Case Report

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ECMO Rescue Therapy in Diffuse Alveolar Haemorrhage: A Case Report with Review of Literature

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ABSTRACT

Extracorporeal Membrane Oxygenation (ECMO) has evolved as a treatment option for patients having potentially reversible severe respiratory failure who are deteriorating on conventional ventilation. During ECMO, systemic anticoagulation is needed to maintain patency of the circuit. Therefore, ongoing haemorrhage remains a relative contra-indication to ECMO as it can further increase the bleeding. There is only limited evidence available for the use of ECMO in patients with alveolar haemorrhage. Most of these patients did not receive any anticoagulation during ECMO. We describe our experience with a patient who received intravenous anticoagulation during ECMO for refractory hypoxemic respiratory failure due to Diffuse Alveolar Haemorrhage (DAH) associated with Granulomatosis polyangitis (Wegner's GPA). ECMO sustained life by maintaining gas exchange support and provided the time for the immunotherapy to be effective. We report the successful use of anticoagulation during ECMO in a patient with DAH.

Keywords: Extracorporeal membrane oxygenation, Granulomatosis polyangiitis, Haemoptysis, Systemic anticoagulation

CASE REPORT

A 28-year-old, previously healthy male was admitted to another hospital with haemoptysis and hypoxemic respiratory failure. He was well until a month before the hospital admission, when he developed cough and dyspnea associated with joint pain's for which he took treatment from a general physician. Twenty days prior to hospital admission, he had an episode of haemoptysis and was started on antitubercular drugs by a general practitioner. He had recurrent episodes of haemoptysis and progressive dyspnea for which he was admitted to a local hospital where he was managed with non-invasive ventilation and was put on broad spectrum intravenous antibiotics. His Chest X-ray revealed bilateral alveolar infiltration. His laboratory investigations revealed a low haemoglobin and leukocytosis. He had abnormal kidney function test result and RBCs in the urine, hence vasculitis screen was advised.

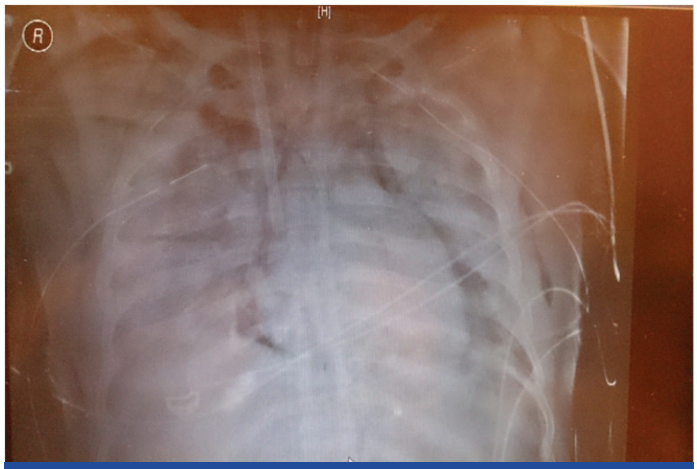
His general condition continued to deteriorate and over the next 24 hours and required intubation and mechanical ventilation. He had increased blood stained secretion in endotracheal tube and was difficult to ventilate. He remained on pressure controlled ventilation with Positive End Expiratory Pressure (PEEP) of 10cm H_20 and Fraction of Inspired Oxygen (FiO_2) increased up to 1.0 to maintain blood oxygen saturation (SpO_2) above 90%. At this stage his vasculitis screen results came strongly positive for protienase3 antineutrophil cytoplasmic autoantibody (PR3 ANCA). He was started on pulse methylprednisolone and a pulse of cyclophosphamide was given.

Later he developed bilateral subcutaneous emphysema and was found to have pneumo-mediastinum on chest X-Ray. His SpO_2 dropped to 80% and he had a partial pressure of oxygen (PO_2) of 45mmHg in blood gas analysis, despite the maximum ventilator support. His overall condition continued to deteriorate over time and he also started requiring nor-epinephrine to maintain blood pressure. His family transferred the patient to our facility for further management and consideration of Extracorporeal Membrane Oxygenation (ECMO).

On arrival to our facility, he was sedated with fentanyl and midazolam, his pupils were equal and reactive, his pulse-150/min, blood pressure- 100/50mmHg on nor-epinepherine, his SpO_2 was 85% on Pressure Controlled Ventilation (PCV) with FiO_2 of 1.0 and PEEP of 12cm H_20. He was passing 30-50ml/hour of urine. He had bilateral extensive subcutaneous emphysema and his chest X-ray showed bilateral haziness suggestive of Acute Respiratory Distress Syndrome (ARDS). Bilateral chest drain was inserted. However, there was no significant change in his SpO_2.

After observing him for a few hours it was decided to rescue him by ECMO. After consent, he was put on veno – venous ECMO (Maquet system) with 24 F multistage medtronics cannula in femoral vein and 21 F return cannula in the right internal jugular vein [Table/Fig-1]. His ECMO flow was initially set at 4.5 L/Min, FiO2 of 1.0 and sweep gas at 4 L/min. His SpO_2 improved to 94% after initiating ECMO and he was put on rest ventilator setting with PEEP of 5cmH_20. Heparin was used for anti-coagulation with an aim of Activated Clotting Time (ACT) of 140-160 seconds. There was no further major bleeding complication.

His further investigations revealed high ANCA levels, the presence of acanthocytosis with red blood cell casts, which together with acute renal failure and diffuse haemorrhagic alveolar infiltrates, was suggestive of the diagnosis of GPA presenting as pulmonary-renal syndrome. Immunosuppression therapy in the form of steroids and cyclophosphamide was given. In addition to this patient also underwent plasma exchange therapy. He was supported by broad



[Table/Fig-1]: Chest X-ray showing Bilateral alveolar infiltrates due to diffuse haemorrhage with bilateral intercostal drains with endotracheal tube and right internal jugular ECMO cannula

spectrum antibiotics to control infections. The patient made a gradual but remarkable recovery. He was successfully weaned from ECMO after 3 weeks, off ventilator at 4 weeks and discharged home after 6 weeks of hospitalization. He is on regular follow-up as an outpatient with the rheumatologist. His steroids were tapered off and renal functions normalized with medical management. The patient did not show any further signs of complications or worsening of symptoms.

DISCUSSION

Diffuse Alveolar Haemorrhage (DAH) is a life threatening pulmonary condition caused by a diverse group of medical disorders and it requires prompt diagnosis followed by aggressive treatment. The majority of these patients present with active haemoptysis and may have a hypoxemic respiratory failure and some of them develop refractory hypoxaemia despite appropriate positioning, intubation and mechanical ventilation. Use of ECMO as a rescue therapy in patients with severe respiratory failure has shown to improve outcomes [1]. However, use of ECMO in patients having refractory hypoxaemia secondary to DAH can increase the bleeding risk due to need of anticoagulation for circuit patency and platelet dysfunction [2]. A few case reports available suggest avoiding anticoagulation during ECMO in DAH [3-6]. However, these patients remain at a very high risk of circuit thrombosis and systemic thromboembolism, which can increase morbidity and mortality. We used anticoagulation during ECMO run to maintain the circuit patency without any adverse effect.

Extracorporeal Membrane Oxygenation (ECMO) is an advanced circulatory and ventilatory support system, which is used to salvage the patients with refractory hypoxaemia and / or cardiac failure when the conventional treatment fails [1]. The Veno-Arterial (VA) ECMO is used in cardiac or cardiorespiratory failure and the Veno-Venous (VV) ECMO is used in respiratory failure without cardiac compromise. VV ECMO is indicated in patients of severe respiratory failure where the cause is potentially reversible. The Extracorporeal Life Support Organization (ELSO) General Guidelines recommend the ECMO treatment to be considered when the expected mortality with conventional measures is higher than 50% and is indicated when the mortality is higher than 80% [7].

ECMO technology is used as bridge therapy (sometimes rescue therapy), for cases where conventional ventilation and haemodynamic support measures fail to improve the patient's clinical condition. General indications for the use of ECMO are cardiac pump failure and respiratory insufficiency, commonly secondary to acute respiratory distress syndrome (ARDS), widely used in cases of H1N1 epidemic pneumonia, graft dysfunction following lung transplant, cardiogenic shock and drug overdose causing profound cardiac depression [1,7,8]. Although there is no absolute contraindication for the use of ECMO, however, any condition that restricts the use of systemic anticoagulation or the patients with established multi organ failure or poor chances of recovery from the primary disease can be seen as relative contraindication [7].

ECMO is associated with an inflammatory response that promotes a hyper-coagulable state, thus requiring anticoagulation with heparin (to maintain an ACT of 1.5 times the normal) to prevent thromboembolism originating in the non-biological surfaced circuit [2]. The ELSO data documents haemorrhage to be a major non-ECMO circuit related complication, showing that the percentage of patients having bleeding complications from various sites as: surgical incisions 19.1%, cannulation sites 17.1%, pulmonary 8.1%, gastrointestinal 5.1% and intracranial haemorrhage 3.8%, respectively [9]. Thus, any condition that precludes the use of systemic anticoagulation is considered as a relative contraindication for ECMO, making the management of DAH with hypoxemic respiratory failure on ECMO a challenging task.

Despite this fact, ECMO and concomitant aggressive immuno-modulatory therapy has been used successfully in patients with refractory hypoxaemia from pulmonary haemorrhage secondary to various causes, including auto-immune vasculitis [10,11], and also provide evidence that the anticoagulation used with VV ECMO does not worsen pulmonary haemorrhage. This may also be due to the fact that the modern ECMO technology requires lower levels of anticoagulation for maintaining circuit patency which minimizes the risk of bleeding. In this particular case we accepted ACT levels between 140-160 and heparin was titrated accordingly.

ECMO proved life-saving in our patient by maintaining oxygenation with decreased ventilator induced injury. We could support the patient until resolution of the respiratory failure by providing time for treatment and control of the underlying disease.

CONCLUSION

DAH can be a life threatening presentation of the various vasculitis syndromes with potential cure through immunosuppressive treatments available, which take time to have an effect. ECMO can provide the opportunity and time for the treatment to be instigated. It is of great importance that the treating clinicians have a low threshold to seek advice and refer these patients to an ECMO center, as its use can dramatically improve the clinical outcome of the patient.

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