Extracorporeal membrane oxygenation: Is it another slower way to die?

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Extracorporeal membrane oxygenation (ECMO) is an advanced respiratory support that is being adopted as salvage therapy in acute respiratory failure [1]. The widespread use of this technology came as a result of a large multicenter randomized UK study showing a survival benefit for severe acute respiratory distress syndrome (ARDS) patients transferred to an ECMO-capable specialist center [2]. Moreover, improvements in clinical management and advances in technology have gradually changed ECMO from a "rescue therapy of last resort" to a type of standardized therapy for severe impairment with clear indications and contraindications in many specialized centers around the globe, including for the treatment of COVID-19 patients.

The procedure is usually considered in the case of refractory but potentially reversible diseases as a bridge to recovery, transplantation, or when the prognosis is uncertain [3]. However, it is not common to deal with an unpredictable outcome during the crucial critical decision-making period, which may result in prolonged ECMO support with no exit strategy, sometimes referred to as a "bridge to nowhere." This may happen for various reasons, including unknown underlying progressive diseases, rapid progression of acute illnesses despite maximal therapy, complications related to ECMO, prolonged intensive care unit (ICU) stay, the non-availability of destination therapy, and the inability to transfer patients to centers with the most advanced capabilities due to financial or other restrictions.

Qatar's adult ECMO program was developed in 2013 in response to the Middle Eastern Coronavirus outbreak in the Arabian Peninsula region [4], which faced new challenges in the context of public hospitals in a unique multicultural and multiethnic environment, where the majority of patients and population are expatriates with constrained financial resources and most were without family in Qatar. The high mortality rate, the failure to receive conventional ICU care, the high costs, and marked impracticalities of transporting and hospitalizing these patients in other countries with advanced respiratory support capability precipitated the development of the Severe Respiratory Failure and Extracorporeal Membrane Oxygenation Service in Qatar. The core concepts of the ECMO program were a multidisciplinary approach-based partnership with an international center of excellence to provide hands-on experience and the establishment of local simulation-based training. The goal of the service was to provide high-level specialized severe respiratory failure lung protective ventilation, prone positioning, and the best supportive care before advancing to venous-venous (VV) ECMO.

In early 2013, an ECMO partnership with a UK-based academic health-care system was established with the view to train and initially mirror the UK-based ECMO program with subsequent tailoring and localization to fit the local need in Qatar. The team members were chosen locally and were physicians, nurses, perfusionists, respiratory therapists, nutritionists, pharmacists, physiotherapists, and critical care paramedics. After extensive training abroad, the team members returned to Qatar where further training through simulation was carried out. In April 2014, the first case qualifying for ECMO due to severe respiratory failure was treated at the Hamad Medical Corporation (HMC) ECMO center. For the rest of 2014, the center was treating one patient per month with a survival rate of 100% for the six cases who received VV-ECMO. The first ECMO retrieval occurred in October 2014, while the year 2015 saw the expansion in the ECMO team size, its consolidation through in-house simulation courses, and the HMC ECMO center joining the extracorporeal life support organization (ELSO). The year 2016 witnessed the introduction of the veno-arterial (VA) ECMO modality and the first aeromedical ECMO transfer occurred in June that year. In 2017, extracorporeal cardiopulmonary resuscitation (ECPR) service was started. It is to be noted that our center participated in the international ELSO registry and received the gold level award in 2018.

By the end of November 2018, the center had carried out 102 cases of ECMO with 48 (47%) patients dying while on ECMO. The ECMO patient survival to ICU discharge was 53% (54 patients) and to hospital discharge was 50% (51 patients). Of those, 83 (81%) cases were VV ECMO with a survival rate of 58% (48 patients), 6 (6%) cases of VA ECMO with a survival

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rate of 50% (three patients), and 13 (13%) cases of ECPR with a survival rate of 23% (three patients).

Apart from these, we have experienced other therapeutic and emotional catastrophes. We have found it challenging to ensure that some patients have reversible diseases before starting ECMO in certain situations. With the non-availability of lung/heart transplants as destination therapy and the constraints in transporting patients to centers with these capabilities, the "bridge to nowhere" is the unanticipated, awful, and inevitable outcome in such situations.

One example was a 35-year-old Filipino mother of a 7-year-old son back home, working as a house-maid in Qatar, who presented with refractory hypoxemia with widespread bilateral infiltrates and cavitary lesions. Sputum samples were obtained and she was put on life-saving ECMO, with initial transient improvement. Results of the sputum proved active pulmonary tuberculosis and anti-tuberculosis therapy was initiated. She remained hypoxemic and ECMO-dependent despite ultra-protective lung ventilation with <4 mL/Kg and negative sputum smear and culture at 65 days. She continued on ECMO and during most of her stay, she remained awake and attentive, maintained a daily routine of physical therapy, self-oral feeding while on tracheostomy and mechanical ventilation, and ambulated daily. A bond of friendship and compassion developed between her and the critical care staff. She was an extremely bright, inquisitive, and cheerful young lady who became familiar with the basic ECMO parameters, including the requirements of sweep gas flow when dyspneic! During the multiple discussions with the ECMO team members and the hospital ethical committee members and while talking through tracheostomy speech valve and writing boards, she clearly communicated her desire to continue with ECMO support despite her understanding that she would live only in the ICU environment with no chance of hospital discharge. After multiple discussions, she was continued on full ECMO care, but ultimately developed severe right heart failure and died after spending 303 days on ECMO.

A second example was a 40-year-old man who had life-saving VV-ECMO instituted for refractory hypoxemia with ARDS thought secondary to community-acquired pneumonia. He had a history of orchiectomy 9 months before presentation for an unclassified stromal cord tumor with metastasis to the lung but had uneventfully received five cycles of cisplatin and bleomycin-based chemotherapy. He was alert and communicative but was unable to mobilize himself because of persistent hypoxemia that was later attributed to bleomycin-induced pulmonary toxicity. He suffered from recurrent ventilator-associated cases of pneumonia with multidrug-resistant organisms complicated by septic shock and ultimately died of multiorgan failure after spending 73 days on ECMO.

The staff working in ICU is all too familiar with the grief and pain caused by the diseases and try to cope with it in personal ways. However, experiences with our patients and their families, at times, can become too burdensome for us "professionals" to handle. There are as many cases as we care to count which are unforgettable.

Anthony was conscious until the last moments of his life, whose piercing eyes haunt some of us still. We tried to look away from his gaze, glancing away at the bedside monitor and other equipment but his eyes spoke clearly and told a story of dread, fear, and worry for what the future held in store for him-and for us. We wondered what he was thinking-perhaps, he was still hoping for a long, fulfilling life. Perhaps, he still held onto his dreams for a bright future, for adventure, for love, and for fulfillment. Hiding from the truth became the only way to go on working in this environment. We, the professionals, continue to hope for miracles – a trait we share with the families of our patients – even though these miracles rarely come to pass, and all too often, we see hope turn to defeat and despair.

In the case of Anthony, six of our most experienced physicians, and other members of the multi-disciplinary ECMO team met to discuss his case, treatment, and prognosis. We fooled ourselves; let ourselves believe that a miracle could happen. "Let's wait," we said.

What were we waiting for? We all knew that the odds were stacked against Anthony. Waiting would not make the slightest bit of difference to the outcome we all knew would come. How could we prepare Anthony and his family when we were finding it difficult to admit even to ourselves that there was only one expected outcome?

Each day, the following rounds were harder to negotiate but we continued with our usual ICU jargon and statistics:

His urine output is down. We think that his kidneys are shutting down.

His saturations are dropping and we cannot get them up with 100% O_2.

He is barely conscious.

He is crashing

We wondered, is ECMO a cure or a curse? I am losing hope in this theatre of technology. I no longer see recovery; instead, I have doubts now about whether ECMO was the right choice for several patients. I reassure myself – if not for ECMO, they would be dead already. Perhaps, the ECMO was a good thing for them and their family, to make it less painful when they did go, to allow them the chance to say goodbye to each other before the long separation of eternity. Perhaps, there is some brightness among all this darkness?

Too often, we just want days to pass and another colleague would take care of him; then to hear that it is over and that it was a beautiful end, the poignant end of the story of an active life but one that leaves behind beautiful memories of that life. It is so sad when the shining treatment ends up just prolonging the pain and we, the professionals, have to carry on, looking as poised and calm as those fantastically swimming ducks you hear about. I have had enough of these tragic stories!

Obviously, ECMO has undergone advancements and developments in the techniques and its management and has saved several patients. However, it cannot work in every patient with respiratory or cardiac failure. Should there be stricter criteria to use ECMO? Should it be a case-to-case-based decision? Do patients actually die because of severe hypoxemia? Are there good

patient-specific predictors to guide us if it is not going to work? Does it require continuing the support when it does not work in the absence of an exit strategy? What if the patient decided to continue support when the recovery is very unlikely?

Does it add to the burden of the emotional stress of the practitioners when they feel they are helpless in the presence of a hopeless outcome? What further can be done then? While there are many discussions and proposed solutions, the efforts toward ECMO continue and so do the joys and sufferings of ECMO therapy for medical professionals, patients, and their families.

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