



## EDITORIAL

## The ProtekDuo cannula for extracorporeal membrane oxygenation: A game changer in COVID-19!

The ProtekDuo is a single site, dual lumen cannula that may be used in a multitude of configurations.<sup>1</sup> It was initially designed as right ventricular assist device (RVAD) cannula that comes in conjunction with the TandemHeart pump (LivaNova PLC, London, UK). It has also been described as RVAD with oxygenator, left ventricular assist device (LVAD), biventricular assist device when combined with LVAD's, as double lumen drainage cannula for cardiopulmonary bypass, and in various extracorporeal membrane oxygenation (ECMO) configurations with veno-pulmonary (V-P) as its default position.<sup>1</sup> As the onset of the COVID 19 pandemic produced much longer ECMO run times than physicians were accustomed to, the incidence of right heart failure increased as a logic consequence and the ProtekDuo was used more frequently as RVAD with oxygenator even as primary device to initiate ECMO.<sup>2</sup> According to a systematic review of 28 observational studies including 4218 COVID-19 patients performed by Mariani et al., the use of mechanical circulatory support (MCS) for cardiocirculatory compromise has been reported only in 7.3% of COVID-19 patients requiring extracorporeal life support, which is a lower percentage compared to the incidence of any severe cardiocirculatory complication.<sup>3</sup>

In the current issue of *Artificial Organs*, Durham and colleagues presented their institutions' outcomes on ECMO in acute respiratory distress syndrome (ARDS) across multiple waves of the COVID-19 pandemic.<sup>2</sup> The authors demonstrated the benefits of the ProtekDuo cannula providing V-P ECMO in comparison to veno-venous (V-V) ECMO. The total in-hospital mortality was 42.6% (39.5% V-P ECMO, 50.0% V-V ECMO). Cumulative mortality 120-days post-cannulation was 45.7% (V-V ECMO 60.8%, V-P ECMO 40.0%).<sup>2</sup> Due to these data and benefit from configuration change, cardiocirculatory compromise might be underestimated in COVID-19, as well as presumably MCS. This significant survival benefit in the reported literature is underscored by the study of Cain and colleagues in patients with ARDS secondary to COVID-19 infection.<sup>4</sup> The authors compared patients either undergoing V-P ECMO (18 patients) or invasive mechanical

ventilation (IMV, 21 patients) without ECMO support. The in-hospital (52.4% vs. 11.1%,  $p = 0.008$ ) and 30-day mortality (42.9% vs. 5.6%,  $p = 0.011$ ), as well as the incidence in acute kidney injury (AKI,  $p < 0.001$ ), was significantly lower in the V-P ECMO group.<sup>4</sup> In addition, Tatoes et al. demonstrated a 73% discharge rate, and a low mortality of 15% with their retrospective study of 40 patients on V-P ECMO with early extubation.<sup>5</sup> Saeed and colleagues recently presented a retrospective multicenter trial including 435 patients with COVID-19 ARDS. The major finding of this study was an in-hospital mortality of 60% for patients who had dual site ECMO compared to 41% for patients with a ProtekDuo.<sup>6</sup>

The benefits of the ProtekDuo cannula appear to come from its default V-P position with drainage of venous blood in the right atrium (RA, inflow or proximal lumen) and return of arterialized blood into the pulmonary artery (P, outflow or distal lumen), when an oxygenator is added to the circuit. By bypassing the right ventricle (RV) it serves as both RVAD and as double lumen ECMO cannula. Considering the diameter and length of the distal lumen, an average blood flow of 4.5 LPM may be achieved. This is a sufficient flow when considering that two cardiac valves are in between both cannula openings and prevent recirculation. In rare cases of high body mass index however, flow and oxygenation may not be sufficient. Maybauer et al. recently published a novel method of veno-venopulmonary (V-VP) ECMO configuration, facilitating 7 LPM blood flow when using the ProtekDuo as double lumen return cannula, which resulted in significant increase in flow and oxygenation.<sup>7</sup> In this method, a 25 Fr multistage drainage cannula was inserted in a femoral vein leading blood through the oxygenator. Blood was returned to the patient by splicing the return tubing, using a Y-piece to flow blood through both lumen of the ProtekDuo. This method still provides reduced RV blood flow by about 40% and was sufficient offloading the RV in this patient.<sup>7</sup>

At the present time, ECMO management with the ProtekDuo cannula appears to reduce mortality, AKI and length of the ECMO run. As such it is a game changer in

the setting of ECMO in COVID-19 patients suffering from ARDS and may be recommended for initial use in these patients. However, prospective trials are necessary to determine its overall efficacy and outcome.

### CONFLICT OF INTEREST

Prof. Dr. Lorusso is a consultant for Medtronic, Getinge and LivaNova and medical advisory board member for EUROSETS, all unrelated to this work; all honoraria to the university for research funding. The remaining authors declare that they have no competing interests.

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