

A case study on Extra Corporeal Membrane Oxygenation for Airlifted case with Covid-19 Pneumonia

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Abstract

Extracorporeal Membrane Oxygenation (ECMO) is a life-support technique used in patients with severe cardiac or respiratory failure when conventional therapies, including cardiopulmonary resuscitation (CPR), are unsuccessful. ECMO functions by diverting blood from the body through a circuit where it is oxygenated and returned, allowing the heart and lungs to rest and recover. The system typically includes two cannulas: a drainage cannula that removes deoxygenated blood and a return cannula that delivers oxygenated blood back into circulation. There are two main types of ECMO. Veno-venous (VV) ECMO, primarily used for severe respiratory failure. Veno-arterial (VA) ECMO, used for cardiac or cardiorespiratory failure. During ECMO support, anticoagulation monitoring is critical to maintain a delicate balance between thrombosis and bleeding risks. Continuous heparin administration is commonly used, necessitating close monitoring due to potential complications such as Heparin-induced thrombocytopenia (HIT) Neurological complications, including ischemic or haemorrhagic stroke Infections and sepsis, which can worsen outcomes and complicate management. Outcomes with ECMO have improved in recent years, especially in conditions such as cardiac arrest, cardiogenic shock, and acute respiratory distress syndrome (ARDS), including cases caused by COVID-19. Careful patient selection and expert multidisciplinary management are essential for optimizing survival and minimizing complication

Key words:- ECMO – Extra corporeal Membrane Oxygenation, ARDS-Acute Respiratory Distress Syndrome, VV ECMO- Veno-venous Extra corporeal Membrane, VA ECMO-Veno arterial Extra corporeal membrane

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I. Introduction

Extracorporeal membrane oxygenation (ECMO) provides both respiratory and cardiac support and is utilized as a rescue therapy in cases of severe respiratory or cardiac failure. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus responsible for coronavirus disease 2019 (COVID-19), first emerged in Wuhan, China in December 2019. As of April 2020, the global COVID-19 pandemic had resulted in an estimated case-fatality rate of approximately 6.8% [1]. According to data from the Johns Hopkins Center for Systems Science and Engineering (CSSE), by mid-October 2020, there were over 39 million reported cases worldwide, with more than 1 million deaths [2]. While the majority of COVID-19 infections are asymptomatic or mild, around one-third of patients require admission to the intensive care unit (ICU), and nearly 30% develop acute respiratory distress syndrome (ARDS) [1,3]. ECMO was previously demonstrated to be an effective salvage therapy during the 2009 H1N1 influenza pandemic for patients with severe pneumonia and respiratory failure [4]. However, evidence on the use of ECMO in COVID-19-associated pneumonia remains limited. In January 2020, the World Health Organization (WHO) issued interim guidance regarding the use of ECMO in COVID-19 patients [5]. Despite the limited data, the National Institutes of Health (NIH) has included ECMO as a potential therapeutic option in its treatment guidelines for COVID-19 [6].

Survival for patients with ICATT's ECMO varies between 30% and 50%, depending on the cause of the cardiac dysfunction[7]. ECMO can be considered in patients with systolic blood pressure below 85 mm Hg. If the cardiac index is below 1.2-litre min/m² despite sufficient preload, more than two inotropes are used, intra-aortic balloon counter pulsation (IABP) and signs of low systemic levels of cardiac output.[7,8]

Chief complaints, history of presenting illness, past history, family history, previous medical assessment involving any hospitalisations, investigations, diagnosis, medical management, indications for ECMO, complications during ECMO, post procedure status emphasizing on clinical status and role of nurses in improvement of clinical status at every stage leading to successful discharge from ICU, transit to ward, ward care, discharge from hospital and follow up

Results: The patient, initially presenting with hypoxemia and dyspnea, underwent successful veno-venous extracorporeal membrane oxygenation (VV-ECMO) support. Post-procedure, the patient's recovery was uneventful, demonstrating significant improvement in respiratory function during hospitalization. This outcome underscores the efficacy of ECMO as a life-saving intervention for severe respiratory failure.

Conclusion: In patients undergoing ECMO, COVID-19-associated pneumonia was associated with poorer outcomes compared to non-COVID-19 pneumonia, independent of sociodemographic characteristics and comorbidity burden.

Key words:- ECMO – Extra corporeal Membrane Oxygenation, ARDS-Acute Respiratory Distress Syndrome, VV ECMO- Veno-venous Extra corporeal Membrane, VA ECMO-Veno arterial Extra corporeal membrane

II. Case Description

A 34-year-old gentleman from Patna tested positive for COVID-19 and was admitted to a local hospital, where he was initiated on non-invasive ventilatory support, along with intravenous antibiotics and corticosteroids. Due to clinical deterioration, he was transferred to another hospital, where he developed bilateral pneumothoraces, necessitating insertion of bilateral intercostal chest drains.

Despite these interventions, the patient remained hypoxic, with oxygen saturation persistently below 75%, and was subsequently intubated and placed on mechanical ventilation. As his condition failed to improve on maximal ventilatory support, veno-venous extracorporeal membrane oxygenation (VV-ECMO) was initiated via the right internal jugular vein and right common femoral vein by the Apollo ECMO team.

He was airlifted to Apollo Hospitals, Jubilee Hills, for advanced care. Upon arrival, the patient was sedated, paralyzed, and hemodynamically stable, with oxygen saturation of 98% on 7 L/min oxygen via ECMO and FiO₂ 0.5 on the ventilator.

On day 2 post-transfer, weaning from mechanical ventilation was initiated. Due to difficulty in weaning, a percutaneous tracheostomy was performed. Bronchoscopy revealed mild mucoid secretions. Subsequently, chylous drainage was noted from the right chest tube, for which the patient was started on a medium-chain triglyceride (MCT) diet. The chylous effusion resolved with this intervention.

On day 11, the patient developed painful bluish discoloration of the toes. Venous Doppler studies ruled out deep vein thrombosis, and arterial Doppler showed normal arterial flow. Microvascular thrombosis was suspected based on hematology consultation, and antiplatelet agents with vasodilatory properties were initiated. The toe discoloration gradually improved.

The patient experienced episodes of melena during hospitalization, for which he was started on pantoprazole infusion. He developed anemia and thrombocytopenia, with deranged liver function and coagulation parameters. Acinetobacter species were isolated from blood cultures, and minocycline was initiated. Multiple blood and blood product transfusions were administered as needed.

On day 17, the patient was successfully weaned off ECMO and decannulated. He remained hemodynamically stable and was alternated between T-piece and CPAP ventilation. He was gradually weaned off the ventilator, maintaining adequate oxygenation on T-piece with decreasing flow rates.

The patient's caloric intake was optimized, and he began weight-bearing exercises with physiotherapy support. He was mobilized to a chair, and the left-sided chest drain was removed. However, he developed a recurrent left-sided pneumothorax, for which a CT-guided pigtail catheter was inserted.

Tracheostomy decannulation was done approximately one month after placement. At the time of discharge, the patient was symptomatically improved, hemodynamically stable, and maintaining SpO₂ of 98% on 1 L/min oxygen. The patient was discharged home in stable condition.

A case study on Extra Corporeal Membrane Oxygenation for Airlifted case with Covid-19 Pneumonia

Progress on ECMO

| Parameters | Day 2 | Day 3 | Day 5 | Day 8 | Day 11 | Day 14 | Day 16 | Day 17 |
|---------------------------|-------|-------|-------|-------|--------|--------|--------|--------|
| ECMO Fio2 | 100 | 100 | 100 | 100 | 70 | 60 | 21 | 21 |
| Sweep Gas Flow | 5 | 7 | 7 | 4 | 5 | 4 | 2.5 | 1 |
| Pre-oxygenator pressure | 144 | 139 | 135 | 131 | 98 | 106 | 90 | 53 |
| Post-oxygenator pressure | 128 | 128 | 98 | 111 | 69 | 94 | 71 | 40 |
| Delta oxygenator pressure | 16 | 11 | 37 | 20 | 29 | 12 | 19 | 13 |
| Pump RMP | 2880 | 2880 | 2720 | 2695 | 2400 | 2375 | 1910 | 1689 |
| Heparin Dose(ml) | 2 | 1.8 | 1.6 | 1.5 | 1.6 | nil | 1.9 | 2.4 |
| ACT | 128 | 142 | 194 | 179 | 210 | 123 | 206 | 146 |

Lab reports

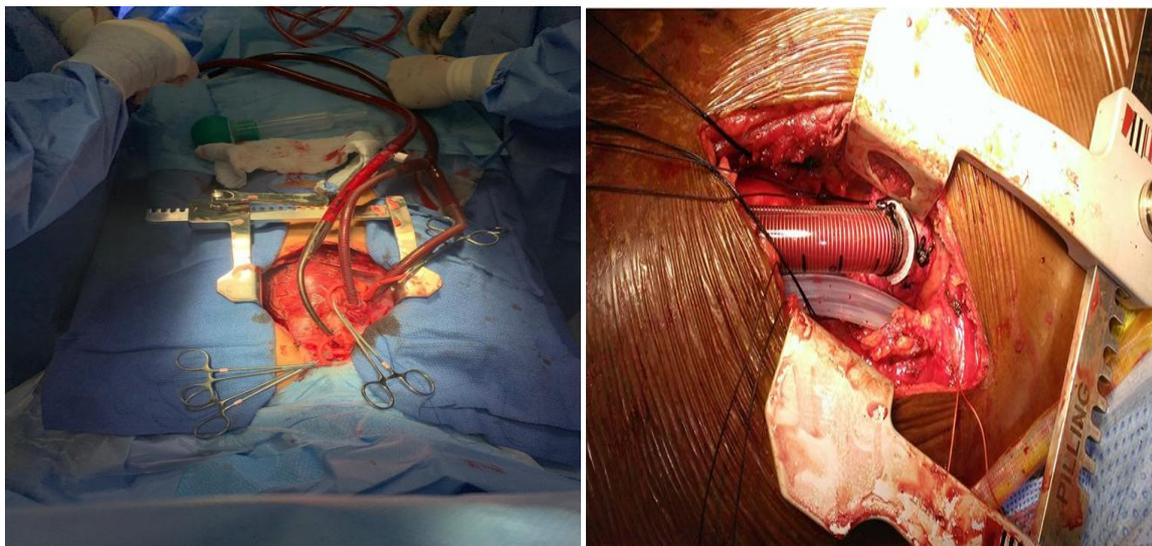
| INVESTIGATIONS | Day2 | Day5 | Day8 | Day11 | DAY14 | DAY17 | DAY18 |
|-----------------------|------|------|------|-------|-------|--------|--------|
| Hemoglobin(gm/dl) | 10.4 | 9.2 | 10.4 | 9.1 | 8.6 | 8.7 | 10.6 |
| Platelet(x1000/cumm) | 1.30 | 1.1 | 2.09 | 1.81 | 1.21 | 52,000 | 79,000 |
| INR | 1.16 | 1.31 | 1.23 | 1.15 | 13 | - | 1.24 |
| Fibrinogen(mg/dl) | 426 | 317 | 331 | - | 151 | | |
| APTT(sec) | 48 | 39.4 | 40.8 | - | 30 | | 77.1 |
| D-dimer(ng/ml) | 776 | - | 1847 | - | 5478 | 8379 | 3085 |
| Ferritin(microgram/L) | 1334 | 695 | - | - | - | - | |
| CRP(mg/dl) | 80.7 | 38.2 | 65.5 | - | 76.5 | - | 49.9 |

Infection Prevention:

- Hand hygiene was performed by following of six steps for 5 moments
- Aseptic precautions while handling line
- Scrub the hub and close all the ports with alcohol swab or curo caps
- Ports should be covered with sterile drape all the time
- Cleaning of equipment every shift
- Linen to be sterilized before use for the patient



ECMO CIRCUIT IN OUR HOSPITAL



Care of Central Line:

Complete aseptic technique maintained throughout the stay

Drugs

| SL NO | DRUG NAME | DOSAGE | INDICATION | ROUTE | 6AM | 8AM | 2PM | 6PM | 8PM | DURATION |
|-------|-------------|--------|----------------|--------|-----|-----|-----|-----|-----|---------------------------|
| 1 | T.ELIQUIS | 2.5MG | ANTICOAGULANT | ORALLY | - | - | - | - | - | CONTINUE |
| 2 | T.MET-XL | 50MG | TACHYCARDIA | ORALLY | - | - | - | - | - | CONTINUE |
| 3 | T.THYRONORM | 100MCG | HYPOTHYROIDISM | ORALLY | - | - | - | - | - | CONTINUE |
| 4 | T.VIT -D3 | 60K | VITAMIN D | ORALLY | - | - | - | - | - | ONCE A WEEK AS PER ADVICE |
| 5 | T.A-Z | 1 TAB | MULTIVITAMIN | ORALLY | - | - | - | - | - | 1MONTH |

A case study on Extra Corporeal Membrane Oxygenation for Airlifted case with Covid-19 Pneumonia

| | | | | | | | | | |
|----|--------------------|-----------|--------------------|--------------------|---|---|---|---|---|
| 6 | T.PANCREOFLAT | 1 TAB | GASTRITIS | ORALLY | - | - | - | - | 2 WEEKS |
| 7 | T.RESTYL | 0.25MG | SLEEP | ORALLY | - | - | - | - | IF REQUIRED FOR SLEEP |
| 8 | SYP.DUPHALAC | 30ML | LAXATIVE | ORALLY | - | - | - | - | IF REQUIRED FOR CONSTIPATION |
| 9 | T.MONTEK-LC | 1 TAB | ALLERGY | ORALLY | - | - | - | - | 1 WEEK |
| 10 | T.PIRFINIX | 400MG | FIBROSIS | ORALLY | - | - | - | - | CONTINUE AS PER PULMONOLOGIST |
| 11 | T.MEDROL | 2MG | STEROID | ORALLY | - | - | - | - | AS PER PULMONOLOGIST ADVICE |
| 12 | T.ZOFER MD | 8MG | NAUSEA/VOMITING | ORALLY | - | - | - | - | 3DAYS & IF REQUIRED FOR VOMITING/NAUSEA |
| 13 | T.DOLO | 650MG | PAIN | ORALLY | - | - | - | - | IF REQUIRED FOR PAIN |
| 14 | T.IVABRAD | 7.5MG | TACHYCARDIA | ORALLY | - | - | - | - | CONTINUE |
| 15 | OXYGEN INHALATION | 1-2 LITRE | SOB | PER NASAL | - | - | - | - | TO MAINTAIN SPO2 MORE THAN 90% |
| 16 | OINT.SILODERM | - | SKIN CARE | LOCAL APPLY | - | - | - | - | TILL REVIEW |
| 17 | NEOSPORIN OINTMENT | - | NASAL BRIDGE WOUND | NASAL BRIDGE APPLY | - | - | - | - | TILL REVIEW |
| 18 | NEBZMART-G NEB | 0.5ML | BRONCHOSPASM | PER NASAL | - | - | - | - | CONTINUE AS PER PULMONOLOGIST |
| 19 | FORACORT NEB | 1 RESP | BRONCHOSPASM | PER NASAL | - | - | - | - | CONTINUE AS PER PULMONOLOGIST |

Nutritional needs

On admission: - 50 ml 2nd hourly Nasogastric feed was given i.e. 930(Kcal)and protein 47grmAsper patient tolerance feed was increased to 120ml 2nd hourly feed i.e. Energy 2223(kcal) and protein 113grm along with oral double soft diet as per patient preference.

Patient and Family Education: Patient and family education is a collaborative team effort that begins the moment the patient or their family engages with the ECMO team and continues throughout the entire ECMO journey. The ECMO nurse plays a pivotal role in this process. As they are consistently present at the bedside, they become the primary point of contact for the patient and their family. The ECMO nurse bears the crucial responsibility of providing ongoing education and emotional support, ensuring that families understand the purpose, process, and potential complications of ECMO therapy.

In addition to explaining the technical aspects of ECMO, nurses also play a key role in reinforcing the importance of Isolation practices and infection control policies,Strict hand hygiene,Personal hygiene and safe caregiving practices.By fostering a clear, compassionate, and continuous dialogue, the ECMO team helps reduce anxiety, build trust, and empower families to participate meaningfully in the care and recovery process.

Follow-up care: Provide ongoing support and education to promote long-term management and prevention of further complication

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We also express our appreciation to the healthcare team involved in the comprehensive care of the patient. The dedication and expertise of the physicians, surgeons, nurses, and supporting staff have been instrumental in the successful diagnosis, treatment, and recovery of the patient. Once again, our heartfelt appreciation goes to everyone who played a role in bringing this case study to fruition. This case study contributes valuable insights

into the clinical course and management of Extra Corporeal Membrane Oxygenation for Airlifted case with Covid-19 Pneumonia

III. Conclusion

It was an anxiously anticipated and unforgettable moment filled with pride and joy for all health care workers when after much hard work and untiring persistent care that this young man was finally weaned and decannulated on 17th day of ECMO

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