

Sepsis Care in the Air



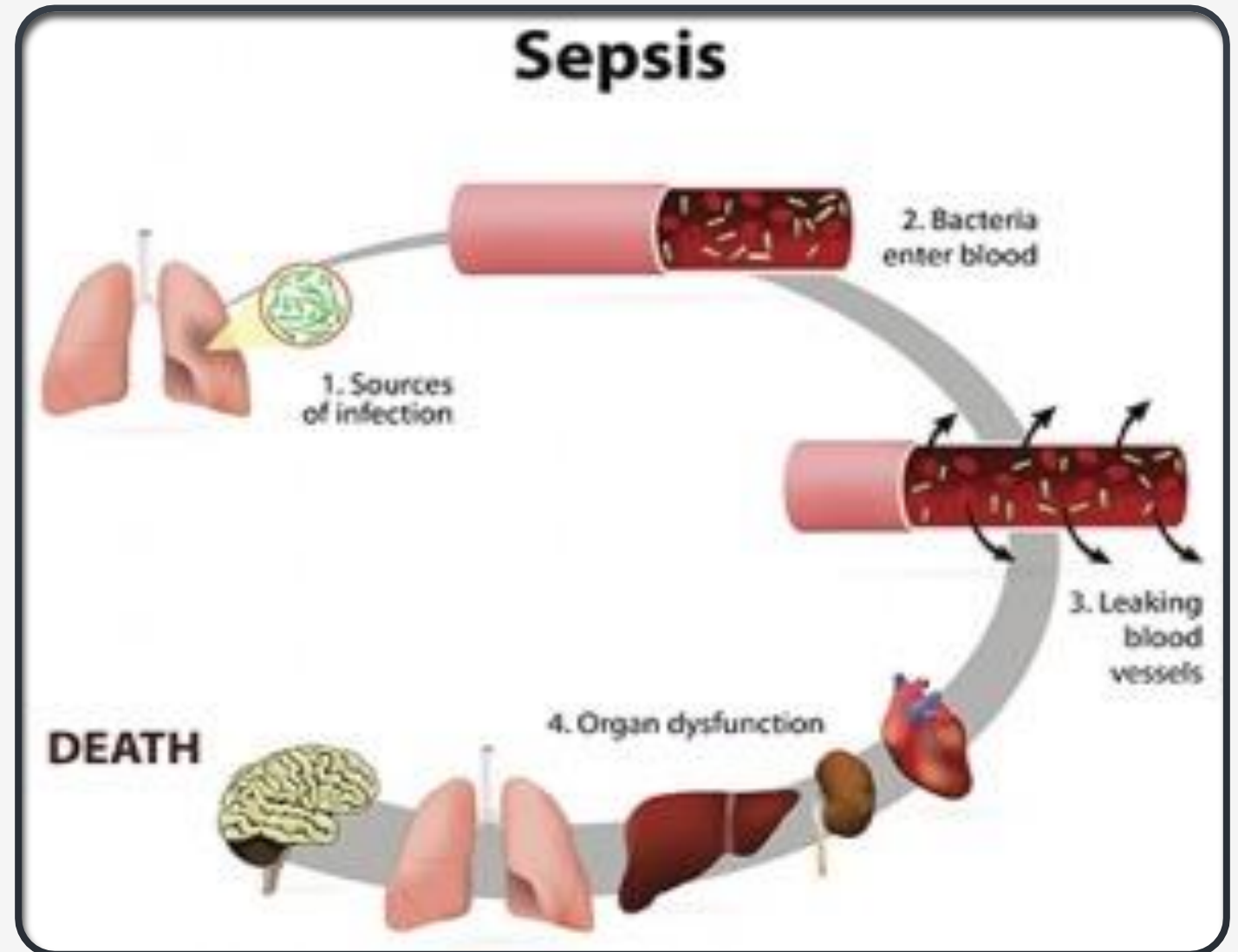
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What is Sepsis?

Sepsis was formally defined in a 1992 consensus statement by the ACCP/SCCM as systemic inflammatory response syndrome (SIRS) in the setting of infection.

The presence of bacteria (bacteremia), other infectious organisms, or toxins created by infectious organisms in the bloodstream with spread throughout the body (medicine.net)





Sepsis is fundamentally a systemic response to infection that results in organ dysfunction

Sequential [Sepsis-Related] Organ Failure Assessment (SOFA) Score

System	0	1	2	3	4
Respiration PaO ₂ /FiO ₂ , mmHg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation Platelets, x10 ³ /uL	≥150	<150	<100	<50	<20
Liver Bilirubin, mg/dL (umol/L)	<1.2 (20)	1.2 - 1.9 (20 - 32)	2.0 - 5.9 (33 - 101)	6.0 - 11.9 (102 - 204)	>12.0 (204)
Cardiovascular	MAP ≥70mmHg	MAP <70mmHg	Dopamine <5 or Dobutamine (any dose)	Dopamine 5.1 - 15 or Epinephrine ≤0.1 or Norepinephrine ≤0.1	Dopamine >15 or Epinephrine >0.1 or Norepinephrine >0.1
CNS GCS Score	15	13 - 14	10 - 12	6 - 9	<6
Renal Creatinine, mg/dL (umol/L) Urine Output, mL/d	<1.2 (110)	1.2 - 1.9 (110 - 170)	2.0 - 3.4 (171 - 299)	3.5 - 4.9 (300 - 440) <500	>5.0 (440) <200

*Catecholamine Doses = ug/kg/min for at least 1hr

Hospital vs Prehospital differences in sepsis

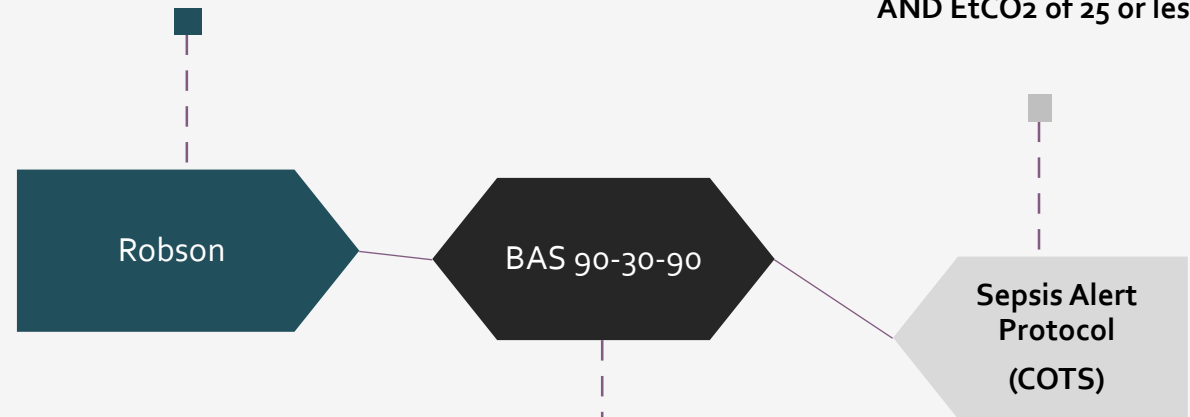


Prehospital Sepsis Criteria

The Society of Critical Care Medicine's definition of sepsis contains thorough and sensitive tools to assist physicians with diagnosis. In most EMS systems the ability to draw labs or blood gases does not exist. However, there are several prehospital screening tools that aid in the decision making process for EMS providers so that early sepsis therapy can be initiated.

- Two or more criteria met:
1. Temp <96.8 or >100.9
 2. Heart rate >90 bpm
 3. Respiratory rate >20
 4. Acute altered mental status
 5. Serum glucose >120

- A suspected infection
SBP <90 plus 2 of the following:
1. HR >90 bpm
 2. Temp <96.8 or >100
 3. Respiratory rate >20
 4. Acute altered mental status
 5. Serum lactate >4 mmol/L
AND EtCO₂ of 25 or less



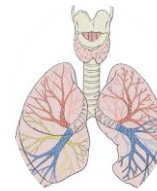
- One or more criteria met:
1. SBP >90
 2. RR >30 breaths per min
 3. Oxygen saturation <90

Prehospital Considerations and Sepsis

Vital signs and end tidal carbon dioxide (EtCO₂) monitoring are used as key factors in the prehospital assessment of the septic patient.



Blood pressure/Heart rate



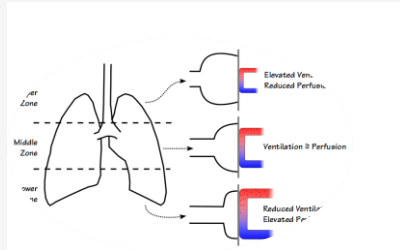
Respirations-
Ventilation



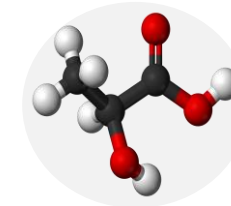
Perfusion

Capnography

Capnography is a very important tool for the prehospital clinician. It provides information about both ventilation and perfusion. As long as the body is working and metabolizing glucose and oxygen waste products will be eliminated into the bloodstream. Those wastes can only be released into the bloodstream if there is normal perfusion of the lung.



As perfusion decreases EtCO₂ decreases along with it.



This results in an increase in metabolic waste in the bloodstream (lactic acid)



EtCO₂ level is inversely proportional to lactate levels



As we see lactate levels rise, we see EtCO₂ levels drop.



EtCO₂ readings < 25 mmHg in the clinical setting of shock are associated with increased mortality.



Patients with EtCO₂ of 25 mmHg may have associated lactate levels of 6.1 mmol/L

Prehospital Management

Prehospital caregivers focus primarily on fluid resuscitation and vasopressor infusions. The goal is to increase the patients perfusion to vital organs.



Fluid Resuscitation



Vasopressor Infusions



Advanced airway management



Volume Status and Resuscitation

- As cytokine (proteins important in cell signaling) levels increase due to infection, the immune response creates massive vasodilation and a decrease in systemic vascular resistance. This creates hypotension in the septic patient.
- Prehospital goals are to get enough fluids in the vasculature to increase preload and increase blood pressure high enough to perfuse the bodies vital organs. We are continually assessing level of consciousness.
- Septic shock is different than hypovolemic shock in that it does NOT need more oxygen carrying fluid.
- Isotonic fluids are adequate in the initial phases of treatment for increasing blood pressure in the septic patient

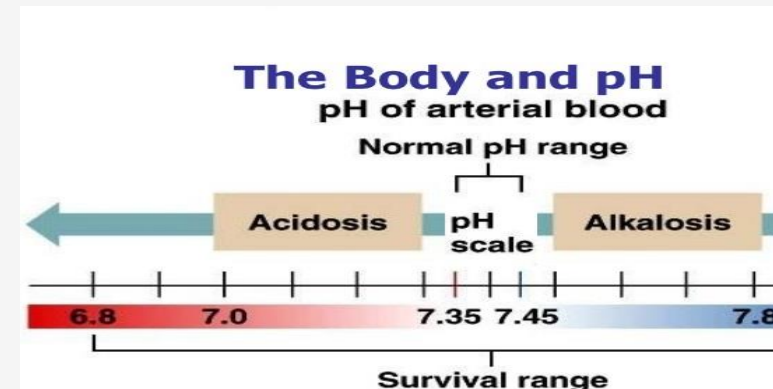


IV fluids continued...

Surviving Sepsis Initiative
Guidelines

Call for 30ml/kg crystalloid over
first 3 hours of treatment

- Complications of this:
 - Fluid resuscitation should be based on ideal body weight
 - How are we figuring that out?
 - Over first 3 hours.....not the first 3 minutes
 - pH of normal saline is 5.5
 - How do you think this affects a person who is septic?
 - Think about acidosis.....



*In general
EMS will
administer
500 ml bolus
NS as
tolerated
until SBP > 90
or MAP > 65*

$$\text{MAP} = \frac{2(\text{DBP}) + \text{SBP}}{3}$$

3

MAP offers a better representation of overall perfusion to the vital organs of the body.

Vasopressor

Preferred pressor is Norepinephrine(Levophed)

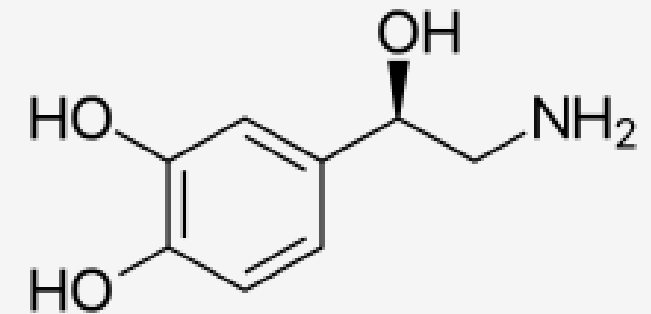
Primarily Alpha Stimulation (Squeeze)

Some Beta 1 (Heart rate/Contractility)

Dose range:

1-30mcg/min

(Some protocols may be weight based)



Other Vasopressor Medications

- Epinephrine gtt: 2 to 10 mcg/min inopressor (alpha and beta 1 and 2)
- Push Dose Epi until gtt is mixed. Note that epinephrine will cause a rise in serum lactate levels
- **Dopamine:** (Is anyone still using this?) **5 to 20 mcg/kg/min**. Often times these patients are already tachycardic and therefore dopamine is omitted.
- **Dobutamine** **5-20 mcg/kg/min** for aid in contractility.
- **Vasopressin:** 0.04-0.12 units/hr
- **Neosynephrine:** **pure alpha** 50 to 200 mcg/mg initially



- *Airway and Breathing*

Maintain SpO₂
of 94-99%

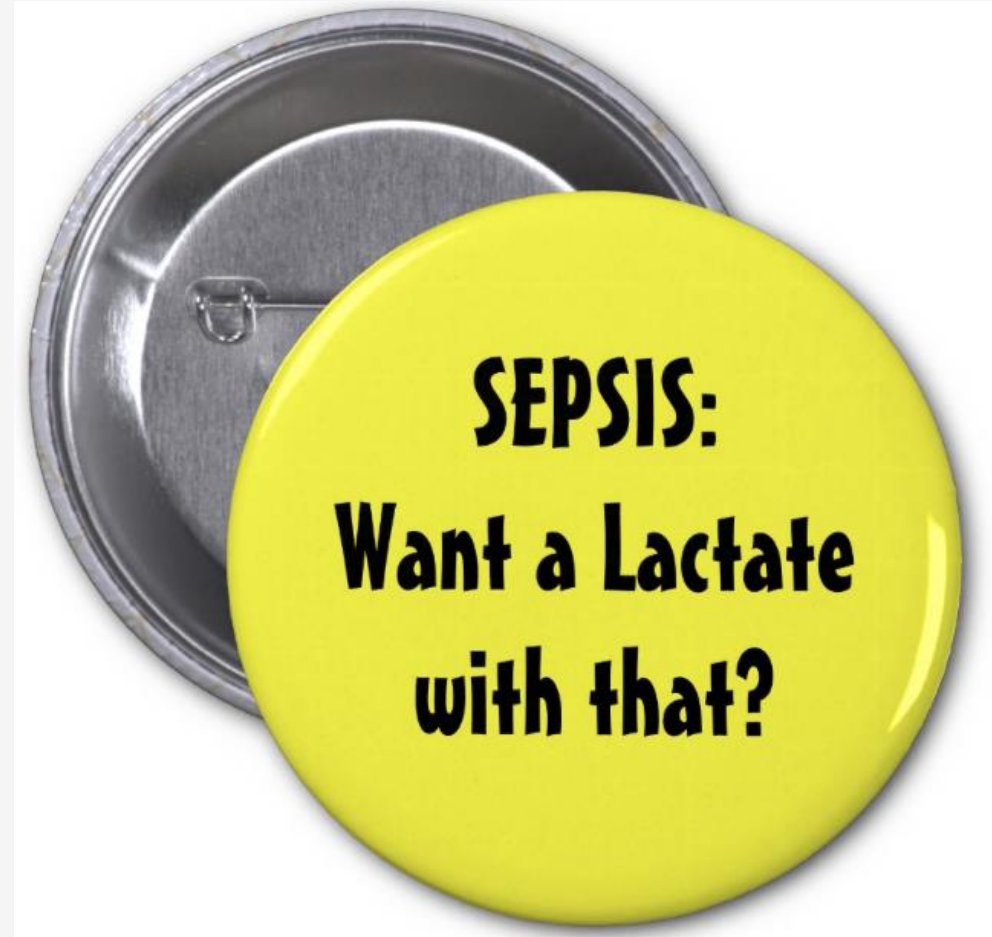




*Follow your protocol!
If you have to intubate via
RSI consider avoiding
etomidate. Etomidate
suppresses corticosteroid
production. Our patients
need corticosteroids to
heal and recover from
their illness.*

LACTIC ACID

IF EMS has capability to monitor serial serum lactate levels via fingerstick this can be useful to ED staff. Even if an initial fingerstick lactate can be acquired, it is helpful for the ED to have as a baseline prior to fluid resuscitation.



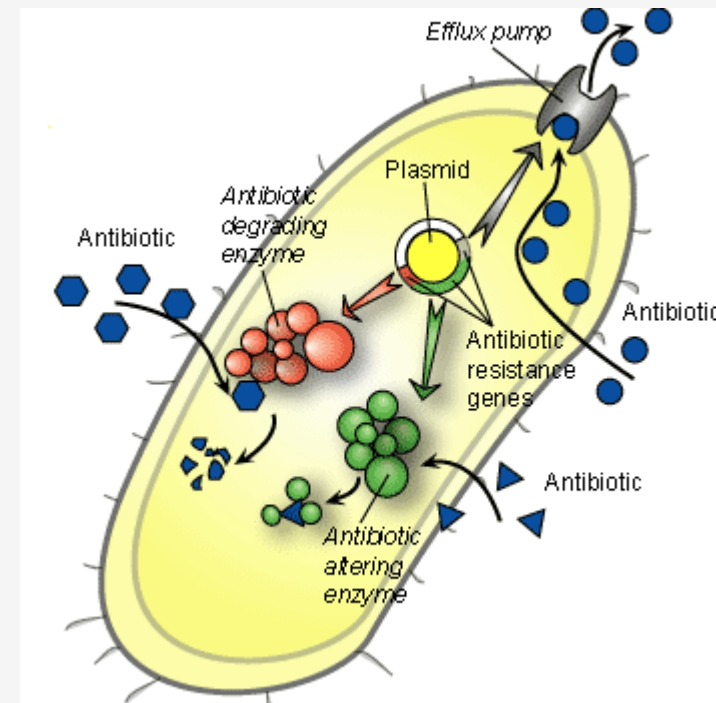
*HOW CAN
WE HELP
OUR
PATIENTS
THE
MOST???*

- Proper assessment
 - Be proactive
 - Be aggressive

Call a
**SEPSIS
ALERT**
to the hospital!

Why call a
**SEPSIS
ALERT?**

- To help initiate prompt antibiotic treatment!!!



Interfacility transports and septic shock

- Continue the treatment started at the referring facility
- Follow our companies protocol
- Ensure the patient continues to perfuse and ventilate properly with adequate blood pressures and minute volumes



What makes a patient septic?

(Labs help us identify these patients at risk)

Patient meets SIRS criteria in the presence of possible infection.

SIRS Criteria

Temperature $>38^{\circ}\text{C}$ (100.4°F) or $<36^{\circ}\text{C}$ (96.8°F)

Heart rate > 90

Respiratory rate >20 or $\text{PaCO}_2 <32\text{ mm Hg}$

WBC $>12,000/\text{mm}^3$ or $<4,000/\text{mm}^3$ or $>10\%$ bands

CMS Definitions

Sepsis	≥2 SIRS criteria + known or suspected infection
Severe Sepsis	Sepsis AND At least 1 sign of organ dysfunction: <ul style="list-style-type: none">• Sepsis-induced hypotension<ul style="list-style-type: none">• SBP <90• MAP <65• ↓ SBP >40 from normal baseline• Cr >2.0 or urine output <0.5 mL/kg/hr x2 hours• Bilirubin >2.0 mg/dL• Platelet count <100,000/mm³• INR >1.5 or PTT >60 sec• Lactate >2 mmol/L
Septic Shock	Severe sepsis AND <ul style="list-style-type: none">• Persistent hypotension after 30 mL/kg crystalloid• Lactate ≥4 mmol/L

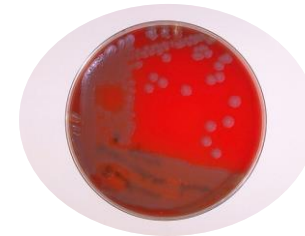
Hospital Sepsis Criteria

Getting Report: Why do they ask these questions???



4 hrs after admission.

Is the source of infection known?



Did you already draw blood cultures?
Have antibiotics been given?
Allergies?



How much fluid has the patient received?
How has their blood pressure and heart rate been trending?

VBG	7.28/34/-6	EKG unchanged
Lactate	4.5	Trop 0.19
T _s	wnl	BNP 1285
	N/A	

What was the patients WBC, electrolytes, creatinine, and lactic acid?



Do we have an ABG?
What are those results?
Do we have any relative Ct results?



What initially brought the patient to the hospital? Does the patient have significant medical history?



MIST handoff

- **M= Mechanism-** What was the cause of the injury or illness
- **I= Injury or Illness-** What is the injury sustained or illness found? What injury/illness did you suspect?
- **S= Signs and Symptoms-** What physical signs of injury or illness is the patient displaying? What are the symptoms the patient describes to you?
- **T= Treatment-** What treatments have been administered? What medical care did you provide up until the handover to the ED/ICU?
- You may hear this referred to as DMIST were the
D= Detail- What is the patients chief complaint, what is their age, medical history, allergies etc.



Survival Flight Ohio
Survival Flight 14- Grove City
Survival Flight 13- Westerville



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