Operative technique

Operative technique

Coordination between the retrieval team and the implanting team is of paramount importance to minimise ischaemic time and the duration of cardiopulmonary bypass. A median sternotomy incision is performed and the aorta, SVC and IVC are encircled. After heparin administration the to establish cardiopulmonary bypass. Blood is drained from the ca vae into a reservoir, then oxygenated, cooled to 32°C and returned via a roller pump to the ascending aorta to perfuse the bod y while the heart is excised and the transplant performed (Figure 92.4). Carbon dioxide is insu ffl ated into the pericardial cavity to reduce the risk of air embolism. When the donor heart arrives in the operating theatre, the recipient aorta is cross-clamped and the heart excised by dividing the SVC, IVC, aorta and pulmonary artery . The left atrium is incised, leaving a cu ff of atrium into which the f our pulmonary veins drain. After administering a dose of cardioplegia to the donor heart, the left atrial cu ff is anastomosed, followed by the pulmo - nary artery , aorta and both cavae. Donor and recipient vessels are trimmed to obtain a perfect match in ter ms of length and width. A vent is placed in the ascending aorta for de-airing and the cross-clamp is removed, allowing reperfusion of the heart (Figure 92.5). Steroids are usually administered to reduce rejection. Sinus rh ythm is usually restored but temporary pacing wires are sutured to the heart for heart rate control. After a period of reperfusion (20 minutes for each hour of ischaemic time) to allow myocardial r ecovery , the new heart can be separated from cardiopulmonary bypass gradually , until it has taken over the circulation. Nitric oxide is useful at this stage to reduce pulmonary vascular resistance and protect the right ventricle from dysfunction. Isoprenaline is commonly infused. A transoesophageal echocardiogram can help to assess biventricular function and valvular competence.

Oxygenator Right atrium Reservoir Figure 92.4 Cardiopulmonary bypass is used in heart transplantation and sometimes in lung transplantation. Blood is

drained from cannulae in the superior and inferior venae cavae to a reservoir, then oxygenated in a membrane oxygenator before return to the ascending aorta via a roller or centrifugal pump. The patient can have their circulation maintained with oxygenated blood while the heart or lungs are explanted during transplantation.

Operative technique

The decision as to whether to use extracorporeal support during the transplant in the form of cardiopulmonary bypass or ECMO during bilateral lung transplantation varies with institutional experience, intraoperative stability and patient selection. Cannulation can be achieved either within the thorax or peripherally via the femoral vessels. A clamshell thoracotomy incision (Figure 92.8) through the fourth or fifth intercostal space is often favoured with divi sion of the sternum, but the procedure may also be performed using separate bila teral sternum-sparing anterior thoracoto mies or via median sternotomy . After opening both pleurae the pericardium is opened in preparation for central cannulation and to aid with hilar dis section and r etraction of the heart. There are often significant adhesions in the pleural spaces that need dissection, although care not to injure the phrenic or vagus nerv es should be exer cised. If an elective decision is made for cardiopulmonary bypass or ECMO, heparin is administered and aortic/femoral artery Victor Satinsky , 1912–1997, American cardiovascular surgeon and co-creator of coronary bypass sur right atrial (direct or via the femoral vein) cannulation for venous drainage. Extracorporeal support is generally avoided where possible owing to increased b leeding and an association with ischaemia–reperfusion injury . After releasing the inferior pulmonary ligament, hilar dis - section is

carried out and pneumonectomy performed by divi - sion of the bronchus, pulmonary artery and both pulmonary veins. A large Satinsky clamp is placed across the left atrium and the individual pulmonary veins are opened and connected, creating a recipient cu ff for anastomosis. Recipient lung bronchial secr etions are sent for microbiol - ogy and the hilum is prepared by circumferentially opening the pericardium to mobilise the left atrium and pulmonary artery . Mediastinal lymph nodes may need excision to facilitate the transplant. Bronchial arteries are ligated to prevent significant b leeding. Denudation of the recipient bronchus should be avoided to limit local ischaemia at the site of the anastomosis. The pleural space is then liberally irrigated with antibiotic or aseptic solutions. The donor lungs are prepared for implantation by obtain - ing bronchial cultures for microbiology and dissecting the bronchus, pulmonary arteries and the left atrial cu ff , into which the two pulmonary veins drain. Importantly the donor bronchus should be cut short just one or two rings from the - bifurcation into the upper and lo wer lobe bronchi to minimise ischaemia at the anastomosis. The implantation is then conducted by sequentially cre - ating anastomoses between the bronchus, the left atrial cu ff of the donor lung and the left atrium of the recipient and the pulmonary artery (Figure 92.9). Prior to reperfusion, 500 /uni00A0 mg of intravenous methylprednisolone is administer ed. The pulmonary artery clamp is removed slowly to lessen reperfusion injury and blood is permitted to escape from the left atrial suture line to de-air the vasculature before the left atrial clamp is opened. After a period of ventilation on a lo w inspired oxygen con - centration to reduce oxygen free radical release, the patient is ventilated and weaned from cardiopulmonary bypass or - - - - gery .

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Bronchus Recipient left atrium Pulmonary artery Donor pulmonary vein Figure 92.9 Hilum of the lung during lung transplantation. A left atrial cuff is fashioned into which the donor pulmonary veins drain. This is anastomosed to the left atrium of

the recipient. The bronchus has been anastomosed already and the pulmonary artery is to be con

nected next.

phy is used to check de-airing and the patency of the vascular anastomoses. There has been a growing trend in the use of living related lobar lung transplantation for small recipients, especially in restrictive lung disease with low intrathoracic lung volume with two relatives each undergoing lower lobectomy . Results in a limited number of centres have been good but must be balanced against the risk of complications or death in the two donors. Alternatively larger donor lungs can be reduced in size through multiple wedge resections and right middle lobectomy . With this technique, variable outcomes have been reported when using o versized donor lungs with donor–recipient size mismatch.

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