Original Article

Severe SARS-CoV-2 Pneumonia in a 29-Year-Old Patient with Extracorporeal Membrane Oxygenation (ECMO): A Clinical Case Report from the Republic of Cyprus

Andria Syka, RN, BSc, MSc
Intensive Care Unit, Nicosia General Hospital, Cyprus

Despo Karatzia, RN, BSc, MSc
Intensive Care Unit, Nicosia General Hospital, Cyprus

Martha Kyriakou, RN, BSc, MSc, PhD
Intensive Care Unit, Nicosia General Hospital, Nicosia, Cyprus

Lakis Palazis, MD, EDIC, M.P.
Consultant Intensivist, Head ICU, Nicosia General Hospital, Nicosia, Cyprus

Correspondence: Intensive Care Unit, Nicosia General Hospital,Cyprus. Address: Mosxatou 1 Agios Georgios Xabouzas, Limassol Cyprus. TK.3071, telephone: +35797613398

Abstract

The SARS-CoV-2 is considered a public health emergency where it causes a serious respiratory illness. It first started in Wuhan, China and spread rapidly to most parts of the world. In this article you will record a case of a patient with severe pneumonia due to SARS-CoV-2 who was subsequently treated with extracorporeal membrane oxygenation (ECMO). We describe the patient's clinical course, from the onset of mild symptoms at the onset of the disease to the onset of symptoms of severe pneumonia and how the disease has progressed. We provide important information about clinical experience in this area, and treatment with extracorporeal membrane oxygenation or pharmacotherapy.

Keywords: Coronavirus, extracorporeal membrane oxygenation, SARS-CoV-2.

Introduction

A number of unexplained cases of pneumonia were reported by the Republic of China to the World Health Organization on 31 December 2019. The cause of these pneumonias was SARS-CoV-2 which is responsible for covid-19 disease (Zhu et al., 2020). Severe covid-19 pneumonia has posed critical challenges for the research and medical communities. Older age, male sex, and comorbidities increase the risk for severe disease.

For people hospitalized with covid-19, 15-30% will go on to develop covid-19 associated acute respiratory distress syndrome (CDC 2020). The Intensive Care Units of the Public Hospitals of Cyprus gave their own fight to deal with the pandemic.

Remarkable for the data of Cyprus is the treatment of an incident with COVID -19, a young lady without particular health problems, the criticality of his condition and at the same time the ECMO application that was applied for the first time in the Intensive Care Unit of Nicosia General Hospital.

Case presentation

Late April 2020, a 29-year-old patient with a background of obesity (98Kg, height 1.65, BMI

36) and polycystic ovaries, was admitted in Intensive Care Unit of Nicosia General Hospital after infection with SARS-COV-2. During the COVID-19 epidemic in Cyprus, she developed muscle aches and cough by 18th of April and tested positive for SARS-Cov-2. Four days later, she admitted in COVID ward due to respiratory failure and fever. Three days after admission she developed severe respiratory failure and she was intubated and put on mechanical breathing support. Glasgow Coma Scale 3/15 under propofol and fentanyl iv infusion.

She was transferred in Nicosia General Hospital and admitted in ICU, with metabolic acidosis and severe respiratory failure and set on Assist Control/Volume Control Mode on Ventilator. Laboratory blood tests showed up lymphopenia, low platelets and increased C Reactive Protein (CRP). A portable chest X-ray was done and showed diffuse pulmonary infiltrates (air bronchogram densities) with tension in the lower lobes (Figure 1).

On fifth day from admission, acinetobacter baumanii and Vancomycin Resistance Enterococcus are isolated from blood and tracheal secretions cultures respectively. Collistin and linezolid were started based in cultures and caspofugin empirically. The same day she became more unstable despite prone position and ventilator scalable parameters. She was set on VV ECMO (Venovenous Extracorporeal Membrane Oxygenation). On ECMO first parameters was V 3.9L/min(3115rpm), P vent -85, Part 162, Sweep speed 5L/min, FiO2 100. Also, she was still on ventilator on AC/VC Mode, FiO2 40%, peep 10, TV 250ml, RR 14/min, Pplateau 30mmHg, Compliance 12. Vigileo was set on arterial line for hemodynamical monitoring.

On day 11, a tracheotomy was done due to prolonged need for ventilator. Total 12 days she was on ECMO treatment. Eventually, she was able to breath by her own on day. Due to prolonged need for mechanical ventilation a tracheotomy was done. Five days later, the patient was released from ECMO machine and she was still on ventilator. Eight days later she was able to be released from ventilator and breath and after two days tracheostomy was off and she was breathing spontaneously with nasal cannula 2 litre O2. She mobilized to the chair and standing.

After three days she was discharged from ICU and transferred to pneumonology ward, on nasal cannula, GCS 15/15, hemodynamically stable. Neuromuscular she shows symmetrical weakness on both, upper and lower limbs. Respiratory assessment showed normal respiratory whisper on both sides, and good gas exchange and <RR 20/min (pH 7.45, pCO2 39, po2 102, Hb 11, SaO2 98.1, Lac 0.8, HCO3 27.5). On Normal Sinus Rhythm, hemodynamically stable with no need for inotropes. Normothermic. Good swallow trial. Gastrointestinal assessment showed normal findings, soft abdomen, with normal bowel sounds, laxatives given. Proteus mirabilis in tracheal secretions and morganella morganii in urine are present. Thirty three days after the very first Sars Cov 2 PCR test, she was tested negative (table 1).

Treatment plan after discharge from ICU was discontinuation of antimicrobial treatment, respiratory physiotherapy and kinesiotherapy and negative 24hr balance. Assessment and redefining goals.

Discussion

Covid-19 is caused by SARS-CoV-2 with most patients having moderate symptoms recovering quickly but some patients develop interstitial pneumonia that in some cases it progresses towards severe acute respiratory syndrome demanding intensive care unit (ICU) (MacLaren, 2020).

In some cases, this progresses to acute respiratory distress syndrome (ARDS). This was applied to this patient who had no other medical history than obesity and polycystic ovaries. Overweight and obesity seems to be associated with higher risk of severe pneumonia requiring hospitalization to ICU and invasive ventilation (WHO, 2020). This patient classified among obese classs II and III based on World Health Organization cut points with a BMI of 35; obese class I (30–35 kg/m2) and obese class II (35-40 kg/m2) (Zhu et al.,2020).As stated by Lehmann et al., (2015), obese patients with ARDS are found to be younger with lower disease severity compared with normal weight patients

(Lehmann et la., 2015), something that much the profile of this patient.

The general treatment approach, pharmacological and non- pharmacological was in linear with the guidelines of the World Health Organization (WHO, 2020) mechanical ventilation implemented using lower tidal volumes (4–8 mL/kg) and lower inspiratory pressures (plateau pressure < 30 cmH2O) and breathing rate titrated to ensure adequate minute volume. Furthermore, patient placed in prone position for 16 hours as indicated for this category of patients (WHO, 2020).

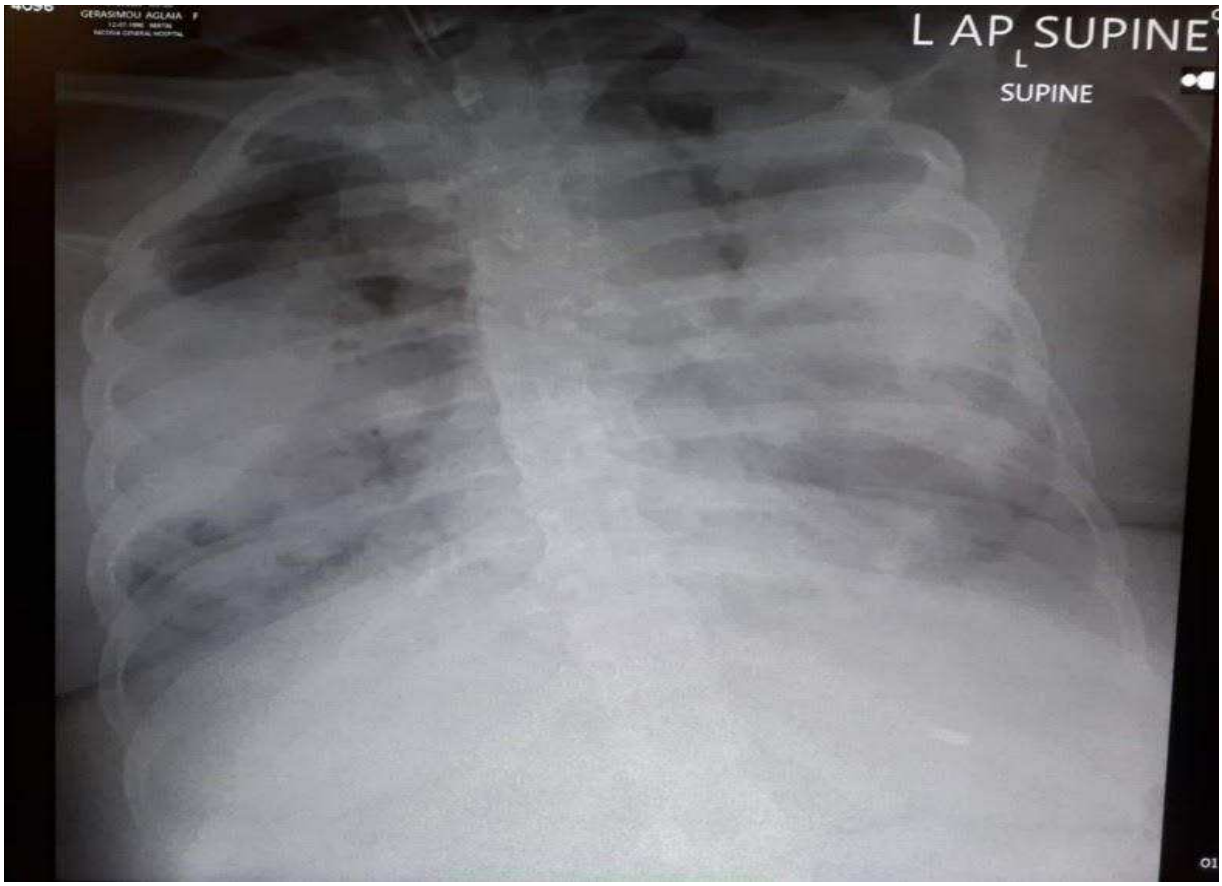

Figure 1: A portable chest X-ray was done and showed diffuse pulmonary infiltrates (air bronchogram densities) with tension in the lower lobes.

Table 1: Highlights

Date	Action	Results
23/4/20	Start Azithromycin and hydroxychloroquine	
26/4/20 ICU ADMISSIO	Start lopinavir/ritonavir Tocilizumab 800mg (first dose) was given Prone position for 16	

N	hours	
27/4/20	She was set on supine position. Need for high Fio2 on ventilator. Tocilizumab 800mg (second dose) was given Furosemide infusion due to low urination. Fluid balance goal: negative.	Hypernatremia due to furosemide fluids modification via intravenous and nasogastric on as long as she is in supine position.
28/4/20	Muscle relaxation stopped. Still on noradrenaline for Hemodynamically stability. Well urination with furosemide na+ 149 fluids modification Decreased CRP	
29/4/20	Aerometrically deteriorated. Lower compliance and slightly high p plateau. Pplat 30 Pcomp 33 Opt Peep 10-12	
30/4/20	Compliance 24, pplateau 28, OptPeep 10-12 Endotracheal tube change to 7.5 Improved urination-on furosemide Slightly high na+ (147mmol) Lac˜ 3 Positive fluid balance Decreased CRP. Low grade fever	
1/5/20	Severe Respiratory Failure I without position or mechanical ventilation improvement. (Po2: 40.2, SaO2: 74), hemodynamically unstable, chest xray showed deterioration –> vv ECMO **Isolation**: Acinetobacter in blood and tracheal secretions and VRE in tracheal secretions. Collistin, linezolid and caspofugin started.	
4/5/20	- Sedation OFF Impairment to achieve the anticoagulants goal according apTT. - consultation with Hematologist (increase iv heparin dose and anticoagulation monitoring) - apt goal- 40-60, anti Xa 30-60	Spontaneous eye opening without following orders. Tachypnea and cough are present.
5/5/20	Chest Xray	Bilateral infiltrations all over Quite a lot and purulent secretions. Without restpiratory improvement – severe hypoxemia incompatible with life without ECMO support. AptTT 44/heparin infusion 1900iu/hr
7/5/20	- Heparin resistance Suspicion, Change Heparin to Argatroban. - Tracheotomy	
8/5/20	Low propofol dose	Tachypnea and cough are present On vv ecmo (flow 3.65l/min, FiO2 100%, air flow 7λιτρα/min). On ventilator (rest settings) - FiO2 45%, peep

		10mmHg, TV 240ml, RR 18 Fluid secretions Respiratory assessment: Auscultation - respiratory whisper is present on both sides until bases. Tachycardia 110/min, lower need for noradrenaline. Soft abdomen, bowel sounds and GI motility is sparse, high gastric residual volume – naloxone per gastric tube, Infusion diuretic medication - furosemide - Satisfactory diuresis. Acetazolamide was given pos. Maintain Negative fluid balance). Normal creatinine and uria. Bed sore at nose and eyebrow (after prone position) – Local treatment.
11/5/20	Sedation OFF	Spontaneous eye opening, moves to localized pain and seems that she understands – Low need for noradrenaline. Good gas exchange on Ventilation - Pressure Support. CRP 16. PCR Sars Cov2 test was sent.
12/5/20		ECMO OFF
14/5/20		Weaning trial, Warm limbs, CRT >2 sec, linezolid therary was stopped after 7 days of administration Good gasses exchange on ventilator on PAV Mode, Good spontaneous tidal volume, T piece trial with good tolerance
16/5/20		stazobactam/piperacillin 4.5gr started because of proteus infection in tracheal secretions.
21/5/20		GCS 15/15 equal pupils and reacted to light, obeys to commands, oriented converses normally. Tracheostomy with speaking valve was placed. In tracheostomy filter. Oxygen is given 2-3 litres.

Although using all recommended strategies patient deteriorated, thus the challenge of introducing ECMO in the treatment was faced by our team. The findings regarding ECMO support in COVID-19 are still controversial. Studies have mentioned that ECMO can ameliorate survival in patients with ARDS, but the same applies for COVID-19? According to ELSO guidelines(Munshi et al., 2019).

ECMO could act as salvage treatment for COVID-19 patients with ARDS but is not a therapy of a frontline. The key element for ECMO is the early decision for implementation. Early ECMO support treatment helps patients to overcome the most severe lung lesions and up-regulate the success rate of treatment (Brodie et al., 2019).

As in our case, the release of the patient from the ECMO and the removal of the vascular catheters and consequently the cessation of support depended on the improvement of the respiratory failure and the stabilization of her general condition.

In particular, the following were ensured:

1. Improving arterial and mixed venous blood gas values with complete and progressively decreasing patient ECMO support

2. Improving chest x-ray

3. Hemodynamic stability of the patient, with or without minimal support with inotropic drugs

4. Normal hematocrit and hemoglobin values

5. knowledge of the release technique by experienced personnel taking into account the fact that another procedure is followed in cases of venous ECMO and another in cases of venous arterial ECMO.

In general, patients who have been released from ECMO need to be given inotropic medicine for a shorter or longer period of time and should never be overlooked. Improving heart function will lead to the gradual cessation of their administration. Renal function should be given special care and treatment until complete recovery occurs. The same guidelines apply to liver function (Kowalewski et al., 2020).

Nutrition plays an important role in improving the overall economy of the body and should not be secondary given that these patients are over-catabolic and do not have the ability to eat normally. Until they start swallowing properly again. The treatment of any bed sores and the progressive mobilization of patients are of great importance. The same goes for psychological support. Despite the above problems, the overall benefits from the application of this technique are positive and justify everyone's efforts (Alshahrani et al., 2018).

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