

# A new role of extracorporeal membrane oxygenation in the management of tuberculosis with acute respiratory distress syndrome: A case report and review of literature

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## ABSTRACT

Pulmonary tuberculosis (PTB) can lead to acute respiratory distress syndrome (ARDS), which can be at times fatal. Venovenous extracorporeal membrane oxygenation (VV-ECMO) ensures adequate oxygenation and carbon dioxide removal, avoiding ventilator-induced lung injury. We present a case where a young woman with refractory respiratory failure caused by PTB, unresponsive to conventional mechanical ventilation, but was successfully managed with prolonged VV-ECMO support. The patient diagnosed with PTB was started on antitubercular treatment but went into respiratory failure and ARDS. The patient was put on mechanical ventilation, on which she was not improving. The patient was then put on ECMO. On the 9<sup>th</sup> day, lung compliance and gas exchange were good enough to resume conventional mechanical ventilation. ECMO was weaned and removed. This is one of few cases of survival of the patient with PTB with ARDS utilizing ECMO.

**KEY WORDS:** Adult respiratory distress syndrome, extracorporeal membrane oxygenation, pulmonary tuberculosis

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**Submitted:** 17-Mar-2021    **Revised:** 20-May-2021    **Accepted:** 24-Jun-2021    **Published:** 28-Dec-2021

## INTRODUCTION

Pulmonary tuberculosis (PTB) can lead to acute respiratory distress syndrome (ARDS), which can be at times fatal. The mortality rate of tuberculosis (TB) associated with acute respiratory failure requiring mechanical ventilation varies from 60% to 80%.<sup>[1]</sup> Venovenous extracorporeal membrane oxygenation (VV-ECMO) may be an accepted alternative option in refractory hypoxemic respiratory failure. Extracorporeal membrane oxygenation (ECMO) ensures adequate oxygenation and carbon dioxide removal, avoiding ventilator-induced lung injury. However, till date, globally,

only ten cases of TB have been described, out of which six cases were of PTB patient with ARDS and four cases of miliary tuberculosis with ARDS which were subjected to ECMO.<sup>[2-11]</sup> Among the ten cases reported so far, there has been one death while recovery in other nine cases. From India, no case of PTB with ARDS subjected to ECMO has been described so far.

We present a case of survival of a young woman diagnosed with PTB and started on antitubercular treatment (ATT)

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**How to cite this article:** Anand S, Singla R, Kumar V, Dewan S, Faye A, Gupta A. A new role of extracorporeal membrane oxygenation in the management of tuberculosis with acute respiratory distress syndrome: A case report and review of literature. Lung India 2022;39:77-9.

Access this article online	
<b>Quick Response Code:</b> 	<b>Website:</b> www.lungindia.com
	<b>DOI:</b> 10.4103/lungindia.lungindia_173_21

who developed ARDS. She was subsequently put on ECMO due to refractory hypoxemia and improved.

## CASE REPORT

A 31-year-old female, nonsmoker, known case of diabetes mellitus for 8 years, on oral hypoglycemic drugs, was referred to our hospital with fever and cough for 1 month along with loss of appetite and associated weight loss. Fever was of intermediate grade with evening rise of temperature and was not associated with chills or rigor. Cough was nonproductive with no hemoptysis and without diurnal or postural variation.

Chest X-ray posteroanterior view on presentation showed bilateral infiltration with a cavity in the right upper zone [Figure 1]. The patient could not expectorate even after sputum induction. High-resolution computed tomography chest [Figure 1] showed large thick-walled cavitary lesions in the bilateral upper zones, largest measuring 2.7 cm × 2.4 cm on the right and 3.8 cm × 3.0 cm on the left side with perilesional patchy consolidation with air bronchogram. Multiple enlarged lymph nodes were seen in the prevascular region and right axillary region.

Fiber optic bronchoscopy was done. Bronchoalveolar lavage (BAL) fluid on Ziehl–Neelsen smear was positive for acid-fast bacilli. GeneXpert of BAL showed *Mycobacterium tuberculosis* detected and rifampicin resistance not detected. Hence, the patient was started on first-line ATT as per the national guidelines.<sup>[12]</sup>

Patients' total leukocyte count, liver function test, and kidney function test were unremarkable, but she had high blood sugar levels, and urine was found to be positive for ketones at the time of admission. Treatment was started for diabetic ketoacidosis, and the patient was shifted to intensive care unit under isolation. On examination, the patient was found to be tachypneic, hypotensive with arterial blood gas (ABG) showing hypoxemia, and predominant high anion gap metabolic acidosis.

The patient was given noninvasive ventilation support and started with broad-spectrum antibiotics, and ATT was continued. Two-dimensional echocardiography was

done which was normal. However, within 24 h, patient's condition deteriorated due to severe respiratory and metabolic acidosis and shock. The patient was intubated and put on mechanical ventilator (MV) and started on vasopressor support.

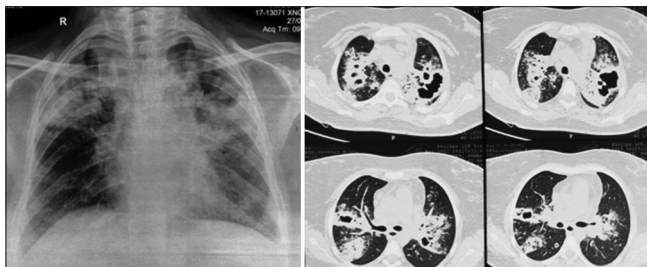
The patient was continued on ATT and antibiotics were stepped up as the urine culture showed growth of *Escherichia coli* extended-spectrum beta-lactamase. However, the patient deteriorated and showed features of severe ARDS requiring FiO<sub>2</sub> of 100% with low PaO<sub>2</sub>/FiO<sub>2</sub> ratio. Chest X-ray showed bilateral infiltrates with air-space consolidation. There was persistent hypoxemia and respiratory acidosis, despite all conventional modes of ventilation. Patient's condition further deteriorated.

The patient continued to be in refractory hypoxemia, and therefore, decision was taken to put the patient on ECMO. The patient was put on VV-ECMO for persistent hypoxemia and was also started on steroid. The patient was started on intravenous methyl prednisolone 1 g daily for 3 days. Clinical, biochemical, and hematological parameters started improving. ABG analysis started showing improvement, hypoxemia improved, and slowly, the patient was weaned off vasopressor support. After 9 days on ECMO, the patient was weaned off from ECMO and extubated. The patient was continued on ATT, and there was significant radiological and microbiological improvement. After 8 months of ATT, the patient improved clinically, bacteriologically, and radiologically [Figure 2], and anti-TB treatment was stopped.

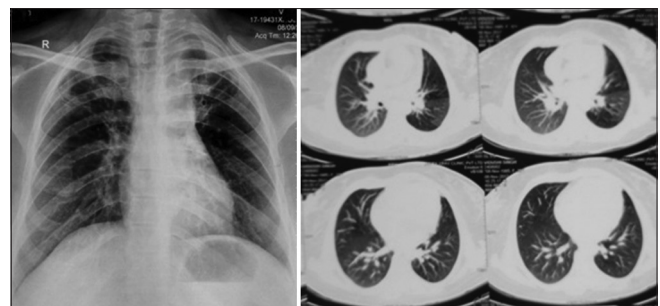
## DISCUSSION

ECMO is one of the treatment options for severe ARDS.<sup>[13]</sup> ARDS is rare but life-threatening complication of PTB. The mortality of ARDS patients with PTB requiring MV is relatively high. Given the high mortality rate of ARDS patients with PTB, ECMO could be an important treatment option.

Review of literature found ten cases globally of PTB with ARDS who were put on ECMO [Table 1]. This is first case report from India of survival of the patient of PTB with ARDS utilizing ECMO. Role of ECMO in patients with miliary TB with ARDS has also been described in



**Figure 1:** Chest X-ray posteroanterior view and computed tomography chest at the initiation of treatment showing bilateral upper zone consolidation with cavities



**Figure 2:** Chest X-ray posteroanterior and computed tomography chest view at the end of treatment showing clearance of parenchymal opacities and resolution of cavitary lesions

**Table 1: Review of literature of cases of pulmonary tuberculosis with acute respiratory distress syndrome put on extra corporeal membrane oxygenation**

Age (years)	Sex	Anti-TB treatment	Steroid use	Length of ECMO (days)	Outcome	Author
58	Female	None	None	5	Death	Homan <i>et al.</i> , 1975 <sup>[7]</sup>
15	Female	H/R/E/Z	None	6	Recovery	Petrillo <i>et al.</i> , 2001 <sup>[9]</sup>
20	Male	H/R/E/Z	None	89	Recovery	Mauri <i>et al.</i> , 2012 <sup>[6]</sup>
14	Female	H/R/E/Z	Methyl prednisolone 2 mg/kg/day	6	Recovery	Monier <i>et al.</i> , 2013 <sup>[8]</sup>
24	Female	H/R/E/Z	Methyl prednisolone 250 mg/day	36	Recovery	Andresen <i>et al.</i> , 2013 <sup>[4]</sup>
20	Male	H/R/E/Z	None	89	Recovery	Cogliandro <i>et al.</i> , 2014 <sup>[5]</sup>
44	Female	H/R/E/Z	None	73	Recovery	Nam <i>et al.</i> , 2015 <sup>[10]</sup>
48	Male	H/R/S/Z	Methyl prednisolone 1000 mg/day	52	Recovery	Omote N, 2016 <sup>[2]</sup>
18	Male	H/R/E/Z	None	50	Recovery	Vesteinsdottir <i>et al.</i> , 2019 <sup>[3]</sup>
48	Male	H/R/E/Z	100 mg of hydrocortisone/8 h	5	Recovery	Binh <i>et al.</i> , 2019 <sup>[11]</sup>

H: Isoniazid, R: Rifampicin, E: Ethambutol, Z: Pyrazinamide, S: Streptomycin, TB: Tuberculosis, ECMO: Extracorporeal membrane oxygenation

the literature.<sup>[3,7,8,10]</sup> Steroids were used in four of these cases.<sup>[2,4,8,11]</sup> The mortality rate of ARDS patients with PTB has been found to be as high as 80% and above for miliary TB with ARDS.<sup>[1]</sup> ECMO could be an important treatment option for such group of patients.

Systemic corticosteroid therapy during ECMO support led to progressive improvement of respiratory function as reported by Andresen *et al.*<sup>[4]</sup> VV-ECMO is effective for TB-induced ARDS even in short-term administration if progression of ARDS is rapid as described by Binh *et al.*<sup>[11]</sup>. Similarly, in our case, our patient was put on VV-ECMO for shorter duration of time (9 days) as the progression of ARDS was rapid. Cases have been described where ECMO has been used for longer duration also.<sup>[2-6,10]</sup> In our case, we gave intravenous methyl prednisolone 1 g daily for 3 days. In the literature, four such cases have been described where steroids had been used.<sup>[2,4,8,11]</sup>

Long-term use of ECMO may lead to a higher risk of complications such as secondary infections, but recent development in the techniques and equipment used in ECMO has made prolonged ECMO support feasible.

## CONCLUSION

VV-ECMO is effective for TB-induced ARDS even in short-term administration. VV-ECMO is effective and can be considered as an adjuvant method in TB-induced ARDS. With the review of literature, it is evident that ECMO can be lifesaving in some cases of TB with ARDS.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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