Operative Techniques in
Thoracic and
Cardiovascular Surgery

Heart Transplantation: Donor Operation for Heart and Lung Transplantation

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Procurement of thoracic organs in anticipation of subsequent heart and lung transplantation is often a second thought to most surgeons, lacking the dramatic environment associated with implantation and the resulting resumption of normalized function. However, transplant surgeons recognize that this first technical intervention begins a critical and time-sensitive cascade that is very much dependent on the precise, timely, and accurate actions of the transient organ preservation and anatomic dissection/resection. Added complexity is the need for a solid understanding of the needs of each transplanting cardiothoracic team by the other (heart, lung) to coordinate the preservation and allocate tissue margins fairly. Poor preservation at the time of procurement can lead to early graft dysfunction, or more critically, graft failure following implantation. Dissection between the organs being procured has several points that have a very small margin for error. A surgeon's lack of understanding of this aspect of the operation can severely and adversely impact the implantation of all thoracic organs and has led to the unplanned discard of thoracic organs following inattention to anatomic landmarks and intrusion into critical organ structures.

When first arriving at a center for planned thoracic organ procurement, there is a critical list of confirmations and verifications that must occur. Before beginning any clinical assessment, the donor must be properly identified using their United Network for Organ Sharing donor-specific ID as well as a second unique identifier, and then the ABO compatibility of the donor and recipient must be documented. Subsequently, the collection of donor-specific documentation must be reviewed to assure that the donor has met the local definition of brain death (if not donation after cardiac death [DCD]) and that appropriate consent for all specific thoracic organs and tissues has been obtained. Furthermore, the surgeon must carefully review the health information and data to assure that no previously unreported health issues (infectious disease, high-risk behavior, other relevant medical findings) are noted in the donor's information packet or were unappreciated by the local Organ Procurement Organization representative.

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Immediately after completing the administrative duties of the procurement surgeon, the clinical status of the donor must be assessed, including current interventions and changes since the accepting thoracic team last reviewed the clinical data. Often the unique physiology of the organ donor is not fully appreciated by all members of the care team. Many procurements occur at smaller facilities or locations that do not frequently care for the organ donor. Fluid management and appropriate use and dose of cardiovascular agents must be discussed with the local providers to maintain stability and avoid potential complications. Hemodynamic monitoring should be continued in the OR, including blood pressure, central filling pressures, pulmonary artery monitoring (if available). Vasoactive medications should be titrated to maintain a normal mean arterial pressure, and overhydration should be avoided. Ventilation should provide 10 mL per kilogram with FiO_2 maintained at, or below, 0.50 if possible. Positive end-expiratory pressure (PEEP) should be continued at 5 to 8 mm Hg, and if the patient is taken off the vent, brief recruitment should occur. Coordination with the OR nursing staff about specific instrument needs and unique setup or orientation to your team's specific profusion arrangement should occur shortly after arriving in the OR.

Many abdominal transplant centers have protocols for donors that involve agents that may not be appropriate in the setting of thoracic organ procurement. Discussion of all planned interventions, use of protocols, and/or specific medications should be discussed before initiating the operation. Furthermore, clarification about the status of each of the intended recipients is important before initiating any operative intervention. In this age, many recipients have undergone previous surgery and it should be anticipated that additional time will be required for the implanting surgeon to provide adequate exposure for the intended implant. Most thoracic transplant surgeons prefer to delay induction of anesthesia for their recipients until the procurement surgeon has confirmed the appropriateness of the donor. This lowers the potential risk to the recipient but creates a need for subsequent time that must be understood, communicated, and coordinated by their procurement team. This in turn impacts each of the other procurement teams and their recipients. Good communication between all procurement teams can minimize donor organ ischemic time, lower the risk of a donor becoming unstable if open but "waiting," and is, frankly, polite.

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The heart procurement surgeon should personally review the echocardiogram and coronary arteriogram. Although mild valvular disease and ventricular hypertrophy are not clinically significant in most patients, they can have a very important impact in terms of heart transplantation. Hypertrophy in the ventricle makes tissue preservation more difficult and postimplant function can be markedly reduced both from poor tissue preservation as well as from increased diastolic dysfunction due to tissue ischemia during preservation and transportation. Mild coronary artery disease is rarely clinically significant in the average patient. However, the milieu following transplantation promotes early and relatively rapid atherosclerotic coronary artery disease. As such, even "mild" disease may be appreciated in a more cautious manner by a transplant surgeon when considering the intended recipient.

The lung procurement surgeon should personally review all the chest imaging studies, check the most recent blood gas, and perform a flexible bronchoscopy to assure the airway is free of significant airway secretions and is not unduly inflamed or edematous and that there is no anatomic variation that could limit surgical implantation. One common mistake in evaluation of lungs for transplantation is confusing consolidation on imaging for infection rather than atelectasis. Bronchoscopy in the hands of an experienced surgeon can differentiate minor airway plugging, mucus from the upper airway, and purulent secretions that might be associated with a true lobar process. Anatomic variations are reportedly uncommon but it is our experience that they seem to be far too common when evaluating a donor. Nonsurgeons do not evaluate airway anatomy in terms of subsequent anastomotic risk; thus, the unique surgical perspective is important.

When the patient is positioned on the OR table, coordination with the anesthesia staff regarding what physiologic changes should be promptly communicated, and what the surgical teams will need to have done with deep central lines and the endotracheal tube, should be clearly stated. The OR table should be moved well down and away from the anesthesia devices to help accommodate the 6 to 10 surgeons, fellows, residents, and others.