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Extracorporeal Membrane Oxygenation in Respiratory Failure: The Challenges Ahead for a Nation

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Extracorporeal membrane oxygenation (ECMO) is a life-saving modality popular during the coronavirus disease-19 (COVID-19) pandemic.[1,2] It consists of removing blood from the patient's venous system, oxygenating, and returning to the venous or arterial side. It has been used to salvage critically ill patients with heart, lung, or both failures. The Extracorporeal Life Support Organization (ELSO) recommends "considering" ECMO therapy in patients with an age-adjusted oxygenation index (AOI) of 60 or more and "initiating" ECMO therapy with AOI >80 because the mortality risk is 50% and 80%, respectively.[3] The survival of patients to discharge or transfer after venovenous ECMO is 58% for adults and 60% for children.[4]

The awareness about ECMO in the general public stems from news articles (undertreatment politicians, outbreaks of viral infections, for example, H1N1 infection, etc.), internet searches (Google), hearsay practices, and advertisements of private hospitals.[5,6] This information lacks statistics on duration, outcomes, complications, and cost of therapy. Equipped with piecemeal information, families of such patients have difficulty accepting complications and adverse events during ECMO therapy.

In India, among practicing professionals, there needs to be more uniformity of knowledge about ECMO as a treatment modality for respiratory failure. No standard nationwide course or training program exists exclusively for ECMO in India. Various societies or individual hospitals organize 1- or 2-day workshops, but more is needed to prepare the attendees to practice such intensive therapy.[7,8] The clinicians need to know the correct mode, time, or if to initiate ECMO therapy. Often, the patients are subjected to ECMO after prolonged sessions of prone ventilation, high-frequency oscillatory ventilation trials, and when other organs become dysfunctional, leading to dismal outcomes.

In India, the equipment and disposables for ECMO are still imported. Even centers with a thriving ECMO program often suffer a shortage of cannulae (of the required size) and circuits (inclusive of oxygenators). This also leads to increased costs of treatment. On average, there is an initial 1-time cost of approximately 3.5–5.0 lakh rupees for the institution of ECMO.[9,10] Once initiated successfully, ECMO therapy has no maintenance cost except anticoagulation. However, patients subjected to this therapy are incredibly sick and require intensive care. Initiating ECMO puts the patients at risk of fluid shifts, coagulation–anticoagulation issues, infections, blood transfusions, dialysis, etc. The requirement of close monitoring and multiple investigations to prevent or treat complications adds to the initial daily maintenance cost for the intensive care unit. Heparin-induced thrombocytopenia may occur during ECMO therapy and necessitate alternate anticoagulants. Bivalirudin and argatroban increase the cost of maintaining anticoagulation when

used as alternatives to heparin. Moreso, the availability of both these drugs is limited in the country due to less use. The reported cost for a gain of each quality-adjusted life year on ECMO therapy is approximately 36,001 Canadian dollars.[11]

In India, most patients visiting a public sector hospital cannot afford ECMO treatment on their own. The Ayushman Bharat scheme of the Government of India provides cashless treatment of up to 5 lakhs per family per year which is insufficient for patients undergoing treatment with ECMO. A separate category, "ECMO therapy," with a ceiling limit of 10 lakhs or more, is required under this scheme.

At present, the use of ECMO in India is unregulated, non-monitored, and does not mandate reporting. There is no government body for keeping track of the number, complications, and outcomes of patients subjected to ECMO. There are no national or regional structured training courses for training in ECMO, either for paramedical staff or doctors. There is no particular qualification required for practicing ECMO in India. The first step in this direction will be establishing a national body (like the national organ and tissue transplant organization (NOTTO) was constituted for organ transplant) that will act as a licensing, registering, and regulatory body for ECMO in India. Even the use of ultrasonography in India is regulated by the pre-conception and pre-natal diagnostic techniques (PCPNDT) Act.[12]

Conventionally, the use of ECMO was restricted to cardiac surgeons. Then, with the progress in technology and improvement in cannulas, percutaneous insertion of cannulas was made possible, and the persistent requirement of a perfusionist was eliminated. Therefore, the use of ECMO for respiratory failure (venovenous ECMO [VV ECMO]) increased exponentially during the COVID pandemic with no demographic, outcome, or follow-up data at a national level in India. Few publications provide insight and add to the existing literature and evidence.[13,14]

Often the quality of the ECMO program is evaluated by patient mortality during or after ECMO therapy instead of the duration of freedom from complications. Most worldwide data is based on the Western population, and the practices in developing countries, including India, are driven by the evidence generated from this data. In India, complete data are often unavailable due to poor record-keeping or unawareness about data collection. An unbiased, transparent, and well-supervised government registry is required to collect, assimilate, and analyze our data. The evidence, thus, generated (through research) will be more representative and applicable to our population. A clear set of guidelines stating when to withhold ECMO will go a long way in improving the outcome statistics.

ECMO-aided cardiopulmonary resuscitation (CPR) is a critical procedure where ECMO is instituted while doing CPR on a patient in cardiorespiratory arrest. The time window for this procedure to be beneficial is brief. Many centers follow a cutoff duration of 20- or 30 minutes of CPR without return of spontaneous circulation (ROSC).[15] In India, some tertiary care centers provide ECMO therapy but are often confronted with indecisive or confused patient attendants and cost constraints. It is not uncommon for patients' relatives to pressure the emergency team to start ECMO after more than 30 min of CPR for an unwitnessed cardiac arrest (when "no benefit" is expected). These circumstances, combined with knowledge based on a quick search on the internet, often lead to discontent and distrust among the general population.

A retrospective analysis of the ELSO database showed that 7.2–7.7% of patients on VV ECMO develop neurological complications. The incidence of intracranial hemorrhage, acute ischemic stroke, seizures, and brain death was 4.0%, 1.7%, 1.3%, and 1.8%, respectively.[16] Sometimes, a neurological event is followed by a coma and brain stem death. Declaring a patient's brainstem dead on VV ECMO is challenging and requires utmost caution. Often the cause is a convulsion or a stroke. After stabilization following an acute neurological event, all sedative agents are withheld for five half-lives of the drug earlier used. In renal failure, more time may be given as an extra precaution. In patients on VV ECMO, performing an apnea test satisfactorily or with conclusive results may not be possible.[17] A decision to continue or withdraw support requires an ancillary test like computed tomography angiography, which is not feasible. Therefore, the decision to withdraw support needs to be based on the clinical judgment of an experienced multidisciplinary team. The family members' acceptance of such a decision depends on the rapport and trust between the family members and the treating team.

A national ECMO program with a regulatory body will provide supervision, guidance, constant development, evaluation, and a future road map for ECMO therapy in this country. It will go a long way in improving the trust and confidence of the general public in this intensive and life-saving therapy.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

Sarvesh Pal Singh is the member of the Editorial Board.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The author(s) confirms that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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