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Review Article

Extra Corporeal Membrane Oxygenation- A Life Saver

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Abstract

A type of supportive measure where an external artificial circulator carries a deoxygenated blood from the patient to an oxygenator a gas exchange device in which the gas exchange takes place. ECMO was developed gradually from cardiopulmonary by – pass. Types of ECMO is said to be two types they are Veno-Venous ECMO and Veno-Arterial ECMO. Veno-Venous ECMO was used only for supporting the lungs and Veno – Arterial ECMO was used for supporting both the lungs and heart. In both the cases blood is withdraw from venous and goes to machine for purifying. In veno arterial blood is returned directly to the aorta and goes to the systemic circulation. At the same time in veno venous after oxygenation the blood is returned to right atrium and circulates in systemic circulation.

Keywords:Ecmo,Veno-Arterialecmo,Veno-Venousecmo.

Introduction

It is a type of supportive measure where an external artificial circulator carries a deoxygenated blood from the patient to an oxygenator a gas exchange device in which the gas exchange takes place. The deoxygenated blood gets oxygen and turns to oxygenated blood and goes back to the circulation. The blood can be taken out of vessels with the help of centrifugal or roller pump [1].

ECMO was developed gradually from cardiopulmonary by - pass

Types

ECMO is said to be two types, they are Veno-Venous ECMO and Veno-Arterial ECMO

Veno-Venous ECMO

This type of ECMO was used only for supporting the lungs. If a patient is having respiratory failure for reducing the workload of lungs or to compensate the lung function this type of ECMO is used. In this type deoxygenated blood is withdrawn from major veins and goes to oxygenator. After oxygenation the blood is returned to right atrium and circulates in systemic circulation.

This type also enhances the oxygen level by reducing the amount of deoxygenated blood passing through the lungs and also removes carbondioxide from patient's blood. The oxygen regulation by the ECMO circuit is based on the pump flow respective to cardiac output.

Veno-Arterial ECMO

This type of ECMO was used for supporting both the lungs and heart. If a patient is having cardiogenic shock to compensate the lung and heart function this type of ECMO is used. In this type deoxygenated blood is withdrawn from major veins and goes to oxygenator. After oxygenation the blood is returned directly to the aorta and goes to the systemic circulation [2].

In this type, the oxygenated blood after the gas exchange is directly transport to the arterial circulation helps to achieve the partial oxygen level. The changing flow rate of blood from the ECMO will not affect the partial oxygen level and malfunction of this circuit will leads to cardiac arrest because the ECMO flow rate is the patients cardiac [output].

Indications

Pulmonary Problems

- Respiratory Failure
- ARDS
- Pneumonia
- Asthma
- Post lung transplant
- Lung contusion

Cardiac Problems:

- Post cardiac arrest
- Pulmonary embolus
- Drug Overdose
- Post cardiac surgery
- Cardiogenic Shock

Contra Indications

- Severe neurological condition
- Cirrhosis of liver with ascites

History of variceal bleeding
Human Immuno Deficiency Virus
Terminal Malignancy
Severe Left ventricular Failure
Cardiac Arrest
Aortic Dissection
Multiple organ Failure
Peripheral Vascular Disease

Differentiation between Veno-Venous ECMO and Veno – Arterial ECMO

Veno-Venous ECMO	Veno – Arterial ECMO
Provides Respiratory Support	Provides support for both respiratory and cardiac
Blood withdrawal from venous circulation and back to venous circulation	Blood withdrawal from venous circulation and back to arterial circulation
Cardiac output not affected	Affects cardiac output by changing the outflow
Haemodynamic instability will be less	Haemodynamic instability will be more

ECMO Machine

ECMO machine contains the following

1. Cannula
   - Arterial Kits 50cm Medtronic Biomedicus cannulae: sizes: 19 and 21F
   - Venous Kits 150 cm Medtronic Biomedicus cannulae: sizes: 19, 23 and 27
2. Hand crank
3. Brackets for Rotaflow oxygenator / pump
4. Oxygenator – which acts like lungs
5. Sensor – which senses the oxygen level and blood flow in the body
6. Centrifugal pump – helps in blood rotation
7. Pump Console – controls the blood flow rate and speed
8. Heater/ Cooler – Maintains thermoregulation

Management

Initiation of ECMO:

- Check blood clotting time
- Oxygen line to be connected to oxygenator
- Circuit will be managed with vaccum
- Securing the access lines and return lines of blood
- Heater or cooler hoses and oxygen flow tubing is not obstructed by feet, bed etc
- Never allow the circuit to have contact with alcohol or organic solvents

Respiratory Management:

Respiratory parameters has to be maintained and to improve the oxygen. The parameters are fractionated oxygen above 0.7, partial expiratory end pressure below 15 cm water and the respiratory rate as below 10 bpm [3].

Pump Flow Rate:

In Veno – Venous ECMO:

Two thirds of patients cardiac output or minimum 50% of patient's cardiac output

In Veno – Arterial ECMO:

2.1 to 2.4 L/min

Temperature:

Temperature should be kept at body temperature (37degrees)

Anti Coagulation:

Low dose heparin is used to prevent the blood from clotting although the tubing's of circuit has anticoagulant lining.

Investigations for Patients on ECMO

Chest X ray
Blood Test – Electrolytes, LFT, RFT, FBS
Clotting Time, Bleeding time, APTT
Blood Culture, urine culture

Complications

Hypoxia
Hypercapnia
Bleeding
Hemolysis

Emergency Complications

Pump failure
Cardiac Arrest
Decannulation
Air Embolism
Circuit Rupture

Nursing Management

The Nurse has to perform safety checks like
Checking flow rate
Secure oxygen flow to oxygenator
Never allow the patient alone

All the vital signs and hemodynamic monitoring to be checked.

Lower extremities to be checked for temperature, colour, pulse and capillary refill

Observe for oozing of blood from cannulas

Sterile dressing to be maintained at cannula sites

Input and out put chart to be maintained

Urine to be checked for hematuria

Patient should be given care in supine position with elevation of head by 30 degrees

Pressure points to be checked frequently and anticipate for pressure ulcer

Pupillary and neurological assessment to be done
Patient should be moved under proper supervision

Management of Complications

Hypoxia and Hypercapnia

- Increase the pump flow
- Increase ventilation
- Cool patient to 35 deg
- Muscle relaxants can be administered

Bleeding

- Stop heparin. Heparin coated circuits can run for couple days without heparin
- Find out the cause
- Administer Platelets, packed cells or Fresh Frozen Plasma

Cardiac Arrest

- Call for Help/ Code Blue
- Cardio Pulmonary Resuscitation

Air Embolism

- Clamp arterial return line
- Stopping the pump
- Keep the patient head down
- Increase ventilation & Inotropic drugs
- Volume
- If embolus entered patient arterial system (VA)
- hypothermia'
- Barbiturates, steroids, mannitol, lignocaine
- If embolus entered venous system (VV)
- Aspiration of right heart using existing lines

Weaning ECMO

Veno-Venous ECMO

Maintain the flow rate of oxygen
Restore the patient with full ventilation
Slowly Turn Off oxygen to oxygenator
Check the patient for stabilization and then decannulate

Veno-Arterial ECMO

Decrease the pump flow and assess the ventricular function
Turn off the oxygen slowly and assess the oxygen level
If oxygen is good and carbon di oxide is managed by ventilation then decannulation can be considered [4].

Conclusion

ECMO was developed gradually from cardiopulmonary by – pass. It is a type of supportive measure where an external artificial circulator carries a deoxygenated blood from the patient to an oxygenator a gas exchange device in which the gas exchange takes place. ECMO is said to be two types they are Veno-Venous ECMO and Veno-Arterial ECMO. This can be a live saving modality for patients with cardiopulmonary instability.

Reference

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