
- Can be upto 97% efficient
- Have good self priming capability



Pump composition

- Double diaphragm pumps consists of two diaphragm connected to a piston and contained within two separate displacement chambers , each with an inlet and discharge valve
- The diaphragms are made of **flexible material** compatible with the pumped media
- They are sealed in place b/w the side of the displacement chamber and an attached flange.
- The chambers volume is slightly greater than what the diaphragm can displace the valves are typically spring loaded ball valves or flapper valves and they function to admit the fluid in and out of the chamber



Advantages

- Seal less and oil free
- Almost steady flow
- Handless most media types-Particularly corrosive or abrasive chemicals

Disadvantages

- Low maximum speed













THANK YOU