

# Letter to the Editor: Development and establishment of the ECMO program in the Olomouc region

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Dear Editor,

Extracorporeal membrane oxygenation (ECMO) is a life-saving procedure in various situations of respiratory and cardiac failure. The pivotal role of ECMO is providing a bridge to temporarily insufficient or failing vital organs, maintaining perfusion and oxygenation to all systems and tissues important for the preservation of human life<sup>1</sup>. Connection to ECMO circuit is vital important mainly in scenarios where conventional therapy such as artificial lung ventilation or pharmacological agents supporting the function of the lungs, heart, or peripheral circulation prove insufficient<sup>2</sup>. The history and advancement of ECMO therapy are closely associated with the development of cardiopulmonary bypass (CPB). The first veno-arterial (VA) circuits were used with successful survival of adult patients in the 1970s (ref.<sup>3</sup>). The following years were characterized by the use of VA-ECMO in neonates, mainly for those suffering from acute respiratory failure caused by meconium aspiration and as a circulation support following reconstructions of congenital heart defects. The evolution of oxygenators over the last 30 years has helped to increase the lifespan of the circuits and improve the survival rates. ECMO is now a recommended support treatment for many different situations of cardiorespiratory failure, including its almost routine use in cases of refractory cardiac arrest. The concept of extracorporeal cardiopulmonary resuscitation (ECPR) has already been embedded in the newest resuscitation guidelines<sup>4</sup>.

In this letter, we would like to describe the initiation, development, current status, and future plans of the ECMO program in the Olomouc region.

The ECMO was first used in our region in 2008. A 32-year-old female was connected to the VA-ECMO

circuit due to a fulminant course of viral myocarditis. She concurrently developed lower extremity ischemia and acute renal failure, with the need for continuous renal replacement therapy (CRRT). The patient spent 7 days on VA-ECMO and, after successful weaning, more than four weeks in the hospital until home discharge. Her outcome was excellent, with a Cerebral Performance Score (CPC) 1. The only long-term complication was one-sided peroneal palsy.

Following the first successful use of ECMO in a critically ill patient, our institution performed 15–20 cannulations per annum, with the majority of them being VA-ECMO configurations. Insertion access was mostly percutaneous, using either femoral or axillary arteries. Distal perfusion of the lower extremity has been routinely performed during VA-ECMO use since 2014. Both central and peripheral cannulation sites were used, with a predominance of peripheral access. In 2017, our team began employing passive venting of the left ventricle and also using the VAV-ECMO configuration.

A very important milestone was achieved in 2018, when our center launched the extracorporeal cardiopulmonary resuscitation (ECPR) program. Selected patients with out-of-hospital and in-hospital cardiac arrest and prolonged return of spontaneous circulation (ROSC) were percutaneously cannulated and connected to VA-ECMO circuits in the Emergency Department (ED) or on the beds of the Intensive Care Unit (ICU). Their standard pathway was also established, including early selective coronary angiography and percutaneous coronary intervention<sup>5</sup>.

Further development of the ECMO program was closely associated with the outbreak of the COVID-19

**Table 1.** ECMO support during the period of the COVID-19 pandemic.

| Year | VV-ECMO total (n, %) | VV-ECMO COVID-19 (n, %) | VA-ECMO (n, %) | ECMO total (n) |
|------|----------------------|-------------------------|----------------|----------------|
| 2020 | 19 (55.9)            | 17 (50)                 | 15 (44.1)      | 34             |
| 2021 | 26 (53.1)            | 23 (46.9)               | 23 (46.9)      | 49             |
| 2022 | 3 (18.8)             | 2 (12.5)                | 13 (81.2)      | 16             |

pandemic<sup>6</sup>. Close cooperation of cardiovascular surgeons with intensive care physicians entailed significant growth of procedures, mainly VV-ECMO configurations for the support of oxygenation in cases of acute respiratory failure (Table 1). The COVID-19 pandemic also brought new clinical challenges to our intensive care practice, such as concurrent use of VV-ECMO in patients in semi-prone or prone positions, and transport of these critically ill persons between different departments of the hospital<sup>7,8</sup>.

Following the termination of the COVID-19 pandemic, the ECMO program moved to another dimension. Approximately 25–35 patients per annum are referred to the center either from our institution or from other district or private hospitals in the entire Olomouc region. The distribution between VV and VA configurations is more equal; we have established clear indications for ECPR initiation and widened the spectrum of indications. Currently, not only cardiac failure, respiratory failure, and cardiac arrest are the indications for ECMO support, but also various types of life-threatening poisonings or distributive shock due to sepsis or anaphylaxis may be considered. ECMO support can be supplemented with left-heart mechanical support, such as Impella CP or Impella 5.5, in indicated cases. Most ECMO cannulations are performed by an intensive care physician in close cooperation with a cardiac surgeon, predominantly in the ED, Catheterization Laboratory (Cath Lab), or ICU. Locally adapted guidelines are available for all types of ECMO configurations. Recently, we have also established the ECMO Mobile Retrieval Team, which should be able to initiate ECMO support in the near future outside of the hospital directly at the site of a life-threatening event.

All patients treated with ECMO at our institution are hospitalized in the intensive care units. Those with the diagnosis of cardiac arrest (ECPR) or shock conditions of various etiology are treated in the general ICU. Patients with acute heart failure after cardiac surgical procedures are hospitalized in the cardiac ICU. A multidisciplinary team involving an intensive care physician, perfusionist, cardiac surgeon, cardiologist, and specialized ICU nurses is caring for these patients. A qualified perfusionist is available 24/7.

Outcome data from our ECMO program are recorded in the registry and subsequently analyzed regarding in-hospital survival, 30-day survival, complications, and quality of life after discharge from hospital facilities. A special outpatient clinic following ECMO patients after discharge home at regular intervals (1 month, 3 months, 6 months, 1 year) was established in early 2026 and started its activity in April.

In conclusion, 282 patients have received ECMO support from 2008 to date, including 191 with a VA-ECMO configuration and 91 with a VV-ECMO circuit. The one-month survival rate was 49.6% in the VA-ECMO group, with 35.8% survival at one year. In the VV-ECMO group, 61.3% of patients survived one month, and 41.9% of them achieved survival for a one-year period<sup>7</sup>. In total, 40 patients have been treated with ECMO after cardiac arrest within the program of ECPR since 2018. Their one-year survival was 41.6% in the subgroup of patients with in-hos-

pital cardiac arrest (IHCA) and 33.3% in out-of-hospital cardiac arrest (OHCA), respectively<sup>9</sup>. The outcomes of the Olomouc ECMO program are comparable with contemporary ELSO registry data and with results reported by other high-volume Czech ECMO centers. One-month survival was 49.6% in VA-ECMO and 61.3% in VV-ECMO patients, while one-year survival after ECPR was 41.6% for IHCA and 33.3% for OHCA, corresponding to outcomes reported in international registries and recent Czech ECPR cohorts. Unfortunately, detailed neurological follow-up data were not available for all patients in the present cohort, precluding direct comparison with studies reporting functional and neurological outcomes after ECPR.

The observed survival rates are comparable with contemporary ELSO registry data and outcomes reported by other Czech ECMO centers. According to the most recent ELSO Registry data<sup>10</sup>, survival to hospital discharge or transfer is approximately 50% among adult patients supported with VA-ECMO for cardiac indications, whereas patients undergoing ECPR achieve survival rates of approximately 31%. In the Prague OHCA randomized controlled trial, Bělohávek et al.<sup>11</sup> demonstrated 180-day survival with favorable neurological outcome in 31.5% of patients treated with ECPR, while neurological recovery at 30 days was observed in 30.6% of patients. Similarly, in a recent study of the University Hospital Ostrava, Burša et al.<sup>12</sup> reported a survival-to-discharge rate of 39.1% among patients with refractory OHCA treated with ECPR, while 29.0% of patients achieved 30-day survival with favorable neurological outcome (CPC 1–2) and full independence. The six-month survival rate was 33.3%, with 10.1% of patients returning to work. Our one-year survival rate of 33.3% in OHCA patients is consistent with these findings and further supports the effectiveness of ECPR in carefully selected patients.

Regarding outcomes of VV-ECMO in patients with severe respiratory failure, the ELSO Registry reports a survival-to-discharge or transfer rate of approximately 58% (ref.<sup>10</sup>). In a review published by Burša et al. in 2023 (ref.<sup>13</sup>), mortality among patients with acute respiratory distress syndrome (ARDS) treated with and without ECMO was compared across six studies. Reported mortality rates in ECMO-treated cohorts ranged from 26% to 37%, suggesting a potential survival benefit in selected patients with severe respiratory failure. Furthermore, in a single-center study conducted by Dinh et al.<sup>14</sup> during the COVID-19 pandemic (2020–2022), 90-day survival was achieved in 48.8% of patients supported with VV-ECMO. Our results, demonstrating a one-month survival of 61.3% among VV-ECMO patients, are therefore comparable with outcomes reported in contemporary international literature.

Despite functioning primarily as a regional referral program, our center has achieved results within the range reported by experienced high-volume institutions, supporting the role of regional ECMO networks in delivering advanced cardiorespiratory support. Given the expanding indications for extracorporeal support and increasing awareness of its potential benefits, the number of patients

considered for ECMO therapy is expected to rise in the coming years. Continuous development of the regional ECMO program will therefore be essential to ensure timely access to this advanced life-support modality.

The plans for the near future include the development of a mobile ECMO retrieval team equipped with dedicated ambulance vehicles, enabling routine prehospital initiation of ECPR and early extracorporeal support in selected patients. However, successful implementation of this strategy will require additional resources, including specialized personnel, continuous multidisciplinary training, close integration with regional emergency medical services and ongoing evaluation of clinical outcomes and cost-effectiveness.

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