



POINTS OF VIEW: MEDICAL TRANSFER

ECMO retrieval in NSW and beyond

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S U M M A R Y

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This article discusses the background, logistics and safety of ECMO retrieval in New South Wales, Australia. We look at the experiences of a well established, high volume medical retrieval service and the challenges presented during the recent H1N1 swine flu pandemic. In outlining the referral and retrieval process utilised in NSW we hope that other retrieval services can gain from our experience.

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1. Introduction

Extracorporeal membrane oxygenation (ECMO) is a modification of cardiopulmonary bypass technology used to support potentially reversible, life-threatening forms of acute respiratory or cardiac failure which are unresponsive to conventional therapy. Despite descriptions of ECMO use as early as the mid 1970s, evidence of benefit had until recently, been limited to acute respiratory and cardiac failure in neonates. However, the persisting high mortality and morbidity of adults with acute respiratory distress syndrome (ARDS) as well as developments in perfusion technology have continued to generate interest in ECMO as a meaningful therapeutic modality in these settings. In a recent Australasian report, adults with severe H1N1 pneumonia who were treated with ECMO had a 78% survival rate, which is the highest reported adult survival rate in the literature to date.¹

2. Background

NSW has challenging demographic and geographical considerations for a medical retrieval service. It covers 809,444 km² (which is roughly three times the size of UK) but has a population of only 6.1 million, 4 million of whom live in the greater Sydney area.

The Aeromedical and Medical Retrieval Service (AMRS) was established to provide central coordination of all hospital transfers within NSW by road, rotary wing or fixed wing. Greater Sydney Area-Helicopter Emergency Medical Service (GSA-HEMS) is one arm of AMRS conducting both road and rotary wing transfers and

operates a doctor/paramedic medical crew. The service performs on average 2500 retrievals annually, 70% are inter-hospital and 30% are pre-hospital.

Prior to 2009, GSA-HEMS retrieved in total 7 patients on ECMO within NSW, all by road. However, this service was unfunded and provided on an ad-hoc basis. With small numbers it was difficult to adequately train up large numbers of retrieval doctors and transfers were therefore only undertaken by experienced senior retrieval doctors. As part of the 2008/09 adult intensive care services funding enhancement, The NSW Department of Health agreed to support the NSW ECMO medical retrieval strategy, with capital and recurrent funding for up to 10 ECMO retrievals per year. The strategy included the promulgation of indications for ECMO referral (Fig. 1) which were formulated by an expert clinical group. The NSW ECMO Retrieval Service was formally established in May 2009. The service is provided by the GSA-HEMS, Royal Prince Alfred Hospital (RPAH) and St Vincent's Hospital (SVH) in Sydney. These hospitals are the designated destination hospitals (out of 7 tertiary ICUs that are able to provide ECMO services). Retrievals are coordinated through AMRS and are performed by dedicated ECMO retrieval teams.

The NSW ECMO Retrieval Service was introduced one month prior to the onset of the H1N1 Influenza A pandemic in Australia and New Zealand, which during the winter of 2009 placed huge demands upon the retrieval, ambulance and ICU services.³ Between June 1st to August 31st 722 patients with confirmed infection were admitted to ICU in NSW, 456 required mechanical ventilation and 24 received ECMO. Of these patients, 19 patients were retrieved on ECMO. (Median age 34, IQR 26–42, male patients 50%).

In total, during 2009, 31 ECMO retrievals for all indications were performed in NSW by GSA-HEMS and CareFlight Ltd (a private, not for profit company providing fixed wing medical retrieval and also

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INDICATIONS FOR ECMO REFERRAL

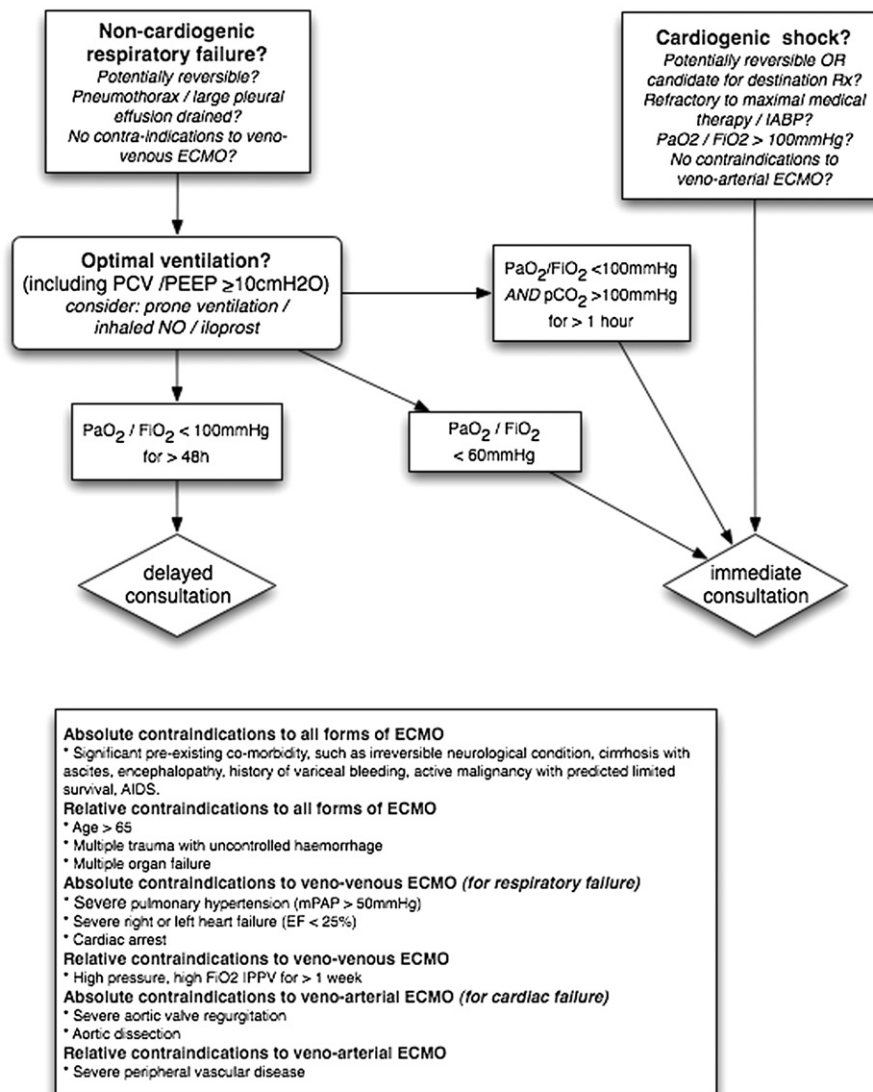


Fig. 1. The Indications for ECMO referral in NSW.

doctors for GSA-HEMS). Transportation was by a combination of road, rotary and fixed wing (including 3 international retrievals from New Caledonia).¹¹ In common with other authors^{4,5} we found that the transport of adults patients on ECMO was safe, despite a few potentially serious retrieval related complications (including one pump battery failure requiring manual pump operation – see Fig. 2, one case of air entrainment into the circuit and one patient who became hypothermic at 32.2 °C).

3. ECMO

ECMO is a modified heart-lung bypass circuit used to support life-threatening acute respiratory or cardiac failure. In these cases, it is usually used in venovenous (VV) or venoarterial (VA) configurations via the femoral vessels. VV ECMO is used for respiratory failure; VA ECMO is used if cardiac support is also required. Despite a 30 year history and an established role in neonates, the use of ECMO in adults has been controversial. Early randomised trials failed to demonstrate a survival benefit and the highly specialised

and expensive nature of ECMO have limited expertise.¹² However, adult survival rates have been improving, which may be due to improvements in ECMO technology. The most important of these advances include polymethylpentene (PMP) oxygenators,^{6,7} centrifugal pumps⁸ and surface-modified circuit components that together increase the durability of the circuits (to weeks instead of days), reduce haemolysis, cause less activation of the systemic inflammatory response and decrease the requirement for anticoagulation to prevent circuit thrombus formation.^{9,10}

Patients who require ECMO support are often too unstable to transfer by conventional means, particularly when distances are long and travel times/delays are protracted. In the recently published CESAR trial 180 patients with severe ARDS were randomised to receive ECMO at Glenfield Hospital (UK) or conventional treatment at a participating tertiary care centre.² They demonstrated a 16% survival benefit without severe disability in the ECMO referral group (63% vs. 47%). Of note, all patients were transported conventionally. Five patients that had been randomised to the ECMO group died before they could receive it (3 died before

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