Sepsis Management - Pediatric

Disclaimer: *This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson's specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care. This algorithm should not be used to treat pregnant women.*

PRESENTATION

Patient exhibits 2 or more of the following criteria:

- Temperature < 36°C or > 38.1°C
- Unexplained tachycardia or bradycardia[1]
- Respiratory rate[1] greater than normal for age
- WBC count < 3 or ≥ 15 K/microliter
- Pediatric early warning score (PEWS)[2] ≥ 6
- Nurse or parental concern

Note: If on steroids and/or scheduled acetaminophen, patient might not have temperature elevation

EVALUATION

Is patient unresponsive?

Yes

- Call **CODE Blue Team (x2-7099)**
- Notify the following teams:
  - **PICS Team (x5-0570) and**
  - Inpatient G9 Team[3] for inpatients **or**
  - Triage APP for outpatients

→ Admit to PICS

No

- Call **MERIT (x2-7090)**
- Administer oxygen via nonrebreather face mask at 10 L/minute to maintain O_2 saturation > 92%
- Notify the following teams:
  - **PICS team (x5-0570) and**
  - Inpatient G9 Team for inpatients **or**
  - Triage APP for outpatients
- Teams to assess for suspicion of infection[4]

→ Suspicion of infection?

Yes → See Page 2: Sepsis Management

No → Continue evaluation for further treatment or alternative diagnosis

APP = advanced practice provider
PICS = pediatric intensive care service

[1] See Appendix A: Age Specific Vital Signs
[2] See Appendix B: Modified Pediatric Early Warning Signs (PEWS) Tool
[3] See Appendix C: Pediatric Primary Teams
[4] See Appendix D: Suspicion of Infection

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TREATMENT

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- Initiate sepsis orders
- Obtain Cultures (blood[1] x2 sites with one set preferably from peripheral site, and other sources as indicated) **STAT**
- Give broad spectrum antibiotics – first dose **STAT** *Do not delay antibiotic therapy if cultures cannot be obtained within 45 minutes*
- Obtain the following **STAT**: CBC with differential, complete metabolic panel, VBG+, lactic acid, magnesium, phosphorus, calcium, PT, PTT, fibrinogen, cortisol, CRP, procalcitonin, NT ProBNP and type and screen
- Initiate cardiac monitoring
- Verify and if needed, obtain adequate IV access
- Give fluid challenge up to 20 mL/kg[2] crystalloids [*e.g.*, plasmalyte, Lactated Ringer's, sodium chloride 0.9% (NS)]; each fluid challenge should be given over 10 - 30 minutes
- Monitor vital signs every 15 minutes for 1 hour, then every hour for 5 hours, then every 2 hours for 24 hours
- Titrate oxygen to maintain SpO_2 > 92%
- Consider transthoracic echocardiogram

Hypotensive[3] **or** lactic acid > 2 mmol/L despite adequate fluid resuscitation?

Yes →

Septic Shock

- Transfer to PICS for further management
- Consider placement of arterial line and additional venous access
- Monitor and maintain respiratory/hemodynamic status
- May repeat fluid challenge if indicated[2]
- If lactic acid elevated, repeat level within 4 hours
- Consider norepinephrine for persistent hypotension[4]
- Obtain transthoracic echocardiogram if not already completed

See Page 3 for EC/PICS Management

No →

Sepsis

- Continue to monitor and maintain respiratory/hemodynamic status
- Review stat labs
- Assess IV fluid provision
- Continue broad spectrum antibiotics
- Request appropriate team consults

VBG = venous blood gas

[1] Preferable volume includes 5-10 mL per blood culture bottle for children < 20 kilograms and 10 mL for children ≥ 20 kilograms

[2] Considerations for fluid resuscitation:
- If not hypotensive (See Appendix A) but with history of insensible losses, administer fluid challenge of 10–20 mL/kg
- If history of cardiomyopathy, administer fluid challenge of 10 mL/kg
- Monitor for signs of fluid overload: signs of fluid overload (worsening tachypnea/respiratory distress, desaturations) during administration of bolus

[3] See Appendix A: Age Specific Vital Signs

[4] If inpatient, may start norepinephrine as listed above while awaiting transfer to PICS; may administer peripherally if central access is not available

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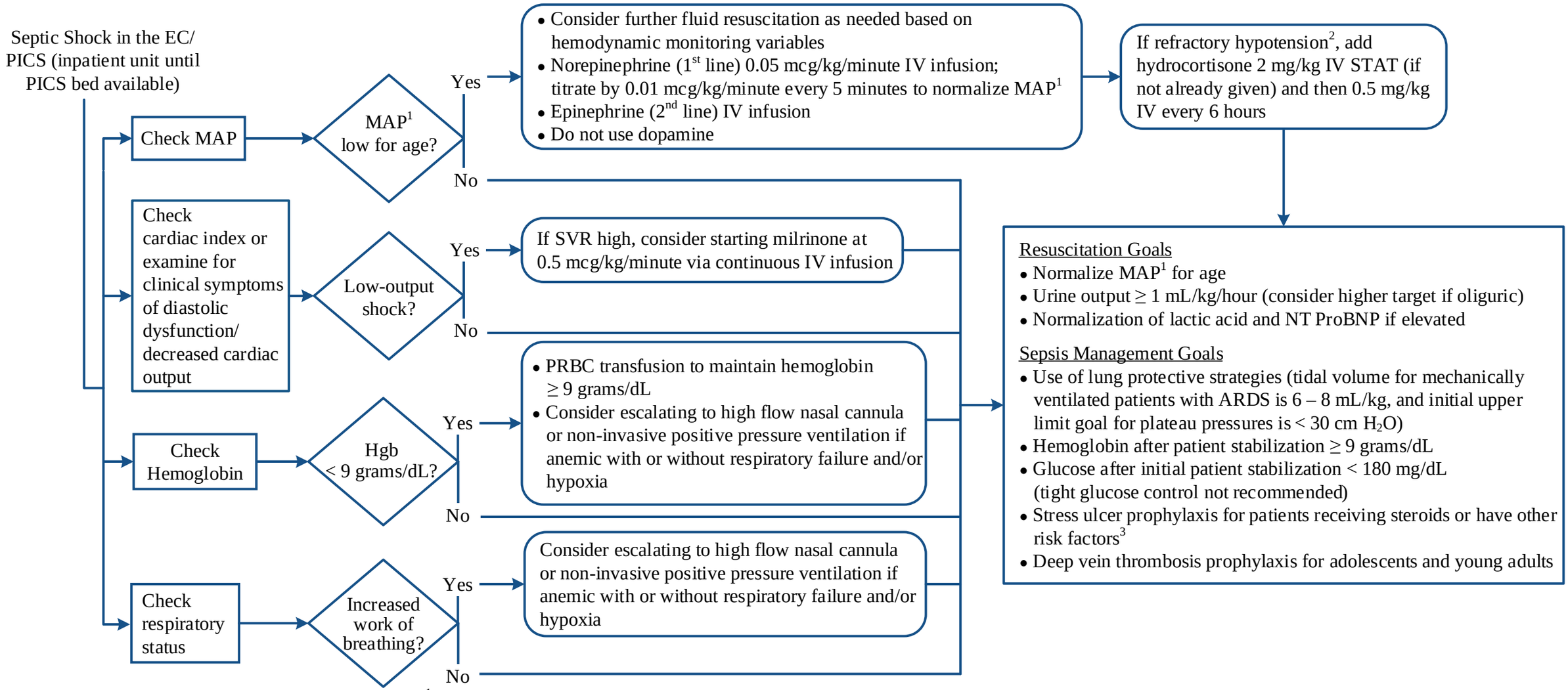

MAP = mean arterial pressure
SVR = systemic vascular resistance
ARDS = acute respiratory distress syndrome

[1] See Appendix A: Age Specific Vital Signs
[2] Refractory hypotension is hypotension despite adequate fluid resuscitation and vasopressors
[3] Risk factors for GI bleeding include: mechanical ventilation, coagulopathy, thrombocytopenia, higher severity of illness score, renal failure, liver failure, hypotension, heart failure and arrhythmias

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APPENDIX A: Age Specific Vital Signs

Age Group	Tachycardia Heart Rate	Tachypnea Respiratory Rate	Hypotension	
			Systolic Blood Pressure	Mean Arterial Pressure[1]
Infant 1 month to 1 year	> 180 beats/min	> 34 breaths/min	< 70 mmHg	< 55 mmHg
Toddler and Preschool 1 to 5 years	> 140 beats/min	> 24 breaths/min	< [70 + (2 x age in years)] mmHg	< 60 mmHg
School Age 5 to 12 years	> 130 beats/min	> 22 breaths/min	< [70 + (2 x age in years)] mmHg	< 65 mmHg
Adolescent 12 to 18 years	> 110 beats/min	> 20 breaths/min	< 90 mmHg	< 65 mmHg

[1]Minimum goal for Mean Arterial Pressure (MAP) is [55 + (1.5 x age in years)] mmHg

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APPENDIX B: Modified Pediatric Early Warning Signs (PEWS) Tool

	Score[1]			
	0	1	**2**	**3**
Behavior	• Playing • Appropriate	Irritable, but consolable	Irritated, but not consolable	• Lethargic • Confused • Reduced response to pain
Cardiovascular System				
Rate	• Within normal parameters for age	• Tachycardia < 20 above normal for age	• Tachycardia 20-29 above normal for age	• Tachycardia ≥ 30 above **or** bradycardia ≥ 10 below normal for age
Color	• Pink	• Pale **or** dusky	• Mottled	• Gray
Perfusion	• Capillary refill 1-2 seconds	• Capillary refill 3 seconds	• Capillary refill 4 seconds	• Capillary refill ≥ 5 seconds
Respiratory System				
Rate	• Within normal parameters for age	• Tachypnea 10-19 above normal parameters for age	• Tachypnea ≥ 20 above normal parameters for age with retractions	• Bradypnea ≥ 5 below normal parameters for age with retractions
Effort	• No retractions	• Mild retractions/accessory muscle use	• Moderate retractions/accessory muscle use (including tracheal tugging)	• Severe retractions/accessory muscle use (including tracheal tugging) **and** grunting
Oxygen	• N/A	• Oxygen required to maintain normal[2] SpO_2 ◦ FiO_2 24-40% ◦ 2 L/minute O_2 • Any assisted ventilation[3] or initiation of O_2	• Oxygen required to maintain normal[2] SpO_2 ◦ FiO_2 40-49% ◦ O_2 ≥ 3 L/minute	• Oxygen required to maintain normal[2] SpO_2 ◦ FiO_2 ≥ 50%

[1] Add 2 extra points if patient requires frequent interventions (*e.g.*, suctioning, positioning, change in O_2 needs, multiple IV attempts required, **or** every 15-minute or continuous nebulized treatments) **or** has persistent post-op vomiting
[2] As defined in patient's orders
[3] Includes home bilevel positive airway pressure (BiPAP)/continuous positive airway pressure (CPAP) or home ventilator at baseline settings

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APPENDIX C: Pediatric Primary Teams

Inpatient G9 Team: For pediatric inpatients on G9 or other floors
- AM Team (7am-5pm) – G9 Resident + Fellow + APP + Attending
- PM Team (5pm-7am) – G9 Resident + Nocturnalist + Fellow + APP + Attending

APPENDIX D: Suspicion of Infection

- Fever or hypothermia
- Recent surgical procedure
- Immunocompromised
  - Chemotherapy
  - Steroids/immunosuppressed
  - Loss of skin integrity
  - HIV/suspected HIV
- Skin wound
- Invasive device
  - Central line
  - Foley catheter
- Infiltrate on chest x-ray
- Cough with sputum production
- Diarrhea with or without abdominal pain
- Diabetes mellitus
- Unilateral sinusitis (and/or facial swelling)

SUGGESTED READINGS

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