Adult donor treatment: Intensive care unit

Recommendations for the topic
Management and monitoring of adult organ donors with preserved heart function in intensive care units

Module — 3

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Contents

The term "organ donation" also includes tissue donation wherever appropriate.

1.0
Introduction

1.1 Scope and objectives

The guidelines for adult donor treatment after brain death (donation after brain death – DBD) are intended for medical personnel (doctors, nurses / therapists) in intensive care units in Switzerland. The aim is to minimize the number of lost donors due to inadequate donor treatment and thus increase the quantity and quality of organs available for transplantation.

1.2 Ethical considerations

According to the Swiss Academy of Medical Sciences (SAMS), dignified dying has the priority over saving lives or restoring health when it comes to patients with a terminal diagnosis. This guiding principle also applies to patients who are being evaluated as potential organ donors, or are already being treated as organ donors, so that they are handled with dignity throughout the donation process. It is also important to support the relatives in this very difficult situation.

1.3 Start of donor treatment

Monitoring and actual treatment as a potential donor begins after brain death has been determined. However, the **continuation of organ preservation measures** – as described in chapters 2 and 3 below (the latter with the exception of subchapter 3.2) – are permitted from **before** death, until the patient's will has been clarified or brain death has been determined. After (brain) death, organ preservation measures may be continued for a maximum of 72 hours until the will of the donor has been clarified (e.g. decision of the relatives).

Comment: Preparatory medical measures (including, for example, the tests mentioned in chapter 3.2) must be clearly distinguished from the organ preservation measures mentioned above. According to the SAMS Guidelines on the "determination of death with regard to organ transplantation and preparation for organ procurement" of 16.05.2017, preparatory medical measures **prior** to death are only permitted if the patient has given his and her consent for these measures. In the absence of the patient's consent to preparatory medical measures, the relatives may consent to the implementation of such measures, provided that the following cumulative conditions are met:

1. There is no evidence that the patient would have refused the measures (presumed will).
2. The measures cannot expedite death or lead to a permanent vegetative state.
3. The measures are essential for a successful transplantation and involve only minimal risks and burdens for the donor. Measures that do not meet these criteria are listed in a negative list (Annex H of the SAMS Guidelines).

1.4 Life-saving emergency measures during donor treatment

If a brain-dead patient who has consented to organ donation suffers cardiac and circulatory arrest prior to organ procurement, resuscitation measures including defibrillation and cardiac massage are strongly recommended.

Comment: The SAMS guidelines of 16.05.2017 (Section H: Negative list) are against the use of mechanical resuscitation **before** death; the use of mechanical resuscitation **after** (brain) death is left open.

1.5 End of donor treatment

The monitoring and care of the organ donor ends with the cross-clamping of the aorta and procurement of the thoracic organs.

2.0

Point-by-point recommendations for donor treatment

Signs of adequate organ perfusion
- Mean arterial blood pressure 60 – 75 (maximum 90) mmHg
- Warm periphery
- Urine output ≥1.0 ml / kg / hrs
- Lactate ≤2 mmol / l
- SvO_2 >65% or $ScvO_2$ >70%

With the lowest possible dosage of vasoactive agents.

SvO_2: mixed venous oxygen saturation; $ScvO_2$: central venous oxygen saturation

Preliminary remark on the following chapters 2.1 (Volume therapy) and 2.2 (Haemodynamics): Transplant medicine has different expectations regarding the balance between volume and vasoactive therapy: For heart transplantation, no / minimal doses of vasoactive agents should be used during donor treatment (instead, if necessary, more volume), for lung transplantation, on the other hand, a restrictive volume supply should primarily be observed. The therapeutic objective of adequate perfusion of all organs at the lowest possible dosage of vasoactive agents, as described above, optimally accommodates the conflicting expectations.

2.1 Volume therapy

Targets
- Mean arterial blood pressure 60 – 75 (maximum 90) mmHg
- Central venous pressure (CVP) 8 – 12 mmHg
- Pulmonary arterial wedge pressure (PAWP; if available) 10 – 15 mmHg; in case of refractory hypovolaemia / hypotension also possibly >15 mmHg
- Pulse pressure variation (PPV) <10%
- Urine output ≥1.0 ml / kg / hrs
- Lactate ≤2 mmol / l

Interventions

Hypovolaemia
- Crystalloids to normovolaemia (avoid hypervolaemia)
  - First choice: crystalloids (e.g. balanced solutions), avoidance of large amounts of NaCl 0.9%
  - Use of colloidal solutions (e.g. HES 130 / 0.4, albumin); at most in combination with crystalloids
  - In the presence of renal dysfunction, crystalloids are preferable to colloids (especially HES)
  - Administer warmed infusions if necessary

Hypervolaemia
- Diuretics
  - Furosemide, torsemide; consider thiazide diuretics in case of elevated sodium levels

Verification of adequate organ perfusion and sufficient blood pressure

Adequate | **Inadequate**

Exclusion of:
- (Tension) pneumothorax
- Pulmonary embolism
- Pericardial effusion / tamponade
- Takozubo myocardiopathy

Normovolaemia?

Signs of normovolaemia:
- CVP >8 mmHg

and / or:
- Pulmonary artery wedge pressure (PAWP) >10 mmHg (if a pulmonary catheter is available)

and / or:
- Pulse pressure variation <10%

No ← Bleeding ? → **Yes**

Volume support

- Crystalloids

Or
- Combination of crystalloids and colloids

Cardiac support

1. Dobutamine ≤5 mcg / kg / min
2. Levosimendan (Simdax®) 0.1 mg / kg / min
3. T_3 or T_4 (T_3 preferred)
4. Also consider:
   Low dose steroids:
   - Hydrocortisone 50 mg every 6 hrs
   - Additional volume
   - Glucose insulin potassium (GIP)

Cardiac or distributive issues?

- Clinical signs: warm extremities
- 2D echocardiography: preserved heart function
- SvO_2 >65% or $ScvO_2$ >70%

No, or cardiac issues ← → **Yes, or distributive issues**

Support for vasoplegia

Vasoactive agents
Either:
Step 1: Noradrenaline ≤0.5 mcg / kg / min
Step 2: Noradrenaline ≤1.0 mcg / kg / min
Step 3: Noradrenaline ≤2 – 3 mcg / kg / min
Or (particularly in case of diabetes insipidus):
Step 1: Noradrenaline ≤0.5 mcg / kg / min
Step 2: Empressin® 0.01 – 0.03 IE / min

Further support
1. Low-dose steroids:
- Hydrocortisone 50 mg every 6 hrs

2. Also consider:
   Additional volume
- T_3 or T_4 (T_3 preferred)
- Dobutamine ≤5 mcg / kg / min
- Glucose insulin potassium (GIP)

2.2 Haemodynamics

Targets

Mean arterial blood pressure
- 60 – 75 (maximum 90) mmHg if organ perfusion is adequate

Heart rate
- 60 – 120 / min; <60 / min if an adequate organ perfusion is guaranteed

Mixed venous (SvO_2) or central venous ($ScvO_2$)
Oxygen saturation
- SvO_2: >65% or $ScvO_2$: >70%

Comments:
- The target values for SvO_2 / $ScvO_2$ were chosen as an indicator for adequate organ perfusion with regard to physiological oxygen extraction
- Due to the absence of cerebral oxygen extraction, higher values are recommended for $ScvO_2$ than for SvO_2
- SvO_2 / $ScvO_2$ can be measured either intermittently using blood samples or continuously using an optical module via a central venous catheter ($ScvO_2$) or pulmonary catheter (SvO_2)

Lactate
- ≤2.0 mmol / l

Pulmonary catheter
(PAC; preferably in case of pulmonary hypertension and / or cardiac dysfunction [especially of the right heart])
- Cardiac index (CI): ≥2.5 l / min / m^2
- Pulmonary artery wedge pressure (PAWP): 10 – 15 mmHg; for refractory hypovolaemia also >15 mmHg
- Systemic vascular resistance (SVR):
  No recommendations are made as this is a calculated value from measured cardiac output and measured mean arterial blood pressure

Pulse Contour Cardiac Output (PiCCO; preferably in case of a distributive issue)
- Cardiac index (CI): ≥2.5 l / min / m^2
- Global end-diastolic volume index (GEDVI): 680 – 800 (possibly up to 950) ml / m^2
- Pulse pressure variation (PPV): <10%
- Extra-vascular lung water index (EVLWI): <7 ml / kg (for refractory hypovolaemia / hypotension: up to 10 ml / kg)

Interventions

Hypotension
1. Check and correct any possibly existing hypovolaemia (e.g. due to [occult] bleeding, dehydration etc.). **Note:** Hypovolaemia is associated with a relevant loss of transplantable organs
2. Exclusion of an obstructive shock form such as pneumothorax / tension pneumothorax, pulmonary embolism, pericardial effusion / pericardial tamponade
3. Exclusion of Takotsubo cardiomyopathy
4. Establish whether the hypotension is due to a cardiac (inotropic) or distributive (vasoplegia) issue

In case of hypotension due to cardiac issues, this can be identified by:
- Clinical signs: cold extremities, marbled skin (cutis marmorata)
- 2D echocardiography: reduced heart function (e.g. LV-EF <45%)
- Increased oxygen extraction: SvO_2 <65% or: $ScvO_2$ <70%

In such cases the following cardiac support is recommended:

Cardiac support
1. Dobutamine ≤5 mcg / min / kg
2. Levosimendan (Simdax®) 0.1 mg / kg / min
3. T_3 or T_4 (T_3 preferred)
4. Also consider:
   - Low-dose hydrocortisone 50 mg every 6 hrs (or continuously 200 mg / 24 hrs)
   - Additional volume with verified volume reactivity
   - Glucose insulin potassium (GIP)
4.

In case of hypotension due to a distributive disorder, this can be identified by:
- Clinical signs: warm extremities (cool in case of sepsis, with massive hypovolaemia)
- 2D echocardiography: preserved heart function (possibly diffusely restricted in case of septic cardiomyopathy)
- Normal oxygen extraction: SvO_2 >65% or: $ScvO_2$ >70% (possibly increased in case o sepsis, with massive hypovolaemia)

In such cases the following support is recommended:

Support for vasoplegia	
Vasoactive agents	
Either: Step 1: Noradrenaline ≤0.5 mcg / kg / min Step 2: Noradrenaline ≤1.0 mcg / kg / min Step 3: Noradrenaline ≤2 – 3 mcg / kg / min	**Or:** (particularly in case of diabetes insipidus) Step 1: Noradrenaline ≤0.5 mcg / kg / min Step 2: Empressin® 0.01 – 0.03 IE / min
Further support 1. Low-dose steroids: Hydrocortisone 50 mg every 6 hrs [1] 2. Also consider: Additional volume T_3 or T_4 (T_3 preferred) Dobutamine ≤5 mcg / min / kg	

Comments:
- Vasopressin (Empressin®): infusion of 0.01 – 0.03 IE / min
  (check the ionized calcium, target >1.1 mmol / l)
- Triiodothyronine (T_3, preferred) or thyroxine (T_4):
  T_3: (e.g. Thyrotardin®): bolus 4.0 mcg; infusion of 3 mcg / hrs
  T_4: (e.g. Thyroxin Henning®: bolus 20 mcg; infusion of 10 mcg / hrs
  alternatively a single bolus of 0.1 mg TSH (Relefact®: synthetic thyrotropin-releasing hormone) can be administered

Comment: Intravenous administration of thyroid hormones (T_3 or T_4) is recommended for the treatment of decreased, refractory cardiac output and / or persistent, refractory hypotension for the treatment of brain-dead organ donors (with corresponding failure of the hypothalamic-pituitary axis). Currently, only the oral, not the intravenous forms of thyroid substitution are authorized in Switzerland. Intravenous dosage forms, for example from Sanofi-Synthelab Pharmazie, are available in Germany as L-Thyroxin Henning® Inject (T_4) or Thyrotardin® Inject N (T_3) and can be administered without approval. The same applies to Relefact® (synthetic thyrotropin-releasing hormone TSH).

[1] Alternatively, hydrocortisone can also be administered as a continuous infusion of 200 mg / 24 hrs.

– Glucose insulin potassium (GIP): glucose 10% 1 ml / kg / hrs, in combination with Actrapid® or Novorapid® and potassium in one dose, in order to keep blood sugar and serum potassium within the targeted levels (see below)

Hypertension
– Nitroglycerin 0.5 – 8 mcg / kg / min
  (if administered in high doses: monitoring of meth-haemoglobin)

  Or:
  Sodium-nitroprusside 0.5 – 5 mcg / kg / min
  (if applied over a longer period of time: monitoring of cyanmethaemoglobin and / or cyanide level in whole blood)
– If in combination with tachycardia and high cardiac output:
  – Esmolol (Breviblock®):
    Bolus 100 – 500 mcg / kg / min, followed by infusion: 100 – 300 mcg / kg / min
  – Or: labetatol (Trandate®):
    Bolus: 20 – 50 mg i.v. followed by infusion: 0.2 – 2 mg / min
  – Or: metoprolol (Beloc Zok®):
    Bolus: 3 – 5 mg up to 2 – 3 mg every 4 hrs
– Urapidil (Ebrantil®)
  Bolus: 10 – 50 mg i.v. followed by infusion: 2 – 15 mg / hrs
– Clevedipin (Cleviprex®)
  Infusion: 2 – 6 (up to 32) mg / hrs

Arrhythmias

Bradycardia
– Transjugular or external pacing. If not possible or as a temporary measure:
– Dobutamine up to 5 mcg / kg / min
  Alternatively adrenaline or isoprenaline (Isuprel®) may be considered

Note:
Atropine is **not** effective in treating bradycardia arrhythmias in brain-dead patients.

Tachyarrhythmia
– Correction of any fluid and electrolyte disorders (potassium, magnesium), correction of hypothermia or hypoxaemia.
– Amiodarone; in case of hypertension with a high cardiac index, short-acting beta-blockers (e.g. esmolol) may be preferred.
– Possible electrical cardioversion (if possible, draw blood beforehand to determine the level of heart enzymes).
– Possible glucose insulin potassium (GIP) therapy: glucose 10% 1 ml / kg / hrs in combination with Actrapid® or Novorapid® and potassium in one dose, in order to keep blood sugar and serum potassium within the targeted levels (see below).

2.3 Body temperature

Target
Normothermia

Note:
During the determination of death (brain death diagnostics) the body core temperature must be >35 °C (SAMS guidelines)

Interventions

Hypothermia
– Warm infusion solutions, warmed inspiratory gases, warm blankets etc.

Hyperthermia
– Search for possible infections (hyperthermia is rather unusual in brain-dead patients)
– Physical cooling methods (antipyretics are usually insufficient)

2.4 Diabetes insipidus

Occurs in up to 80% of all DBD donors

Diagnosis
– Urine output >4 ml / kg / hrs
– Serum-sodium ≥145 mmol / l and increasing (note: may increase rapidly)
– Serum osmolarity ≥300 mosmol / l and increasing
– Urine osmolarity ≤200 mosmol / l and decreasing

Target
The target of the interventions is primarily based on the fluid status as well as the sodium concentration and osmolarity in the patient's serum, and only secondarily on the urinary excretion, which should be kept between 1.0 – 4.0 ml / kg / hrs.

Interventions
– Desmopressin (Minirin®) 0.25 – 2.0 mcg i.v. every 6 hrs
  Or:
– Vasopressin (Empressin®) especially in case of hypotension as a continuous infusion of 0.01 – 0.03 IE / min

2.5 Sodium

Target
130 – 150 mmol / l

Interventions

Hypernatremia
Note:
Hypernatremia can particularly damage the liver transplant:
- Stop infusions containing NaCl; look for other sources of sodium (e.g. colloidal solutions, penicillin antibiotics etc.) or reasons for osmotic diuresis (hyperglycaemia, elevated serum urea, mannitol therapy etc.)
- With concomitant diabetes insipidus: desmopressin or vasopressin (see point 2.4)
- For hypovolaemia (hypertonic hypovolaemia): infusion of glucose 5% or NaCl 0.45% or a combined infusion with glucose 5% and NaCl 0.9% in a ratio of 1:1 or 2:1
- For hypervolaemia (hypertonic hypervolaemia): first choice: natriuretic diuretics (e.g. hydrochlorthizide); second choice: natriuretic diuretics combined with intravenous administration of free fluid (glucose 5%)

Note:
The supply of free water through an enteral probe increases the risk of aspiration due to the high gastric fluid levels. The lung transplant is therefore at risk.

Hyponatremia
- For hypovolaemia (hypotonic hypovolaemia: infusion of NaCl 0.9% with additional 100 – 200 mmol NaCl (e.g. from a 23.5% NaCl solution) over 4 – 6 hours (if necessary)
- For hypervolaemia (hypertonic hypervolaemia): fluid restriction, possibly diuretics

2.6 Other electrolytes: K, Ca, Mg, Phosphate

Target
The values should be kept within the normal range (if possible, the ionized values should be taken into account in each case).

Interventions
Correction or substitution of the corresponding electrolytes. Note: The intravenous administration of calcium should be performed slowly, as a too fast injection can lead to hypertension.

2.7 Blood glucose

Target
5 – 10 mmol / l

Interventions
Hyperglycaemia
Continuously adapted insulin infusion (e.g. with Actrapid® or Novorapid®)

Hypoglycaemia
Glucose 5% – 20% depending on fluid status

2.8 Haemoglobin

Target
≥70 g / l (≈haematocrit >25%)
Aim for 80 g/l when removing the heart.

Intervention
Erythrocyte concentrates (leucocyte-depleted, filtered). Transfusion of blood products whenever possible after taking blood samples for HLA typing and virological tests.

2.9 Thrombocytes

Target
>20 giga / l if there is no bleeding
>50 giga / l if there is active bleeding (also search for other coagulation disorders)

Intervention
- Thrombocyte concentrates (pooled, filtered)
- Transfusion of blood products whenever possible after taking blood samples for HLA typing and virological tests.

2.10 Blood Coagulation

Target
INR <2.0

Intervention
- Coagulation factors, e.g. Prothromplex® or Beriplex® especially if there is a risk of volume overload
- Fresh frozen plasma (FFP) only in exceptional cases due to the risk of a transfusion-associated acute lung injury (TRALI)
- Possible Vitamin K (Konakion®)
- Possible protamine hydrochloride with prior therapy with heparin
- Possible fibrinolysis inhibitors such as tranexamic acid (Cyclokapron®) or aprotinin (Trasylol®)

2.11 Corticosteroids

High-dose corticosteroids (intravenous methylprednisolone 15 mg / kg)
in the event of a planned procurement of lungs and / or liver.

Comment:
- The evidence for high-dose corticosteroids as preparation for lung and / or liver procurement is very limited and contradictory. In addition, these studies did not distinguish between anti-inflammatory effects of corticosteroids on the one hand, and substitution of relative or absolute adrenal cortex insufficiency on the other; the latter could be achieved with low-dose hydrocortisone (see below) alone. However, since in the environment of organ procurement / transplantation with subsequent obligatory immunosuppression no additional relevant side effects of high-dose methylprednisolone are to be expected during donor treatment, the possible advantages outweigh the potential risk.

Low-dose corticosteroids (intravenous hydrocortisone 50 mg Every 6 hrs = 200 mg / day)
Recommended for persistent hypotension and / or reduced cardiac output; a prior ACTH test (Synacthen® test) is only recommended in exceptional cases.
Alternatively, the 200 mg hydrocortisone can also be given in a continuous infusion over 24 hours.

2.12 Dopamine

Low-dose dopamine (4 mcg / kg / min intravenous) after death has been diagnosed
Low-dose dopamine – if administered for more than seven hours between the time of death and cold ischaemia – leads to better early function (fewer dialyses) and better transplant survival (post-hoc analysis) after kidney transplantation and better survival (reduced early mortality) after heart transplantation with no negative effects on the transplantation of other organs.

In case of haemodynamic side effects (hypertension, tachycardia), any other vasoactive agents should first be reduced or discontinued and only then – if hypertension / tachycardia persists, should the dopamine dosage be reduced to 2 mcg / kg / min or discontinued.

2.13 Antibiotic Therapy

No prophylactic antibiotic therapy: antibiotics only in case of confirmed or suspected infection

2.14 Feeding

- Continuation of existing enteral or parenteral feeding
- Continuation of the existing substitution of vitamins and trace elements

2.15 Ventilation

- Ensure adequate airway lavage (tracheal suction under sterile conditions) (may have been somewhat neglected in the previous treatment phase due to possible interactions with intracranial pressure [ICP]).
- Aspiration prevention, e.g. by elevating the head by at least 30°, sufficiently high cuff pressure (at least 25 mbar) etc.
- Ventilation therapy for an organ donor is performed as a lung-protective ventilation. For the setting of ventilation, this means accordingly: Tidal volume 4.0 – 7.7 ml / kg or driving pressure ≤15 mbar, inspiratory ventilation pressure ≤30 mbar and adequate PEEP of at least 5 mbar.
- In the presence of severe ALI / ARDS or other lung diseases where lung procurement is ruled out, the ventilation strategy can be reduced to sufficient oxygenation, for example PaO_2 >9 kPa (≈70 mmHg) and SaO_2 >88%.
- **Caution:** It should be noted that in ventilated, brain-dead patients (after brain death diagnosis) the auto trigger phenomenon can occur, which simulates breathing by itself. In such cases the inspiratory trigger should be switched off or set to a less sensitive setting.

3.0

Point-by-point recommendations for monitoring

The following recommendations for monitoring are limited to the treatment of the organ donor and to the tests that must be carried out as part of the assessment of donor suitability. (Please also consult Module 7 of the Swiss Donation Pathway: "Organ and tissue procurement from DBD donors").

3.1 Standard monitoring

Monitoring parameters	Measuring interval	Remarks
Vital signs	Continuously	Documentation[2] every 1 hrs
Fluid balance	Every 6 hrs	For diabetes insipidus every 1 hrs
CVC / CVP	Continuously	Documentation[2] every 1 hrs
Peripheral venous catheter		For high fluid or volume requirements
Arterial pressure measurement	Continuously	Documentation[2] every 1 hrs
Urine catheter	Continuously	Documentation[2] every 1 hrs
Feeding tube		
Pulse oximetry	Continuously	
3-channel ECG	Continuously	
12-lead ECG	Every 24 – 48 hrs	
Chest X-ray	Every 24 – 48 hrs	
Temperature	Continuously	

[2] Documentation in PDMS, deviating documentation obligation in the Swiss Organ Allocation System (SOAS) (see there).

3.2 Extended monitoring

Monitoring parameters	Measuring interval	Remarks
Combined venous / central venous saturation SO_2 (SvO_2 / $ScvO_2$)	Continuously or every 2 – 4 hrs	For manifest / suspected organ hypoperfusion
PAC / PiCCO		PAC: for manifest / suspected reduced cardiac output with left ventricular ejection fraction <40% PiCCO: for manifest / suspected distributive shock (SIRS / sepsis) with CVP >12 mmHg
TTE	Every 6 – 12 hrs	If EF <40%
Bronchoscopy BAL	On request	For diagnostics in case of suspected infection
CT-thorax / CT-abdomen	On request	For further diagnostics

3.3 Standard laboratory tests

Monitoring parameters	Measuring interval	Remarks
Blood group ABO and Rhesus)		Twice, if possible
Arterial blood gas analysis	Every 8 – 12 hrs	If unstable: every 2 – 4 hrs
Electrolytes (Na, K)	Every 4 – 8 hrs	If unstable: every 2 – 4 hrs
Creatinine, urea	Yes, once for normal values	
ASAT / ALAT / direct and total bilirubin	Every 8 – 12 hrs	
Blood sugar	Every 4 – 8 hrs	If unstable: every 2 – 4 hrs
Lactate	Every 8 – 12 hrs	If unstable: every 2 – 4 hrs
Troponin (I or T)	Once, if normal	Every 12 hours under therapy with desmopressin or vasopressin
Serum osmolality	Every 24 hrs	
Full blood count	Minimum 24 hrs	
Coagulation: INR, PT, PTT, fibrinogen, factor V	Once, if normal	
Urine analysis (spot and sediment)	Once, if normal	

3.4 Microbiology

Monitoring parameters	Measuring interval	Remarks
Blood cultures	If advisable	
Urine cultures	If advisable	
Tracheal secretion	If advisable	

4.0

Specific tests for organ procurement

4.1 Specific tests for organ procurement

Monitoring parameters	Measuring interval	Remarks
Coronary angiography	On request	
2D echocardiography	When collecting donor data (ideally without vasoactive agents)	
Abdomen sonography	When collecting donor data	

4.2 Specific laboratory tests for organ procurement

Monitoring parameters	Measuring interval	Remarks
Blood group (ABO and Rhesus)		Confirmation by a reference centre
HLA typing		By a reference centre
HIV, hepatitis B and C, CMV, syphilis, toxoplasmosis, EBV, HTLV I & II, herpes simplex & herpes zoster		
Calcium, magnesium, phosphate, LDH, gammaGT, alc. phos., CPK, CK-MB, pancreatic amylase, lipase, EW, albumin, ammonia, CRP	Once, for normal values	
Arterial blood gas analysis (ABGA)	Every 4 hrs	With PEEP 5 mbar and FiO_2 0.4 for 10 min
Arterial blood gas analysis (ABGA)	Every 4 – 8 hrs	With PEEP 5 mbar and FiO_2 1.0 for 10 min

4.3 Microbiology

Monitoring parameters	Measuring interval
Blood and urine cultures, tracheal secretions	Standard <24 hrs before multi-organ procurement

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Changes

Date	Version	Changes
February 2023	4.1	Correction
December 2020	4.0	Revision
March 2018	3.1	New logo
April 2014	3.0	Layout and title adapted Text adapted: chapters A, B, C; fusion chapter D and annex 1
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