TRANSPLANT QUÉBEC

PEDIATRIC ORGAN DONOR ASSESSMENT AND MANAGEMENT GUIDE

For children weighing over 60 kg or who are post-pubertal, please refer to the adult organ donor assessment and management guide

Standard orders

The following are recommendations only and are not intended to replace an integrated approach to clinical judgement.

A Patient positioning

- A1 • Head of bed elevated at 30 °
- A2 • Turn and position q2h

B Nutrition

- B1 • Standard tube feeding
- B2 • Do not initiate parenteral nutrition. However, do not discontinue if already initiated.

C Hydration

- C1 • D5 Saline 0.9 or 0.45 % or RL according to sodium level, KCl 20-60 mEq/L according to potassium level. Rate of administration may vary according to maintenance needs.

The rate and type of IV fluids may vary according to sodium and potassium levels as well as enteral nutrition tolerance. Target homeostasis.

D Minimal monitoring required and targeted goals

- D1 • Cardiac monitor
- D2 • Arterial line; monitor blood pressure (BP) q1h, target: ➤ Heart rate (HR) and ➤ Systolic and diastolic BP according to age and hemodynamics (see Section 1.8)
- D3 • Continuous arterial oxygen saturation (SaO_2) monitoring, document SaO_2 q1h, target ≥ 95 %
- D4 • Urinary catheter; strictly monitor intake and output document hourly urine output, target 0.5-3.0 mL/kg/h
- D5 • Nasogastric tube to gravity drainage (if unfed)
- D6 • Capillary blood glucose levels* q1h, target 6-10 mmol/L
- D7 • Body temperature q4h, target 35-37.5 °C

* Blood glucose: If capillary blood glucose within normal range and stable, levels may be monitored q2h, then q4h.

E Ventilation

- E1 • Controlled mechanical ventilation
- E2 • Tidal volume (TV); 5-8 mL/kg of ideal weight
- E3 • Positive end-expiratory pressure (PEEP); 5 cm H_2O and above
- E4 • If possible, adjust respiratory frequency to obtain arterial $PaCO_2$ between 35-45 mmHg
- E5 • Minimum fraction of inspired oxygen (FiO_2) to maintain SaO_2 ≥ 95 %

F Eye care

- F1 • Keep eyelids closed
- F2 • Avoid oily or greasy substances

G Prophylaxis

- G1 • Pharmacological thromboprophylaxis according to standard indications. If contraindicated, use mechanical thromboprophylaxis.

H Donor assessment

Initially	**H1 Identifying or retrieval centre *** • Blood group + antibodies + crossmatch (4 units of packed red blood cells in reserve, at retrieval centre) • Weight / Height • Urinalysis and urine culture (albumin / creatinine ratio) • Blood cultures X 2 • Sputum gram stain and culture • Chest X-ray and EKG • Albumin / protein • CK, CK-MB, or Troponin I/T • Abdominal ultrasound, if requested by Transplant Québec • Echocardiogram, if requested by Transplant Québec • Abdominal and thoracic CT scan, if requested by Transplant Québec • Arterial blood gas, AST, ALT, alkaline phosphatase total and direct Bilirubin, GGT, LDH, amylase, lipase, Na, K, glucose, urea, creatinine, lactate, CBC, PTT, INR, Cl, Mg, Ca, PO_4
H2 **q8h**	CK, CK-MB, or Troponin I/T q8h x 24h If patient unstable, continue monitoring CK, CK-MB, or Troponin I/T q8h
H3 **q12h**	AST, ALT, Alkaline phosphatase , total and direct Bilirubin, GGT, LDH, amylase, lipase, Na, K, glucose, urea, creatinine, CBC, PTT, INR, lactate, arterial blood gas
H4 **q24h**	Chest X-ray, EKG, Cl, Mg, Ca, PO_4
H5 **q72h**	Blood cultures X 2, sputum gram stain and culture, urine culture

* Serology, virology, and tissue typing with Transplant Québec clinical coordinator / advisor's approval.

TRANSPLANT QUÉBEC

PEDIATRIC ORGAN DONOR ASSESSMENT AND MANAGEMENT GUIDE

For children weighing over 60 kg or who are post-pubertal, please refer to the adult organ donor assessment and management guide

Management criteria and goals

The following are recommendations only and are not intended to replace an integrated approach to clinical judgement.

1 Hemodynamics

1.1 Basic monitoring

Arterial line

Intake and output q1h

1.2

D5 % NaCl 0.9% or 0.45% or RL depending on sodium level

+

KCl depending on potassium level

Rate according to maintenance needs

Adjust according to urine output

1.3

VS q1h

EKG QD

1.4 General goals

- Normal HR and BP according to age
- Target euvolemia

Specific goals according to age group (see Section 1.8)

1.5 If hypotension and signs of hypovolemia

NaCl 0.9% 10 mL/kg IV bolus q15 min x 3

(or Ringer's lactate or albumin 5%*) PRN

1.6 If hypotension

1. Vasopressin** 0.0003-0.0007 U/kg/min
2. Norepinephrine 0.05-0.2 µg/kg/min
3. Epinephrine 0.05-0.2 µg/kg/min

If indicated:

Hydrocortisone 1 mg/kg IV q6h max 50 mg per dose

1.7 If hypertension according to age group

- 0-3 months BP > 90/60 mmHg
- 3 months-1 year BP > 110/70 mmHg
- 1-12 years BP > 130/80 mmHg
- 12-18 years BP > 140/90 mmHg

1. Wean amines
2. Nitroprusside 0.5-5.0 µg/kg/min and/or
3. Esmolol 100-500 µg/kg bolus followed by 100-300 µg/kg/min IV infusion

1.8 Heart rate and blood pressure

Age group	HR (beats per minute)	Systolic / diastolic BP
• 0-3 months	• 100-150	• 65-85 / 45-55 mmHg
• 3-6 months	• 90-120	• 70-90 / 50-65 mmHg
• 6-12 months	• 80-120	• 80-100 / 55-65 mmHg
• 1-3 years	• 70-110	• 90-105 / 55-70 mmHg
• 3-6 years	• 65-110	• 95-110 / 60-75 mmHg
• 6-12 years	• 60-95	• 100-120 / 60-75 mmHg
• > 12 years	• 55-85	• 110-135 / 65-85 mmHg

The rate and type of IV fluids may vary according to serum sodium and potassium levels as well as enteral nutrition tolerance and should target homeostasis.

* Recommendation: The use of hydroxyethyl starch products should be avoided.

** Vasopressin is the number one recommended agent for hemodynamically unstable patients, except if instability is primarily due to left ventricular dysfunction. In such cases, norepinephrine is the number one recommended agent.

2 Mechanical ventilation

2.1 Goals

- Minimal FiO_2 to maintain $SaO_2 \geq 95\ \%$ ($PaO_2 \geq 80$ mmHg)
- pH 7.35-7.45
- $PaCO_2$ 35-45 mmHg
- Tidal volume (TV): 5-8 mL/kg of ideal weight
- PEEP at 5 cm H_2O minimum or above
- Peak inspiratory pressure (PIP) ≤ 30 cm H_2O

2.2

- Continuous SaO_2 monitoring
- Head of bed elevated at 30 °
- Endotracheal suctioning q8h and PRN
- Chest physiotherapy PRN
- Turn and position q2h

3 Diuresis

3.1

Goal

0.5-3.0 mL/kg/h

3.2 Oliguria

If urine output < 0.5 mL/kg/h

↓

NaCl 0.9 % bolus (10 mL/kg), repeat PRN

3.3

If urine output < 0.5 mL/kg/h

Rule out secondary causes (postrenal obstruction)

Rule out low cardiac output and/or hypovolemia

3.4 Polyuria

If urine output > 4 mL/kg/h

Rule out diabetes insipidus*

3.5

DDAVP 0.25-1.0 µg IV q6h or nasal spray

or

If hemodynamic support required, use vasopressin as first choice

(vasopressin 0.0003-0.0007 U/kg/min IV infusion max. 2.4 U/h)

* Diabetes insipidus: Urine output > 4 mL/kg/h, Na ≥ 145 mmol/L, serum osmolarity ≥ 300 mOsm, urine osmolarity ≤ 200 mOsm, urine specific gravity < 1.005

Management criteria and goals (continued)

4 Temperature

4.1

Goal

Core T° 35.0-37.5 °C

4.2

Monitor T° q4h

4.3

< 35.0 °C

- Warming blanket
- Cover the head (transfer, transport, or if supplies are not available)

4.4

> 38.0 °C

- Septic profile
- Antibiotics in case of confirmed or suspected infection or broad-spectrum antibiotics, as deemed necessary by the medical team

5 Cardiac dysfunction

5.1

Indicated by

Echocardiogram with ejection fraction (LVEF) < 50 % or hemodynamic instability

Shock unresponsive to reestablishment of volume status and that requires vasoactive support (epinephrine 0.2 µg/kg/min or more).

5.2

At the discretion of the medical team: initiate hemodynamic monitoring (either continuous or intermittent) including, but not limited to:

- Targeted echocardiogram*

or

- Other non-invasive procedures for cardiac output monitoring

5.3

Hemodynamic management according to basic management standards (consider employing inotropes)

* Note that targeted echocardiograms are not intended as substitutes for trans-thoracic echocardiograms (TTE).

6 Electrolytes

6.1

Goals

Na 135-155 mmol/L
K 3.5-5.0 mmol/L
Mg 0.65-1.05 mmol/L
PO_4 0.74-1.52 mmol/L
Ca 2.2-2.6 mmol/L

6.2

Correct electrolyte abnormalities

7 Glycémie

7.1

Goal

6-10 mmol/L

7.2

Capillary blood glucose* q1 h

7.3

Insulin infusion PRN

* Blood glucose: If capillary blood glucose within normal range and stable, levels may be monitored q2h, then q4h.

8 Coagulation and CBC

8.1

Goals

- Optimal hemoglobin > 70 g/L
- Administer platelets and fresh frozen plasma if clinical signs of hemorrhage or coagulopathy
- Blood products should be administered according to clinical criteria similar to routine ICU care. Preventive administration is discouraged
- CMV-negative blood is not required

8.2

Attention!

Communicate with Transplant Québec before administering blood products that may interfere with the following:

- Tissue typing
- Serology and virology

Appendix (Recruitment)

Organs previously deemed inadmissible for transplant may necessitate recruitment manoeuvres to regain function.

The following are recommendations only and are not intended to replace an integrated approach to clinical judgement.

Lung donor — X

- **X1** • Perform **lung challenge test***
- **X2** • Arterial blood gas ± q2h and pulmonary recruitment PRN (according to the lung transplant program, with approval of the intensivist)
- **X3** • Avoid pulmonary edema
- **X4** • Early bronchoscopy (Gram stain and culture), if interest from lung transplant program
- **X5** • Chest X-ray QD and PRN

▶ *** Lung challenge test**

- **X1.1** • Ventilate with 100 % FiO_2, minimum PEEP of 5 cm H_2O, and tidal volume of 8-10 mL/kg of ideal weight
- **X1.2** • Arterial blood gas after 20 minutes (benchmark blood gases)

Heart donor* — Y

- **Y1** • Perform EKG
- **Y2** • Troponin I or T q12h, CK, CK-MB q8h
- **Y3** • Perform an echocardiogram according to orders from the heart transplant program
- **Y4** • Avoid administering significant inotrope support
- **Y5** • Notify if inotrope needs increase

* If donor presents with a patent foramen ovale or an ASD (atrial septal defect) use IV in-line filter

References:

1. Ball IM, Hornby L, Rochwerg B, et al. *Management of the neurologically deceased organ donor: A Canadian clinical practice guideline*. CMAJ. 2020 April 6; 192(14):E361-E369. DOI:10.1503/cmaj.190631.
2. Nakagawa BP, Shemie SD, Dryden-Palmer K, Parshuram CS, Brierley J. *Organ Donation Following Neurologic and Circulatory Determination of Death*. Pediatric Critical Care Medicine. 2018; 19:S26-S32. DOI:10.1097/PCC.0000000000001518.1.
3. Weiss MJ, Blanco AP, Ben Gelbart. *Special issues in pediatric deceased organ donation*. Intensive Care Medicine. February 2019:1-3. DOI:10.1007/s00134-019-05523-2.

The Transplant Québec team would like to thank everyone who participated in the revision of this document.

To download or print this guide: www.transplantquebec.ca/maintien-et-evaluation

This guide is overseen by Transplant Québec and is revised periodically.

Please ensure that you have the most recent version.