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UPDATED Pediatric Donor Management and Dosing Guidelines

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The following provides standard pediatric dosages for various drugs. Doses provided are guidelines only and are not intended to substitute for the medical judgment of the treating physician or transplant coordinator. Actual doses may vary depending on the child's condition and other relevant circumstances.

Formulas for Weight, ETT Size, Depth ETT, IV Fluids, and Vital Signs

Estimated Wt in kg: 2 (age in years) + 8

Estimated body surface area: $\frac{4 \times \text{wt(kg)} + 7}{90 + \text{wt(kg)}}$

ETT size: $\frac{16 + \text{age in years}}{4}$

Depth of ETT (cm) = 3 x size of the ETT ***or*** 10 + age in years (children 1-12 years of age)

Lowest Acceptable Systolic Blood Pressure = (2 x age in years) + 70

Abnormal Vital Signs	***RR***	***Pulse***	***SBP***
Neonate	> 40	> 160	< 60
Infant	> 40	> 160	< 70
Toddler	> 30	> 140	< 75
School age	> 25	> 120	< 85
Adolescent	> 20	> 110	< 90

Hypoglycemia: 2 cc/kg IV of 25% Dextrose

Hourly Maintenance fluids: 1st 10 kg = 4 cc/kg
2nd 10 kg = 2 cc/kg
>20 kg = wt(kg) + 40

Fluid Resuscitation: 20 cc's/kg of Lactated Ringers, Normal Saline or 5% Albumin
Reassess, repeat x 2 as needed

(Hypotonic and dextrose containing IVF's should **never be used for fluid resuscitation)*

Hetastarch (Hespan) or other artificial plasma expanders should be avoided for fluid resuscitation
(Note: Large amounts of Hepsan or artificial plasma expanders can result in a coagulopathy and should be avoided in patients with severe bleeding disorders)

PEDIATRIC CODE MEDICATIONS

AGE	NB	3-9 mo		1 yr	2-3 yr	4 yr	5-6 yr	7-8 yr	9 yr	10 yr	11 yr
Weight (kg)	**3**	**5**	**7**	**10**	**12**	**15**	**20**	**25**	**30**	**35**	**40**
EPINEPHRINE 1:10,000 Conc: 0.1 mg/cc IV Dose: 0.01 mg/kg	0.3 cc	0.5 cc	0.7 cc	1 cc	1.2 cc	1.5 cc	2 cc	2.5 cc	3 cc	3.5 cc	4 cc
ATROPINE Conc: 0.1 mg/cc IV Dose: 0.02 mg/kg	1 cc	1 cc	1.4 cc	2 cc	2.4 cc	3 cc	4 cc	5 cc	6 cc	7 cc	8 cc
8.4% Na BICARBONATE Conc: 1 meq/cc IV Dose: 1 meq/kg	3 cc	5 cc	7 cc	10 cc	12 cc	15 cc	20 cc	25 cc	30 cc	35 cc	40 cc
10% Ca CHLORIDE Conc: 100 mg/cc IV Dose: 20 mg/kg	0.6 cc	1 cc	1.4 cc	2 cc	2.4 cc	3 cc	4 cc	5 cc	6 cc	7 cc	8 cc
ETT SIZE	3.0	3.5 – 4.0		4.0 – 4.5		5.0	5.0-5.5	5.5-6.0	6.0-6.5	6.5-7.0	7.0-7.5
	Uncuffed ETT						***Cuffed ETT***				
Depth of ETT (cm)	9.0	10	10	11	12-13	14	15-16	18	20	21	22

Defibrillation: 2 joules/kg. May double and repeat X 2, and then as necessary

Synchronized Cardioversion: 1 joule/kg or ½ the defibrillation dose. May double and repeat X 2, and then as necessary

Pharmacologic Agents Used for Hormonal Resuscitation

Drug	Dose	Route	Comments
Desmopressin *(DDAVP®)*	0.5 mcg/hour	IV	½ life 75-120 mins Titrate to decrease urine output to 3-4 cc/kg/hour May be beneficial in patients with an ongoing coagulopathy
Vasopressin *(Pitressin®)*	0.5 milli-units/kg/hour	IV	½ life 10-35 mins Titrate to decrease urine output to 3-4 cc/kg/hour Hypertension can occur

Treatment of diabetes insipidis should consist of pharmacologic management to decrease but not completely stop urine output. Replacement of urine output with ¼ to ½ normal saline should be used in conjunction with pharmacologic agents to maintain serum sodium levels between 130-150 meq/L

Levothyroxine *(Synthroid®)*	0.8 – 1.4 mcg/kg/hour	IV	Bolus dose 1-5 mcg/kg can be administered. Infants and smaller children require a lager bolus and infusion dose.
Triiodothyronine *(T_3)*	0.05 – 0.2 mcg/kg/hour	IV	
Methylprednisoione *(Solucortef®)*	20 – 30 mg/kg	IV	Dose may be repeated in 8-12 hours Fluid retention Glucose intolerance
Insulin	0.05 – 0.1 units/kg/hour	IV	Titrate to control blood glucose levels to 60-150 mg/dL Monitor for hypoglycemia

Hormonal replacement therapy should be considered early in the course of donor management. Use of hormonal replacement therapy may allow weaning of inotropic support in the pediatric donor

Antiarrhythmic Agents

Drug	Dose	Route	Comments
Adenosine *(Adenocard IV®)*	100 mcg/kg	Rapid IV push	Repeat dose: 200 mcg/kg Max single dose: 12 mg
Amiodarone *(Cordarone®)*	5 mg/kg infused over 30 mins	IV	Repeat dose: 5 mg/kg Infusion: 5-10 mcg/kg/min Monitor for hypotension
Atropine	0.02 mg/kg	IV	Min. dose: 0.1 mg Max. dose: 0.5-1.0 mg
Lidocaine	1 – 2 mg/kg	IV	Infusion: 10-50 mg/kg/min
Magnesium Sulfate	30 mg/kg infused over 10 mins	IV	Max. dose: 2.5 grams Repeat dose: 10 mg/kg

Correction of Metabolic Acidosis

Sodium bicarbonate	1 meq/kg	IV	May increase plasma osmolarity Hypernatremia can occur or be aggravated with repeated dosing
Tromethamine *(THAM®)*	Base deficit x wt(kg) = cc's of 0.3 molar solution of THAM	IV	Does not increase osmolarity or CO_2 production Hypoglycemia can occur Contraindicated in renal failure May increase coagulation time

Inotropic Infusions

Drug	Dose	Comments
Milrinone *(Primacor®)*	0.25 – 0.75 mcg/kg/min	Loading dose: 50 mcg/kg Hypotension can occur
Dopamine	2 – 20 mcg/kg/min	Titrate to desired blood pressure
Dobutamine *(Dobutrex®)*	2 – 20 mcg/kg/min	Titrate to desired blood pressure
Epinephrine	0.1 – 1 mcg/kg/min	Titrate to desired blood pressure
Norepinephrine *(Levophed®)*	0.05 – 2 mcg/kg/min	Titrate to desired blood pressure
Phenylephrine *(Neo-Synephrine®)*	0.1 – 0.5 mcg/kg/min	Bolus: 5 – 20 mcg/kg Titrate to desired blood pressure
Vasopressin *(Pitressin®)*	0.0003 – 0.002 units/kg/min ***Note: Dosing is different for treatment of diabetes insipidis***	Limited data in children. Not recommended as first line therapy. Titrate to desired blood pressure

Inotropic agents are used for low cardiac output states to improve end organ perfusion. These agents should be titrated to maintain a normal blood pressure for age. Blood pressure alone does not indicate adequate tissue perfusion. Serum biomarkers such as lactate should be followed as inotropic support is titrated.

Antihypertensives

Drug	Dose	Comments
Sodium Nitroprusside *(Nipride®)*	0.5 – 10 mcg/kg/min	Side effects include thiocyanate and cyanide toxicity Mix 10 mg thiosulfate for every 1mg of nitroprusside Titrate to control blood pressure Monitor for hypotension
Esmolol *(Brevibloc®)*	50 – 250 mcg/kg/min	Loading dose: 100 – 500 mcg/kg Bronchospasm can occur Titrate to control blood pressure Monitor for hypotension
Labetalol *(Normodyne®)* *(Trandate®)*	Bolus: 0.2 – 1 mg/kg Infusion: 0.4 – 3 mg/kg/hour	Titrate to control blood pressure Monitor for hypotension
Nicardipine *(Cardene IV®)*	1 – 3 mcg/kg/min	Titrate to control blood pressure Monitor for Hypotension
Hydralazine *(Apresoline®)*	0.1 – 0.5 mg/kg up to 20 mg	Dose may be repeated every 4 – 6 hours Monitor for hypotension

Antibiotics

Ampicillin	100 – 200 mg/kg/day IV divided every 6 hours Meningitis: 200 – 400 mg/kg/day IV divided every 6 hours
Gentamicin	< 30 days of age: 4 mg/kg/dose IV every 24 hours >30 days of age: 2.5 mg/kg/dose IV every 8 hours **Dosing adjusted based upon serum levels*
Cefazolin *(Ancef®, Kefzol®)*	25 mg/kg/dose IV every 8 hours
Ceftriaxone *(Rocephin®)*	50 – 75 mg/kg/day IV/IM daily or divided every 12 hours Meningitis: 100 mg/kg/day IV daily or divided every 12 hours **Use with caution in neonates because of risk for hyperbilirubenemia*
Cefotaxime *(Claforan®)*	< 7 days of age: 100 mg/kg/day IV/IM divided every 12 hours > 7 days of age: 100 – 200 mg/kg/day IV/IM divided every 8 hours Meningitis: 200 mg/kg/day IV divided every 6 hours
Cefuroxime *(Zinacef®)*	100 – 150 mg/kg/day IV/IM divided every 8 hours
Ceftazidime *(Fortaz®)*	100 – 150 mg/kg/day IV divided every 8 hours
Clindamycin *(Cleocin®)*	10 mg/kg/dose IV every 6 hours
Oxacillin	50 mg/kg/dose IV every 6 hours
Vancomycin	< 30 days of age: 15 mg/kg/dose IV every 12 hours > 30 days of age: 40 mg/kg/day IV divided every 6 hours Meningitis: 60 mg/kg/day IV divided every 6 hours **Dosing adjusted based upon serum levels*

Bronchodilator Therapy

Drug	Dose	Route	Comments
Aerosolized Agents			
Albuterol	2.5 – 5 mg	Aerosolized	Repeat as needed
Continuous Albuterol	10 – 20 mg/hour	Aerosolized	
Ipratropium Bromide *(Atrovent®)*	0.5 – 1 mg	Aerosolized every 4 – 6 hours	
Steroids			
Methylprednisoione (Solumedrol®)	1 mg/kg	IV	
IV Agents			
Magnesium Sulfate	50 – 75 mg/kg administered over 20 mins		Max. 2.5 grams
Terbutaline *(Brethine®)*	0.5 – 3 mcg/kg/min		Loading dose: 10 – 20 mcg/kg

Transfusion Therapy

Packed red blood cells	10-15 cc's/kg	Administer over 2-3 hours. May be administered faster if hypotension or bleeding requires more aggressive correction.
Fresh frozen plasma	10-15 cc's/kg	Administer over 1-2 hours. May be administered faster if correction of coagulopathy is associated with volume depletion or hypotension
Cryoprecipitate	5-10 cc's/kg ***or*** 1 unit for every 10 kg of body weight	Administer for low fibrinogen levels
Platelets	< 15 kg 10-20 cc's/kg >20 kg single unit of platelets	Administer slowly over 2-3 hours

Maintaining Mean Arterial Pressure in the Pediatric Organ Donor

Hemodynamically Stable

- Methylprednisolone
- Levothyroxine ***OR*** Triiodothyronine administration should be considered in this patient population
- Diabetes Insipidus
  a. Desmopressin
     1. Continuous infusion (preferred)
     2. Intermittent dose

     OR
  b. Vasopressin administered by continuous infusion

Hemodynamically Unstable

- Volume loading with crystalloid or colloid
- Inotropic support
  - Dopamine
  - Dobutamine
  - Epinephrine
  - Phenylephrine
  - Norepinephrine
- Methylprednisolone
- Bolus dose of Levothyroxine followed by continuous infusion ***OR*** Triiodothyronine infusion
- Diabetes Insipidus
  - Vasopressin administered by continuous infusion

Desmopressin has a longer ½ life. This agent can be discontinued 2-3 hours prior to organ recovery. Consultation with pediatric intensivists and transplant surgeons should occur to discuss preferences in pharmacologic agents used to maintain hemodynamic stability.

Pediatric Donor Management Goals

Hemodynamic Support

- **Normalization of blood pressure**
  - **Systolic blood pressure appropriate for age**
  - **Note: Lower systolic blood pressures may be acceptable if biomarkers such as lactate are normal.**
- **CVP < 12 *(if measured)***
- **Dopamine < 10 mcg/kg/min**
- **Normal serum lactate**

Blood Pressure

	Systolic	Diastolic
Neonate	60-90	35-60
Infants (6 months)	85-100	50-65
Toddler (2 years)	90-105	50-65
School age (7 years)	90-115	60-70
Adolescent (15 years)	110-130	65-80

Normal systolic blood pressure = 80 + 2 x age in years

Oxygenation and Ventilation

- **Maintain PaO_2 > 100 mmHg**
- **FiO_2 0.40**
- **Normalize $PaCO_2$ 35-45 mmHg**
- **Arterial pH 7.30-7.45**
- **Tidal volumes 8-10 cc/kg**
- **PEEP 5 cm H_2O**

Fluids and Electrolytes

- **Serum Na^+ 130-150 meq/L**
- **Serum K^+ 3-5.0 meq/L**
- **Serum glucose 60-150 mg/dL**
- **Ionized Ca^{++} 0.8-1.2 mmol/L**

Thermal Regulation

- **Core body temperature 36 – 38°C**

- The management of the pediatric organ donor will be dictated by regional standards of care and the physicians caring for the child.
- Consultation with a pediatric intensive care specialist and your regional medical director is essential to ensure the best possible outcome for organ recovery
- Become familiar with the intensivist care specialists and transplant surgery guidelines in the institutions that you serve.

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