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Commentary: Quo vadis ex vivo lung perfusion—regionalization or centralization?

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CENTRAL MESSAGE

Regionalization and centralization will both play a role in the future of EVLP.

I read with great interest the article "Human Organ Repair Centers: Fact or Fiction?" published by Dr Keshavjee in the latest issue of the *JTCVS Open*.[1] This work provides a comprehensive summary of the current state of ex vivo lung perfusion (EVLP) and proposes a centralized organizational structure for organ-repair facilities.

EVLP is applied by an increasing number of lung transplant programs worldwide, and there is no doubt that this technique will be further exploited. In my opinion, the 2 key applications of EVLP are (1) optimizing organ preservation and thus prolonging preservation time and (2) serving as a platform for organ repair.

Limited preservation time remains one of the unsolved problems in clinical lung transplantation. With currently available preservation techniques, lungs can be maintained viable outside the body for only 6 to 8 hours without jeopardizing graft function.[2] The potential of EVLP to overcome this tight time frame has been highlighted in an analysis from the Toronto group showing that preservation times of >12 hours can be reached safely with EVLP.[3] A fascinating outlook of current limits was given by the Zurich liver transplant team, where preservation times of 1 week were reached by normothermic ex vivo perfusion in a study on human livers.[4] This certainly raises the question if lung transplantation will eventually become an elective procedure. Standardized perfusion protocols are currently developed aiming to maintain grafts stable for an extended period of time. Using EVLP to prolong organ-preservation times implies that it is done on a regional level, at the site of implantation.

The concept of using EVLP as a platform to resuscitate primarily unacceptable grafts opens a whole field of thrilling, new applications. Apart from structural parenchymal changes (ie, emphysema or fibrosis), almost all quality flaws of donor lungs are potentially reversible. This, however, requires an individual approach according to the needs of each organ: grafts that are primarily edematous might be treated by high-oncotic perfusion solutions,[5] organs with signs of pneumonia might need high-dose antibiotic treatment,[6] hepatitis C virus–positive grafts could be sterilized during EVLP,[7] pulmonary embolism could be treated by fibrinolytic drugs,[8] et cetera.

I foresee that only a limited number of high-volume facilities will develop sufficient expertise in lung repair and offer it to a network of surrounding referral centers. Such a centralization will facilitate smaller lung transplant programs to use marginal grafts and expand their local donor pool without the need of spending significant resources in maintaining their own organ-repair platform. A prerequisite for a centralized organ-repair concept is a clear definition, which quality criteria a graft has to fulfill after EVLP. These criteria have to go beyond mere reporting of Pao_2/Fio_2 ratios but include real-time testing of the grade of parenchymal damage as well as the true functional reserve of an organ.

In conclusion, I believe that the future of EVLP will be characterized by both—regionalization and centralization. Plug-and-play perfusion machines using highly standardized perfusion protocols will improve organ preservation

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on a regional level. The requirements for an organ repair facility, however, can only be provided by a supra-regional, centralized approach.

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