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A Case of Adult Survival Following Multidisciplinary Treatment Including Venovenous Extracorporeal Membrane Oxygenation (VV-ECMO) for Severe Mycoplasma Pneumonia

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Abstract A 58-year-old male with a history of smoking presented to a local hospital with cough and dyspnea for one week. He was transferred to our hospital due to decreased right lung transparency and impaired oxygenation. Upon arrival, his PaO2/FiO2 ratio was approximately 70, necessitating intubation and mechanical ventilation. Levofloxacin was initiated due to a positive Mycoplasma antigen test. After admission to the intensive care unit, steroid pulse therapy was also initiated. However, oxygenation and ventilation deteriorated further. It was determined that mechanical ventilation alone could not sustain life, leading to the initiation of venovenous extracorporeal membrane oxygenation (VV-ECMO) on the second day of hospitalization. Subsequently, oxygenation and ventilation showed a trend of improvement. Due to bleeding from the cannula insertion site, the ECMO was weaned off on the fifth day. Respiratory status subsequently stabilized, leading to extubation on the seventh day of illness. Oxygen requirements ceased, and the patient was discharged home walking unaided on the thirty-third day of illness. This case demonstrates the value of using ECMO when indications are met and it is determined that mechanical ventilation alone is unlikely to sustain life in severe Mycoplasma pneumonia.

Keywords: *mycoplasma pneumonia,ECMO, steroid*

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1. Introduction

Most cases of Mycoplasma infection are limited to a single organ and present with only mild systemic symptoms, allowing for full recovery after treatment and generally favorable outcomes. However, reinfection can occur.1,2 In rare cases, fulminant or fatal disease caused by Mycoplasma pneumoniae has been reported, often associated with complications or severe systemic involvement leading to multiple organ failure. [1,2,3,4] Fulminant cases of Mycoplasma pneumonia are estimated to account for 0.2–0.5% of all cases. [1] Severe manifestations are most commonly observed in children and young adults. [3,4,5] Herein, we report an adult case of severe Mycoplasma pneumonia requiring multidisciplinary treatment, including mechanical ventilation and veno-venous extracorporeal membrane oxygenation (VV-ECMO).

2. Case Report

A 58-year-old man with a history of smoking presented to a local clinic with a one-week history of cough and dyspnea. Chest radiography revealed decreased transparency in the right lung, and hypoxemia was also noted. He was transferred to our hospital. On arrival, he exhibited tachycardia and tachypnea with poor oxygenation, necessitating tracheal intubation and mechanical ventilation. Chest computed tomography demonstrated right lung-dominant infiltrates (Figure 1). Laboratory tests revealed a white blood cell count of 12,400/μL (neutrophils 71.2%, monocytes 19.2%, lymphocytes 8.4%) without a left shift, suggesting atypical pneumonia. A rapid diagnostic test was positive for Mycoplasma antigen, and the patient was diagnosed with Mycoplasma pneumoniae pneumonia. Treatment with levofloxacin and steroid pulse therapy was initiated. Despite intensive care unit (ICU) management,

oxygenation and ventilation remained inadequate, and progressive respiratory acidosis due to CO_2 retention developed on the following day. Therefore, venovenous extracorporeal membrane oxygenation (VV-ECMO) was initiated. After initiation, oxygenation and radiographic lung transparency showed gradual improvement. However, persistent bleeding from the cannulation site increased transfusion requirements. Although the patient's P/F ratio remained approximately 130, which did not meet the standard criteria for weaning, VV-ECMO was discontinued on hospital day 5. Because of signs of heart failure, diuretics were administered. Steroid therapy was gradually tapered over one month to prevent the progression to pulmonary fibrosis. The patient's respiratory condition subsequently stabilized, and he was extubated on hospital day 7. Oxygen supplementation was no longer required, and he was discharged home ambulatory on hospital day 33.

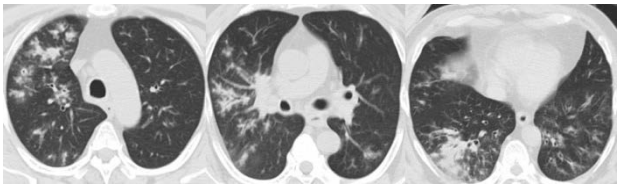

Figure 1. Chest computed tomography (CT) at admission

The CT revealed infiltrates predominantly in the right lung.

3. Discussion

This case involved a patient with Mycoplasma pneumonia who developed severe disease but improved following multidisciplinary treatment including ECMO. A literature search was conducted using the keywords Mycoplasma and either ECMO or PCPS, which yielded 23 reports comprising 42 cases (Table 1). [6-28] The ages of the patients ranged from 1 to 67 years (mean, 13.4 years), with most cases involving children or adolescents. Regarding sex distribution, excluding one case reported by Masuda et al. in which the sex was not specified, 18 of 23 cases were female, indicating a slight female predominance. As for outcomes, excluding the nine cases reported by Zhou et al. in which the prognosis after ECMO initiation was not described, the mortality rate was 7 of 33 cases (21.2%). The oldest patient was 67 years old, and this case resulted in death. In terms of age among reported ECMO cases, the present patient represents the second oldest, following a 67-year-old patient. As the 67-year-old case resulted in death, the present case is the oldest patient to be successfully treated with ECMO.

Most cases of Mycoplasma pneumonia that progress to severe pneumonia occur in young individuals (Table 1). This is thought to be due to the absence of prior infection with Mycoplasma, together with immature immune function and insufficient acquired immunity during childhood. 4 In contrast, elderly individuals may also develop severe Mycoplasma pneumonia. Possible explanations include the presence of multiple Mycoplasma species, the possibility of infection with different strains, and attenuation of previously acquired active immunity due to age-related decline in immune function or comorbidities. [1,30,31,32] In the present case, the patient was 58 years old, and factors such as age-related immunosenescence and a history of smoking—which can lead to altered ciliary motility, increased nasopharyngeal carriage of organisms, impaired alveolar macrophage function, and increased epithelial permeability—may have contributed to both susceptibility to Mycoplasma infection and progression to severe disease. [33,34]

Delay in diagnosis has also been considered a contributing factor to disease severity. In the present case, however, severe pneumonia without a left shift of leukocytes led us to suspect atypical pneumonia. Prompt diagnostic testing allowed us to establish the diagnosis of Mycoplasma pneumonia on the same day and initiate levofloxacin therapy, which may have contributed to survival. Furthermore, disease progression in severe Mycoplasma pneumonia is thought to be associated with a delayed-type hypersensitivity reaction to Mycoplasma, and reports have demonstrated lower mortality in patients treated with corticosteroids, which suppress this response. In this case as well, the use of steroid pulse therapy followed by a tapering regimen over the course of one month may have played an important role in the favorable outcome. [3]

The ECMO is a life-support modality for adults and children with life-threatening cardiac and respiratory failure who are unresponsive to conventional therapies, including cardiopulmonary resuscitation. [35] The ECMO circuit consists of a pump and an oxygenator, providing temporary cardiopulmonary support and allowing time for organ recovery. [35] A review of previous reports of severe pneumonia caused by Mycoplasma pneumoniae (Table 1) indicates that approximately 80% of cases were successfully rescued with ECMO, suggesting that ECMO demonstrates a certain degree of efficacy in severe Mycoplasma pneumonia. While the tendency of Mycoplasma pneumoniae infection to progress to severe disease in children and young adults is likely reflected in the age distribution of ECMO-treated cases, the relatively higher proportion of younger patients may also be due to the more restricted indications for ECMO in the elderly. With an aging society, the incidence of severe Mycoplasma pneumonia in elderly patients with declining immune function is expected to increase. This case highlights that even in elderly patients, if the indications for ECMO are met and mechanical ventilation alone is considered insufficient for survival, the use of ECMO can be justified.

Table 1. Review of Previous Reports on the Use of ECMO for Mycoplasma pneumoniae Pneumonia

No	Reference number	Case / Original	Child/Adult	Number	Age	Sex	Symptom	Treatment	Outcome
1	6	Case	adolescence	1	16	female	autoimmune encephalitis ARDS	omadacycline methylprednisolone immunoglobulin plasma exchange	Survive
2	7	Case	adolescence	1	15	male	fulminant myocarditis	azithromycin VA-ECMO IABP	Survive
3	8	Case	Child	1	8	female	ARDS diffuse alveolar hemorrhage	azithromycin fresh frozen plasma immunoglobulin glucocorticoids	Survive
4	9	Case	Child	1	2	female	ARDS Necrotizing pneumonia by Streptococcus pneumoniae, Influenza A, and Mycoplasma pneumoniae	ceftriaxone vancomycin clarithromycin chest drain steroid VV → VA-ECMO	Survive
5	10	Case	Child	2	6y/5y	male/female	ARDS	doxycycline/ azithromycin	Survive
6	11	Case	adolescence	1	15	male	ARDS pulmonary embolism antiphospholipid syndrome	minocycline steroid heparin	Survive
7	12	Original	Child	9/203	41 mo (20-67)	45.8% female	100% ARDS 38.9% cardiovascular disorder 11.8% gastrointestinal dysfunction	90.2% macrolide resistant 90.6% Methylprednisolone 70.9% immunoglobulin 64.5% mechanical ventilation 4.4% ECMO (9 case)	fatality rate 3.9%
8	13	Case	adolescent	1	11	male	shock ARDS	azithromycin methylprednisolone	Dead
9	14	Case	Adult	1	30	female	haemolytic anaemia septic shock ARDS positive cold agglutinins DIC acral necroses	doxycycline	Survive
10	15	Original	adolescence	2*	17/17	female/male	ARDS	moxifloxacin	All suvive
11	16	Case	Adult	1	30	female	pulmonary embolism ARDS	antibiotics VA-ECMO IABP monteplase/heparin	Survive
12	17	Case	adolescence	1	12	female	shock, arrest ARDS intraparenchymal hematoma	doxycycline renal replacement therapy	Survive
13	17	Revew Regitry data	Adult	8	21.6 (11-67)	62.5% female	ARDS?	?	Fatality rate 25%
14	18	Case	Adult	1	20	female	ARDS	Antibiotic Steroid Nitric oxide	Survive
15	19	Case	Adult	1	36	?	ARDS	?	Dead
16	20	Case	adolescence	1	13	female	ARDS Stroke	broad-spectrum antibiotic	Dead
17	21	Case	Adult	1	34	female	ARDS	?	Survive
18	22	Case	adolescence	1	17	female	ARDS trisomy X	broad-spectrum antibiotic	Survive

No	Reference number	Case / Original	Child/Adult	Number	Age	Sex	Symptom	Treatment	Outcome
							fetal alcohol syndrome mild asthma		
19	23	Case	Child	1	6	female	ARDS	Doxycycline	Survive
20	24	Original	Child	2	3	2 male	ARDS	VA-ECMO	Survive
21	25	Review	adolescence	1	18	male	ARDS	nitric oxide	Survive
22	26	Case	adolescence	1	18	female	ARDS	clarithromycin, azithromycin, ciprofloxacin, amikacin, trimethoprim-sulfamethoxazole hydrocortisone	Dead
23	27	Case	Child	1	7	male	Down sx ARDS	nitric oxide minocycline cefotaxime methylprednisolone	Survive
24	28	Original	Child	1	6	male	ARDS	nitric oxide inhalation	Dead

ARDS, acute respiratory distress syndrome; VA, venoarterial; VV, venovenous; ECMO, extracorporeal membrane oxygenation; IABP, intra-aortic balloon pump

*, Among 10 adult cases with ARDS, 5 receive mechanical ventilation, and 2 ECMO.

4. Conclusion

This case represents the oldest surviving patient with severe Mycoplasma pneumonia who was treated with ECMO. This case demonstrates that in elderly patients as well, when the indications for ECMO are met and survival is unlikely with mechanical ventilation alone, the introduction of ECMO can be a reasonable treatment option.

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