Extracorporeal membrane oxygenation —the good, the bad and the ugly (for want of a “few dollars more”): and would “a fistful of dollars” make any difference?

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The concept of extracorporeal membrane oxygenation (ECMO), which is merely an offshoot from cardiopulmonary bypass (CPB), is nothing new for the cardiac surgeons. They are familiar with this versatile tool for several decades. It has been an integral part of their armamentarium for the safe conduct of operations on and in the heart. The tool was available only within the cardiac operation theatres and could be used for varying periods of time measured in hours only.

Although ECMO was first described in 1971, it is only after the turn of the millennium, more so during the last decade [1], that ECMO (after numerous adaptations and miniaturisations) became popular with intensivists and gained widespread use at the bedside of the patient in intensive care units (ICU). Percutaneous initiation of ECMO support which could provide “rest” for the heart and lungs for prolonged periods of time (weeks to months) until recovery or escalation of therapy was extremely attractive, and when improved outcomes were reported, their adoption by units across the world increased.

The good points

Ever-expanding indications for ECMO

ECMO was first used in neonatal and paediatric patients mainly for respiratory failure. Later, ECMO found use in supporting adult patients with adult respiratory distress syndrome (ARDS). The indications subsequently widened with their use in cardiogenic shock. In cases of cardiac arrest, extracorporeal cardiopulmonary resuscitation (eCPR) is now the

standard of care—when “routine” cardiopulmonary resuscitation (CPR) does not achieve return of circulation after a specified period.

The incredible true story of an unfortunate young patient who suffered a prolonged period of cardiac arrest requiring eCPR with ECMO and who survived - not only to tell the tale – but also to graduate as a doctor and work in the same very ICU.... bears testimony to the endless possibilities that ECMO can provide.

Support in operation theatres and intensive care units when the operated heart does not “come off” CPB

Varying periods of rest on ECMO have brought many a stunned heart back to fruitful life. A proportion of this subset of patients who would have otherwise succumbed in operation theatre have been given a new “lease” of life—thanks to the hollow fibre microporous oxygenators and centrifugal pumps available in ECMO circuits—which allows prolonged support, much more than the conventional CPB circuits.

Short-term support of circulation in cardiac catheterisation laboratory

In the cardiac catheterisation laboratory, the interventional cardiologists are emboldened to take on more challenging and risky cases for percutaneous interventions (PCI), with circulation supported by ECMO. Electrophysiologists can now work more meticulously on tackling the arrhythmic focus with the comfort that the circulation is being taken care of with the use of short-term ECMO. Short-term ECMO is as efficient as the more expensive alternatives to circulatory support such as the Impella device.

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Bridging therapies with ECMO

ECMO was primarily used as a “bridge to recovery” of the lungs by providing for the oxygen demands of the body, while allowing the lungs to heal. When it became apparent that prolonged support is possible, other “bridging” therapies utilising ECMO soon followed. “Bridging to advanced devices” or “bridging to transplant” showed a ray of hope to people with end-stage heart and lung disease. “Bridging to decision-making” is a recognised practice which is possible with ECMO in cases of prolonged eCPR when there are serious concerns about possible hypoxic brain injury. After allowing for the circulation and gas exchange to stabilise on ECMO and sedation to wear off completely, the neurological status of such patients is assessed. If the neurological injury is found to be irreversible with no prospects of recovery, futile attempts on prolonged ECMO support can be avoided.

The bad aspects

As with any therapy, ECMO comes with its own share of complications which must be dealt with appropriately. This is not the point of discussion here. What really qualifies as a “bad aspect” is the development of a clinical scenario which is a “bridge to nowhere”. Fortunately, this is not a common occurrence. When a patient does not recover fully and cannot be escalated to advanced device or transplant (for various medical reasons), stagnation in patient progress occurs. A stalemate ensues which can be a challenge for all—the patient, family and healthcare providers.

The ugly ones (all for want of “a few dollars more”)

Initiation of ECMO and providing prolonged cardiorespiratory support until recovery, advanced device or transplant comes with a considerable cost. It is just not the cost of disposables which the patient incurs. The costs of continuing care in ICU, blood products, drugs and interventions add to the escalating cost. This life-saving therapy may, thus, not be an option to everyone due to the financial constraints.

Scenario at large

The cost involved is not only at the level of the patient alone. Establishing an ECMO programme requires investment in infrastructure, equipment, ICU, blood banks, different

departments, dialysis machines, laboratories and trained staff, round-the-clock doctors, nurses and perfusionists, and physiotherapists—to name just a few. The costs to the hospitals for setting up a full-fledged ECMO unit are, therefore, not inconsiderable. Globally, despite its increased use, ECMO is not available in all institutions for the above reasons.

The negligible impact of “a fistful of dollars”

Thus, “a fistful of dollars” may only help a patient or two on an individual basis. However, in the grand scheme of things, it fails to make an impact on the provision of healthcare at large. The global burden of cardiovascular [2] and respiratory disease [3, 4] looms large and has increased in recent years. At a global level, it becomes a formidable challenge to narrow the gap between “supply” and “demand”, as far as provision of ECMO services is concerned.

Solution?

On a sobering note, the figures from the global disease burden data are staggering. The pragmatic solution lies in the oft-repeated cliché—“prevention is better than cure”. More attention needs to be directed towards primary and secondary prevention of cardiovascular and respiratory diseases, at both individual and societal levels. Conducting educational and awareness programmes of non-communicable disease starting from schools, colleges, associations and clubs needs to be considered, which in the long run should reap benefits.

On a lighter vein, for those like me, it might be time to discard the TV remote, get off the couch, climb into the walking shoes and venture out for that much-needed brisk walk—not forgetting the mask, of course.

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