

Sepsis: An unrecognized killer

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Illustration photo by Dawn McGee.

Scenario

It's about four hours into your Saturday shift at a suburban, fire-based EMS system. The station duties are finished and you've gotten breakfast. You and your partner are preparing to rest up for a busy night shift when the tones at your station go off. "Engine 4, Medic 4, respond to Resthaven Nursing Center for a medical call. Call type 26-C-1. Respond on Tac-2."

When you and your paramedic partner arrive at the nursing home along with the engine company, the nursing staff quickly escorts you to the room of an 85-year-old male. The charge nurse informs you that this patient was admitted to their facility last year with a diagnosis of dementia as well as a previous history of cardiac issues, including atrial fibrillation and hypertension. Over the past few days, the

man has become more confused and is now describing vivid hallucinations. The on-call physician instructed the facility staff to arrange for the patient to be evaluated at the nearest emergency department. When the local transfer provider was unable to respond within an acceptable timeframe, the nursing facility called 9-1-1.

Working as a team, the engine company and the medic unit apply oxygen via non-rebreather mask to the patient at 12 LPM and you hook the patient up to your unit's cardiac monitor. The monitor shows a ventricular paced rhythm at an approximate rate of 80 beats per minute. Initial respiratory rate is approximately 20 and a manual blood pressure is obtained showing 98/40. One of the firefighter/EMT-Bs obtains a blood glucose reading of 74 mg/dL. Out of an abundance of caution,

you perform a prehospital stroke screen, which does not seem to indicate that the patient is suffering from a cerebrovascular accident (CVA).

You next talk to the nurse, who is able to locate the patient's medications. They include warfarin, ramipril and donepezil. Considering the low blood pressure, you cautiously administer a 250 mL fluid bolus via an 18 gauge IV, which you established in the left antecubital vein during transport to the nearby community hospital. During your ongoing assessment, you also note rales and diminished lung sounds over the left lower lobe of the lung. Upon arrival at the emergency department, you release the patient to the nursing staff and return to service. Approximately a week later, during a response to the same nursing facility, you find out that your patient died of sepsis four days after you transported him to the hospital.

Introduction

Simply put, sepsis is defined as the systemic response to an infection.¹ Septicemia is an overwhelming bacterial infection occurring from the multiplication of bacteria throughout the bloodstream. Severe sepsis is ordinarily associated with organ dysfunction, shock or hypotension. Septic shock is sepsis with associated

hypotension that occurs despite fluid resuscitation along with other perfusion anomalies such as lactic acidosis, decreased urinary output or a sudden change in mental status.² Several medical texts define sepsis in the context of meeting two or more of the criteria for systemic inflammatory response syndrome (SIRS), see table below.

In fact, sepsis has been receiving significant attention in the popular press outside of the EMS and medical communities. The newspaper USA Today recently ran an article regarding a push for hospitals to recognize and treat sepsis earlier, with a physician from The Ohio State University stating that each hour of delay in treating a septic patient with IV fluids and antibiotics lowers the patient's survival by approximately eight percent.⁴

Knowing that sepsis is a deadly disease where rapid recognition and treatment is time sensitive and critical, we can address how EMS can make a difference in the recognition and treatment of sepsis.

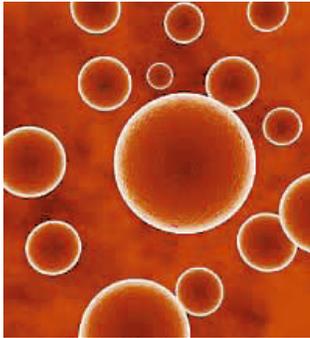
Recognizing sepsis

Sepsis is not always well recognized by physicians, even with advanced diagnostic procedures and laboratory reports. However,

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SIRS criteria in adults³

Systemic	Criteria
Core Temperature	Greater than 100.9°F or less than 96.8°F
Heart Rate	Unexplained tachycardia
Respiratory Rate	> 20 breaths/minute
Leukocyte Count	> 12,000 mm ³ or < 4,000 mm ³ or < 10% immature (band) forms



there are certain clues for EMS providers that may indicate a patient is septic. EMS educator Ryan Mayfield has lectured and written about the criteria that the Porter, Littleton, and Parker Adventist Hospitals near Denver use in allowing EMS providers to declare a “sepsis alert.”

commonly associated with hyperfusion. Although lactate meters are commonly used in personal fitness settings and can be easily acquired and used, EMS providers should consult with a medical director and/or EMS administration prior to adopting the use of lactate meters. The device falls within the federal Clinical Laboratory Improvement Amendments (CLIA) guidelines relating to clinical laboratory testing performed on patients.

Sepsis Alert Criteria (as adopted by Porter, Littleton, and Parker Adventist Hospitals)⁵

- A) Patient older than 18 and *not* pregnant
- B) Two or more SIRS criteria
 - a. Temperature greater than 100.4 or less than 96.8
 - b. Pulse greater than 90
 - c. Respirations greater than 20
- C) Suspected or documented infection
- D) Either of the following physiological criteria
 - a. Hypoperfusion as indicated by a systolic blood pressure less than 90 mm/Hg and/or a mean arterial pressure less than 65 mm/Hg
 - b. Lactate reading greater than or equal to 4

Several of the sepsis alert criteria may present atypically in the elderly.

Mean arterial pressure (MAP) is an important measurement relating to the perfusion of internal organs. A MAP below 60 mm/Hg is considered insufficient to perfuse organs, leading to organ ischemia and the organ death associated with multiple organ dysfunction syndrome (MODS). Many cardiac monitors that provide non-invasive blood pressure (NIBP) automatically calculate the MAP of the patient being monitored. Alternately, several formulas for calculating MAP exist. One of the easiest formulas involves doubling the patient’s diastolic blood pressure and adding the systolic blood pressure, then dividing the sum of those numbers by 3.⁶ The Porter, Littleton, and Parker Adventist Hospitals remove the potential for miscalculation by providing paramedics in their service area with a

The “sepsis alert criteria” described above are, overall, fairly adaptable to most EMS agencies. The EMS systems that transport to these hospitals in Colorado have acquired meters similar to glucometers to obtain a blood lactate reading. Lactate (or lactic acid) is a common byproduct of anaerobic respiration. Anaerobic respiration is

laminated reference card that calculates mean arterial pressure.

Be aware, however, that several of the sepsis alert criteria may present atypically in the elderly. Some patients may not have a pulse rate greater than 90 due to a previously implanted pacemaker for underlying cardiac dysrhythmias. Also, due to changes in the thermoregulation of many elderly patients, temperature spikes may be less common.

Altered mental status may be the primary index of suspicion in the geriatric population. EMS providers should be cognizant of the difference between the rapid onset of altered mental status—delirium—as opposed to a gradual decline in mental status—dementia. Delirium is an acute global disorder of cognition and attention, abnormal vital signs, and a disturbed sleep-wake cycle. Dementia is indicated by significant loss of intellectual



abilities, such as memory capacity, severe enough to interfere with social or occupational functioning.⁷ In fact, the Advanced Medical Life Support (AMLS) curriculum specifically states,

“the key to possible sepsis is altered mental status with a history of fever or infection.”⁸ In some septic patients, petechiae may be observed.

Most EMS services should have little trouble adopting the evaluation criteria for determining whether a patient is septic. Lactate meters are not commonly found or accepted in most Texas prehospital settings, but the sepsis alert criteria provide

for the presence of hypoperfusion as an alternative to a lactate reading.

Besides the sepsis alert criteria adopted in Colorado, EMS providers should be especially cognizant of those patients at a higher risk for infection, and thus becoming septic. Patients with a cough, an indwelling catheter (whether urinary or IV), open wounds/injuries, paralysis, bedridden, or recent antibiotic use should be considered at risk for becoming septic. Immuno-compromised patients such as those who are diabetic, suffering from cancer, HIV positive, or who take steroids, anti-rejection medications (post-organ transplant) or anti-inflammatory medications are also at greater risk for becoming septic.⁹

Treating sepsis

As previously discussed, the early recognition of sepsis is crucial to treating and ultimately saving the life of a septic patient. Obtaining a thorough patient history and assessment (specifically including obtaining a temperature) as well as observing aseptic practices are the first steps in caring for a potentially septic patient.

For providers who are authorized to administer intravenous fluid therapy, large bore IV access should be initiated, as with any patient suspected of hypoperfusion or shock. Mayfield recommends a 20 mL/kg bolus in 500 mL increments. For patients with pulmonary edema, advanced level providers, in accordance with their local protocols and/or medical direction,

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may wish to consider administration of vasopressors, most commonly dopamine. In patients with a systolic pressure below 70 mm/Hg, consideration may be given to the use of Levophed/Norepinephrine.¹⁰ Whether through fluids or vasopressors,



the goal is to maintain a systolic blood pressure above 90 mm/Hg or a mean arterial pressure of 65-70 mm/Hg. Aggressive fluid resuscitation and/or vasopressor therapy may be required to achieve these goals. In fact, in the hospital setting, patients have received multiple liters of fluid, coupled with blood products and vasopressors to keep the patient's organs perfused.¹¹

As in all shock cases, oxygenation is a critical consideration as a result of the increased oxygen demand brought on by the patient's hypermetabolic state as well as their impaired oxygen extraction. In these patients, sudden respiratory failure is a very real possibility. Providers should keep the patient oxygenated and be prepared to provide ventilatory support.

Critical care providers and those in the transfer setting may encounter a septic patient who requires a ventilator to maintain respiratory status. Typically, septic patients receive lung protective ventilation. The tidal volume setting

is lowered and the respiratory rate is increased. The goal in these patients is to maintain an oxygen saturation in the range of 88 to 92 percent.¹²

Once admitted to the hospital, patients who are thought to be septic are usually placed in an intensive care setting. In most locations, the accepted standard of care has become or is becoming early goal-directed therapy (EGDT). EGDT is the goal-oriented manipulation of cardiac preload, afterload and contractility coupled with balancing between oxygen delivery and oxygen demand. Within six hours of being placed in the hospital, the goal has become to obtain serum lactate levels, blood cultures and to initiate appropriate antibiotic therapy within one hour of diagnosis.¹³

Invasive pressure monitoring is typically initiated in order to maintain central venous pressure (CVP) in a range of 8-12 mm/Hg. This maintains the patient's preload. As in the prehospital setting, vasopressors may be utilized to maintain the systolic blood

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pressure and/or mean arterial pressure within an acceptable range. The invasive pressure monitoring also allows for an accurate measurement of central venous oxygen content (ScvO₂). If the ScvO₂ range drops below 70 percent, blood products may be considered. EGDT also includes

lung protective ventilation, administration of activated protein C (to control clotting in ischemic tissue) and controlling the patient's blood glucose.¹⁴

Conclusion

With both the growth of evidence-based medicine and the increased focus from insurers, both public and private, on payment for outcomes, the medical community is likely to increase its emphasis on prevention, recognition and treatment of sepsis. Although not every EMS system or hospital may have a "sepsis alert" program, EMS providers can play a critical role in the early recognition and urgent treatment of sepsis. EMS providers have the training and skill-set to treat hypoperfusion. These same skills apply to sepsis. When coupled with good patient assessment skills, EMS can play an increased role in the recognition and treatment of sepsis.

References

1. Aehlert, Barbara. *Paramedic Practice Today*. St. Louis: Mosby JEMS Elsevier, 2010, Vol. I, pp. 1272-1273.
2. Id at 1272-1273. (Aehlert, 2010)
3. Jui, John. Septic Shock. In J. Tintinalli (Ed.) *Tintinalli's Emergency Medicine: A Comprehensive Study Guide*. New York: McGraw Hill. 2011. pp. 1003-1014
4. Neergard, Luran. "As Sepsis Turns Fatal Fast, More Aggressive Care Urged." *USA Today*. 27 October 2010.
5. Mayfield, T. Ryan. "What Do You Know About Sepsis?" Texas EMS Conference, Texas Department of State Health Services, Fort Worth, Texas November 2009.
6. *Mean Arterial Pressure*. (2011). Retrieved February 14, 2011, from www.monroecc.edu/depts/pstc/backup/parmap.htm
7. Hogan, Teresita. *Geriatric Emergencies: An EMT Teaching Manual*. Turlock, CA: MedicAlert Foundation, 2004.
8. Dalton, A., Limmer, D., Mistovich, J, and Werman, H. *Advanced Medical Life Support*. Upper Saddle River, NJ: Brady/Prentice Hall Health, 2007.
9. Mayfield.
10. Harris County Emergency Services District 1 (2010). *Standing Orders and Emergency Medical Protocols*. Houston, TX.
11. Mayfield.
12. Mayfield.
13. Jui.
14. Mayfield.



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