

• The outline of lung transplant

Lung transplantation is an important mode of therapy for patients with a variety of end-stage lung diseases. The most common diseases that lead to lung transplant are chronic obstructive pulmonary disease, interstitial lung disease, cystic fibrosis, alpha-1 antitrypsin deficiency, and idiopathic pulmonary hypertension.

The qualification for recipient includes consideration of the severity of the underlying lung disease, likelihood of benefit from lung transplantation, presence of comorbid diseases, age of the candidate, ability to participate in an exercise program, nutritional status, psychosocial support and so on. On the other hand, the donor ideally should have good lung function (P/F ratio > about 300, no pulmonary edema on chest radiograph, and PEEP = about 5 cm H₂O).

If these conditions are matched, transplant surgery is scheduled and carried out.

Four types of transplant procedures are generally available. [1] Single lung transplantation (SLT) [2] Bilateral lung transplantation (BLT)

[3] Transplantation of lobes from living related donors [4] Heart-lung transplantation (HLT) . Before perfusion of the transplanted lung, immunosuppression is begun with loading doses of cyclosporine or azathioprine and methylprednisolone. Postoperatively, the three-drug maintenance regimen is begun, using cyclosporine or tacrolimus, azathioprine or mycophenolate mofetil, and prednisone.

Just after the surgery, ischemia-reperfusion injury(IR injury) is the main cause of primary graft dysfunction. Inhaled nitric oxide (iNO) and extracorporeal membrane oxygenation (ECMO) may be useful in the management of severe cases of ischemia-reperfusion injury.

Lung function improves over the first three to six months after transplant and is then stable. Transbronchial lung biopsy is a safe and effective method for identifying acute rejection and infection. Routine surveillance transbronchial biopsy is carried out about once a month for the first three months after transplantation.

After the first year, bronchiolitis obliterans syndrome(BOS) and restrictive allograft syndrome (RAS) is the main cause of the chronic lung dysfunction. BOS is especially the serious complication because the incidence of BOS approaches 50% within 5 years of transplant, and survival 5 years after the onset of BOS is only 30%~40%.

• The characteristic problems of lung transplantation

The number of lung transplantation is lower than other organ transplantation because of its low procurement rates from deceased donors. In fact, Lungs are

harvested from only 15 percent of all deceased donors, while kidneys and livers are harvested from 88 percent and hearts from 30 percent of deceased donors. This disparity is likely due to the lung's vulnerability to potential complications that often arise before and after donor brain death such as thoracic trauma, aspiration, ventilator associated lung injury, pneumonia, and lung edema.

Moreover, the survival after lung transplantation is too short compared with other organ transplantation. The median survival for all adult recipients is 5.7 years, whereas the median survival for adult and pediatric heart transplants performed between 1982 and June 2013 was 11 years. This is because the lung graft is vulnerable to the complications such as ARDS, RAS, and BOS.

• ex vivo



In order to improve the quality of the graft and prevent the complications such as lung edema and IR injury, ex vivo lung perfusion is being explored. Ex vivo is the devise which create the living body like environment outside of the living body. Actually studies suggest that ex vivo lung perfusion and

reconditioning may ameliorate lung injury in some cases and allow transplantation from donors previously deemed unsuitable.

In UPMC, ex vivo is also used for the research of the complications, especially BOS. BOS is chronic lung allograft dysfunction and is one of the main cause of mortality after lung transplant. The researchers try various surgery ways with ex vivo and injured grafts and check out how the lung cells get injured. If we can find out the way to cure or prevent this complication, the survival after lung transplant will improve extremely.