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Mobile extracorporeal membrane oxygenation after traumatic freshwater submersion using bi-caval dual lumen catheter

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Dear Editor,

After traumatic freshwater submersion, severe respiratory failure and destructive lung injury are dreaded complications [1]. If conventional treatment fails to provide adequate oxygenation, veno-venous extracorporeal membrane oxygenation (VV-ECMO) is the only remaining treatment modality [2]. Yet, in the presence of concomitant trauma, the need for anticoagulation in VV-ECMO poses a therapeutic dilemma [3]. Here, we report two trauma patients treated with mobile VV-ECMO after freshwater aspiration despite an increased trauma-related bleeding risk.

A 33-year-old healthy male fell off a tilted wagon, lost consciousness, and suffered from freshwater submersion, resulting in brain and lung contusion, and an injury severity score (ISS) of 26. Despite lung-protective ventilation and prone position, respiratory failure progressed (Murray score 3.0 [4]) and VV-ECMO was initiated within 24 h

after admission. The further clinical course was uneventful and no additional pulmonary complications occurred. Successful weaning from ECMO was accomplished on day 11, followed by intensive care unit (ICU) discharge on day 13.

A 24-year-old healthy male experienced freshwater aspiration after a quad bike accident, resulting in bilateral brain contusion, lung contusion, rib fractures, bilateral pneumothoraces, and splenic rupture grade II/VI (ISS 29). On day 6, the respiratory condition deteriorated (Murray score 3.5 [4]), necessitating VV-ECMO. The subsequent clinical

course was complicated by persistent pneumothoraces, multiple pulmonary abscesses, empyema, and parenchymal destruction (Fig. 1a–c), ultimately allowing successful weaning from VV-ECMO (day 54), mechanical ventilation (day 66) and ICU discharge (day 69).

In both patients, referral on mechanical ventilation from the primary hospital to a tertiary academic center was considered impossible because of respiratory instability. Therefore, our mobile team comprising two experienced senior intensivists, an ICU nurse, and a perfusionist initiated VV-ECMO

Fig. 1 Serial chest CT scans on day 34 (a), 46 (b), and 58 (c) of VV-ECMO support in the 24-year-old male showing gradual improvement of pulmonary injury. Mobile VV-ECMO equipment mounted on the transport trolley (d). Bi-caval dual lumen catheter (e) optimally positioned under echocardiographic guidance into the inferior vena cava (IVC) (f) with its single infusion port (e inset, f circle) overlying the right atrium (RA) and directed towards the tricuspid valve. L indicates liver

off-center before transport (Prolonged Life Support, Maquet[®], Fig. 1d). One intensivist introduced a 27-French bi-caval dual lumen catheter (Avalon Elite, Avalon Laboratories[®], Fig. 1e) via the right internal jugular vein, resulting in a blood flow of 4 L/min. Optimal catheter positioning was guided echocardiographically by the second intensivist adhering to a protocolized combined transthoracic-transesophageal approach using our mobile equipment (Philips CX 50) (Fig. 1f) [5]. The use of a single insertion site minimized the risk of cannula displacement, introduction of site bleeding, and infection while facilitating patient handling. In both patients no VV-ECMO related complications occurred.

Considering the bleeding risk due to concomitant multitrauma, therapeutic anticoagulation was undesirable [3]. Consequently, the first patient received a half-therapeutic dose of unfractionated heparin intravenously (5,000 IU bolus), the second acetylsalicylic acid (100 mg orally (300 mg bolus). In the absence of hemorrhagic complications, both patients switched to a therapeutic dosage of unfractionated heparin 48 h after the start of VV-ECMO.

Severe but potentially reversible pulmonary injury can successfully be treated with VV-ECMO in trauma-related freshwater submersion. The combined advantages of mobile, off-center VV-ECMO initiation using a bi-caval dual lumen catheter in trauma patients have, to the best of our knowledge, not been described

before. As pointed out earlier, this approach should be considered as a valid therapeutic option in this category of patients despite the assumed increased bleeding risk associated with multitrauma.

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