The application of ECMO in critically severe Covid-19 patients

Ning Zhou M.D., Ph.D
Division of Cardiology
Tongji Hospital HUST
Wuhan-Epicenter

Lockdown due to COVID-19 epidemic on **January 23, 2020**

**Wuhan**
Location: central China  
Population: ≈12 M  
Transmission: commuter area

Lessons and experiences from the front-line of fighting against Covid-19 in China should be shared globally.
≈20% Covid-19 developed into severe or critically severe type

Critically severe type
Patients meet any of the following conditions:
(1) Respiratory failure requiring mechanical ventilation;
(2) Shock;
(3) Patients combined with other organ failure needed ICU monitoring and treatment.

What if the patients still have severe hypoxemia on ventilation?
Extracorporeal membrane oxygenation (ECMO)
Typical ECMO case

• **Patient**: Mr. Cheng, 50 yrs, admitted on 11 Feb, 2020

• **Chief complaint**: Fever for 11 days, short of breath for 2 days

• **Present medical history**: Intermittent fever, Max T 39°C, shortness of breath in recent 2 days

• **Past medical history**: No special history

• **Epidemiological history**: Confirmed patients in the residential area.
**Physical examination:**

- SpO2 75%, HR 92 bpm, BP 132 / 86 mmHg, RR 24 bpm, t 36.4 °C; clear mind, passive position; No other positive signs.

**Auxiliary examination:**

Chest CT showed infectious diseases, considering the possibility of virus 2019-ncov virus test: positive
Lab test

- hsCRP: 70.4 mg/L, Cr 67 umol/L,
- ALT 54 U/L↑, AST 62 U/L↑, ALB 33.9 g/L↓,
- WBC 7.07 *10^9/L, N 81.6 %↑, L 0.81 *10^9/L↓(11.5%), HB 125.0 g/L↓.
- **ABG:** PH 7.43, PO_2_ 51mmHg, PCO_2_ 30.8mmHg, SB 22.0 mmol / L, BE - 2.40 mmol / L, SPO_2_ 81.8% ↓(BiPAP);
- NT-proBNP 1077 pg/mL↑; cTnI 217.1 pg/mL, Myo 67.6 ng/mL, CK-MB1.6 ng/mL; LDH 413 U/L↑;
- **Echocardiography:** EF 45%;
Treatment

• Anti-bacteria
• antiviral: arbidol and Chinese traditional medicine
• Relieving asthma and resolving phlegm
• Enteral nutrition

Hypoxemia was getting worse.
He was transferred to ICU.
Additional treatment in ICU

- Endotracheal intubation
- Prone position ventilation: **Oxygenation Index 95mmHg.**
- **ABG:** PH 7.13, PO₂ 61mmHg, PCO₂ 42mmHg, SB 19.0 mmol / L, BE 4.40 mmol / L, SPO₂ 88% -90%↓;
- LAC 2.42 mmol/L↑

A choice that has to be considered: **ECMO**

Date: Feb 18, 2020.
Initial Parameters:
- Speed:3000rpm
- Flow: 3.2L /min
- Oxygen: 4 L/min
- Concentration:40%
tracheal intubation + ECMO + CRRT for 10 days
From Feb 18 to 28.
HR 62, BP 138/84mmHg.

**ABG**: PH 7.40, PO$_2$ 91mmHg, PCO$_2$ 39mmHg, SPO$_2$ 99% -100%↓;

LAC 1.42 mmol/L, D-D 0.73 ug/mL; CTnI <1.9 pg/mL; CRP 0.7 mg/L; NT-proBNP 43 pg/mL;

PCT 0.06 ng/mL; TNFα 10.8 pg/mL, IL1β <5.0 pg/mL;

2019-ncov: (-) for three times

Total antibody for Covid-19: (+)
Remove ECMO date: Feb 27

In recovery, Mar 19

Will be discharged, Mar 20
So far……

ECMO

Number: 5
Finished: 4
Ongoing: 1

Duration: 9.25 days

Age 55.6yrs, from 44 to 68

VV ECMO (4) VA ECMO(1)

4 male
Lessons and experiences

01

Indication

Critically severe respiratory failure and hypoxemia

OI < 100

Not always
Lessons and experiences

02

Contraindication

MODS (HF/DIC/LF)
Bleeding
Irreversible severe brain injury
elder (>70 yrs???)

Not always
Lessons and experiences

Opportunity

The earlier, the better
The later, the worse

ECMO is not for prolonging life for days. It's an opportunity for patients to survive.
Lessons and experiences

Mode

First: VV ECMO
Second: VAV ECMO, if pts have HF.
Last, VA ECMO for pts with both heart and respiratory failure.
Lessons and experiences

Consciousness

Traditional: Intubation first, then ECMO. Remove ECMO first then Intubation.

How about ECMO first, or even further ECMO without intubation?
Acknowledgement

Thanks to my patients, heroes of this city

No.1

No.2

No.3

No.4

No.5 ongoing
Acknowledgement

Appreciate for guidance from Dr. Ge Junbo and CCA.
Appreciate for helps from friends and organs overseas.
Appreciate for supports from my hospital, Tongji Hospital.
Appreciate for forgiveness from my family for not staying with them in this special period.
Thanks for your attention!