Towards a better understanding of ex vivo lung perfusion

Clemens Aigner* and Alexis Slama

Department of Thoracic Surgery, Medical University of Vienna, Vienna, Austria

* Corresponding author. Department of Thoracic Surgery, Medical University of Vienna, 1090 Vienna, Austria. Tel: +43-1-404005620; fax: +43-1-404005640; e-mail: clemens.aigner@meduniwien.ac.at (C. Aigner).

Keywords: Ex vivo lung perfusion • Ex vivo lung evaluation • Ex vivo reconditioning • Lung transplantation

Ex vivo lung perfusion (EVLP) is probably the most promising technique currently available to substantially increase the number of acceptable donor lungs and to improve the outcome after lung transplantation. Several ongoing prospective single and multicentre trials are currently investigating the potential and the individual advantages of different platforms available for EVLP.

So far, a number of centres have published their individual experiences with EVLP for reassessment and reconditioning of initially unacceptable donor organs. These reports uniformly confirm that short- and mid-term outcome of recipients receiving lungs after EVLP are comparable with those receiving standard donor lungs during the same observation period. This issue of the "EJCTS" adds two papers on institutional experiences with EVLP to the existing literature. These papers originate from departments with substantially different backgrounds and nicely illustrate some important issues in the development of EVLP programmes. Both centres are using the Toronto technique with acellular Steen Solution [1]. The Foch group reports their results from April 2011 to May 2013. During this time frame, 81 standard double-lung transplants were compared with 31 transplants after EVLP, while 19 high-urgency procedures were excluded [2]. The study was conducted on a national basis in France and 32 of 53 grafts rejected by all other French transplant centres were accepted for EVLP. The outcomes of EVLP and standard donor lung recipients were comparable in all aspects. Furthermore, the introduction of EVLP led to an impressive decrease in waiting time by 60%. A striking feature in this study is that, once accepting the lung into the study, no further efforts to improve or reassess gas exchange within the donor or during the procurement procedure were made. This most likely had an influence on the high conversion rate (96%) after EVLP. An additional evaluation during the procurement procedure should be performed on a routine basis and might avoid the necessity for reassessment by EVLP. In contrast to other centres, the Foch group already takes the final decision on acceptance after 2 h of EVLP. In our experience, truly borderline lungs can be more accurately judged by the development of functional values over time rather than by a single measurement reaching a predefined threshold value.

The second paper comes from the smaller centre in Turin and reports on the results of 28 standard lung transplants compared with 8 lungs transplanted after EVLP during a similar observation period from July 2011 to February 2013 [3]. In their experience, the conversion rate after EVLP was 72.7% (8/11). Again no significant differences between the groups were observed in terms of clinical outcome parameters, even though the reported primary graft dysfunction (PGD) rate substantially from the Foch group. This paper nicely illustrates that, even in departments with a relatively low number of lung transplant procedures, the logistical barriers of implementing an EVLP programme can be overcome. In Turin, the number of transplantations was raised by 29% due to the implementation of EVLP. In smaller centres, the relative increase of transplantable donor lungs might even be higher than in larger centres.

Beyond reassessment and reconditioning of initially unacceptable donor organs, the role of EVLP in the preservation of standard donor lungs is currently intensively investigated. A prospective randomized clinical trial assessing a potential benefit of EVLP according to the Toronto protocol in standard donor lungs has been suggested in the discussion of the Turin paper. Such a trial is ongoing in Vienna since October 2013.

Additionally, all multicentre trials investigating the different EVLP platforms are listed in the review article from the Newcastle group [4]. This comprehensive overview outlines in detail the development, current knowledge, unsolved questions and potential future directions of EVLP.

It might be critically seen that some current trials and some of the recent publications are to a certain extent driven by the competition of different commercially available EVLP platforms. Until now, a thorough scientific evaluation of some differences in the available systems and perfusion strategies is still missing. Furthermore, the best parameters to assess outcome after EVLP are yet to be defined. The frequently used PGD score seems to be a weak measurement in non-blinded trials as the classification of PDG 0 or 3 might depend on the subjective interpretation of a chest X-ray, e.g. in a patient with a P/F ratio of 199.

Even though many questions remain to be solved, EVLP is an exciting tool to increase the number of available donor lungs. The role in the procurement of standard donor lungs will become clearer within the next months when the results of multiple ongoing prospective randomized trials are available. Given the intensity...
of current research, a range of therapeutic interventions might become realistic once longer perfusion periods can be achieved.

REFERENCES


