Extracorporeal Membrane Oxygenation for Adult Respiratory Distress Syndrome after Near-drowning

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Abstract

Background: Near-drowning victims surviving the initial period of asphyxia may develop life-threatening adult respiratory distress syndrome (ARDS). We highlight current understanding of extracorporeal membrane oxygenation (ECMO) for successful clinical management of severe ARDS in adult near-drowning victims with reference to a recent case of accidental submersion.

Patient: Previously healthy 18-year-old female near-drowning victim with progressive hypoxaemia, hypercapnaemia, acidemia and multiple organ failure.

Results: Rapid restitution of respiratory function during a three-day period of treatment with venovenous ECMO.

Conclusion: Extracorporeal membrane oxygenation is a feasible option in near-drowning adult victims with progressive ARDS not responding appropriately to conventional protective ventilation.

Keywords: Case reports; Extracorporeal membrane oxygenation; Near drowning; Respiratory distress syndrome; Adult

Introduction

A near-drowning victim surviving the initial period of prolonged asphyxia may develop life-threatening Adult Respiratory Distress Syndrome (ARDS). Some centres recommend Extracorporeal Membrane Oxygenation (ECMO) in selected near-drowning paediatric patients [1-5], whereas few adult cases have been reported [6].

We highlight current understanding of this option of treatment in adult near-drowning victims with reference to a recent case, where ECMO was successfully used to treat a young female near-drowning victim with severe ARDS. Informed written consent was obtained from the patient, and the clinical report was approved by the Ethics Review Board at Lund University Faculty of Medicine, Lund, Sweden.

Patient

A previously healthy 18 year-old female was rescued from a sunken car in a city canal in Malmö in southern Sweden in the end of May. She had carotid pulsations, apnoea and dilated pupils, and was endotracheally intubated at the site of the accident.

In the emergency room the patient was hypothermic (33.1°C) and acidotic (pH 7.1) with bilateral pulmonary rales. She was initially extubated and transferred to the intensive care unit.

During the first hour after arrival in the intensive care unit, the patient developed pulmonary oedema and was reintubated. Within the next 48 hours she deteriorated with pneumomediastinum, pneumoperitoneum, hypoxaemia, hypercapnaemia, and ARDS, as part of multiple organ failure including leucopenia, progressive coagulopathy, and systemic hypotension (systolic arterial pressure 30-40 mmHg). She was transferred to the national ECMO centre in Stockholm within the next twelve hours. Arterial blood gas levels immediately preceding ECMO treatment were PO2 5.5, PCO2 12.2, and pH 7.2, at an inspired oxygen fraction of 1.0, with positive end expiratory and peak pressure levels of 16 and 36 cm H2O, respectively.

The patient gradually stabilized during the 73-hour period of venovenous ECMO treatment, was referred back to her hospital and recovered with no major neurological deficit.

Discussion

In drowning or near-drowning, an initial episode of laryngospasm is often followed by aspiration of water [7]. The volume of water aspirated is often not enough to induce classical signs of hyper- or hypovolaemia (depending on the tonicity of the water), as reported in early experimental studies [8, 9]. Nevertheless, prolonged submersion may lead to inactivation of surfactant [10], alveolar damage, ventilation-perfusion mismatch [11], reduced pulmonary compliance [12], and (as reported here) ARDS.

Extracorporeal membrane oxygenation enables protective ventilation in patients with severe ARDS, otherwise requiring ventilator settings detrimental to pulmonary tissue and to vital organ perfusion [13].

There are few publications on ECMO treatment for pulmonary injury in adult near-drowning victims [6]. The British conventional ventilation or ECMO for severe adult respiratory failure (CESAR) multicenter trial, has reported non-significantly (P=0.07) higher...
survival in the ECMO group (odds ratio 0.73; 95% confidence interval 0.52–1.03) [14].

Early clinical recognition of respiratory failure indicating rapid need for ECMO is crucial, since it may take several hours to reach the patient from an ECMO centre. More than one patient in twenty (5.5%) in the ECMO arm of the CESAR study died before ECMO could be initiated [14].

Venovenous ECMO is a feasible therapeutic option worth considering in near-drowning adult victims with severe or rapidly progressive ARDS not responding appropriately to conventional protective ventilation.

Conflict of Interest

No conflict of interest is reported, and no financial or technical support is acknowledged.

References