TSANZ

The Transplantation Society of Australia and New Zealand

TSANZ/ADTCA guidance document

Surgical technique for deceased donor abdominal organ retrieval

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Australasian Transplant Co-Ordinators Association Inc.

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I. Purpose

The purpose of this reference document is to provide guidance on surgical techniques for retrieval of abdominal organs for transplantation. Health regulations and delivery of health services vary between jurisdictions in Australia and New Zealand and therefore the guidelines should be treated as reference material rather than a prescribed surgical procedure.

II. Introduction

The guidance document is intended to be used by surgeons and trainee surgeons. The guidelines should be viewed only as recommendations; they do not establish legally enforceable responsibilities. The word ‘should’ in this document means that something is suggested or recommended, but not required. The guidelines do not represent the sole approach and jurisdictions may use alternative methods.

Mention of specific products or equipment in this document does not represent an endorsement of such products or equipment by the Transplantation Society of Australia and New Zealand (TSANZ) nor does it necessarily represent preference for those products or equipment over similar competitive products or equipment. It is incumbent on the reader who intends to use any information, forms or procedures contained in this document to evaluate such materials for use in the light of operational requirements associated with his or her facility.

III. Preamble

1. The procedure will be performed by donor surgical teams accredited by a transplant centre.
2. Liaison with donor coordinators, operating room staff and members of other retrieval teams and recipient surgeons, where necessary is primarily the responsibility of the senior donor surgeon of that team performing the procedure.
3. The lead retrieval surgeon is responsible for:
    a. careful checking of the donor documentation, including confirmation of death, consent of next of kin, Designated Officer and Coroner (if required), blood group, serology and the Electronic Donor Record; (N.B serology will be a laboratory report).
    b. “Time out” check of patient identification (name, UR number and date of birth) against the documentation, particularly the declaration of death and consent forms,
    c. ensuring that relevant medications (muscle relaxation, methylprednisolone 1 g, broad spectrum antibiotics) have been given,
    d. ensuring that labelling of the organ bags is correct,
    e. ensuring that adequate descriptions of the anatomical, pathological and perfusion characteristics are recorded for recipient surgeons,
    f. communicating with recipient surgeons if there are issues that require discussion,
    g. supporting the operating room personnel. This is particularly relevant for staff who have had little or no experience of organ retrieval, and
    h. ensuring that a brief operation report is completed for inclusion in the donor hospital record.

The surgical technique description that follows is that of donation after neurological determination of death (DNDD). The principles of the surgical technique for donation after circulatory determination of death (DCDD) are similar, but the processes occur more rapidly. DCDD will occur in accordance with the National Best Practice Guideline for Donation after Circulatory Determination of Death in Australia (https://www.donatelife.gov.au/for-healthcare-workers/clinical-guidelines-and-protocols/national-guideline-donation-after-circulatory-death) and relevant hospital or jurisdictional protocols.

The thoracic and abdominal surgical teams participate in the pre-withdrawal meeting and check the relevant documentation prior to withdrawal of cardiorespiratory support. When the donor is brought to the operating theatre, the lead surgeon checks the declaration of death form and ensures that the “time out” check is performed. The warm phase dissection described below will not be carried out in DCDD. The key in this setting is rapid access to the retroperitoneum, cannulation of the aorta just above the bifurcation, decompression by drainage of the supra hepatic inferior vena cava (IVC) and clamping of either the supracoeliac aorta or distal thoracic aorta. Precedence should be given to removal of the abdominal organs over the lungs since the ischaemic tolerance of the lungs is greater than that of the abdominal organs in the setting of DCDD.

IV. Surgical Technique for the Multi-organ Donor

1. The incision for the multi-organ donor is a long midline incision from the sternal notch to the symphysis pubis. Midline sternotomy is standard, but might be avoided in the setting of kidney only retrieval or when there has been a previous sternotomy or at the request of the family. On entering the abdomen a thorough examination of the intra-abdominal +/- thoracic viscera is performed to exclude conditions that would contra-indicate organ donation.
2. Initial operative exposure for retrieval of the liver/pancreas will provide access to the kidneys after cross clamping and flushing with preservation solutions. These steps include:
    a. mobilisation of the right colon, descending and sigmoid colon and small bowel mesentery to expose the kidneys, inferior vena cava (IVC), aorta and its bifurcation, duodenum and pancreas
    b. mobilisation of the duodenum and pancreas off the IVC and left renal vein
    c. identification of both distal ureters **below** the pelvic brim
    d. identification of the junctions of the right and left renal veins with the IVC
    e. identification of origin of superior mesenteric artery
    f. slinging of the aorta just above the bifurcation with two heavy ties (e.g., no. 2 silk). Care should be taken to ensure that there are no inferior renal arteries at or below the intended level of aortic cannulation.
    g. mobilisation of segments 2/3 of the liver by division of the left triangular ligament and gastro-hepatic omentum (with care to avoid damage to an accessory or replaced left hepatic artery arising from the left gastric artery, if present. The artery is confirmed to be absent by both inspection and palpation or CT imaging (if available).
    h. identification of the common bile duct (CBD) just above the pancreas and ligation distally. It is transected just above the tie (care to avoid vessels). The gallbladder is incised, aspirated and flushed with normal saline until the effluent at the CBD is clear. The bile duct is flushed with 100 ml normal saline.
    i. identification of the supracoeliac aorta by division of the right crus of the diaphragm to facilitate cross clamping. Note that attempting to sling the supracoeliac aorta can result in posterior perforation, and if it is intended that the supracoeliac aorta be slung, this is best left to the end of the warm phase.
    j. If whole pancreas is to be procured, the lesser sac is entered by ligating and dividing gastro-epiploic and short gastric vessels. Ligasure or harmonic scalpel is ideal for pancreas retrieval as avoids the need for vessel ligation.
    k. If pancreas (whole or for islets) is to be procured, the splenic flexure, spleen and body and tail of pancreas are mobilised to allow adequate subsequent cooling of the pancreas. Ideally mobilised almost back to aorta from spleen to the midline. The antrum of stomach and third part of duodenum are slung with vessel loops in preparation of subsequent division post perfusion. A nasogastric tube is placed across the pylorus for betadine flushing of graft duodenum (see notes below).
3. If thoracic organs are to be retrieved, the cardiothoracic team performs a sternotomy, and the organs are inspected. Initial dissection of the heart, great vessels and lungs are undertaken. Cardioplegia and pneumoplegia cannulae are then inserted into the aorta and main pulmonary artery respectively.
4. 300 IU/kg of heparin are given intravenously to the donor (approximately 25,000 IU for an adult donor).
5. The appropriate perfusion cannula is inserted and tied into the infrarenal aorta. Care should be taken to ensure that the cannula is intraluminal in the presence of severe atherosclerosis. If it is intended that the IVC be cannulated, this occurs at this stage. Ensure that the tubing attached to the IVC cannula is clamped.
6. Where thoracic organs are being retrieved, the thoracic team cross-clamps the ascending aorta and vents the IVC, along with the left atrial appendage. A further cross-clamp is placed across the descending thoracic aorta if requested by the abdominal surgeon.

7. If thoracic organs are not retrieved, cross clamping of the supracoeliac aorta is performed simultaneously with, or immediately following decompression of the venous system. This can be done by venting of the right atrium or IVC below the renal veins, by the abdominal team. Cold perfusion is then commenced. The details of perfusion may vary between units. Some units use UW Solution alone, although Hartmanns is often used prior to the more viscous UW. If only liver and kidney retrieval 4L of Hartmanns may be used prior to UW. If the pancreas is also being retrieved, only 2L of Hartmanns is used prior to 2 – 4L of UW. The amount of UW solution used for in situ perfusion is usually about 1.5 to 2 L but may be as much as 4L by some units. An alternative approach is to use a low viscosity solution, such as histidine-tryptophan-ketoglutarate (HTK) solution, although not ideal for pancreas retrieval. Perfusion may be performed either by gravity feed, at a height of approximately 1 m, or by pressurised perfusion at approximately systemic arterial pressure. Aortic only perfusion is the commonest approach, but a combination of aortic plus portal venous perfusion may be used by some units or under some circumstances. Cold saline ice slush is placed in the abdominal cavity, surrounding the liver, in front of both kidneys, behind and in front of the pancreas. Care is taken not to over perfuse the pancreas and volume is limited if this organ is also being retrieved as specified above.
8. The sequence of organ removal is the thoracic viscera first, followed by liver and pancreas en bloc, kidneys (either en bloc ideally if a paediatric donor or individually), iliac vessels. In some jurisdictions, mesenteric lymph nodes and spleen are sampled. The **right kidney** must include the whole circumference of the adjacent IVC. **Both kidneys** must include half circumference of adjacent aorta from level of superior mesenteric artery to aortic bifurcation.
9. Organs removed en bloc are separated on the back table where the organs are checked for adequacy of perfusion. When indicated, core biopsies of the kidneys are taken.
10. Liver and Kidneys are flushed with further preservation solution on the back table. See following special notes for kidney, liver, and pancreas.
11. All organs are bagged according to the *National Standard Operation Procedures Electronic Donor Record Utilisation for organ offer process organ transfer documentation, version 1 TSANZ SOP 002/2014*; the organ is triple bagged with at least 500 ml of preservation solution surrounding the organ in the first bag, slush is placed in the second bag and the third bag is dry.
12. Vessels will be packaged according to the *OTA/ADTCA/TSANZ National Standard Operating Procedures for packaging, labeling, storage, and documentation of deceased donor vessels - Version 5.0 Nov 2020*. The liver and pancreas (for whole organ transplantation) should each be accompanied by a set of vessels (for example, an iliac artery and vein) and if the liver is split, each lobe should be accompanied by a set of vessels. A segment of the IMA is often useful for the right lobe graft if vessel extension is required.
13. Any organs or tissues that have been removed and are not required for transplantation are returned to the body. Standard closure of the skin using a continuous suture and staples is performed and a dressing applied.
14. The principles with respect to organ biopsy are as follows:
    a. Any suspicious lesion in either the chest or abdomen must be biopsied, and arrangements made for urgent frozen section and/or any other tissue sample processing that may be required. Consideration may need to be given to the availability of pathology resources (including the requisite expertise).
    b. Biopsy of the liver can be performed either in-situ or ex-situ.
    c. Biopsy of the kidney(s) may also be indicated in donors with risk factors for chronic kidney disease and is best performed on the back table after a comprehensive examination of the cortex has been undertaken.
    d. All biopsies must be appropriately packaged and labelled, and the relevant information must be conveyed to the pathology laboratory.

V. APPENDICES

Appendix 1: Special Notes for Kidneys

1. The IVC should remain intact as a tube with the right kidney allowing transplanting surgeon option to extend right renal vein prior to transplantation.
2. Removal of the peri-nephric fat is required to examine the cortex for evidence of adequate perfusion and presence of obvious pathology. (The incidence of renal tumours discovered at the time of cadaveric nephrectomy is said to be approximately 1%.) Additional back table perfusion with 100ml of perfusion fluid is undertaken before bagging for transport for DCDD .

Appendix 2: Special Notes for Liver

1. Assessment of the suitability of the liver for transplantation is a subjective skill which relies to a large extent on experience. Features which may indicate an increased risk of primary non- function include steatosis (yellow appearance, which is often most obvious after perfusion), rounded edges and excessive firmness on palpation. Any concern about the macroscopic appearance of the liver necessitates communication with the recipient surgeon and may require biopsy (two core biopsies and one wedge biopsy are recommended for adequate microscopic assessment of the donor liver).
2. The gallbladder is opened, and distal CBD ligated just above the pancreas and transected during the early phase of abdominal dissection and the gallbladder is lavaged with normal saline. This step may be performed later in the process prior to aortic cross clamp.
3. The accessory right hepatic artery if present is not always readily palpable behind the common bile duct. Assume the presence of this vessel until proven otherwise by dissection.
4. If the heart is also being retrieved, the Cardiothoracic team transects the IVC midway between the thoracic diaphragmatic surface and right atrium, resulting in an adequate cuff for implantation of both liver and heart.
5. Hilar dissection is deferred to the back table by ensuring part/whole of the pancreas is removed en bloc with the liver after cold perfusion.
6. The bile duct is flushed on the back table with ~200ml of cold UW solution.
7. If aortic cool perfusion only is performed, a further 500ml – 1L of cold UW solution is flushed through the liver via the portal vein and Hepatic artery is also flushed with UW (in some units, this is performed under pressure set at 100mmHg). The final bag will contain 900 - 1000 ml of UW.
8. The diaphragm is divided to the left of the aorta, the thoracic aorta is transected, and the diaphragm is divided around the bare area of the liver, with care to avoid traction injuries to the liver, which tend to occur where the peritoneum overlying the right kidney attaches to the capsule of the liver. The left renal vein is mobilised, dividing a small rim of IVC around the insertion of the left renal vein, and dividing the loose tissue between the aorta and left renal vein. Care should be taken during this manoeuvre to avoid injury to the right renal artery, which may lie immediately posteriorly. The IVC is transected just above the top edge of the right renal vein and just above the confluence of common iliac veins. The lymphatics lying anterior to the aorta are divided with care to avoid injury to the left renal vein and the aorta is then transected at the level of the cannulation site and then split longitudinally along the anterior midline, again taking care not to injure the left renal vein. The renal artery orifices are identified from within the lumen of the aorta. It is essential to

identify and preserve any accessory renal arteries, which may be present superior to the main renal artery orifices or occasionally coming from low down, or even from the iliac vessels. The aorta is transected above the renal arteries, with care to avoid injury to the superior mesenteric artery in the case of retrieval for whole pancreas transplantation, or aberrant right hepatic artery from SMA. With the pancreas and spleen safely lifted anteriorly, the tissues to the left of the aorta are divided up to the level of the transection of the thoracic aorta. With the liver, pancreas and aortic tube held anteriorly, the tissues behind the aorta and IVC are divided, and the liver and pancreas bloc can then be removed to the slush bath on the back table.

9. Separation of the liver and pancreas (whole graft) on the back table involves:
    a. Division of the aortic patch with the celiac axis staying with the liver and the superior mesenteric artery with the pancreas. If an aberrant (replaced or accessory) right hepatic artery arises from the superior mesenteric artery, it is usually still possible to facilitate liver and pancreas transplantation. In such cases, care should be taken to ensure that the maximum length of the right hepatic artery is preserved. The right hepatic artery is divided close to the pancreas and can subsequently be reconstructed by anastomosis to the gastroduodenal artery at the recipient back table. An alternative approach, if the right hepatic artery arises close to the origin of the superior mesenteric artery, is to divide the superior mesenteric artery distal to the origin of the right hepatic artery, which can enable both the superior mesenteric artery and coeliac axis to be preserved with the liver.
    b. Mobilisation of the coeliac axis and common hepatic artery.
    c. Transection of the splenic artery with a small rim (2 mm approximately) at the origin staying with the liver and the majority staying with the pancreas. The splenic artery stump on the pancreas side should be marked with a fine (e.g. 5/0 Prolene) suture to assist subsequent identification.
    d. Ligation of the gastroduodenal artery on the pancreas side and transection leaving a good length on the liver side.
    e. Transection of the portal vein. A level that balances the needs of the liver and pancreas recipient surgeons is selected. One cm above the superior level of the pancreas is reasonable. The portal vein on the pancreas side should be marked with a fine (e.g. 5/0 Prolene) suture to assist subsequent identification.
    f. Transection of tissues (nerves, lymphatics etc.) posterior to the portal vein. If an aberrant (replaced or accessory) right hepatic artery arises from the superior mesenteric artery, care should be taken to ensure that the maximum length of the right hepatic artery is preserved – see point ‘a’ above.
10. Separation of the liver and pancreas is best performed with one of the abdominal surgeons assisting the other and with each surgeon “protecting” the vessels of each organ, to minimise the risk of accidental injury.
11. In separating the liver from the pancreas when the pancreas is being procured for islets, vessels can be transected in a way that maximises the length on the liver side, and without ligating vessels on the pancreas side. However, it is essential that the capsule of the pancreas is not breeched, as this would result in leakage of the collagenase during islet preparation, resulting in a reduced islet yield.

Appendix 3: Special Notes for Pancreas

1. The same surgical requirements exist for removal of the donor pancreas if it is to be used for vacularised whole pancreas transplantation or isolated islet transplantation, other than the need to preserve the vessels to the pancreas.
2. A naso-gastric tube is inserted during the initial dissection phase to permit gastric and duodenal suction and instillation of 50 -100ml of half strength povo-iodine. This solution should be aspirated prior to withdrawal of NG tube.
3. The duodenum is divided above and below the pancreas with a linear cutting stapler (blue insert). The SMA and SMV can similarly be divided as close to the inferior border of the uncinate process as possible, ideally using a vascular cartridge of the linear cutting stapler. Care must be taken not to injure the pancreas at this point, but this technique reduces blood loss in the recipient operation significantly.
4. One of the iliac arteries and veins accompany the pancreas if it is being procured for whole pancreas transplantation. It is important to include a good length of common, external and internal iliac artery, because the splenic and superior mesenteric arteries are routinely reconstructed using a Y graft of iliac artery at the recipient back table. The bifurcation of the CIA must not be injured and must be included to enable back table reconstruction.
5. If the pancreas is being retrieved as a whole graft with duodenum, the spleen is often left attached to the pancreas. However, the spleen can be removed at the donor procedure, provided there is sufficient gap between pancreatic tail and splenic hilum. A vascular stapler can be used for this manoeuvre. If the pancreas is being retrieved for islets, the spleen and duodenum can be removed prior to bagging the pancreas with scissors.

VI. Version Control

TSANZ recognizes the efforts of the following surgeons who generously donated their time and expertise in creating and updating this document. This guidance document is reviewed every 3 years by TSANZ Council, DSDC, relevant surgical expertise/LiTAC and the ADTCA executive committee.

Next scheduled review date: June 2026.

Version #	Changes	Key Authors	Approved by	Review Date
1.0	Original Guidance Document	Prof Richard Allen Dr John Chen Dr Michael Crawford Dr Michael Fink Prof Henry Pleass Dr Deborah Verran	TSANZ Council DSDC ADTCA Exec	12/02/2015
1.1	Review of entire document • Nomenclature changes to DCDD & DNDD. • Added technical detail of pancreas retrieval. • Inclusion of cardiothoracic consideration and technical requirements. • Revised abdominal perfusion fluids. • Inclusion of version control/Section VI	Dr Mark Connellan Dr Michael Fink Prof Henry Pleass Dr Handoo Rhee	TSANZ Council DSDC ADTCA Exec	30/06/2023