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The evolution of adult Extra-Corporeal Membrane Oxygenation (ECMO): An emerging standard of care

A cute Cardio-Respirtory Failure refractory to conventional therapy has been perceived of as a therapeutic exercise in futiluty for over half a century. In the 1950s, Cardio Pulmonary Bypass (CPB) was introduced by Dr. John Gibbon Jr at Thomas Jefferson Hospital in Philadelphia, PA. While the use of CPB for surgical procedures has flourished, important "spin-off" technologies began to be conceived of and considered for use beyond the operating room—hence, Extra-Corporeal Membrane Oxygenation (ECMO). ECMO came into existence approximately four decades ago primarily through the efforts of its pioneers Drs. JD Hill and Robert Bartlett. However painful and disappointing the results were initially (and for several decades thereafter) these investigators and others persisted in the belief that this technology was life-saving and not likely to be discarded. In 1983, only three institutions regularly performed ECMO (Medical College of VA, University of Michigan, and University of Pittsburgh). By 1986, nineteen institutions provided ECMO support for neonates. And by 1989, the Extra-Corporeal Life Support Organization (ELSO) was established. It would take another two decades before ECMO for adults was more formally adopted, particularly for respiratory failure. In 2009, two important events occurred: 1) The CESAR Trial was published and 2) The H1N1 Flu epidemic. The CESAR Trial compared ECMO therapy versus Conventional Ventilatory Support for respiratory failure and showed superior outcomes in the former. At the same time, the treatment for ARDS related to the Flu epidemic also showed improved outcomes with ECMO support. As a result of these findings, rescue ECMO therapy for respiratory failure in a variety of clinical conditions (i.e. pre and post-lung transplant, sepsis etc.) has exploded in popularity. Similar findings began to be observed in the cardiac failure categories, both medical (e.g. AMI-Shock) and surgical (e.g. Post-Cardiotomy Shock).

As of 2014, there are 278 ECMO Centers that are members of and report to the ELSO Organization. The number of cases for calendar year 2014 was 6510! The latest ELSO Registry Data (July 2015) reported that for adults the survival for Respiratory, Cardiac, and E-CPR ECMO were 58%, 42%, and 30% respectively. These results, compared to the outcomes four decades earlier, represent a monumental improvement with every reason to believe that further success is ahead. Among the reasons for continued opimism with ECMO therapy is the progress made in education and technology. With the help of the ELSO Organization, data driven quality measures are being reported and presented at national and international meetings. Every aspect of ECMO application is being critiqued, including patient selection, technical issues, and post-cannulation managment. Furthermore, commercial industry has contributed to marked improvements in the device itself, particularly the pump-oxygenator unit along with the monitoring safeguards that go along with it. Lastly, innovative strategies combining ECMO with other tecnologies -hybrid mechanical support may prove worthwhile in selected cases.

In summary, ECMO in general and Adult ECMO in particular is emerging as something much more than an exercise in futility. It is evolving into a standard of care for acute cardio-respiratory failure refractory to conventional therapies.

Biography

Louis Samuels received his undergraduation education at the University of Rochester in New York and attended Medical School at Hahnemann University in Philadelphia. He completed his General Surgery and Cardiothoracic Surgery training at Hahnemann and joined the faculty in 1995, assuming the Directorship of the Heart Transplant and Ventricular Assist Device Program in 1997. In 2001, along with his team implanted the world's fifth total artificial heart (AbioCor). In 2003, he joined the Main Line Health System at Lankenau Medical Center(Wynnewood) as the Surgical Director of Heart Failure and rose to the rank of Full Professor of Surgery at Thomas Jefferson University School of Medicine (Philadelphia). Since 2009 he has published more than 100 peer-reviewed manuscripts, has participated as Principle or Co-Investigator in numerous Ventricular Assist Device (VAD) trials, serves as the medical monitor for and Clinical Events Committee member of VAD trials, and continues to engage in a busy clinical practice.

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