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# ECMO retrieval: A case for Critical Care Paramedic integration into the team

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**Introduction:** The provision of an effective extra-corporeal membrane oxygenation (ECMO) service requires a dedicated unit with sufficient caseload and access to specialised resources.<sup>1</sup> Moving unstable patients, with refractory respiratory failure on conventional mechanical ventilation, to the specialised centre for ECMO poses great risk to the patient.<sup>1,2</sup> Therefore, there is a need to have mobile ECMO capabilities with specialised retrieval teams, capable of initiating ECMO in the referral hospital and safely transporting the patient to the ECMO centre. Transport of patients on ECMO has been demonstrated to be safe, if undertaken by well-trained teams<sup>2-7</sup> providing seamless care.<sup>8</sup> However, most studies pay little attention to the role of the ambulance service within the ECMO team. The ideal configuration of the team has yet to be demonstrated, with different regions using different models.<sup>2</sup> The ELSO guidelines recommend, beside the ECMO specialist and cannulating physician, a transport nurse or respiratory therapist to provide ongoing critical care to the patient.<sup>9</sup> This recommendation presupposes a model where nurses are routinely involved in interfacility transport of patients. It further ignores the role of ambulance service staff, who potentially play an integral role in the movement of the patient. This model is by no means universal, and certainly not the case in Qatar, hence the decision to include Critical Care Paramedics (CCP) as an integral part of the Qatar ECMO team, in service of safe ECMO patient transport.

**Multidisciplinary team dynamics in patient transport:** As with the management of the ECMO patient within the ICU unit, the success of each retrieval and transport depends as much on team dynamics as on the technical skills of the individual specialities represented in the team.<sup>10</sup>

Due to the specialised nature of ECMO, the retrieval team cannot rely on the referring hospital having all the required equipment. Thus, the team needs to be self-sufficient and the team members interdependent on each other. Prior to activation of the team, each speciality is responsible for ensuring their specific retrieval equipment has been checked and sealed in readiness for the next retrieval. As part of this process, the ECMO retrieval team developed a set of checklists for each of the equipment sets (checked weekly) and a master retrieval checklist to be used by the CCP on activation of the team. The use of checklists ensures that all equipment boxes, required for cannulation and patient care, are loaded into the transport vehicles.<sup>9</sup>

The design of the retrieval service vehicle and High Acuity Patient Transport Trolley has factored in the principle of redundancy, realising that the patient on ECMO has limited physiological reserve if equipment, power or oxygen supply failure should occur. The close working relationship between the ECMO director and the Ambulance Service staff has helped develop a platform and system that provides redundancy and limits the requirement for the ECMO team to have to carry additional backup equipment.

Once at the referring hospital, each member of the team has preassigned roles. The ECMO physician takes lead on assessment of the patient, deciding on the eligibility for ECMO. The decision to initiate ECMO requires consent from the family to begin. During that time, the rest of the team begin the process of identifying additional resources within the hospital. The ECMO specialist nurse begins assessing the needs of the patient prior to movement. Once consent is obtained, the team can begin the process of preparing the patient for transfer to theatre (unless the decision has been made to cannulate in the ICU) and to prepare the operating theatre for cannulation. Delegating the role of patient safety and logistics to the CCP frees up the need for the lead physician to multitask, thus being able to concentrate on the task of patient assessment, reducing the risk of error and co-ordinating the requirements for cannulation of the patient at the receiving hospital. The CCP also plays a support role for the ECMO nurse specialist in preparing the patient for transfer to the theatre (infusions, monitoring and ventilation), and becomes lead for the safe movement of the patient from the unit to the theatre, and later to the ambulance. Each step in the patient preparation and movement is

confirmed as per the safety checklist to ensure nothing is missed, and the risk of accidental dislodgment of invasive lines or ET tube is minimised. Having a dedicated safety person allows other team members to concentrate on their primary task.

#### **Background:**

**Building the Ambulance Service – Medical Intensive Care Unit relationship:** Following the outbreak of MERS coronavirus, the leadership of HMC made a decision to develop a severe respiratory failure (SRF) service, including the implementation of an ECMO programme, as none existed in the country or the region. This service would be based at Hamad General Hospital in Doha. A centralised model of care would be used, thus requiring the establishment of an ECMO retrieval service.

The project development was tasked to the MICU Director, who also held the Deputy Medical Directorship of the Ambulance Service. This relationship had previously led to the Ambulance Service and the Medical Intensive Care Unit co-developing a multidisciplinary, simulation-based training programme in preparation for the launching of a High-Acuity Adult Retrieval Programme. This model paired MICU intensivists with Critical Care and Ambulance Paramedics on a purpose-built Mobile Intensive Care Ambulance, with the CCP as team leader. Based on the success of this programme, it was decided to include a small group of experienced CCPs in the ECMO training programme, which was initiated in November 2013. The envisaged role of the CCPs was to undertake the logistic lead and patient and team safety role on ECMO retrieval development. As part of the initial training programme, two of the CCPs were included in the team that were sent for training with an established ECMO service in the UK. Their role was to get insight into the logistical requirements and evolution of ECMO retrieval and then become the project leads for the development of the Ambulance Service's capacity to support a seamless ECMO retrieval service.

**The ECMO retrieval team:** In Qatar, the ECMO retrieval team is made up of either two ECMO specialists or an ECMO specialist and a MICU consultant, with an ECMO specialist nurse, perfusionist and respiratory therapist. In addition, the team has a CCP as an integral member of the team, with a central role in logistics and safety. The CCP helps link the decision-making and execution of patient movement and transport to any additional resources within

the Ambulance Service that may be required and adds additional clinical capacity to the retrieval team. In many countries, Critical Care or Intensive Care Paramedics play a central role in the interfacility transport of critically ill or injured patients, either by ground or air ambulance. Advanced Life Support Paramedics receive additional training in Critical Care Transport and Aeromedical Medicine, and then, work in multidisciplinary teams geared to the safe transport of high acuity patients, either by ground or by air. These Critical Care Teams may be composed of two CCPs, or a CCP working with a Critical Care Nurse or Physician.

CCPs develop their skills of leadership, required for working in high-stress environments, through their training and through experience working in complex and austere clinical environments. In many of the countries mentioned above, paramedics are required to gain experience in the emergency setting, before being permitted to transfer into Critical Care Transport teams. This model ensures that the CCP/ICP is not only competent in Advanced Life Support skills but has had time to master the complexity of assessing and managing critical patients, patient advocacy and professional engagement with other healthcare professionals.

Qatar recruits its CCPs from Australia, Canada, New Zealand, USA and South Africa. All these countries have established Critical Care Transport programmes through tertiary-based paramedic education (Associate Degrees or Degrees). CCPs, within the Ambulance Service in Qatar, are able to provide advanced airway interventions (rapid sequence induction and intubation), use multimodal

mechanical ventilation and provide advanced cardiovascular life support – including infusion devices, inotropes, external pacing and mechanical chest compression devices. In addition, the group of CCPs selected to be part of the ECMO programme all had more than 10 years of clinical experience and were trained and experienced in aeromedical work. Being familiar with the equipment and systems of the Ambulance Service, the competencies of interfacility patient transport and having been trained with the MICU multidisciplinary team in the process of ECMO, allowed them a unique ability to take on a lead role in the logistics process and patient safety roles and provide an additional resource for the provision of airway care, ventilation or advanced cardiac life support.

From late 2014 to date, the Qatar ECMO team have undertaken 13 retrievals, including one international transport from Qatar to India, without any adverse incidents. The strong relationship between the ECMO team and the Ambulance Service has facilitated the development of a safe and effective retrieval service. Future plans to include the initiation of ECMO transport simulations to ensure maintenance of skills and develop team dynamics with new staff being added to the Service.

**Keywords:** ECMO retrieval, Critical Care Paramedic, Ambulance Service, patient and team safety, logistics, checklist

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