

ARDS with septic shock managed successfully using a multidisciplinary approach: A case report

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ABSTRACT

Acute respiratory distress syndrome (ARDS) is an inflammatory process in the lungs that results in hypoxemia and decreased lung compliance. Invasive mechanical ventilation and prone positioning have proven benefits in the management of patients with severe ARDS. Post-extubation rehabilitation programs are equally important for the recovery of these patients. We are reporting the case of a 30-year-old male with severe ARDS where lung protective ventilation, timely intubation, early prone positioning, multidisciplinary communication, and post-discharge follow-up with teleconsultation were used under expert supervision in the successful management of the case.

Key words: Acute respiratory distress syndrome, Case report, Multidisciplinary communication, Teleconsultation

Acute respiratory distress syndrome (ARDS) is an inflammatory process in the lungs characterized by a diffuse pulmonary inflammatory reaction leading to increased vascular permeability, capillary endothelial damage, and diffuse alveolar damage, ultimately inducing non-hydrostatic protein-rich pulmonary edema, hypoxemia, and decreased lung compliance [1,2]. The intrapulmonary shunt and dead space are increased, thereby further worsening the hypoxemia. The damage is scattered and non-homogeneous in bilateral lung fields, leading to challenges in the treatment of this syndrome. According to the Berlin definition proposed by a working group under the aegis of the European Society of Intensive Care Medicine, ARDS is defined by the presence of a known clinical insult or new or worsening respiratory symptoms of a combination of acute hypoxemia ($\text{PaO}_2/\text{FiO}_2 \leq 300$ mmHg) within 7 days, in a ventilated patient with a positive end-expiratory pressure (PEEP) of at least 5 cm H_2O , and bilateral opacities not fully explained by heart failure or volume overload [3]. The Berlin definition uses the $\text{PaO}_2/\text{FiO}_2$ (P/F) ratio to distinguish mild ARDS ($200 < \text{PaO}_2/\text{FiO}_2 \leq 300$ mmHg), moderate ARDS ($100 < \text{PaO}_2/\text{FiO}_2 \leq 200$ mmHg), and severe ARDS ($\text{PaO}_2/\text{FiO}_2 \leq 100$ mmHg) [3].

We hereby report the case of a 30-year-old male who developed severe ARDS during the intensive care unit (ICU) admission

course and was successfully managed by a multidisciplinary approach despite the various challenges faced during the treatment.


CASE REPORT

A 30-year-old man presented in triage after being referred from a private hospital in an ambulance on oxygen support with complaints of breathlessness, altered sensorium, generalized tonic-clonic seizures for 1 day, and fever for 1 month. The patient gave a history of similar episodes of breathing difficulty in the past 1 year and took a metered-dose inhaler of levosalbutamol during these exacerbations. The patient had a history of tuberculosis 20 years ago, for which he took antitubercular treatment for 6 months. He was also a known case of type 2 diabetes mellitus for the past 8 years and was on regular medication for the same.

On general examination, the patient had tachycardia (140 beats/min), hypertension (150/100 mm Hg), dyspnea (respiratory rate [RR] 36/min, use of accessory respiratory muscles), a temperature of 98.7°F, and saturation (SpO_2) of 90% at 10 liters of oxygen on a face mask. His urine output was 50–70 mL/h. The patient was immediately placed on a non-rebreathing mask at 12 liters of oxygen, and his SpO_2 was increased to 95%. He had altered the sensorium with the Glasgow coma scale of E3V4M6 on presentation.

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Arterial blood gas (ABG) showed pH-7.214, pCO₂-110, pO₂- 65.5, lactate -2.1, and HCO₃-42.8, which was suggestive of respiratory acidosis with metabolic acidosis. The electrocardiogram was suggestive of prolonged QT interval T wave inversion in leads V1-V6, II, III, and AVF, for which cardiology reference was sought and injections of magnesium, troponin I, and 2D echo were advised. Based on this, a probability of raised intracranial tension leading to these changes was calculated.

Bilateral crackles and rhonchi were appreciated on auscultation, and a chest X-ray (Fig. 1) revealed patchy consolidation with increased broncho-vascular markings. The reverse transcriptase polymerase chain reaction report for COVID-19 (coronavirus disease-19) was negative. The non-contrast computed tomography scan (Fig. 2) of the head revealed diffuse cerebral edema, for which neurological consultation was done and injections of mannitol and levetiracetam were added to the treatment.

The patient was intubated in view of respiratory distress and respiratory acidosis as depicted in the ABG and taken on mechanical ventilation with the following settings: pressure-regulated volume control mode, FiO₂-1, PEEP-10 cm H₂O, RR-30/min, tidal volume 400 mL. Baseline investigations showed Hb-14.3, total leukocyte count (TLC)-20200 cells/cumm, differential leukocyte count (%) -92/5/1/2, platelet -2.2 lakh/cumm, Serum bilirubin -0.4 mg/dL, serum glutamic-oxaloacetic transaminase-899 U/L, serum glutamate pyruvate transaminase-1393 U/L, and serum alkaline phosphatase-69 U/L, S. Urea-91 mg/dL, serum creatinine 0.8 mg/dL, sodium -139 mmol/L, potassium -6.2 mmol/L, serum procalcitonin -0.846 ng/mL, serum ammonia -77 mg/L, serum albumin -2.8 g/dL, and total protein 8.6g/L. Fundoscopy ruled out raised ICT, following which lumbar puncture was performed, which revealed - TLC <5 with predominant lymphocyte protein of 88 mg/dL and sugars of 112 mg/dL, the corresponding random blood sugar being 152 mg/dL. Blood cultures, routine urine microscopy, and culture sensitivity were sent.

Treatment was started according to protocols. The patient was initially started on meropenem and doxycycline (for a suspected tropical infection). Anti-hyperammonemia measures were taken for the raised serum ammonia levels. Good nutritional support was ensured in the form of a high-protein diet and micronutrients. The patient was extubated 4 days post-intubation but had extubation failure and had to be reintubated the next day.

However, his condition continued to deteriorate, and he developed ventilator-acquired pneumonia (VAP) and went into septic shock. The chest X-ray worsened, and his P/F ratio went down to 140, suggesting moderate ARDS. Injection Colistin was added for suspected VAP. Later, blood culture, endotracheal culture, and sensitivity reports revealed multidrug-resistant *Klebsiella*, for which antibiotics were modified to Cefazidime-Avibactam and Aztreonam. His PF ratio decreased to 88, and SpO₂ decreased to 81%. Ventilator settings were changed to favor recovery from ARDS by using lung protective ventilation



Figure 1: Chest X-ray on presentation showing bilateral infiltrates

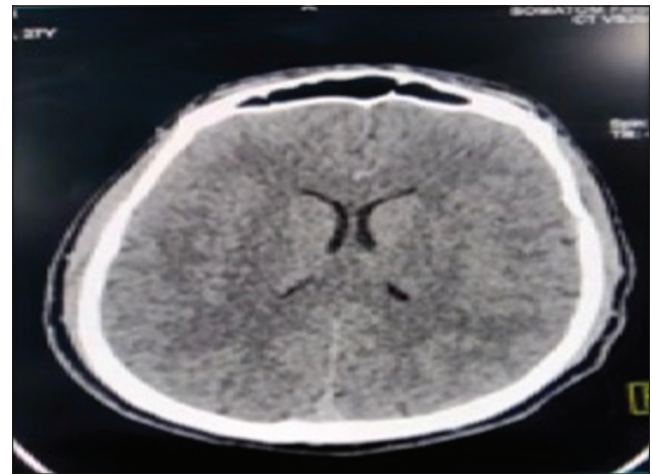


Figure 2: Non-contrast CT of the brain showing cerebral edema

in the form of low tidal volume (4–6 mL/kg predicted body weight), optimal peep, high RR, and plateau pressure <30 cm H₂O, and he was given 2 sessions of proning for 16 h each. His SpO₂ and P/F ratio improved after two sessions of proning. After 48 h, vasopressors were tapered off, and the patient was able to maintain steady blood pressure without vasopressor support. A spontaneous breath trial was given, but he proved to be difficult to wean and hence a percutaneous tracheostomy was performed. The patient's oxygen requirement came down until after 20 days when the patient was maintaining saturation on room air via T-piece.

The patient was finally decannulated after 20 days of tracheostomy, and rehabilitation programs, including physiotherapy, speech therapy, and regular counseling sessions, were continued. Special emphasis was given to adequate nutritional support, mobilization, incentive spirometry, and speech therapy. The patient recovered gradually and subsequently started to perform his daily routine activities. The patient was shifted to the ward on the 30th day of admission and was ultimately discharged after the 32nd day of admission. Regular follow-up was done using a WhatsApp video call (Fig. 3) by the senior intensivist. The patient recovered completely with no residual weakness and started his job on day 45 of admission.

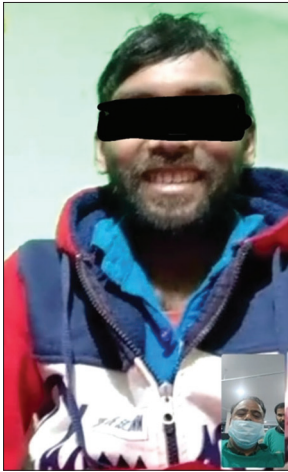


Figure 3: Telecommunication of the patient with senior Intensivist post discharge

DISCUSSION

ARDS is a form of severe lung injury that is associated with a high mortality rate of 46–60% [4] if not managed judiciously and aggressively. The direct risk factors are pneumonia, aspiration of gastric contents, inhalational injury, pulmonary contusion, and near drowning. Indirect lung injury risk factors include sepsis (non-pulmonary source), pancreatitis, major burn injuries, drug overdose, transfusion of blood products, cardiopulmonary bypass, and reperfusion edema after lung transplantation [1,2]. Our case involved a 30-year-old male who developed ARDS during the course of his ICU stay, and the cause of ARDS was VAP.

Mechanical ventilation, pharmacological management, and supportive therapies form the mainstays of treatment. Management of ARDS requires a multidisciplinary approach, including lung protective strategies, proning sessions, aggressive treatment with antibiotics based on culture sensitivity reports, regular counseling, and rehabilitation strategies [4]. In our case, after the initial improvement with the antibiotics, the patient developed VAP and subsequently landed up in ARDS. The treatment was started according to the standard protocol [5]. Even after following the standard protocol of lung protective ventilation, antibiotic modification, and other supportive measures, the $\text{PaO}_2/\text{FiO}_2$ ratio didn't improve significantly; hence, two sessions of proning were done according to the guidelines [6]. The patient's condition continued to improve after the above interventions.

Our case emphasizes the importance of rehabilitation strategies after the initial response with pharmacological treatment and mechanical ventilation. It plays a vital role in the recovery of patients with severe respiratory illnesses and not only helps in early recovery but also increases early discharge rates and decreases hospital stays. Standard nutritional support was provided to the patient, and aggressive physiotherapy and mobilization were continued. The counselor provided regular counseling to overcome any psychological issues. Mobilization therapy is associated with fewer ventilator days and a greater likelihood of being able to stay in the hospital until discharge [7].

A trained counselor should assess for depression, anxiety, and other psychosocial issues and help the patient overcome them.

Goodwin *et al.* [8] elaborate in their study that exercise, early mobilization, and multi-component programs may improve recovery following ICU admission for the severe respiratory illness that could be generalizable to those with COVID-19. Rehabilitation interventions can bring hope and confidence to individuals, but there is a need for an individualized approach and the use of behavior change strategies. These strategies were also incorporated in our case and showed positive results [9].

Another aspect that was highlighted in our study is the technique of using telecommunications for the follow-up of the patients. Mistiaen and Poot [10] pointed out in their systematic review that many patients encounter a variety of problems in the 1st week after they have been discharged from the hospital. Telephone follow-up, initiated by hospital-based health professionals, is considered a good means of exchanging information, providing health education and advice, managing symptoms, recognizing complications early, and giving reassurance to patients after discharge. Some research has shown that telephone follow-up is feasible and that patients appreciate such calls.

CONCLUSION

This case report highlights the importance of an early multidisciplinary approach involving early intubation and proning, timely tracheostomy and smooth weaning from it, early mobilization, adequate nutritional support with micronutrient supplementation, rehabilitation programs, early discharge from ICU to home care, and teleconsultation by the intensivist as done in this case, which can lead to successful management and full recovery of such a critically ill patient who otherwise has a very high mortality rate.

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