Editorial

Infection and colonisation in V-V ECMO—not a predictor of poor outcome

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In patients suffering from most sever acute respiratory failure the use of veno-venous extracorporeal membrane oxygenation (V-V ECMO) has become a widely accepted treatment option. Despite improvements in patient management and technical devices mortality in adult patients receiving V-V ECMO is still high (1). Beside the underlying disease accountable for the need of V-V ECMO, treatment complications of the therapy add to morbidity and mortality. The most frequent complications associated with V-V ECMO treatment are bleeding, thrombosis and infections (2,3).

Most patients in need for V-V ECMO are suffering from infections such as pneumonia and sepsis initially, however nosocomial infections further increase mortality in this patient population. In patients on intensive care mortality is known to be increased due to infected central lines (4). To impede catheter related infections, changing of central lines is considered with the occurrence of new signs of infection. In patients on V-V ECMO, changing the cannulas is not feasible due to the high risk of potentially lethal complications and limited venous access.

In pediatric cohorts blood stream infection during ECMO support was associated with increased mortality, whereas such an association could not be demonstrated in the adult population (5). Two recent studies, one by Kutlesa *et al.* (6) and the other by Thomas *et al.* (7) addressed the device related infection rate and the blood stream infection in patients on V-V ECMO.

Kutlesa *et al.* included 100 patients from 2009 to 2016. Nosocomial blood stream infection was defined as positive blood culture 48 hours after ICU admission (≥1 in gram negative, ≥2 in gram positive bacteria). Nosocomial infection was detected in 35%, mostly *Acinetobacter baumannii*, according to local epidemiology. Higher infection rates were seen in patients with more than 250 hours on ECMO and in patients who suffered from hemorrhage. An association between bloodstream infection and mortality could not be demonstrated in the current analysis.

The single center study by Kutlesa and colleagues has some limitations. Time point and frequency of screening for blood stream infection are not well defined. The most frequent pathogen detected was *Acinetobacter baumannii*, a multi-resistant germ, which is not as common in other centers. Further, most of the patients included were already on antibiotics, probably leading to limited detection rates, ECMO cannula tip cultures have not been collected and site of infection was only presumed.

The second study by Thomas *et al.*, is also a prospective single center study focusing on infections of the V-V ECMO circuit. The study reports on 103 ECMO runs and a very thoroughly screening methodology was used at

the time point of ECMO removal. Thomas and colleagues collected blood cultures from the central venous catheter, arterial catheter and post-membrane oxygenator. Skin swaps have been sampled at both cannulation sites and cannula tips have been cultured. Primary end points of this study were infection and colonisations of ECMO device at the time of ECMO removal. Main results of this study are an ECMO device infection rate of 9.7% and a colonisation rate of 32%. No differences have been observed between infected and uninfected ECMO devices with respect to ICU length of stay and in-hospital mortality. Limitations of the presented study are that there is no consensus on the definition of ECMO circuit infection, most patients have received antibiotics and the focus was set on the end of the ECMO treatment and infections during the ECMO run have not been reported.

The Extracorporeal Life Support Organisation (ELSO) reported an incidence of 11.7% ECMO infections in 2011 (8) this is in line with the finding of Thomas at al., the 35% by Kutlesa *et al.*, succeed this number. In comparison to bloodstream infection studies in patients on veno-arterial ECMO the infection rates in V-V ECMO seem to be higher (9). Reason for this might be longer ECMO treatment in V-V compared to V-A populations and the fact that V-V patients often have infectious diseases as the underlying disease.

The most evident problem in assessing device related infection remains the definition and the detection of infection. Most often distinguishing between pathogenic infection and colonisation is difficult to interpret. Detection of infection in patients on ECMO is hampered by assessing blood cultures when the patient is already on antibiotics. The fact that both presented studies did not observe a higher mortality due to ECMO device infections is promising in regard to treatment strategies. However, both studies also reported an association with longer ECMO duration and positive microbial cultures at any time point. Unpublished results from the ECMO center Regensburg are in line with the presented study in regard to increasing risk of infection over time and no influence on outcome. However, at our center we found ECMO patients with aspergillus, cytomegalovirus and pneumocystis jirovecii infection to be associated with higher mortality.

Patients receiving V-V ECMO treatment are at high risk of nosocomial infections. Even though the presented results do not show an influence on outcome or ICU length of stay any acquired infection is a complication and our aim should be to reduce these ECMO related infections. At present it should be recommended to check cannulation sites for any signs of infection on a daily basis, regularly use biomarkers (white blood cell count, C-reactive protein and procalcitonin) to monitor systemic infection signs and use antimicrobial treatments as appropriate. Duration of V-V ECMO runs should be aimed to be as short as feasible and clinicians should always be aware of associated risks during ECMO runs.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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