Standing Orders for the Medical Management of Neurologically Deceased Organ Donors – Adults

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This order set for organ donor management is based on the updated 2020 Canadian Blood Services guideline [1]. Of note, unless indicated by asterisk (*), all recommendations are conditional and based on low or very low certainty of evidence and as such may not be applied in all scenarios or for every patient depending on situational factors and the best judgement of the clinician.

It is important to optimize multi-organ function to improve organ utilization and transplant outcomes. Attentive ICU management and re-evaluation can improve reversible organ dysfunction (myocardial and cardiovascular dysfunction, oxygenation impairment related to potentially reversible lung injury, invasive bacterial infections, hypernatremia and other metabolic abnormalities) and evaluate temporal trends in hepatic aspartate aminotransferase (AST), alanine aminotransferase (ALT) and creatinine or any other potentially treatable situation. This period of donor management should be accompanied by frequent re-evaluation to assess for improvement in organ function toward defined targets prior to surgical recovery of organs for transplant.

Standard monitoring	• Arterial line continuous blood pressure monitoring • Pulse oximetry, 3-lead ECG • Vital signs at least every hour • Core temperature (rectal, bladder or esophageal) every 4 h • Urine catheter to straight drainage, strict intake and output • Nasogastric tube to straight drainage
Laboratory investigations	• Arterial blood gases, lactate, electrolytes and glucose every 6 h, and as needed • Complete blood counts every 12 h, and as needed • Blood urea nitrogen, creatinine, AST, ALT, bilirubin (total and direct), INR (or PT) and PTT every 12 h and as needed • Urine analysis

Hemodynamic monitoring and therapy	• General targets:
	  o heart rate 60–120 bpm
	  o mean arterial pressure ≥ 65 mmHg
	  o systolic blood pressure (SBP) ≤ 180 mmHg and diastolic blood pressure (DBP) ≤ 120 mmHg
	• In case of hypertension, SBP ≥ 180 mmHg or DBP ≥ 120 mmHg diastolic or if there is evidence of end organ damage:
	  o Wean inotropes and vasopressors
	  o Then if necessary, start short acting blood pressure lowering agents:
	  ▪ Esmolol: 100–500 µg/kg bolus followed by 100–300 µg/kg per min, OR
	  ▪ Labetalol 10 – 20 mg IV every 4 h, and as needed. If blood pressure not controlled start Labetalol IV infusion 0.5 – 2 mg per min, AND/OR
	  ▪ Nitroprusside: 0.5–5.0 µg/kg per min especially if HR < 60

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	• In case of hypotension MAP < 65 and/or shock:
	  o Hold short acting blood pressure lowering agents
	  o Fluid resuscitation to maintain normovolemia.
	• Consider serum lactate and/or mixed venous/central venous oximetry; titrate therapy to $MVO_2 \geq 60\%$

Agents for hemodynamic support	• First line: Vasopressin: 2 to 2.4 U per h (0.04 U per min) • Second line: Norepinephrine up to 1 mcg/kg per min • Consider hydrocortisone 50mg IV every 6 h • Additional vasopressors or inotropes depending on etiology (epinephrine, phenylephrine, dobutamine or milrinone) • Avoid the use of dopamine at any dose
Glycemia and nutrition	• Initiate enteral feeding (unless contra-indicated) or continue as tolerated, hold on call to the operating room • If unable to tolerate enteral feeds, consider intravenous dextrose infusions • Continue parenteral nutrition if already initiated prior to declaration • Maintain serum glucose levels in the range of 6-10 mmol/L
Fluid and electrolyte targets	• Urine output goal 0.5–3 mL/kg per h • Serum Na target 135-155 mmol/L • Maintain normal ranges for potassium, calcium, magnesium, phosphate

Diabetes insipidus	• Defined as:
	  o Urine output > 4 mL/kg per h associated with
	  o Rising serum sodium ≥ 145 mmol/L and/or
	  o Rising serum osmolarity ≥ 300 mosM and/or
	  o Decreasing urine osmolarity ≤200 mosM
	• Therapy (to be titrated to urine output ≤ 3 mL/kg per h):
	  o During hemodynamic stability:
	  ▪ Intermittent DDAVP, 1–4 µg IV then 1–2 µg IV every 6 h (there is no true upper limit for dose; should be titrated to desired urine output rate) and/or
	  ▪ Intravenous vasopressin infusion at ≤ 2.4 U per h
	  o During hemodynamic instability:
	  ▪ Intravenous vasopressin infusion at 2 to 2.4 U per h

Hormonal therapy	Routine thyroid hormone therapy is not recommended, unless otherwise indicated or recommended. Thyroid hormone therapy can be considered in cases of cardiac dysfunction or hemodynamic instability (Tetraiodothyronine (T4): 20 µg IV bolus followed by 10 µg/h IV infusion (or 100 µg IV bolus followed by 50 µg IV every 12h) • Routine high dose corticosteroid is not recommended. • Routine infusion of combined solutions of glucose, insulin and potassium (GIK) is not recommended
Hematology	• Transfuse packed red blood cells (PRBC) for target Hb >= 70 g/L • Transfuse platelets to target above 10 x 10^9/L or in cases of clinically relevant bleeding • There are no predefined targets for INR, PTT; avoid transfusion of fresh frozen plasma unless in cases of clinically relevant bleeding. • No other specific transfusion requirements

Microbiology	• Initial screening blood, urine, and endotracheal tube culture • Repeat cultures as needed when clinically indicated • Continue antibiotics started before neurological determination of death • Administer antibiotics only for presumed or proven infection and not prophylactically

Heart-specific orders (to be initiated in potential heart donors)	• 12-lead electrocardiogram
	• 2-dimensional echocardiography
	  o Consider repeat (serial) echocardiography as clinically indicated or recommended
	  o Should only be performed after fluid and hemodynamic resuscitation
	• Coronary angiography should only be performed in the presence of risk factors for coronary artery disease according to local criteria

Lung-specific orders	• Mechanical ventilation (*):
	  o Target tidal volumes: 6-8 mL/kg, and PEEP ≥ 8 cm H_2O
	  o Target pH: 7.35–7.45, $PaCO_2$: 35–45 mmHg, PaO_2: ≥ 80 mmHg, O_2 saturation: ≥ 95%
	• Recruitment maneuvers should be done upon ventilator disconnect (*):
	  o preoxygenation with 100% FiO_2
	  o CPAP to 30 cm H_2O of PEEP for 30 seconds
	  o return FiO_2 to previous FiO_2
	  o Use diuresis to target normovolemia
	• Single routine chest radiograph should be done at baseline, additional chest imaging only as clinically indicated
	• At least one-time bronchoscopy with gram stain and culture of bronchial wash

Intra-abdominal organs-specific orders	• If kidneys are considered, target goal core temperature between 34°C and 35°C
	• Can target normothermia if kidneys are excluded
	• Test urine for albumin/creatinine ratio (ACR) only when investigating donor with type I or type II diabetes mellitus
	• Consider abdominal imaging ultrasound or CT abdomen only if:
	  o Age > 50
	  o Comorbid conditions as determined, according to local criteria
	  o High BMI
	  o Clinical history for malignancy

References

[1] Ball I, Hornby L, Rochwerg B, et al. Management of the neurologically deceased organ donor: A Canadian clinical practice guideline. *CMAJ* 2020 April 6;192:E361-9. doi: 10.1503/cmaj.190631