

LETTER



H1N1-related ARDS requiring veno-venous extracorporeal membrane oxygenation and the heart

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Cardiovascular involvement in influenza infection, mainly reported in observational small series [1], is thought to occur through the direct effect of the virus in the myocardium or through exacerbating preexisting cardiovascular disease [2]. Since severe acute respiratory distress syndrome (ARDS) needing veno-venous extracorporeal membrane oxygenation (VV-ECMO) is a known complication of influenza infection even in young people, we specifically addressed cardiovascular involvement (by means of serial echocardiograms) in 22 consecutive patients with H1N1-related ARDS treated with VV-ECMO admitted to our ECMO referral center (January 2016–April 2018).

Echocardiographic examination (transesophageal/trans thoracic) was performed before and during ECMO implantation [3], during ECMO support and ICU stay (according to the physician's judgment), and at discharge. The study was approved by our institutional ethical board and performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Table 1 shows echocardiographic findings before ECMO start. Right ventricle (RV) dilatation was detected in 14 patients (63.6%) while left ventricle (LV) dysfunction (<50%) only in 3 patients (13.6%). During ECMO support, 176 echocardiograms were performed (mean

8 ± 4.1 , range 3–15), among which 22 exams (2.8%) were to verify cannula position. RV dysfunction documented before ECMO start completely resolved in all patients within the first 24 h after ECMO start. Among the three patients with LV dysfunction before ECMO, two patients normalized LVEF in the first 24 h after ECMO start, while one patient showed a significant improvement (LVEF 45% vs 32%). Acute cor pulmonale (ACP) was observed before ECMO implantation in 1 patient (4.5%) and completely resolved 3 h after ECMO start. During ECMO support ACP developed in 6 patients (27.2%). Three of these patients died showing ACP on ECMO support: two patients because of septic shock and bronchopleural fistula and the third one because of severe pulmonary fibrosis and concomitant infection from *Acinetobacter baumannii*. The remaining three patients exhibited transient ACP while on ECMO support, treated with dobutamine infusion in two cases and with iNO in one case. None of these patients needed vasoactive drugs. All three of these patients were successfully weaned from ECMO support and discharged alive. Prone position was performed in 9 patients (41%). Echocardiograms at discharge documented systolic pulmonary arterial pressure of at least 45 mmHg in 83% (15/18) of the survivors.

The novelty of the present investigation is that in severe H1N1-related ARDS supported by ECMO, the dynamic

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Table 1 Blood gas analysis and echocardiographic findings before ECMO start

Variables	Values
PEEP	12 ± 2
Blood gas analysis	
PaO ₂ /FiO ₂ ratio, <i>n</i> (%)	
100 ≤ PaO ₂ /FiO ₂ ≤ 200	2 (9%)
< 100	20 (91%)
pH (units), median (IQR)	7.31 (7.11–7.42)
pCO ₂ (mmHg), median (IQR)	62 (52–67)
pO ₂ (mmHg), median (IQR)	55 (49.5–62)
Lactate (mmol/L), median (IQR)	2 (1.68–2.40)
Echocardiographic findings	
TTE, <i>n</i> (%)	2 (9%)
TTE and TEE, <i>n</i> (%)	20 (91%)
sPAP (mmHg), mean ± SD	58.5 ± 4.9
TAPSE (mm), mean ± SD	16.5 ± 4.9
TAPSE < 16 mm, <i>n</i> (%)	11 (50%)
LVEF < 50%, <i>n</i> (%)	3 (13.6%)
RV dilation, <i>n</i> (%)	14 (63.6%)
Norepinephrine, <i>n</i> (%)	12 (66%)
Admission Tn I, median (IQR)	0.085 (0.038–0.548)
Peak Tn I, median (IQR)	0.10 (0.03–0.567)
NT pro BNP, median (IQR)	1258.5 (473.25–4028.25)

PEEP positive end-expiratory pressure, TTE transthoracic echocardiography, TEE transesophageal echocardiography, sPAP systolic pulmonary arterial hypertension, TAPSE tricuspid annular plane excursion, LVEF left ventricular ejection fraction, RV right ventricle, Tn I troponin I, NT pro BNP N-terminal pro brain natriuretic peptide

changes in cardiac function (LV systolic function) and cardiopulmonary interactions (RV dimensions and function) were assessed by means of serial echocardiograms during ECMO support and throughout ICU stay. This

study design allowed the early detection of abnormalities such as ACP potentially susceptible to efficacious treatment, including the possibility of switching from VV to veno-arterial ECMO in the presence of acute RV failure and shock [4, 5]. At discharge, systolic pulmonary hypertension is the commonest finding, suggesting that an echocardiographic follow-up should be performed to assess the pulmonary circulation and RV function after the complete resolution of lung alterations.

Compliance with ethical standards

Conflicts of interest

All authors declare that they have no conflict of interest

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