Swiss Donation Pathway

Organ and tissue procurement from DBD donors

Module — 7

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CNDO
Nationaler Ausschuss für Organspende
Comité National du don d'organes

swiss transplant

CONTENT

For the sake of readability, the generic masculine form is used. However, all references to persons apply to all genders. Where applicable, the term "organ donation" also includes tissue donation.

1.0
Introduction

1.1 Objective

The optimal preparation and performance of organ removal for transplantation and its conditioning [1;2].

The adapted technique of organ procurement in DCD donors ("Donation after Cardiocirculatory Death") is discussed in more detail in Module 9: "Identification, reporting, and treatment of a DCD donor."

1.2 Principle

Rapid replacement of the blood circulating in the organs with a cold perfusion solution, which puts the organs into a state of minimal metabolism and enables their removal, transport, and preparation for transplantation.

2.0
Organ and tissue procurement

2.1 Coordination of removal

2.1.1 Internal hospital requirements for removal

In principle, organ procurement is possible in any hospital that has the necessary space and personnel resources. Unlike transplantation, organ procurement does not require approval from the Federal Office of Public Health (FOPH). If the structures of a donor detection hospital do not allow for organ procurement, the potential donor is transferred to an organ procurement hospital with the consent of their relatives.

2.1.2 Procurement teams

The personnel required for organ procurement consists of:

- OPS: Instrument technicians and surgical nurses
- Anaesthesia: Physicians and nursing staff
- Surgical removal teams (heart, lung, abdominal team)
- Coordinator with special training in organ procurement (hereinafter referred to as donation coordinator)

If one of the three procurement teams (heart, lung, visceral team) is unable to meet the previously agreed time for organ procurement (transport, weather), this must be taken into account in the planning of the procedure, provided that the donor's condition allows it.

The procurement may also be delayed in order to ensure optimal preparation of the potential organ recipient. Delays must be approved by the Swisstransplant medical advisor. The medical advisor will consult with the organ procurement hospital. The time period should be kept as short as possible.

2.1.3 Decisive factors in the removal of organs and tissues:

- Consideration of the donor's wishes regarding the organs to be removed (all organs / only certain organs)
- The health of the donor and the quality of the organs and tissues
- The order of removal (heart, lung, intestines (if allocated), liver, pancreas, and kidney; followed by tissue removal)

Each procurement team is responsible for its own removal equipment and ensures that this is either brought along or provided by the organ procurement hospital.

- Surgical instruments, materials, and medications
- Preservative solutions
- Sufficient quantities of sterile ice
- Packaging material (Vitalpack)
- If required, kidney perfusion machines including materials and perfusion solution
- OCS, including all materials, if required

The (external) procurement teams are welcomed by the donation coordinator, familiarized with the premises (changing room, operating theatre), and introduced to the surgical teams present and the other persons directly involved in organ procurement.

2.1.4 Time required for preparation, perfusion, and organ procurement

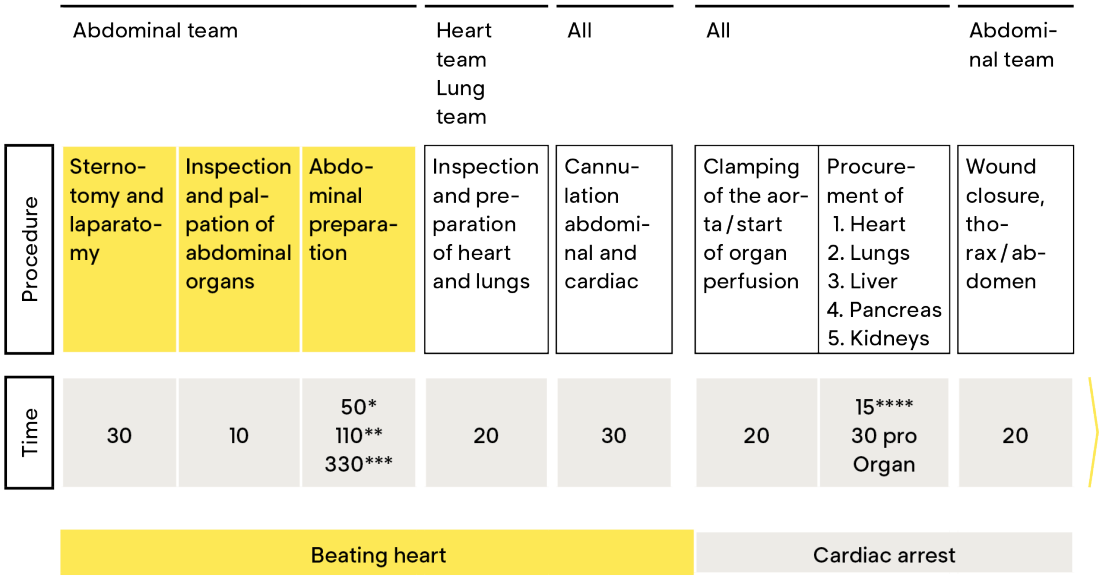
Depending on the number of organs to be removed, four to eight hours must be planned for the removal. This time estimate is non-binding and depends on the donor's physical condition (obesity, previous operations) and the routine of the surgical teams.

Preparation with perfusion

Measure	Time required
Preparation in the operating room	30 min
Abdominal	1 hour – 1 hour 30
With removal of the entire pancreas	2 hours 30
With split liver	4 hours – 6 hours

Organ procurement

	Organ	Time required
Thorax	– Heart (preparation and removal) – Lungs (preparation and removal)	30 min 30 min
Abdomen	– liver – pancreas – Kidneys	30 min 30 min 30 min



*Abdominal **With whole pancreas ***With split liver ****Heart and lungs

1 : Time required for each step

2.1.5 Materials

The surgical team and non-sterile assistants prepare the operating theatre, including the necessary materials:

- Sterile ice (approx. 8 litres)
- Preservative solutions
- Transport boxes

2.1.6 Instruments

The surgical team prepares the instruments for standard laparotomy, sternotomy (with the appropriate saw), and vascular instruments. The special surgical instruments required for organ procurement are usually brought by the procurement teams themselves.

2.1.7 Specific preservation solutions

The organ-specific preservation solutions must be brought along by the procurement teams in a cool box (please note: the preservation solution should not come into direct contact with ice).

Organs	Preservation solutions
heart	4 l cardioplegic solution (St. Thomas® and lidocaine; depending on the explantation team, also Celsior® solution)
Lungs	4 l Perfadex®
liver, pancreas, kidneys	15 L IGL-1®

2.1.8 Procurement report

For each organ removed, the donor section of the corresponding procurement report is completed.
A copy remains at the donation hospital and is filed in the donor's dossier. The original is sent with the organ and, once the transplant is complete, is sent to the Swisstransplant National Transplant Coordination for documentation in SOAS.

2.2 Procedure in the operating theatre

2.2.1 Recommendations

- Strict adherence to aseptic rules
- Availability of the operating theatre for 4–8 hours from the arrival of the donor; the duration depends on the number and type (split liver transplantation in situ takes longer) of organs to be removed

If the donor is stable, organ procurement can be adjusted to accommodate more urgent surgical or obstetric procedures. The departments involved must be informed at an early stage to clarify whether the occupancy of the operating theatre will interfere with the elective program and whether additional personnel (e.g., a transplant coordinator or surgical technicians) can be provided by the transplant centre.

A time-out must be observed before every multi-organ removal, which must be recorded in writing (see Swiss Donation Pathway Module 5: "Coordination and Communication," Chapter 3.2).

2.2.2 Surgical procedure and procurement teams

Standardized sequence of surgical teams:

- Abdominal team
- Heart team
- Lung team

The procurement team must behave correctly at all times during procurement. The transplant centre must ensure that the necessary professional qualifications are in place, as well as knowledge of the processes involved in multi-organ procurement in Switzerland. It is desirable that procurement surgeons in training be accompanied by an experienced colleague at least three times.

Abdominal team
The abdominal team normally performs the sternotomy and laparotomy. This is followed by inspection and palpation of the thoracic, mediastinal, and abdominal organs (including the pelvic area) by the respective team.

Abdomen
Careful inspection and palpation of the liver, pancreas, kidneys, and other organs to rule out any abnormalities or pathologies that could potentially contraindicate the procurement of one or all organs [3]:

- The detection of a malignancy or a special finding requires clarification of the further procedure (if possible, with the biopsy result, if available) and ensuring the flow of information to the transplant centres by the Swisstransplant National Transplant Coordination. If necessary, the medical advisor of Swisstransplant is consulted.
- The hepatic hilum and the arterial blood supply to the liver are now inspected/palpated. (Cave: atypical or accessory hepatic arteries). If pancreatic removal is planned, the omental bursa is opened.
- The visceral surgeon then exposes the iliac arteries, the aorta, and the vena cava up to the renal veins in order to prepare for the subsequent insertion of the perfusion cannula into the common iliac artery. The aorta is exposed at the hiatus of the diaphragm in order to prepare for clamping.
- Alternatively, the super rapid retrieval technique can be used with only visualization and cannulation of the common iliac artery for the insertion of a double-balloon catheter (unstable donor).
- The aortic cannula is only inserted after thoracic preparation (thoracic team), then connected to the cold abdominal perfusion solution via an infusion line and hung on an infusion stand (with pressure cuff).

Caution! Carefully check that there are no air bubbles in the cannulas or tubes.

To prevent thrombus formation on the cannulas, the donor is heparinized (300 IU/kg) at least 2 minutes before the cannulas are inserted into the vessels.

Once the heart and lungs have been prepared, perform distal ligation or clamping of both iliac arteries and insert the aortic cannula at the level of the iliac bifurcation or into the right common iliac artery (to include any renal subpolar arteries in the perfusion). Optionally, a suction cannula for venous blood is installed in the vena cava. If the perfusion situation is unclear, an additional perfusion can be installed (in the presence of dissections), e.g., in the inferior mesenteric vein or in the thoracic aorta.

In **unstable donors**, the aortic cannula is inserted immediately after laparotomy without further preparation, while the preservation solutions are prepared at the same time to ensure rapid perfusion in the event of circulatory arrest.

The visceral surgeon now leaves the surgical field to the thoracic teams.

Heart team
Inspection of the heart and – depending on the findings – final decision on whether to remove the heart. If a malignant process is suspected or the findings are unclear, the next steps are discussed after consultation with the Swisstransplant medical advisor. A rapid section is attempted, ensuring that the investigations are carried out before cross-clamping whenever possible.
If the heart is not suitable for transplantation, it can be removed for the preparation of heart valves, provided that consent has been given.

Lung team
Opening of both pleural cavities for inspection and palpation of the lung. Depending on the findings, a final decision is made on whether to remove the lung, followed by cannulation of the pulmonary artery for perfusion. Perfusion is performed without pressure by hanging the perfusion bag approx. 30 cm above the heart (e.g., Perfadex®).

Organ perfusion
When all teams are ready (organs prepared, all cannulas in place, all perfusion systems vented, heparin administered, 0.5 mg prostigmine administered into the pulmonary artery), the visceral surgeon clamps the aorta infradiaphragmatically in consultation with the other surgical teams; this marks the **beginning of cold ischemia** (cross clamp time). At the same time, the superior vena cava is closed, followed by clamping of the aorta. After making two incisions, one in the left atrial appendage and the other in the inferior vena cava directly at the right atrium, irrigation of the thoracic organs with the preservation solutions can begin.

Simultaneously with the clamping of the infradiaphragmatic aorta by the visceral surgeon, the ascending aorta is clamped by the cardiac surgeon and irrigation of the abdominal organs is started. The blood is drained through the incision made by the cardiac surgeon in the superior vena cava supradiaphragmatically and progressively replaced with the cold preservation solution. In the absence of the cardiac surgeon, this incision is made by the thoracic surgeon. Perfusion of the abdominal organs via arterial cannula (administration under pressure 150 mmHg).

When organ perfusion begins, crushed sterile ice (prepared in advance) or sterile ice-cold water is distributed in both body cavities to cool the organs as quickly as possible from the outside. Care must be taken to ensure that the floor suction devices are emptied beforehand so that the additional volume can be sucked out of the situs as effectively as possible.

The surgical teams check the continuous flow of the preservation solutions and the changes in organ colour.

Once the organs have been perfused and cooled, the heart is removed first. The lung team then takes over.
The lung continues to be ventilated until it is removed. Before final removal, the lung is partially insufflated with 50% O2 air, after which the trachea is closed with a stapler and the organ is removed. This is followed by removing the abdominal organs.
In special cases on the part of the recipient, the heart is removed with pulmonary bifurcation of the
pulmonary artery and/or the entire inferior vena cava.

Good communication between all teams involved before the start of organ procurement is essential to avoid organ lesions or inadequate organ procurement.

The time of the onset of cold ischemia (cross clamp time) and the removal of the individual organs must be communicated to the donor coordinator.

Procedure for removal of the pancreas for islet cells
For the preparation of islet cells, the removal of the pancreas should be immediate after removal of the liver or performed «en bloc» with the liver. In order to achieve the highest possible quality and quantity of extracted islet cells, rapid and complete cooling of the pancreas to approx. 4 °C is essential. To do this, immediately after clamping the aorta and mobilizing the spleen, the omental bursa is opened, and the pancreas is cooled with 3–4 litres of ice water and completely embedded in ice. During removal of the liver, it is essential to ensure that the pancreas remains completely surrounded by ice; otherwise, more ice must be added. Immediately after removal, the pancreas should be adequately packaged (see conditioning of organs) and transported to a suitable laboratory for preparation of the islet cells. The maximum cold ischemia time should not exceed 8 hours.

The quality of the harvested islets depends crucially on the harvesting technique and adequate cooling. Inadequate cooling (warm ischemia) has a devastating effect on the number and functionality of the islets.

2.2.3 Order of organ and tissue procurement

Organ procurement
- Heart
- Lungs
- Liver
- Pancreas
- Intestine
- Kidneys
- Arterial and venous iliac vessels for liver and pancreas implantation (separate packaging)
- Spleen (for the immunology laboratories of the respective transplant centres)
- Procurement of the femoral vessels (if planned)

Subsequent closure of the sternotomy and laparotomy using a single-layer Everett suture, skin stapling, and wound dressing by the visceral surgeon.
The surgeons responsible for the removal (abdominal, heart, and lungs) ensure that an operating report is available within 48 hours, documenting the above steps and recording any special findings.

Tissue removal
Depending on the type of tissue, tissue removal can be performed up to 48 hours after circulatory arrest.
After organ procurement, the person responsible for cornea removal is called in. Cornea removal can be performed either in the operating theatre, in pathology, at the funeral home, or in forensic medicine.

2.2.4 Conditioning of the organs

Before packaging, the organs are rinsed again on the back table. The organs are packaged in a total of three sterile bags:

- The first bag contains at least 500 ml of sterile, cold preservation solution (without ice or air), and the organ should be completely covered by the preservation solution.
- This bag is then placed in a second sterile bag containing sterile, "cold" 0.9% NaCl.
- The whole thing is then placed in a third, empty bag.
- After packaging, all organs must be labelled immediately (which organ, ST number, blood type).

After packaging, the organ is placed in the Vitalpack (cooled with tectonic plates) or stored in a cool box filled three-quarters full of crushed non-sterile ice.
In exceptional circumstances, packaging can be carried out by the local team if they are familiar with the process. Otherwise, care must be taken to ensure that the procurement teams are sufficiently staffed and qualified.

During transport, any direct contact between the organs and ice must be avoided.

The above-mentioned conditioning of organs is not necessary when transporting them using perfusion machines (LifePort, OCS).

2.2.5 Materials and documents for the transport of each organ

- A copy of the procurement report must be enclosed with each organ that leaves the operating theatre. This must be completed correctly and in full by the procurement surgeon. Any lesions to the organ that occurred during or after procurement must be noted.
- All blood tubes must be labelled with the Swisstransplant donor number (ST-No.) and enclosed with each organ.
- A piece of spleen is sent to the histocompatibility laboratory with each abdominal organ removed.
- **Important**: Reallocations are possible at any time. Therefore, blood/spleen must always be sent along with the organ, regardless of whether histocompatibility tests have already been performed.
- Only in the case of the liver and pancreas are the iliac vessels (artery and vein) included.
- Transport document (SLIDS)

If the organ is accompanied by the procurement team, this procurement team is responsible for the proper packaging of the organs it has retrieved. The donation coordinator is responsible – in cooperation with the procurement teams – for the proper labelling of the organs and transport containers, as well as for providing the necessary accompanying documents.

For organs that are not accompanied by the procurement team (unmanned), the donation coordinator is responsible for proper packaging and labelling in cooperation with the procurement team.

2.2.6 Organ preservation

The cold ischemia time is crucial for the preservation and function of organs. The cold ischemia time is defined as the time interval between clamping the donor's aorta (cross-clamp time) and the time of reperfusion of the organ in the recipient (definition according to the SOAS allocation system used in Switzerland).

The procurement report must include the time of aortic clamping, the time of removal, and the reperfusion time of the organs.
The maximum tolerated ischemia times between clamping of the aorta and reperfusion in the recipient are specified below for each organ (cold ischemia time).

Maximum tolerated ischemia time

Organs	**Maximum tolerated time until reperfusion**
heart	4 hours
Lungs	6-8 hours
liver, (intestine)	12 hours for DBD, 8 hours for DCD
pancreas / islet cells	8 hours
kidney	24 hours

Cold ischemia should be kept as short as possible, as it affects organ function immediately after transplantation.

Maximum transport time

Organs	**Transport time/method of the procurement teams**
Heart, lung	2.5 hours; helicopter/airplane/ambulance
Liver, islet cells, intestine, pancreas	3 hours, 4 hours for DBD liver and unaccompanied; helicopter/airplane/ambulance/taxi
Kidneys	20 hours; taxi

Transport is carried out under the responsibility of Swisstransplant and is based on the agreed criteria regarding mode of transport, time window, and urgency. Deviations from these criteria are only possible after consultation with Swisstransplant's medical advisor and must be clearly justified on medical grounds by the surgeon responsible.

Since the test result of the crossmatch between the donor and the potential recipient is relevant for kidneys, there is usually enough time to transport the organs by taxi. However, the cold ischemia time should also be kept as short as possible in this case.

Further information: Swiss Donation Pathway, Module 8: "Transport Logistics"

2.3 Phase after removal

2.3.1 Restoration of the donor's body

It goes without saying that the deceased donor must be treated with dignity and respect by all persons present before, during, and after organ procurement. Once the removal operation is complete, all cannulas and catheters are removed, and the puncture sites are bandaged. The donor's body is washed and covered with a fresh shirt and a cloth. The donor's body is then transferred to the mortuary or, depending on the circumstances at the hospital in question, to a designated location. The donor's body is then released for burial.

If a forensic examination of the donor is planned after the removal, all cannulas, catheters, and the tracheal tube must be left in place.

2.3.2 Support for relatives after donation

The coordination team provides support to the family throughout the entire organ donation process (see also Module 2: "Taking care of relatives and communication").

2.3.3 Completion of documentation

Anaesthesia sheet	– Time of aortic cross-clamping (cross-clamp time) – Name of hospital of organ procurement surgeon
Surgical report	– Time-out – Surgical report – Procurement report
Patient file	– Complete and return to the Intensive care unit
IT register	– SOAS, complete details
Serology results	– Send to tissue bank – Send to national Coordination
Histology results	– Send to tissue bank – Send to Swisstransplant National Transplant Coordination

The Swisstransplant National Transplant Coordination immediately forwards the findings to the relevant transplant centres and attaches them to the donor file in SOAS.

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References

[1] Swisstransplant Working Group for Procurement and Transport (STAPT), Standard Operating Protocol for Multi-Organ Retrieval DBD (Swisstransplant Extranet).

[2] European Directorate for the Quality of Medicines & HealthCare (EDQM), Guide to the quality and safety of organs for transplantation, 9th edition; 2025, Chapter 11, organ procurement, preservation and transportation.

[3] European Directorate for the Quality of Medicines & HealthCare (EDQM), Guide to the quality and safety of organs for transplantation, 9th edition; 2025, Chapter 9, Risk of transmission of cancer.

Changes

Date	Version	Changes
February 2026	3.0	Entire Module: – Changes/corrections to improve readability. – New chapter structure introduced – References revised and updated. Former chapter 1.3 "Quality control" removed. Former chapter 2.1 "intensive care unit tasks" removed. Section 2.1.3 "Decision-making factors in organ removal": Vitalpack, renal perfusion machines, and OCS added. Chapter 2.1.4 "Time required for preparation, perfusion, and organ procurement": Time specifications for tissue procurement removed. Chapter 2.1.8. "Procurement Report": Correction to handling of procurement report (1x original, 1x copy). Chapter 2.2.5 "Materials and documents for the transport of each organ": Note added that reallocations are possible at any time.
February 2023	2.1	Correction
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August 2014	1.2	Packaging of organs
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