

Case Report

A case of refractory hypoxia and shock due to drug overdose successfully managed with ECMO first time ever in Bangladesh

Amina Sultana¹, Susmita Hossain Natasha², Umme Kulsum Chy³, Mohammad Omar Faruq⁴, Jahangir Kabir⁵
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ABSTRACT:

A 36-year-old female developed refractory cardiac and respiratory failure after self-declared ingestion of unknown amount of propranolol, benzodiazepine and few other unknown drugs in unknown dose. She also had vomiting followed by aspiration pneumonia. Despite giving adequate I/V fluid, antibiotics, activated charcoal, lipid emulsion, intravenous sodium bicarbonate and inotropic support, she became hypotensive and developed acute heart failure with pulmonary edema. This patient was managed with extracorporeal membrane oxygenation (ECMO) for 72 h, she survived without any deficit. This records country's first ever use of extracorporeal membrane oxygenation in any patient. In this particular case when traditional antidotes were insufficient to prevent collapse, ECMO was introduced in the form of extracorporeal life support (ECLS) to maintain perfusion, reduce vasopressor requirements, and maintain oxygenation and carbon dioxide removal from blood. With increasing expertise and availability, extracorporeal membrane oxygenation should be considered in patients who develop cardiac or respiratory failure due to any cause, refractory to conventional therapy.

Keywords: ECMO, ECLS, propranolol poisoning, refractory hypoxia, ARDS, refractory heart failure, respiratory failure.

Introduction

ECMO is a technique developed to ensure a prolonged but temporary support of heart or lung in patients suffering from reversible cardiac and/or respiratory failure using mechanical assist device.¹

ECMO is considered as life sustaining procedure when other management options are ineffective. It is being used in cardiogenic shock and severe cardiac failure due to almost any cause like, acute coronary syndrome, refractory cardiac arrhythmia; sepsis, toxicity or myocarditis causing profound cardiac depression, pulmonary embolism, heart trauma, acute anaphylaxis, primary graft failure after heart or heart- lung transplantation, bridge to left ventricular assist device (LVAD), bridge to transplant, periprocedural support for

cardiac intervention, acute respiratory distress syndrome, severe bacterial or viral pneumonia, aspiration syndromes, alveolar proteinosis, lung resting strategy in case of obstructive airway disease, pulmonary contusion, smoke inhalation, bridge to lung transplant, intra operative ECMO, status asthmaticus, pulmonary haemorrhage, massive hemoptysis, Hypothermia, near drowning, primary graft failure after lung transplantation and many more.

In our neighboring country India, ECMO was introduced to intensive critical care unit as a regular practice for refractory cardiogenic shock and acute respiratory distress syndrome since 2008.²

Here we present a unique case of intoxication and pneumonia causing refractory cardiac and respiratory failure was managed with ECMO as temporary rescue therapy. To the best of our knowledge it was the first ever salvage with such intervention in Bangladesh.

This case report is about the use of ECMO in a patient with multiple drug overdose causing cardiotoxicity, acute respiratory failure, in which the usual antidotes were insufficient to prevent circulatory collapse and ventilatory failure. The patient survived without cardiac, respiratory and neurological sequelae.

Our patient is a 36-year-old female with no known previous comorbidity. According to statement of her family members she was suffering from depressive illness, she had previous history of self-harm and suicidal attempt. In her immediate post-ingestion statement, she mentioned about multiple drug overdose, propranolol and benzodiazepine are two of them, doses were not known for any of the drug.

Propranolol is a lipophilic, non-cardio selective beta-blocker

1. Consultant, Critical care medicine and Emergency Medicine, United Hospital Limited, Dhaka 1212, Bangladesh
2. Specialist, Critical care medicine, United Hospital Limited, Dhaka 1212, Bangladesh
3. Junior consultant, Critical care medicine, United Hospital Limited, Dhaka 1212, Bangladesh
4. Chief Consultant, Critical care medicine and Emergency Medicine, United Hospital Limited, Dhaka 1212, Bangladesh
5. Chief Cardiac Surgeon and Director, Cardiac Centre, United Hospital Limited, Dhaka 1212, Bangladesh

*Corresponding Author:

Dr. Amina Sultana
MBBS, MD (CCM)
Consultant, Critical Care Medicine & Emergency Medicine
United Hospital Limited, Dhaka 1212, Bangladesh
E-mail: aminasultana95@yahoo.com

and is highly protein bound drug with large volume of distribution (Vd; 4 L/kg). It is rapidly metabolized by hepatic extraction, it has a short half-life of 3–6 h. When a large dose is ingested, hepatic metabolism of propranolol becomes saturated, elimination half-life prolongs that elevates its serum levels. Cardiac toxicity reflected by myocardial sodium channel involvement resulting in a widened QRS interval and ventricular dysrhythmias. Beta-adrenergic blockade might as well lead to atrioventricular nodal blockade and reduced contractility. It can cross the blood–brain barrier and induce seizure and delirium.³⁻⁵

On the other hand, respiratory compromise is uncommon in isolated benzodiazepine ingestions, but if taken with coingestants such as ethanol or other drugs/medications, respiratory depression can be noted.⁶ Benzodiazepine doses required to produce respiratory compromise depends on multiple factors, e.g., dosage, tolerance, weight, age, coingestants, and even genetics.

When standard therapies and specific antidotes do not prove to be effective in the management of refractory cardiac arrest and refractory shock, ECMO has been described in case reports to be an effective rescue therapy.⁷

ECMO is considered at 50% mortality risk, ECMO is indicated in most circumstances at 80% mortality risk. Severity of illness and mortality risk is measured as precisely as possible using measurements for the appropriate age group and organ failure.⁸

In a rapidly developing country like Bangladesh, where health care facilities are also in a rapidly developing status, our most common challenges of ECMO supposedly to be awareness, cost, initiation at right time, outcome, continuity of care, nosocomial infections, massive bleeding, deep venous thrombosis, etc. This case report is about the use of ECMO in a patient with multiple drug overdose causing cardiotoxicity, acute respiratory failure, in which the usual antidotes were insufficient to prevent circulatory collapse and ventilatory failure. The patient survived without cardiac, respiratory and neurological sequelae.

Case report

A 36 years old female suffering from depressive illness with no other known comorbidity admitted in ICU through emergency department. She was rescued by her family member in a hotel room in unconscious state, door of that room was found to be locked from inside. Earlier she called her sister over phone and confessed that she has ingested huge amount of propranolol and few other drugs. Few empty strips of midazolam, alprazolam, escitalopram was found beside her, but exact dose of drug ingested could not be discovered from history and available evidence.

On examination at emergency room (ER) she was gasping, her tongue, lips and periphery was cyanosed, pulse rate was 67/minute and blood pressure was 60/40 mm of Hg. She was intubated at ER for type 2 respiratory failure and shifted in ICU.

Over next sixteen hours in ICU she was resuscitated and

treated with I/V fluid, vasopressors, atropine, I/V glucose and insulin, I/V lipid emulsion, sodium bicarbonate, and antibiotics for aspiration pneumonia. Despite all supportive managements she remained severely hypotensive, hypoxic despite FiO₂ 1.0 and PEEP at 10 mm of Hg, developed fever from aspiration pneumonia.

At 16 hours of her stay in ICU she suddenly developed pulmonary edema, had a seizure lasting around 1 min which was aborted with IV diazepam 10 mg, her bedside echocardiography revealed global hypokinesia with LVEF 35%.

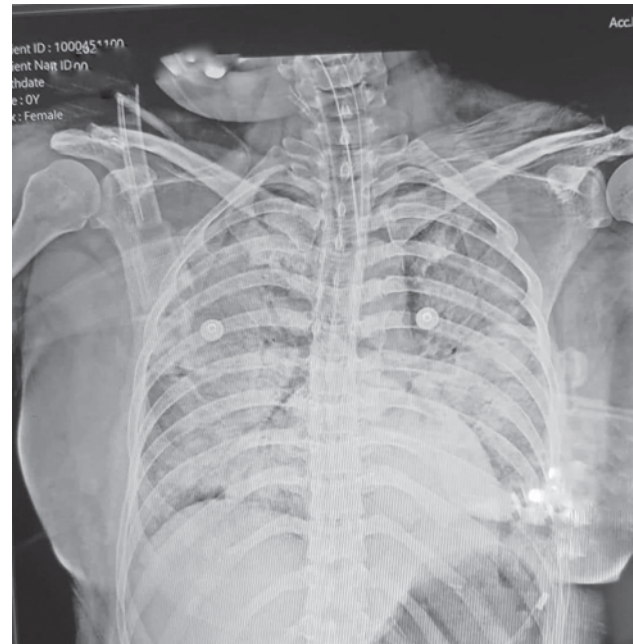


Figure : Chest X-ray antero-posterior view

ECMO was planned by the treating intensivists. ECMO team from cardiac surgery department responded immediately. After counseling her family, patient was transferred to cardiac ICU. Utilizing an open cut-down method, the patient's right femoral artery was cannulated with a 16 Fr cannula, and a 19 Fr cannula was inserted through right femoral vein. In centrifugal pump the initial settings were 3200 rpm resulting in a 2.0 L/min blood flow, FiO₂ 100% with gas flow at 2 L/min. Following the commencement of venoarterial ECMO, patient's blood pressure was improved and maintained around 130/70 mmHg. Venous blood gas results showed pH 7.34 pCO₂ 35 mmHg, pO₂ 70 mmHg, HCO₃ 20 mmol/L, base excess -5.1 mmol/L and lactate of 1.8 mmol/L.

She was kept on mechanical ventilator in controlled mandatory ventilation with low tidal volume (vt) and low RR and 100% FiO₂. Activated charcoal was administered via a nasogastric tube; daily boluses of IV lipid emulsion 250 ml was being given. During sedation free trial in ICU which was started on 3rd Day of ECMO support, her consciousness was regained completely. After 72 hours she was weaned off from extra corporeal membrane oxygenation, after 7days of ICU admission she was weaned from mechanical ventilation.

She developed deep vein thrombosis in her right lower limb,

despite standard dose of heparin on ECMO which is a common complication of ECMO. In a retrospective French study of 17 patients with cardiac arrest from drug overdose, 59% had significant vascular complications.⁹

Psychiatric rehabilitation was planned for her but unfortunately, she and her family decided to have LAMA (leave against medical advice).

Discussion:

To grab the basic concept of ECMO, we should consider it as a technique that stabilizes our patient and sustains life till the time the heart and lung recover. In a potentially reversible organ failure state, it gives rest to the organ which ultimately helps in faster recovery. In irreversible diseases, it facilitate us as a bridge for device therapy or transplant.¹⁰

Our case is the first example all over the country where such critically ill patient is successfully managed with timely initiation of extracorporeal membrane oxygenation. Worldwide there are very few case reports of multidrug toxicity managed by extracorporeal membrane oxygenation.

A case report was published in Hongkong journal of emergency medicine, where massive propranolol toxicity causing cardiac failure was managed with extracorporeal membrane oxygenation.¹¹ For that patient ECMO was started from emergency room. Their patient survived without any neurological deficit.

In another study, a patient with multidrug overdose including beta-blockers who had collapsed, ECMO had been initiated only much later in the ICU when all other treatment options had been exhausted. Although the patient survived to discharge, he was significantly neurologically impaired.⁷

In another case report, Kolcz et al. reported commencing ECMO for a patient with propranolol and verapamil poisoning after 120 min of CPR when the patient had fixed and dilated pupils.¹²

While using ECMO has produced incredible results even in apparently moribund patients, delayed initiation of ECMO would have definite implications on neurological outcomes.¹³

Particularly about starting ECMO support after cardiac arrest resuscitation, there is favourable neurological outcomes for in-hospital cardiac arrests in comparison to out-of-hospital cardiac arrests as the former usually has ECMO initiated earlier.¹⁴

ECMO is established through vascular accesses that are either venoarterial, venovenous or arteriovenous. Venoarterial access is needed for cardiac support whereas venovenous is preferred for respiratory support and arteriovenous for special situations, such as, for CO₂ removal .

The basic circuit includes a blood pump, a membrane lung, and conduit tubing. Depending on the application, additional components may include a heat exchanger, monitors, and alarms. Suction pressure should not exceed minus 300 mmHg and the outlet pressure should not exceed 400 mm/Hg.

Blood flow for cardiac support access is always venoarterial.

The circuit components are selected to support blood flow 3 L/m²/min (neonates 100 cc/kg/min; pediatrics 80 cc/kg/min; adults 60 cc/kg/min.) The best measure of adequate systemic perfusion is venous saturation greater than 70%. Assuming SaO₂ is over 95% venous saturation greater than 70% indicates systemic oxygen delivery is adequate.

Whether the patient is on either VV or VA mode, the ventilator should be managed at low settings to allow lung rest. Typical rest settings include low rate with long inspiratory time, low plateau inspiratory pressure (under 25 cm H₂ O) low FiO₂ (under 30%).

The patient should be thoroughly sedated to the point of light anesthesia during cannulation and management for the first 12 to 24 hours. The purpose is to avoid spontaneous breathing which might cause air embolism during cannulation, to minimize the metabolic rate, to avoid movement which might make cannulation difficult, and for patient comfort. It is rarely necessary to paralyze the patient, except to avoid spontaneous breathing during venous cannula placement. The cannula sites are cleaned frequently with antiseptic solution and may be covered with an antiseptic cream or ointment. Appropriate antibiotics should be given for documented infection. There is no standard policy regarding prophylactic antibiotics simply because the patient is on ECMO. Bacteremia during ECMO may be related to bacterial growth on a component of the circuit, but is usually related to another source in the patient. Unlike suspected "line sepsis" in the usual critically ill patient, it is usually not possible to change the access cannulas if contamination is suspected, and it may be dangerous to change the circuit. If all other sources of bacteremia have been ruled out, the entire circuit up to the cannulas can be changed expeditiously.

Conclusion

Whether be government or private sector, any institution enriched to initiate ECMO quickly and safely should come forward. Critically ill patients with appropriate indications should not be deprived from this therapy. ECMO is neither curative, nor the outcome is guaranteed but it provide support to organs for recovery, buy time to start a curative therapy if any, or serve as a bridge to organ transplant. In our health care setting it is self-sponsored and is an expensive therapy. As beginners our most predicted challenges going to be its expertise, availability, efficacy, cost benefit ratio, awareness in common people, appropriate starting time, outcome, nosocomial infections, and continuity of care. Awareness among the medical fraternity and public education is fundamental to achieve benefits of ECMO. Regular training programs for doctors, nurses, perfusionists will provide confidence to ICU physicians about thinking of ECMO for right patient in right time.

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