The ABCs of Pediatric Sepsis

Unrecognized sepsis kills kids; don’t let it happen on your watch

p. 38
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1 In adult patients with cardiac arrest from cardiac etiology. ResQCPR System Summary of Safety and Effectiveness Data submitted to FDA.
FEATURES
Medics with Guns >> EMSWorld.com/12156825
Should medics carry guns? Maybe, says Mike Rubin, who looks at the pros and cons, on duty and off, in this month’s Life Support.

The Community Paramedic Clinic >> EMSWorld.com/12157188
Last fall Wisconsin’s Ryan Brothers Ambulance opened a pioneering community paramedic clinic to help bring care to underserved patients in Madison. This article looks at who they’re helping, what they’re doing, and how it’s improving outcomes and saving money.

Month in Review >> EMSWorld.com/12156848
If you’re looking to catch up with the latest news, most popular articles and the EMS chatter on social media, check out EMS World’s new Month in Review column for a handy roundup of the top headlines.

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Feb. 10, 2 pm ET: Recognizing and Reacting to the Lost Advanced Airway
All advanced airways are at risk of dislodgement and failing to recognize a dislodgement can lead to serious morbidity ranging from anoxic brain injury to death. This webinar offers best practices to prevent airway dislodgement and immediately recognize the lost airway, and offers five strategies for rapid and effective emergency airway intervention. Presented by Kevin Collopy, BA, FP-C, CCMT-P, NREMT-P, WEMT, and sponsored by Physio-Control.

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Culinary Complications
A call becomes complicated by last night’s dinner, a warm floor and a medication mishap

It’s a hot summer day, and crews receive a call for a patient on the eighth floor of an apartment building where the elevator is out of service. As the crew climbs the last few stairs, they hear the rush of air from a bag-valve mask swooshing, and someone counting, “One and two and three.”

On arrival the crew finds a morbid obesity (around 350 kg) female in cardiac arrest on the floor of her kitchen. Their size-up notes a large quantity of “dark red-bluish-violet emesis.” As the team continues the resuscitation, the monitor shows asystole and the crew discovers the patient is of Eastern European descent. Complications are difficult to perform due to size and slipperiness of the chest. They place a supraglottic airway and find the patient is of Eastern European descent.

The crew notes extreme rigidity of the neck and jaw when trying to open the airway, and food particles “everywhere,” clearly indicating large amounts of red-bluish-violet emesis. An intraosseous line is placed, and one crew member hands the other a syringe with 10 ml of clear fluid. “Here’s your epi,” he says. “I had to draw it up and dilute the 1:1 because the 1:10 in the bag is broken.” The medication is administered quickly.

Soon thereafter medical control approves cessation of efforts; however, during cleanup several twists become evident.

Case Discussion
It turns out that the fluid was not blood, but borscht, a beet soup the patient had served her family the evening before. Once a younger family member arrived on scene to translate, the crew also discovers the patient had probably collapsed the night before after serving the family meal, but was not found until this morning. While a language barrier certainly confused this case, the family on scene could speak enough English to communicate this, but was never interviewed well enough by the responding crews to convey this information.

Why was the patient warm enough that the crew chose to begin resuscitation efforts? The floor of the kitchen was very thin and easily heated due to the downstairs neighbor’s hot water pipe. The ambient temperature and warm wood floor gave the sense the patient had not been down for long.

Last but not least, the crew discovered the multidose vial they used to draw up epinephrine was in fact a vial of amiodarone. Drug shortages had forced a change in supplier, and the vials of multidose epinephrine and amiodarone looked very similar.

Preventable Factors
EMS providers are tested on each case we respond to. Are you capable of quickly climbing eight floors and taking care of a cardiac arrest patient with a clear mind? Staying in shape is certainly a job requirement, but knowing when to slow down enough to regain composure is key. Practicing mental acuity while training with your heart rate is near maximum can help keep you stay sharp.

Recent research has pointed to serious concerns with the accuracy of medication administration in EMS. Medication labeling, storage and inventory are key to creating a system that minimizes the chance of error. The fewer calculations needed on a scene, the better. This crew did not notice the broken epinephrine vial during their initial checks. More important, pausing to double-check a medication with a partner might have caught this error.

After promoting a culture of safety, where errors can be reported without fear of repercussion, Sedgwick County EMS, in Wichita, KS, has done a great job creating a checklist that helps crews double-check with each other before administering any medication. The cross-check takes 20–30 seconds and should be done during any case. Even during a cardiac arrest, we can afford to spend the time to ensure the right medication is administered. You can see this cross-check with accompanying video at www.emsreference.com/checklists.

CRM Tips
CRM techniques have led to improved communication, teamwork and safety in the military, commercial aviation and now EMS/life agencies.

• Task saturation—When multiple key processes are going on at once, EMS providers need to guard against becoming overwhelmed. Critical tasks require us to stop and regain focus. The first responder’s strong belief the patient was covered in blood led the crew to think that was the case, instead of interviewing the family.

• No-blame culture—In a culture of safety, who committed an error is not as important as what caused the error and how to fix it. In this case there were a number of potential blaming recipients. The medic who drew up the wrong medication could be blamed for improperly verifying the medication, and the medic who pushed the drug could be blamed because he neglected to verify the medication, especially in light of the fact that there was a noted variance from the normal packaging and concentration. In addition, both crew members could receive some blame for attempting to resuscitate a dead person. It is easy to be a Monday-morning quarterback and assume we would have done something differently, but it is hard to know for sure.
**Things Smart Managers Never Say**

Effective leaders choose their words carefully.

1. "We have always done it that way." This is a common saying in the fire service, and it seems EMS has latched onto it also. Employees who bring up an issue and want to change things for the better do not want to hear you say you’re not willing to look at improving a process.

2. "I don’t agree with my boss/board of directors on this, but we need to do it." You should never talk about your superior in a disparaging way. How would you feel if your subordinates said this after you told them to do something? While what you’re being told to do by your boss or board may be unpopular, you may want to deflect the criticism off of you, throwing your boss or board of directors under the bus is completely unprofessional.

3. "Because I said so!" When I was little I would ask my parents to do something, and every so often, when I was told no, I would ask why. Sometimes one of my parents would answer, “Because I said so!” I would always be confused, but I knew they meant business by the way they said it. If you say this to one of your employees after you tell them to do something and they ask a question, you will garner very little respect from the employee. In my mind, they are trying to understand your reasoning and rationale for your decision. Obviously, I’m not advocating you take time to explain your decisions to employees after you give them orders on emergency scenes, but there is certainly time to discuss decision-making in an office environment when an employee is trying to understand your thought processes better.

4. "That’s a dumb idea." This statement is especially damaging to make if you say it in front of a bunch of EMTs and paramedics after someone has made a suggestion. Sure, not every idea is going to be of the same value, but a good EMS manager knows that when someone makes a recommendation or suggestion, they should not fear being shot down in flames and insulted.

5. "I am too busy." Your EMTs and paramedics want to feel they matter and their issues are important to you. Blowing someone off can make them feel they have no value. You may be busy, and you can tell them so, but let them know that you will get back to them at the first opportunity.

**Communication is Key to Success**

What you say and how you say it to your employees determines your success as an EMS manager.

Over my career, I have worked for some chiefs who had no communication skills and were despised by their subordinates. Employees did nothing beyond their subordinates without communication. Employees did nothing beyond their superiors, it is your job as an EMS manager to support them and ensure your subordinates do the same.

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In the future, access to healthcare in the rural setting will become increasingly problematic. Fewer and fewer primary care providers will be choosing to practice in rural areas. From 2010–2050, the U.S. population is expected to increase by 40% (from 310 to 439 million). One quarter of Americans will live in rural/remote areas, but only 10% of physicians will practice there. Also, there will be an increasing number of immigrant patients who live in rural settings. By 2042 diverse, racially aggregate minority populations will become the American majority. In addition, there will be a growing number of elderly living in rural areas. By 2030 more than 20% of the U.S. population will be over 65 years of age. Many of these people will have chronic diseases with limited financial resources.

To partially address this lack of healthcare access, the community paramedic can be used to provide some benefit for these groups. As a pioneer in the area of community paramedicine, Minnesota has substantial experience with rural CP programs and needs.

The Rural Community Paramedic
To prepare for their roles, the state’s CPs undergo standardized training developed by experts at Hennepin Technical College in partnership with the Minnesota Ambulance Association. The program includes 144 hours of classroom instruction (half live or via interactive TV; half online/distributed learning) followed by 196 hours of clinical training in their area. Rural CPs gain additional skills by expanding their clinical hours while working with their rural mentors.

Areas of clinical focus include primary care, community health/hospice, wound care, behavioral health, cardiology and respiratory issues, pediatrics and geriatrics, and networking.

As a part of their training, the CP develops a gap analysis of healthcare needs within their community. They then bring to the healthcare team options to assist in filling these gaps. They expand their role in providing healthcare, but they do not change their scope of practice. The state has operated rural programs in three counties.

Minnesota’s approach includes free clinics and a mobile unit that travels the community.

Rice County—Rice County is located in southeastern Minnesota. It has a population of 65,000, of whom 14% are over age 65, 4% are African-American and 8% are Hispanic. The CPs in this county work within a free clinic (HealthFinders Collaborative) with the guidance of a medical director and in partnership with a community health worker to make home visits. They focus on shut-ins, the disabled, the mentally challenged and the underinsured. Their tasks include home safety checks, nutritional counseling, medication review, patient assessment, interaction with support personnel, and mental health monitoring. Collaboration with other healthcare providers has been a key to the program’s success.

Wadena County—Wadena County is located in northwestern Minnesota. It has a population of 13,757, of whom 22% are over age 65 and 4% are Native American. The CPs within this county are a part of the local hospital system and partner with the Wadena County public health program. They provide several procedural services, including lab draws for long-term, chemi-
The CPs in Wadena County are a part of the local hospital system and partner with the county public health program.

Problems Encountered
There have been four major problems encountered in developing CP programs in Minnesota’s rural settings. Solutions to these problems remain an ongoing challenge. These are:

1. The lack of an electronic medical record that is inexpensive, user-friendly and interactive with other systems in sharing data.
2. Funding sources to sustain the program.
3. The lack of common data elements that support the quality of care provided by community paramedics. This is being worked upon by national EMS experts.
4. Potential liability concerns on the part of the CP medical director, especially in areas of increased procedural request.

Conclusion
Access to healthcare in rural areas will be an increasing issue in the future. Especially problematic will be the management of chronic disease in the elderly, the management of immigrant health and the promotion of public health mandates (immunization updates, follow-up of sexually transmitted diseases, mass-casualty event preparation, mental health care and treatment).

The community paramedic, through his or her program’s gap analysis of healthcare needs and attention to complex, underserved and vulnerable populations, will become a valuable resource to assist in addressing these gaps.

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By John Erich, Senior Editor

Last June, the American Heart Association released its latest heart disease and stroke statistics report. Among the takeaways for emergency managers: "Removal of the bystander CPR link is one of the most impactful interventions we can do to save lives."

Aspects of Excellence

To be the best, learn from the best. Seattle and King County, WA, have long been among America’s leaders in cardiac arrest survival. While there are numerous reasons behind that, a prominent one is this: Cardiac arrest is a default assumption.

Not for all callers, of course. But if you collapse in those jurisdictions and aren’t conscious and breathing normally when a bystander calls 9-1-1, you will be getting compressions started.

“What they probably do better than anyone is consider every 9-1-1 call a cardiac arrest/potential CPR call until proven otherwise,” says Bobrow. “In most places, when 9-1-1 dispatchers answer the phone, they aren’t thinking, This is a CPR call. It sort of has to be proven to them that the person’s really in cardiac arrest. They have to ask about breathing, and the type of breathing, and often they’ll listen to the breathing, and still they’ll wonder, Do they really have cardiac arrest? But in Seattle and King County, if you’re unconscious or unresponsive and not breathing normally, you’re getting CPR started right away, and they’ll figure the rest out later. That’s a big paradigm shift in the way this is done from most cities around the country.”

So compression instructions generally get started faster. But not all instructions are equal. Even when given fast, they can come with a wide disparity in quality based on aspects like the dispatcher’s experience, confidence and ability to galvanize action from sometimes-reluctant rescuers.

The dispatch profession’s best can engage and calm jittery callers, establishing rapport and gaining the trust that helps get their directions followed. When compressions begin they’ll count along, help minimize pauses, remind to push hard and allow full recoil. They’ll keep spirits up through the compressor’s fatigue and gut-twisting wait for the pros. That ongoing coaching is also a component of success.

One key to it is experience.

“Most dispatchers, when they go on duty, aren’t thinking, Today I really want to take care of someone in cardiac arrest and have to get someone to do bystander CPR,” notes Bobrow. “So of course they’re reticent to do it—they don’t want to hurt anybody. If you don’t do this a lot, you can have some indecision; when a cardiac arrest happens, fast CPR can help save a life. That’s not in dispute, but the evidence still mounts: A 2015 New England Journal of Medicine review of more than 20,000 cases from Sweden, where around three million people are CPR-trained, found that 30-day survival was 10.5% when CPR was performed before EMS arrival and just 4.0% when it wasn’t.1 “The positive correlation between early CPR and survival rate,” concluded the authors, “remained stable over the course of the study period.”

That’s not an isolated finding; other recent data from Denmark showed that after a sustained decade-long effort to improve bystander CPR rates (increasing the national rate from 21.1% to 44.9%), 30-day and one-year cardiac arrest survival tripled.2

So why don’t more than roughly a quarter of out-of-hospital SCA victims get bystander CPR? Generally we know those answers too; lack of knowledge and lack of confidence are large among them. And part of the remedy for both is a robust program of dispatch-assisted CPR instructions given to those who call 9-1-1 for cardiac arrest victims.

“We believe the earliest links in the chain of survival are most impactful for out-of-hospital arrest, and certainly bystander CPR is one of the most impactful interventions we can do to save lives,” says Bobrow. "When a cardiac arrest happens, fast CPR can help save a life. That’s not in dispute, but the evidence still mounts: A 2015 New England Journal of Medicine review of more than 20,000 cases from Sweden, where around three million people are CPR-trained, found that 30-day survival was 10.5% when CPR was performed before EMS arrival and just 4.0% when it wasn’t." The positive correlation between early CPR and survival rate, concluded the authors, “remained stable over the course of the study period.”

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The makers and takers of 9-1-1 calls have a huge opportunity to help cardiac arrest victims.

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“When we now believe is that having the 9-1-1 call act as a mechanism to strengthen the bystander CPR link is incredibly important and is probably the underpinning of success in some of the communities across the country that have saved the most lives.”

If that’s so, what goes in to what they’re doing, and how can others emulate that success?

Aspects of Excellence

To be the best, learn from the best. Seattle and King County, WA, have long been among America’s leaders in cardiac arrest survival. While there are numerous reasons behind that, a prominent one is this: Cardiac arrest is a default assumption.

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may be that the person is having an arrest but doesn’t realize it. A dispatcher that really gets it can help a caller to assess their situation and make decisions. We think that's part of the disparity in outcomes between different cities. The important component of CPR dispatch-instruction excellence is measurement. That means every aspect of the process—not only how often instructions are given and how often callers actually perform CPR, but metrics like time from call reception to recognition of potential OHCA, and then to the start of instructions and then compressions. Ultimately the most important measure is the duration from call reception to the start of actual compressions.

You can look at two different cases in two different cities, and they may both have gotten CPR started, but in one city maybe that took 90 seconds, and in the other maybe it took seven minutes. We think that's part of the disparity in outcomes among communities.

There's more that goes into it beyond that, too; obviously the proper rate and depth of compressions are vital, as is minimizing pauses. A dispatcher that really gets it can help a caller make a huge difference in all those areas.

**Breathing Normally**

At December's Emergency Cardiac Care Update show in San Diego, where Bobrow and other top docs spoke on this and related matters, there was a lot of talk about gasping—the agonal breaths that can lead a bystander/caller to give an incorrect answer to a dispatcher's inquiry about whether a patient is breathing.

Abnormal breathing is something we can listen for, rather than just quiz the caller about. It's usually subtle and often discernible. And when we ask about it, how we do so matters a lot.

"If you ask a caller 'Are they breathing?' they’ll look down and see someone taking these agonal gasps, and they’ll say 'Yeah, sort of,'" Bobrow says. "But if you ask them, 'Are they breathing normally?,' they’ll look down and tell you, 'No, that’s not normal breathing. I don’t know what that is, but that’s not normal breathing. That’s the way my fish breathes when he falls out of the fishbowl.'"

Normally is an important adverb, and recent changes to the American Heart Association's CPR and Emergency Cardiovacular Care guidelines underline it: "To help bystanders recognize cardiac arrest, dispatchers should inquire about a victim’s absence of responsiveness and quality of breathing (normal versus not normal)," the AHA's document highlighting the revisions says. "If the victim is unresponsive with absent or abnormal breathing, the rescuer and dispatcher should assume the victim is in cardiac arrest. Dispatchers should be educated to identify unresponsiveness with abnormal and agonal gasps across a range of clinical presentations and descriptions." 1

The why behind this further suggests dispatchers be specifically educated to help bystanders recognize that agonal gasps are a sign of cardiac arrest and ask "straightforward" questions about normal/abnormal breathing.

"Often, if you just ask whether they’re breathing, the caller will answer yes when they’re gasping," says Bobrow. "Then the next move for some dispatchers is, ‘OK, turn them on their side in a recovery position, and help us on the way.’ We just missed an opportunity to help that person."

I think that situation happens all the time. Hopefully less and less as we go along, but I still think a lot of times we miss the opportunity to give prescriptive CPR instructions because we confuse gasping with breathing normally.

**It All Matters**

A final best practice is to harness the power of social media. A specific way is by use of something like the PulsePoint app, through which dispatch systems can alert CPR-trained bystanders to nearby cardiac arrests. This lets them get quickly to those victims’ sides and get compressions started. It also tells them where to find the closest AED.

"I really think there’s enormous potential to use social media to basically make the public become the first responders," says Bobrow. "That’s really what we want, and certainly we can do it better than we have in the past. We know social media and using smartphones and things like the PulsePoint app can help us locate able and willing rescuers and connect them to cardiac arrest victims.

We don’t know on a grand scale how beneficial that is or might become, though there seems potential. But it’s worth noting—and this is true of even the best dispatch CPR instructions as well—that there is no single magic bullet to improving survival from out-of-hospital cardiac arrest. Having such weapons in isolation isn’t likely to do much. But as part of a larger system—which includes aware citizens, lots of AEDs, short call intervals, fast EMS response and good hospital and post-arrest care—they can combine for a powerful outcome.

"It all matters," says Bobrow. "High-performance CPR by trained rescuers and public access defibrillation and high-quality post-arrest care are all important. But one thing I’ll say is, if you don’t get anyone to do bystander CPR for an out-of-hospital arrest, the odds of survival are very, very low. It’s not impossible, but one of the things most out-of-hospital cardiac arrest survivors have in common is that they had someone able and willing to do bystander CPR."

**REFERENCES**


Preamble:
Blair Bigham, MD, MSc, ACPf

Coauthors of the infographic:
Teresa Chan, MD, BEd, Sarah Luckett-Gatopoulos, MD, MSc,
Brent Thoma, MD, MA, & Blair Bigham, MD, MSc, ACPf

It’s the quintessential 9-1-1 call: Someone has collapsed, isn’t breathing, and has no pulse. Alarms ring, and we scramble to our ambulances, fire trucks and zoom cars. We hope that this call, unlike the others, will be the one we get back. Our heart rates accelerate and our minds rush. We think about all of the variables within our control: drug dosages, airway adjuncts, defibrillation. We chat about who will do what, and when it will be done. We try to bring order to the chaos that undoubtedly will ensue. Just as quickly as it all started, it will end the exit of an algorithm, the time on our watch, or a rote phone call. We will turn off the monitors, shut off the oxygen, and turn to face the family.

I can easily recall each resuscitation I’ve terminated. The memory is not always vivid, but each pronouncement is there, very real to me still. The “failed” codes I have run are many, and often made me question why we bother to resuscitate those whose hearts have stopped. I can list the causes and describe the pathology. Like a mechanic who declares a car has driven its last mile, I know when the human body has given up. Still, the alarms go off and I don’t sink down in despair; I jump with excitement. This code could be the one! Even when we get that precious return of spontaneous circulation, we can’t help but wonder if our actions have been wise. Will our efforts result in a waste of resources and dollars, with death being postponed only a few hours? Will we add another member to the proverbial cabbage-patch? Will this person ever open their eyes, speak words to a loved one, or live a meaningful life?

Our perspective in these cases is brief, and often negative. That Baywatch moment of coughing, eye-blinking and a full return to consciousness is something I’ve never seen. Recovery from cardiac arrest takes hours, days, weeks, or even months. Despite our limited perspective, the numbers don’t lie: survival from out of hospital cardiac arrest has tripled in the last 10 years. The numbers continue to rise as the science that guides our treatment evolves and is translated into action. Two in one hundred used to survive; now that number is ten. In some places overseas, it is 20. For patients in ventricular fibrillation, survival can be as high as 60%. That’s more than half. This is how far we have come. The science continues to improve, the guidelines continue to evolve, and we continue to get better at bringing back the dead.

In October 2015, the American Heart Association, in partnership with resuscitation organisations all over the world and the highly regarded International Liaison Committee on Resuscitation, released the latest scientific statements, treatment recommendations and practice guidelines for the care of victims of cardiac arrest. This infographic summarizes what you need to know before you respond to your next arrest.

We know that the devil is in the details, and that strong leadership, teamwork and attention to detail make a difference. By studying the latest guidelines and applying them in earnest, we can all make a difference. How high can survival from cardiac arrest go? That’s one question science hasn’t yet answered.

Big Ticket Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Diversify &amp; Intensifying training</td>
<td>Practice makes perfect... and more frequent training will improve performance. This doesn’t all need to be traditional formats though, and can include video or web-based modalities.</td>
</tr>
<tr>
<td>2. Emphasize leadership &amp; teamwork</td>
<td>The “pit crew” approach of performance may allow you to create a high performance team! Strengthen your leadership &amp; team training.</td>
</tr>
<tr>
<td>3. Keep driving for outcomes</td>
<td>No failures! Never give up. Sometimes stopping at the nearest institution may not be best for STEMI or post-arrest patients (if the extra distance is short). These patients may fare better if at a PCI center.</td>
</tr>
<tr>
<td>4. Diastole = Filling</td>
<td>Compress the chest at a rate of 100-120/min. If you go too fast, compressions can impair filling and decrease cardiac output. (Reminder also: Depth 5-6cm!)</td>
</tr>
<tr>
<td>5. Thanks for the feedback!</td>
<td>BLS care is the most important determinant of survival. Audible feedback technology improves compression quality.</td>
</tr>
<tr>
<td>6. Be Hands-On!</td>
<td>Minimize interruptions to chest compressions. Other interventions (i.e. ALS activities) should not compromise high-quality BLS care.</td>
</tr>
<tr>
<td>7. Gas Laws: Maximum Flow!</td>
<td>100% oxygen should be used for patients in cardiac arrest.</td>
</tr>
<tr>
<td>8. Not shokcable? Give epi!</td>
<td>If patient is in a non-shokcable rhythm, epinephrine can be given immediately.</td>
</tr>
<tr>
<td>9. Amio &gt; Lido</td>
<td>While lidocaine can be considered as an alternative, and survival data is lacking, amiodarone leads to higher rates of ROC in shock-resistant ventricular fibrillation.</td>
</tr>
<tr>
<td>10. Don’t stop... to intubate!</td>
<td>Controversy continues around ETI for cardiac arrest in the field. What’s clear is this stopping CPR to intubate is NOT OK. If you do intubate, continuous end-tidal CO₂ is recommended.</td>
</tr>
</tbody>
</table>
### Pediatrics

1. **Amio = Lido**
   
   Although amiodarone is preferred in adults, lidocaine is equivalent in the pediatric population with refractory ventricular fibrillation.

2. **Routine Atropine is OUT!**
   
   Routine use of atropine pre-intubation to prevent bradycardia is not supported by the evidence.

3. **If giving atropine, then no minimum**
   
   Previously, there was a suggested minimum dose for atropine. More recent evidence has suggested that this is not the case! Give weight-based atropine when treating bradycardia.

### Other

1. **Naloxone for OD**
   
   BLS providers who encounter patients with abnormal breathing (e.g. reduced respiratory rate) caused by an opioid overdose should be capable and able to give naloxone to reverse effects!

2. **Manual pressure for pregnancy**
   
   The gravid uterus needs to be displaced to the left manually to relieve vena caval compression and assist with restoring hemodynamics. The tilt makes it hard to do CPR well!

3. **If toxic, take 'em to hospital!**
   
   There are antidotes available at the emergency department that are not available in the field. Termination of resuscitation (TOR) rules DO NOT APPLY to these patients, and this population may benefit from transport.

---

**Once upon a ROSC...**

1. **Focus on Basics**
   
   Return to walking through the ABCs. Aim your interventions to achieve: 
   
   - SpO2 > 94%
   - ETCO2 30–40
   - SBP > 90 (MAP > 65)

2. **To the Cath Lab!**
   
   Post-arrest patients with STEMI should go directly to a PCI center if one is close by. Other patients without ST elevation may also benefit from direct transport for angiography.

3. **No pre-hosp ice!**
   
   Cold saline boluses in the field may lead to heart failure, but in-hospital temperatures should be 32–36°C for 24 hours.
Chest compressions have been the center of attention during cardiac resuscitation for the past few years, and for good reason. In its 2010 guidelines revision, the American Heart Association (AHA) rewrote the ABCs to the now established CAB approach based on increasing data linking improved outcomes to effective compressions.1

Since then the science of chest compressions has developed rapidly. This article reviews two recently published papers on two of the most controversial subtopics: continuous chest compressions and automated chest compression devices.

**Continuous Chest Compressions**


This is a large study performed across eight of the Resuscitation Outcomes Consortium (ROC) sites in North America and 114 EMS systems.

A total of 23,711 adult patients with non-traumatic out-of-hospital cardiac arrest were enrolled and assigned to either the continuous compressions or interrupted compressions groups. The outcomes measured were survival to hospital discharge and favorable neurologic function at discharge. The results showed no significant difference in survival or favorable neurologic outcome between the two methods.

*Table 1* lays out the numbers in the trial. *Table 2* lists the patients who were excluded, which is important to be aware of as these findings do not necessarily apply to them. *Table 3* explains the protocol used in each arm of the trial.

There has been a lot of discussion about whether compression-only CPR is superior to conventional CPR. Previous studies showed an improvement in outcomes for both bystander-provided compression-only CPR and EMS-provided minimally interrupted compressions.2,3 However, these studies were observational, which is a lower-quality standard of evidence than this newer randomized trial. So what does this mean for EMS? Before drawing conclusions, let’s discuss some interesting findings in the data.

### TABLE 1: TRIAL NUMBERS

<table>
<thead>
<tr>
<th></th>
<th>Continuous Compressions</th>
<th>Interrupted Compressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolled</td>
<td>12,613</td>
<td>11,035</td>
</tr>
<tr>
<td>Survived to Discharge</td>
<td>1,129 (9.0%)</td>
<td>1,072 (9.7%)</td>
</tr>
<tr>
<td>Favorable Neurologic Function</td>
<td>(7.0%)</td>
<td>(7.7%)</td>
</tr>
</tbody>
</table>

### TABLE 2: PATIENTS EXCLUDED FROM THE TRIAL

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>EMS-witnessed arrest</td>
</tr>
<tr>
<td>DNR</td>
</tr>
<tr>
<td>Traumatic Injury</td>
</tr>
<tr>
<td>Asphyxial arrest</td>
</tr>
<tr>
<td>Uncontrolled bleeding/exsanguination</td>
</tr>
<tr>
<td>Known pregnancy</td>
</tr>
<tr>
<td>Preexisting tracheostomy</td>
</tr>
<tr>
<td>Prisoners</td>
</tr>
<tr>
<td>CPR in progress on arrival by non-study provider</td>
</tr>
<tr>
<td>CPR with a mechanical device before manual CPR started</td>
</tr>
<tr>
<td>Advanced airway management before study agency arrival</td>
</tr>
</tbody>
</table>
The chest-compression fraction is a measure of the proportion of each minute that compressions were actually being delivered. The 2015 AHA guidelines call for a minimum of 0.6, or 60%. Conventional CPR reduces the fraction by definition due to pauses for ventilations, while other pauses could occur in any setting. So one of the advantages that continuous compressions should have over conventional CPR is a better chest-compression fraction.

In this study, both arms had very high chest-compression fractions, 0.77 and 0.83. Why is this? This is likely the effect of well-trained and effective EMS teams providing high-quality CPR at baseline. CPR training has strongly advocated minimizing interruptions in compressions for several years now, and it seems to be paying off. However, this already high fraction may have reduced much of the possible improvement to be gained from continuous compressions.

Another important point to note is that the continuous compression protocol was not the same as the established cardio-cerebral resuscitations protocol was not the same as the established cardio-cerebral resuscitations protocol. Researchers used three cycles of 200 chest compressions. CPR training has strongly advocated minimizing interruptions in compressions for several years now, and it seems to be paying off. However, this already high fraction may have reduced much of the possible improvement to be gained from continuous compressions.

Automated Chest Compression Devices


The use of mechanical CPR devices has grown considerably over the past decade and continues to be implemented in an increasing number of EMS systems. Despite the promising early observational studies, several randomized trials have shown mechanical CPR devices to be at best equivalent, and at worst harmful. In fact, first randomized trial to have been halted early due to safety concerns. This new meta-analysis looks at 20 published studies on mechanical CPR devices that are yet to be addressed, such as efficacy of incorporated defibrillation algorithms. Most notably, they draw attention to the lack of data on the safety of the devices and suggest that differing injury patterns between manual and mechanical CPR could affect survival.

The authors conclude that “the cumulative evidence of high-quality randomized data does not support a routine strategy of mechanical CPR to improve clinical outcomes.” However, they do not seem to worsen outcomes either, so for now, it is reasonable to continue to use them in the field as an alternative to manual CPR.

REFERENCES


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Getting the Most From Your History and Physical

Done correctly, they can point you toward the right diagnosis

“Paramedics do not make diagnoses.” This is a quote uttered frequently in prehospital emergency medicine, and it’s one of the larger myths that still exists. It is a throwback idea from a bygone era and a thought pattern that restrains the true potential of the field. It supports the erroneous assumption that prehospital emergency medicine is not a true profession with highly skilled and knowledgeable personnel who provide daily advanced assessment and treatment across our nation.

If paramedics never made a preliminary prehospital diagnosis, how would they know which protocol to follow or to which specialty destination a patient must be transported? Indeed, both the National EMS Core Content and the National EMS Scope of Practice Model describe the need for paramedics to develop a differential diagnosis, or field impression, based upon advanced assessment skills in order to provide correct treatment for the patient.

Gone is the time when paramedics had limited training and skills. Paramedics are now routinely called upon to perform advanced emergency medicine skills such as rapid sequence intubation, interpreting 12-lead EKGs, intraosseous line insertion and many others that were once performed solely by physicians. It is time for prehospital healthcare workers to accept their role as professionals.

As professionals, it is important for EMS personnel to formalize and enhance skills in the area of obtaining history and physical examinations. It is the art of patient assessment that separates a technician who performs procedures from a true professional equipped with the scientific knowledge and finely tuned assessment skills to make accurate prehospital diagnoses and deliver accurate high-quality medical care.

Dr. William Osler, often credited as the “father of modern medicine,” promoted the importance of patient history and physical examination. He is quoted as saying, “Listen to your patient, he is telling you the diagnosis.” In this multipart series we will follow Osler’s example and stress the importance of developing the art and skill of the patient history and physical assessment. We will attempt to impart an enhanced ability to skillfully obtain this vital information in order to formulate a differential diagnosis. These skills are essential to ascertaining the correct prehospital diagnosis and determining the correct treatment and transport destination.

"The intent of this series is to assist paramedics in developing a systematic, targeted history and physical exam by focusing on the patient’s chief complaint and considering the differential diagnoses by using the inclusion and exclusion information provided by the patient. The goal is to quickly and accurately determine the prehospital diagnosis so immediate lifesaving treatment can begin. This first installment will discuss the differential diagnosis of chest pain and the manner in which a targeted history and physical exam can narrow down the prehospital diagnosis.

H&P Background

The history and physical exam have long been the basis for determining a diagnosis. It is often said that the diagnosis is made 90% of the time by the history, 9% of the time by the physical exam and 1% of the time by laboratory examination. This has been found to be true. In at least two studies on the relative value of the history and physical exam in making the correct diagnosis, clinicians were found to use a combination of chief complaint and history to make the correct diagnosis in 74%–96% of cases, the physical exam added up to 12%, and the laboratory evaluation supplied the remaining minor amount of information needed.1 Even today, with all the sophisticated diagnostic tests available, the history and physical are still the gold standard for determining a diagnosis. Laboratory tests and imaging studies are largely ordered to confirm or in some cases exclude a diagnosis already determined through the information obtained from the history and physical exam.

Unfortunately, the history and physical exam are probably the most neglected aspects of patient care in today’s prehospital setting. Besides conducting improper or incomplete histories and physicals, many paramedics miss a diagnosis because they look only for its “classic” signs and symptoms. As anyone who has been in the field for a while can attest, many patients don’t have “classic” presentations.

By understanding the etiology and pathophysiology of an illness and conducting the proper history and physical exam, the paramedic’s ability to make the correct prehospital diagnosis will significantly increase. Learning to assess and understand what is going on with your patient is a skill far more important to making a correct diagnosis than just remembering the classic presentations of an illness. Making a correct prehospital diagnosis requires that knowledge and experience be combined with the subjective/objective information obtained from the history and physical exam. Together this information will form the basis of the prehospital diagnosis.

As in the days of Osler, bedside experience is emphasized. Much of medicine is pattern recognition. The authors feel strongly that paramedics should routinely follow up on the patients they transport to the hospital. It is critical to the development of accurate pattern recognition that paramedics discover the actual final diagnoses of the patients they have cared for and then compare each one to their prehospital diagnosis. This will reinforce the recognized pattern or correct their misdiagnosis and thus adjust that recognition for future cases.

The value of establishing an accurate diagnosis is to provide a logical basis for treatment and transport destination. Seriously ill patients need prehospital intervention tailored for their particular diagnosis. Today paramedics are well trained and should be able to recognize, treat and stabilize most medical emergencies.
The following is an outline of a prehospital history and physical exam. Although histories and physical exams vary depending on the chief complaint, all should follow this general outline. However, transport should never be delayed to conduct lengthy histories and physical exams. Unstable patients cannot afford such delays, and stable patients don’t require such in-depth histories and physical exams. Remember, stabilization and rapid transport are the goals of prehospital medicine, and the assessment skills outlined in this article are designed to enhance the success of that mission. We begin with the framework of what information will be gathered and then discuss how to apply it specifically to patients with a chief complaint of chest pain.

This article has two main objectives: first to develop a focused systematic approach to the history and physical exam, and second to develop a better understanding of the etiology, pathophysiology and signs and symptoms of specific diseases so aprehospital diagnosis can be quickly and accurately determined. This concept is important because even patients with the same disease can have different clinical presentations. The process involves four steps, and each should be completed before advancing to the next. Once you become proficient with the process, you will be able to quickly and accurately determine a prehospital diagnosis within 2–3 minutes.

1. Chief complaint;
2. History:
   • History of the present illness;
   • Past medical;
   • Social;
   • Family history;
3. Targeted physical exam;
4. Prehospital diagnosis and differential diagnosis.

Chief Complaint

The chief complaint is the primary reason a patient seeks medical attention. It acts as the logical starting point for determining which emergency medical conditions potentially exist and which follow-up questions will help narrow down those possibilities. Some patients will list multiple complaints, which can make it difficult to determine the actual chief complaint. When treating patients with multiple complaints, determine the patient’s main reason for calling 9-1-1 by asking a question such as, “Of all those problems, which one concerns you the most?” Consider the answer to be the patient’s chief complaint. This will give you a reference point to begin targeting your history and physical exam.

However, don’t disregard the other complaints; unifying them will help determine the prehospital diagnosis. In patients with chronic illnesses, the frequent flyers, it’s easy to become compliant and forgo the history and physical exam. Give your patient the benefit of conducting a history and physical exam for every encounter so you can make an informed decision regarding their treatment. Patients with chronic illnesses are likely to develop new medical conditions and complications from their chronic condition even from their medical treatment.

History

The importance of obtaining a good history cannot be overemphasized. The history combined with the physical exam provides the necessary subjective and objective information to make a prehospital diagnosis. A complete history includes history of present illness, past medical, social and family history. Traditionally there is little emphasis on the family and social history in paramedicine. They are included because often they provide important clues in helping to determine a prehospital diagnosis.

History of the present illness (HPI)—If you only learn one thing from this article, understand that the single most important part of any history and physical exam is the history of the present illness. The sole purpose of the HPI is to get a clear picture of the events that led the patient to seek medical attention. Listen carefully to the patient—most of the information you need to make the prehospital diagnosis is in the history of the present illness. Keep in mind that the HPI is an evolving process, and as you proceed use the inclusion and exclusion information supplied by the patient to narrow the diagnostic possibilities.

As we are all aware, patients are not always the best historians. Paramedics will need to have a degree of investigative prowess to extract the information necessary to arrive at the correct diagnosis. A patient’s fear, confusion and denial can all be obstacles to overcome to obtain a good history. It’s important as a paramedic to have confidence in your history-taking ability.

Taking a history is a skill similar to starting an IV or intubating a patient. Skills take time to develop. Avoid histories that amount to nothing more than a series of random questions, as opposed to questions presented in a logical sequence. In addition, avoid confusing medical terminology or leading the patient with your questioning. Allow the patient to use their own words, but don’t be afraid to clarify vague answers. If necessary, use your resources; family, friends and healthcare workers can help fill in the gaps.

The history of the present illness is based on the chief complaint. Apply the acronym OPQRST to the chief complaint to ensure all necessary questions are asked. Avoid skipping around, as it is confusing, and you are more likely to forget a key question!

• Onset—When did symptoms begin?
• Was the onset gradual or sudden?
• Provoked—What makes the symptoms worse?
• Palliative—What makes symptoms better?
• Previous similar episodes—This question will often give you the diagnosis if previous episodes have already been diagnosed.
• Quality of pain—Sharp, dull, pressure, squeezing, aching, burning?
• Region—Where is the pain located? I’ve heard the pain localized or diffuse?
• Radiation—Does the pain radiate?
• Severity—What is the severity of the pain on a scale of 1–10?
• Time—Duration, frequency, constant/intermittent?
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• Associated signs and symptoms—Review of related body systems. Past medical history (PMHx)—Because time is limited in the prehospital setting, past medical histories are limited to significant illnesses or diseases. In general inquire about any recent surger- ies, cardiovascular disease (coronary artery disease, hypertension, congestive heart failure, arrhythmias, pulmonary disease (COPD, asthma), stroke, diabetes, kidney failure or past similar episodes of their chief complaint.

The past medical history also includes any prescription or over- the-counter medications the patient is taking. Pay particular attention to medications the patient has been prescribed, as they will provide some insight into underlying conditions and general health. Memorizing the most common medications and what they are used for will often let you elicit a patient’s past medical history just by looking at the medications they take. It’s also important to inquire about any recent medication or dosage changes, as either could be responsible for the patient’s condition, as can adverse side effects from a medication or combination of medications.

Also included in the past medical history are allergies to any medications. A urticular rash, angioedema or wheezing character- izes a true allergic reaction. What many patients consider an allergic reaction is really a sensitivity or side effect of the medication—e.g., many patients claim they are allergic to morphine because it makes them nauseous.

Social history (SHx)—As paramedics we tend to overlook a patient’s social history. A patient’s social habits can give insight into their general health and potential medical conditions. Specifi- cally inquire about smoking, drug abuse and alcohol consumption. Smokers have an increased incidence of coronary artery disease, hypertension and stroke. Use of drugs, specifically cocaine and other stimulants, can cause ischemic chest pain, hypertension, arrhythmias and stroke. Always inquire about possible drug abuse in patients with ischemic chest pain, especially patients who would be considered too young for coronary artery disease. Alcohol abuse can cause neurological, cardiovascular and gastrointestinal problems.

Travel history is part of the social history. With the ever-present risk of new transmissible illnesses spreading from one continent to another, this is an additional important piece of information to gather from patients who present with an infectious-disease problem.

Family history (FHx)—Family histories are limited in the prehos- pital setting, as a positive or negative family history cannot rule out a specific illness or disease. Include family histories as part of the big picture. Coronary artery disease, hypertension, diabetes and strokes all have a high incidence of running in families. A positive family history is relevant with immediate family members only (mother, father, brothers, sisters or adult children). Because coro- nary artery disease, hypertension, diabetes and strokes are more prevalent in the fifth, sixth and seventh decades, a family history provides little information for a patient 50 or older. However, a 35-year-old patient complaining of chest pain whose father died of a myocardial infarction at 38 is significant.

Limited Prehospital Physical Exam
The following outline is an example of a limited physical exam. This is the minimum acceptable physical exam and should be done on all adult medical patients. This exam should also include ECG and glucose testing if warranted based upon the chief complaint. Caution: This exam is not for trauma patients.

Vital Signs
- Blood pressure
- Pulse rate and quality
- Respiratory rate and quality
- Skin color, condition, temperature;
- Pulse oximetry

General
- Position (supine, tripod, etc.);
- Level of distress;
- Heart: rate and rhythm;
- Lung sounds;
- Abdomen;
- Soft or rigid;
- Tender or nontender;
- Distention;
- Neurological
- Level of consciousness (AVPU);
- Orientation;
- Gross motor and sensory exam;
- Extremities
- Lower extremity edema.

Once the history and physical exam are com- pleted, there will be enough information to make an informed decision regarding your patient’s care.

Prehospital and Differential Diagnosis
Now let’s apply this template to a chief complaint of chest pain.

In the world of medicine, there exist nearly innumerable potential diagnoses for specific complaints. Memorizing the nuances of each one would be impractical. However, we are in the field of emergency medicine, and since our major role is that of initial stabilization and transport to the correct facility, we can limit our evaluation to those conditions that fall into two major categories: the potentially deadly/disabling and the statistically most common etiologies. This list of possible diagnoses is termed a differential diagnosis.

Taking a look at the chief complaint of chest pain, there are several potential life threats that must be addressed. These include myocardial infarction/ischemia, aortic dissection and pulmonary embolism. There are also several common etiologies that must be considered: pneumothorax, pleurisy, spontaneous pneumo- thorax, acid reflux and costochondritis.

The reader is cautioned that laypersons may mis- interpret some questions and assume “heaviness” in their chest is not actually chest “pain.” It may be bot-
ter to ask if there is any chest “discomfort” to ensure you elicit the correct response.

Once the chief complaint of chest pain is elicited, the next step is to formulate a logical mental framework or algorithm to help distinguish the above list of differential diagnoses from each other. Knowing the presentations expected with each and combining the information gathered from OPQRSTA will assist in arriving at the correct prehospital diagnosis. Table 1 presents an example of how to set up this mental framework. For brevity’s sake we will limit the discussion to the deadly possibilities and defer discussion of the less severe causes of a chest pain chief complaint.

After the initial history, the paramedic should have a fair idea of which possible diagnoses are present. The next step is to add the past, social and family histories to the equation. Specifically look for risk factors (Table 2) to support or refute a paramedic’s preliminary diagnosis. Paramedics can improve their diagnostic skill and accuracy, for future similar cases.

For as long as medicine has existed, the history and physical exam have been the core information-gathering tool to develop a differential diagnosis. Paramedics can improve their diagnostic acumen by adopting this systematic search for clues from the history and physical exam to enable them to accurately formulate a field impression or preliminary diagnosis. After transport to the appropriate facility, follow up to learn what the patient’s final diagnosis is will help to either reinforce or correct a paramedic’s pattern recognition, and with it diagnostic accuracy, for future similar cases.

This process can be applied to most common chief complaints such as shortness of breath, neurological complaints and abdominal pain. Like all skills, the history and physical exam require practice and repetition in order to become proficient. We encourage readers to apply this organized method to all medical patient encounters. As individual proficiency improves, so will the ability to determine the correct prehospital diagnosis.

**TABLE 3: COMMON PHYSICAL EXAM FINDINGS**

<table>
<thead>
<tr>
<th>Pulmonary Embolism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachypnea, tachycardia, low-grade fever, evidence of DVT (lower extremity edema), wheezing and cough may be present.</td>
</tr>
</tbody>
</table>

**Aortic Dissection**

Presentation varies with location of dissection. Hypertension is common. New diastolic heart murmurs can appear. Hypotension is an ominous finding of cardiac tamponade or aortic rupture. Difference in blood pressure from one arm to the other of 20 mmHg may be present. Unequal pulses may occur. Focal neuro signs occur in 20% of cases. Abdominal pain may be present if dissection travels to abdominal aorta. Hoarseness voice may occur with recurrent laryngeal nerve compression.

**Myocardial infarction/Ischemia**

Pallor, diaphoresis, tachycardia and hypertension early; later, hypertension may occur with pump failure. New-onset heart murmurs may occur.

**Conclusion**

As we move on to the physical exam, we again will be looking for evidence of a specific diagnosis (Table 3). While we will in general be performing a rapid generalized head-to-toe exam on most patients, we will in addition be performing a more focused detailed exam looking for evidence of the suspected diagnosis.

If we suspect from our history that a patient may be suffering an aortic dissection, we will pay special attention to bilateral pulsations and blood pressure, looking for asymmetry. If there is a combination of severe chest pain and one-sided neurological deficits, the exam findings support the diagnosis of dissection.

Alternatively, if we suspect the patient has a PE and we find them to be tachycardic, tachypneic and mildly hypoxic with a slight wheeze along with a unilateral swollen leg, then the exam is consistent with pulmonary embolism.

**REFERENCES**


**ABOUT THE AUTHORS**

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The ABCs of Pediatric Sepsis

Unrecognized sepsis kills kids; don’t let it happen on your watch

On January 29, 2007, 14-year-old Andrew John McDonough was brought to the hospital for what his parents thought was appendicitis. Andrew was a healthy teenager who, earlier that week, had attended his high school dance, gone skiing and, less than 48 hours before his illness, helped his team win the Pennsylvania state soccer championship.1

Andrew did not have appendicitis. In the hospital his parents were told he had been diagnosed with leukemia and, before the day was out, Andrew had gone into cardiac arrest due to septic shock. While leukemia was a terrible but familiar word, Andrew’s parents did not understand what “septic shock” was and how it could have hit Andrew so fast and so hard.

The Most Common Deadly Disease You’ve Never Heard Of

Globally, 6 million children die every year from sepsis.1 In the United States more than 750,000 cases of adult and pediatric sepsis are diagnosed each year.1,2 Incidence of sepsis in pediatric patients has been rising in the past decades, growing to more than 75,000 hospitalizations for severe sepsis, with a mortality of greater than 10%, at a cost of $4.8 billion dollars.1,2

So why is pediatric sepsis the most common deadly disease you’ve never heard of? Even among advanced healthcare providers, understanding and documentation of sepsis as a primary disease are poor. Many EMS providers think sepsis is a rare event and documentation of sepsis as a primary disease is often suboptimal.14

EMS Can Make the Difference

While sepsis accounts for approximately one in five ICU admissions, it is not just an “in-hospital” problem.15 Not only does EMS see sepsis often, these patients are some of our sickest.16 In 2010 the EMS system in King County, WA, found an incidence rate of sepsis of 3.2%, yet the incidence rate for MI was only 2.3% and for stroke only 2.2%.16

Studies have shown that when EMS transports sepsis patients, these patients receive IV fluids, antibiotics and in-hospital sepsis treatment much faster.14,16 Likewise, systems with designated sepsis alerts are shown to reduce overall sepsis mortality along with significant reductions in length of hospital stay, time in ICU and cost per stay.14,16

Unfortunately the research also shows that many EMS systems have a long way to go when it comes to identifying sepsis. One study showed that despite significant abnormalities in the vital signs of septic patients (25% had systolic BP <90 mmHg), serial vital signs were often not taken or were poorly documented, only 38% had an IV line started with average fluid delivered of 200mL, and cardiac monitoring was performed less than 50% of the time.17

Is it that we don’t care, or that we don’t know? A 2013 study evaluated over 200 EMS providers, 43% of whom were paramedics and 73% of whom had been in EMS for over 10 years. They were given four scenarios in which to identify septic shock. Only 10% of them got the scenarios correct.18

EMS providers may wonder where to begin. To help victims of sepsis overall and pediatric patients specifically, EMS providers can follow the ABCs:

- Acquire knowledge about sepsis;
- Be ready to give sepsis alerts;
- Children with sepsis need an advocate.

To start acquiring knowledge about sepsis, we can use another set of ABCs to describe the pathology: the patient acquires infection, blood vessel problems develop, leading to circulatory collapse.

Acquire Infection

Sepsis always begins with some kind of infection. Bacterial, viral, parasitic or fungal pathogens get inside the body and begin to reproduce in the area of infection. These pathogens release toxins called exotoxins and endotoxins that damage the local body tissues. Normally the body’s first line of defense—the innate immune response—senses these toxins and begins to act quickly to attack the pathogens producing them.19

The immune system’s first responders are local macrophages and other material that attempt to consume and destroy the pathogens. During this process macrophages release a variety of cytokines (cell signaling proteins) that activate additional immune responses to battle pathogens. Among other actions, these cytokines trigger inflammation in the area of infection that causes blood vessels to dilate, capillaries to leak and tissue edema, all of which allow greater flow of immune responders into the area to attack pathogens.19 Neu- trophils (“fighting” white blood cells) and other immune factors respond to the area of infection to fight pathogens, harming some “good” body tissue along the way.19 This damage can result in even more blood vessel leakage and release of more cytokine signaling chemicals. Cytokines may now cause a temperature increase in the infected tissues and ultimately cue the hypothala- mus to reset the patient’s body temperature, which produces a fever.19

These temperature increases are a good thing as they help to both slow pathogen replication and improve immune system activation. Signaling chemicals also trigger increased clotting and decreased fibrinoly- sis (anti-clotting), causing the neutrophils, macrophages and other material to clump against blood vessel walls.20

All of these physiological responses have intrinsic limits and antagonistic fac-
Mean arterial pressure (MAP) is a measurement of cardiac output superior to blood pressure, yet is not frequently used by many EMS providers. Normal MAP is between 70–110 mmHg and target MAP (treatment goal) is MAP >65 mmHg. There are advanced ways to calculate MAP that involve different mathematical formulas depending on the patient’s heart rate, but a simple rule of thumb is [2 × diastolic BP] + systolic BP] /3. Thus, if your patient has a BP of 100/70 it would be 70×2+140, plus the systolic of 100+240, 240 divided by 3=80 which is a perfectly normal MAP. Of course, in many systems there is an even easier way of calculating MAP: On most monitors that take NIBP measurements, the MAP is displayed right next to the blood pressure.

Sepsis in Pediatric Patients
Neonatal Sepsis
Between 1995 and 2005, the prevalence of severe sepsis in newborns in the U.S. more than doubled from 4.52 to 9.7 cases per 1,000 births.5 While definitions vary, sepsis that develops within the first 72 hours of birth is generally considered early-onset neonatal sepsis, while sepsis that develops more than 72 hours, but up to as many as 30 days after birth, is considered late-onset neonatal sepsis.

Circulatory Collapse
Severe Sepsis, Septic Shock and Multorgan Dysfunction Syndrome (MODS)
As the patient progresses down the sepsis spiral, at some point the body will no longer be able to compensate without assistance. This is when organ dysfunction begins and is the beginning of septic shock. At this point the body may respond well to supportive treatment such as an initial (of possibly many) fluid bolus of 20cc/kg.

When two or more of the body’s organ systems are impacted it is called multorgan dysfunction syndrome, or MODS.25 The most critical organ systems are, of course, the cardiac and respiratory systems, but many other systems can begin to fail.26,27 These systems include the kidneys, liver, GI tract and even the nervous system.27 While the exact timing varies from patient to patient, when severe sepsis progresses far enough that it does not respond to fluid administration, multorgan dysfunction syndrome is likely and we arrive at septic shock.

The clinical definition of MODS is:
• Systolic BP <90
• Mean arterial pressure (MAP) <65
• ARDS
• EtCO₂ <32
• Lactate >4 mmol (Note: Many definitions and protocols use lactate, but it is important to remember that pediatric patients may have normal lactate levels despite being in severe sepsis or septic shock).

When the patient doesn’t respond to >60 cc/kg of fluids, septic shock is a very diffi-
cult and dire situation in adults. In pediatric patients, it is even worse.28

What Can EMS Do On A Call?
To manage pediatric sepsis EMS providers can follow the progression of sepsis pathol-
ogy to identify, assess and treat sepsis:
• Acquired infection? Ask about infec-
tion history;
• Blood vessel problems? Assessment and sepsis alert criteria;
• Circulatory collapse? Aggressively treat severe sepsis and septic shock.

Acquired Infection? Check Their History
Pediatric patients should be assessed using the Pediatric Assessment Triangle (see Figure 1) to identify and begin treat-
ment of immediate life threats.29 The first step in recognizing sepsis is attempting to identify if the patient has an

Figure 1: Pediatric Assessment Triangle

Thermometry
When using a thermometer on a pediatric patient it is important to keep the following items in mind to obtain a clinically relevant and accurate temperature:
• Gold standard for kids is a rectal temperature;
• Oral temperature is fine for older children and adults;
• Axillary temps are not reliable;
• Accuracy of tympanic thermometers is highly technique-dependent;
• Accuracy of newer infrared temporal artery (TA) thermometry is also technique-dependent.

What is MAP?
treatment of severe sepsis and septic shock. Rapid vascular access is crucial in beginning of local protocols are reached. When definite diagnosis of sepsis mean that the patient cannot have other medical problems that EMS may also need to treat. Blood Vessel Problems? Assessment and Sepsis Alert Criteria

If you believe your young patient has an infection, the next step is to identify if SIRS is present. The question you should ask yourself is, “Is this patient hypofunctioning?” Remember, an infection resulting in SIRS – sepsis.

Different assessment tools, techniques and checklists are available to providers in different systems, but signs of pediatric hypoperfusion include the following:}

• Altered mental status (GCS <32 or a change) 29
• Significantly increased or decreased pulse rate for age
• Significantly decreased blood pressure for age (late sign)
• Mean arterial pressure (MAP) <65
• Difference between central and peripheral pulses by >50 mL
• eTCO$_2$ <32
• Temperature >100.0 or <96.0
• Glucometry >180 mg/dl
• Lactate >4 mmol/L
• Ultrasound shows IVC decreases in diameter >50% on inspiration
• Urine output <1 mL/kg/hr (dry diapers).

EMS sepsis alerts have been shown to significantly decrease time to treatment for sepsis patients and reduce mortality rates. Alert criteria are available—some simple and some complex—it is critical for EMS providers to understand that not having a local alert protocol does not mean there is nothing you can do.

While defined sepsis alerts are helpful, there are ways every EMS provider can make a difference for pediatric sepsis patients even if their system does not currently use specific sepsis alert criteria. If you have identified a pediatric patient with an acquired infection who has blood vessel problems (shock) you can still make a tremendous difference for your patient by simply telling the emergency department staff, “I suspect sepsis.”

Circulatory Collapse? Rapidly And Aggressively Treat Severe Sepsis and Septic Shock

When evidence (or strong suspicion) of fluid administration after 60 cc/kg, significant dysfunctions such as systolic BP <100 after administration of a 20cc/kg fluid bolus, acute respiratory distress syndrome (ARDS), or two or more organ dysfunctions, it is considered severe sepsis. If the patient is allowed to move further down the sepsis spiral without interventions, fluid administration may continue up to 60cc/kg. This does not mean that no more fluid will be administered beyond 60cc/kg, but sepsis kills at any point that septic shock. In some cases fluid administration in excess of 200cc/kg may be necessary.

Treatment

The biggest challenge is making sure you recognize your pediatric patient is suffering from sepsis in the first place. Once that has been accomplished, treatment follows the typical ABCD (airway, breathing, circulation, drugs) pathway, along with activation of a sepsis alert and a good patient hand-off with advocacy.

Airway

Pediatric patients experiencing severe sepsis or septic shock may require placement of an advanced airway. While rapid sequence intubation or med-facilitated intubation may be appropriate, it is important that advanced providers do not use etomidate on septic pediatric patients. Etomidate inhibits 11-β-hydroxylase, an enzyme necessary for cortisol production. This can block the body’s normal stress response and increase the severity of septic illness. Breathing

The primary goals are to reduce the work of breathing and increase oxygenation for your pediatric patient. A distressed pediatric patient will be working hard to breathe. This, along with the increased metabolic producing fever, will increase oxygen demand even further. An appropriately sized continuous positive airway pressure (CPAP) or bag mask (BVM) can be used to reduce work of breathing or provide ventilations completely.

Circulation

Rapid and large-bore IV or IO access is important not only for initial fluid resuscitation, but also for possible blood product administration. As previously mentioned, recommended fluid administration is the standard 20cc/kg until any of the following occur:

• Signs/symptoms improve
• Rales
• Hepatomegaly
• MV <60

Fluid administration may continue up to 600cc/kg. This does not mean that no more fluid will be administered beyond 600cc/kg, but sepsis kills at any point that septic shock. In some cases fluid administration in excess of 200cc/kg may be necessary.

Drugs/Differential

In some cases of severe sepsis or septic shock, pressor medications may be necessary to maintain the patient’s circulatory status. The following pressor agents are recommended for pediatric sepsis:

• Cold shock (compensating, cold extremities, delayed capillary refill): Epinephrine 0.1-1 mcg/kg/min IV/IO infusion, titrate to effect

Not every EMS system can be equipped to provide adult or pediatric sepsis patients with antibiotics. Selection of proper antibiotics to administer before blood cultures can be obtained is only one challenge. The agreement of destination hospitals to continue this antibiotic therapy is another. EMS services seeking this level of service must be working in true “sepsis systems of care.”

EMS providers must also keep in mind other possible concurrent medical or trauma issues with sepsis patients. Especially when dealing with shock refractory to fluids), remember to keep issues such as pneumothorax, peripheral tamponade and endocrine emergencies in your differential diagnosis.

Conclusion

After nearly 50 surgical procedures and numerous complications Andrew McDonough passed away on July 14, 2007. The primary cause of death was sepsis triggered by a fungal infection. Andrew’s story, along with the many others, can be found through the Sepsis Alliance (www.sepsisalliance.org), a charitable organization dedicated to raise awareness of sepsis among healthcare providers and the public.

Sepsis is a complex and deadly mixture of inflammatory, immune and coagulation responses resulting in a combination of distributive, hypovolemic and obstructive shock that often goes unrecognized by healthcare providers until it is too late. EMS providers can do plenty for pediatric victims of sepsis.

For Andrew McDonough and the many children like him, EMS providers need to be heard and spread the word: Unrecognized sepsis kills kids. Not every EMS system can be equipped to provide adult or pediatric sepsis patients with antibiotics. Selection of proper antibiotics to administer before blood cultures can be obtained is only one challenge. The agreement of destination hospitals to continue this antibiotic therapy is another. EMS services seeking this level of service must be working in true “sepsis systems of care.”

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Following the A
cquired infection? Ask about infection history: Blood Vessel Problems? Assessment and sepsis alert criteria; Circulatory Collapse? Aggressively treat severe sepsis and septic shock. Overall Aquire knowledge about sepsis; Be ready to give sepsis alerts; Children with sepsis need an advocate.

• Warm shock (decompensated, warm extremities, flush capillary refill): Norepine 0.1-2 mcg/kg/min IV/IO infusion, titrate to effect

While hyperglycemia is a common finding in pediatric septic patients, EMS providers should be alert for low blood sugar as well.

• Neonates <45 mg/dl: Administer glucose 0.5–1 g/kg IV/IO of D50%
• Infants/children <60 mg/dl: Administer glucose 0.5–1 g/kg IV/IO of D50%
• Antipyretics such as Tylenol or Motrin may be considered according to local protocols to reduce fever both for patient comfort, as well as to reduce the physical demands the fever is placing on a body in shock.

When we consider that for every hour administration of antibiotics is delayed, patient mortality increases 7%, it seems only reasonable that antibiotics should be administered as early as possible, even outside of the hospital. 36, 45 Kevin T. Col- lins, BA, FP-C, NRP, CMTE, clinical educa- tion coordinator for AirLink/VitaLink Critical Care Transport in North Carolina says, “Antibiotic treatment is important especially with patients who will undergo extended transport times. In these patients we can make a real difference in the amount of time it takes to get those antibiotics on board to begin fighting back the infection and its effects.”

Initial fluid administration is 20ml/kg boluses until signs and symptoms improve, signs of fluid overload appear, or the limits of local protocols are reached.

Medical history or comorbidities that put pediatric patients at risk for sepsis include:

• Acquired Immune Deficiency Syndrome (AIDS)
• Developmental delay
• Sickle cell disease

Sepsis is a complex and deadly mixture of inflammatory, immune and coagulation responses resulting in a combination of distributive, hypovolemic and obstructive shock that often goes unrecognized by healthcare providers until it is too late. EMS providers can do plenty for pediatric victims of sepsis.

For Andrew McDonough and the many children like him, EMS providers need to be heard and spread the word: Unrecognized sepsis kills kids.

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Available online at EMSWORLD.com/275608

ABOUT THE AUTHOR

Andrew T. Duckworth, EMT-P, is a dedicated emergency responder and award winning educator with more than 25 years working in career and volunteer fire departments, hospital-based emergency services, and private emergency medical services. Currently a state certified paramedic and a contributor to emergency services research, textbooks, and print and online media.
EMT agencies have never been in more need of such analysis. Your Agency’s strategic planning is traditionally thought of as an evaluation of the strengths, weaknesses, opportunities and threats—known as a SWOT analysis—facing any company or organization, then mapping a path forward that addresses those areas. EMS agencies have never been in more need of such analysis, as they attempt to survive in a world where operations and the delivery of clinical care are redefined on a near-daily basis.

The Four Pillars of SWOT

Strengths and weaknesses review internal factors that impact the ability to obtain a goal. In EMS this could include recruiting more volunteers, adding non-emergen-
cy services or managing the operating expenses. Strengths might be:
• Solid community support;
• Meeting response time standards on a consistent basis (time period of 3 or 6 months);
• Collaboration with other stakeholders.
Weaknesses can include:
• Lack of a consistent funding stream that isn’t dependent on billing;
• Lack of volunteers/other staff;
• Antiquated equipment/trucks;
• Poor relationship with acute care facilities resulting in backups of resources at EDs.

Opportunities and threats focus more on external factors impacting an EMS agency and its future development.

Opportunities can include:
• A mobile integrated healthcare initiative based on conversation with other stakeholders in the healthcare arena to fill perceived gaps in service;
• Transition from an all-volunteer unit to paying personnel for specific shifts when necessary;
• Better integration with the existing healthcare system to address gaps (e.g., mental health resources);
• Analysis of regionalization efforts in conjunction with surrounding EMS agencies.

Threats can include:
• The Tennessee Fire Chiefs Association is excited for the opportunity to partner with Firehouse Expo. Firehouse has a long history of supporting firefighter education, training and safety, which aligns with the mission of the Tennessee Fire Chiefs Association and the Tennessee fire service,” — James Fountain, President, Tennessee Fire Chiefs Association
• “I am elated that Firehouse has chosen Music City as its location for Firehouse Expo in 2016. The State Fire Marshal’s Office and the Tennessee fire service are proud to host such an elite conference and exposition. Nashville is an exciting city to visit and will provide an outstanding atmosphere for a successful conference next year.” — Gary West, Tennessee State Fire Marshal

Firehouse and Nashville – A Strong Partnership Begins!

By Raphael M. Barishansky, MPH, MS, CPM
Where To Begin
Successful strategic planning effort is predicated on an agency’s ability to approach it in three distinct phases.

Phase 1
The first phase is "intuitive thinking." This seeks to answer questions such as: Why are we in business? Who are our customers? What do they want from us? What do they get from us? What matters most to us? Where do we see our company going in the future? These are big picture questions. At the beginning of the strategic planning process, people need to deliber-ately and thoughtfully think about how to respond to these questions. This is where you can take the opportu-nity to craft your agency mission statement, which, optimally, answers the questions posed above.

A good example of an EMS-specific mission state-ment comes from the San Diego (CA) Health and Human Services agency, which states: “To ensure that all residents of and visitors to San Diego County receive timely and high-quality emergency medical services, specialty care, prevention services, disaster prepared-ness and response.”

Phase 2
The second phase is long-range planning. Instead of being intuitive, this is very analytical. This phase is about understanding such things as where your company fits in the marketplace, what your strengths are as an organization, where your limitations are, and how you relate to customers and competitors. It also includes understanding the regulatory environment and how major trends in the EMS world affect you. This is also where you are going to take the opportu-nity to craft your agency vision statement so that it conveys how your organization wants its future to look.

A good example of a vision statement comes from the Riverside County (CA) EMS Agency and states: “The Riverside County EMS system's vision is to be the exceptional, outcome-focused EMS leader in the nation.” A vision statement is a declaration that conveys the image of how the organization wants its future to look.

Phase 3
The third phase is operational planning. This is when your strategic planning team takes a 30,000-foot view of previously discussed concepts to make them as practical and specific as possible.

This entails reviewing the issues discussed and realistically deter-mining what your agency can afford to do without overreach-ing. For those things your agency commits to, it is the time to develop your plan for implementing and executing on those issues, which includes understanding who is responsible for what, what guidelines they’re going to be working under, what resources they’re going to have available to them, and what milestones or review points you need to have along the way to make sure every-one is staying on schedule. These are your agency goals and their defining objectives.

An example of a goal would be “to ensure the long-term financial solvency, stability and cost-effectiveness of the EMS system” and the objectives that support this goal could include:
- Establish methodologies to identify the baseline costs of the current system;
- Identify current funding sources for first response, ambulance transportation, education/training, disaster medical preparedness and response and other EMS-related services;
- Develop a mechanism that identifies funding that can sustain system improvements implemented under this strategic plan;
- Define and quantify the potential funding changes driven by the Affordable Care Act for traditional EMS delivery models.

Conclusion
Every day we read news of office departments taking over EMS opera-tions, private EMS services going out of business due to an inability to weather economic downturns, or a volunteer ambulance squad failing to recruit or retain sufficient numbers of volunteers to staff its operation. Rarely is it considered that one of the significant contributing factors may have been the organization’s lack of focus and direction. Perhaps such events would not occur if an agency had a well-thought-out, long-term strategic plan.

Tips for Successful Strategic Planning
Here are some key practices to follow during the strategic planning process:
- Ensure all voices are heard during the planning process. It’s key to include field providers, line supervisors, managers and executive-level personnel in the planning process, as each will have a different perspective to offer. This will also ensure that personnel from all levels will go back to their peers and make the plan understandable.
- Do not let the strategic plan become just another document kept in an office or on a bookshelf somewhere. This document should be given to new employees during orientation, as well as regularly referenced at senior-level management meetings. If the plan is going to be effective, it needs to be used and updated constantly.
- Keep your feet on the ground. Make sure that your goals and objectives are as realistic as possible. One of the primary reasons a strategic plan fails is that it has too many goals and objectives, creating a plan that is, as a whole, unfocused. It is also critical to ensure adequate resources are available to accomplish those goals and objectives outlined in the plan.

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What I Wish I’d Known Then
Survival tips for making it midway through your career

“The years teach much which the days never knew.”
—Ralph Waldo Emerson

In the movie Terms of Endearment, there is a great scene where Emma (Debra Winger) tells her mother Aurora (Shirley MacLaine) that she is pregnant. In response to the happy news Aurora girts out, “Why should I be happy about being a GRANDMOTHER??” Her not-so-thinly veiled outrage at the notion of being bumped up a generation is hilarious and hits home. It is one of thousands of movie references I can make that a growing percentage of you will simply not “get.” My favorite pop culture references and song lyrics moving into obscurity is an early and painful symptom of my inevitable transition to the next phase of my life.

When working out the theme I wanted for this column, I came up with the concept of the “Midlife Medic.” After all, that’s what I am—a career paramedic who has made it just a few miles south of the big 5-0. My experience officially spans a generation. I am proud to have made it this far, and to have had some wonderful opportunities along the way. I recognize that this field is different for the older provider and believe that together we can open conversations about unavoidable transitions. It’s honest and it’s who I am.

I hate it because it’s true and I can’t change it. It is somewhere nobody ever believes they will be until it is too late. I mentally flinch at the term just as quickly as I avert my gaze from the increasing ratio of silver in my hair. I say it aloud and dreams of bifocals and enteric-coated aspirin dance in my head.

I love it. I love it because I’m still here, and my fear of the unknown is less and my confidence is more. I love it because all those years of interacting with people has made me a patient-whisperer. All those different calls have honed my situational awareness and ability to interpret a scene to an edge so sharp I may appear psychic to you. I love it because medicine is dynamic and our field is evolving, so there is always something new to challenge myself with. I am not the Midlife Medic because I am old, but because I am still here and I still love my job.

Overtime is nice, time over with family or friends is nicer.

Here are some tips I would give my 20-year-old self to help move the industry forward in the spirit of mentorship.

1. Everything comes with recovery time. Enjoy going out until all hours and then pulling a double shift, because 10 years from now that will make you cry. Seriously.
2. Stop eating garbage. Make proper diet and exercise a lifestyle habit now. It is SO much harder when you’re older. Skip the fast food and dump the coffee…wait, what am I saying? Life is short, always drink the coffee.
3. Stay current. Read journals, use the Internet, go to conferences or find classes that offer more than the minimum. Don’t reject innovation, leave your comfort zone.
4. Own your age. It’s all right if you do not like the music or speak the slang, just maintain a base knowledge. (Like hazmat awareness, instead of the DOT manual you use “Urban Dictionary” from a non-work Internet source.)
5. Get glasses. If you are having trouble reading dosages and expiration dates, then get it corrected before the next thing you have trouble seeing is vocal cords.
6. Overtime is nice, time over with family or friends is nicer.
7. Diversify. Pursue the topics that interest you, find your passion, finish that degree! Continuing education gives you professional mobility.
8. If you are struggling, ask for help. Whether that help is figuring out a complicated medical call, lifting a heavy patient, or because you are considering ending your life, there is always someone out there willing to help. Always.
9. Your experience has value, share it. Every encounter gives you the ability to either learn or teach something. Use it wisely.
10. Stop carrying your equipment on the same shoulder! (Don’t lie and say that you don’t, I know you do.) Someday you will be where I am. I hope you will remain true to yourself and still love the work, because those are the things that will resonate to the younger providers around you. Work together to learn from each other and help move the industry forward in the spirit of mentorship. Traditions are made by integrating the past, not ignoring it.

My name is Tracey, and I am a Midlife Medic.

ABOUT THE AUTHOR
Tracey Loscar, NRP, FP-C, is a battalion chief for Matanuska-Susitna (Mat-Su) Borough EMS in Wasilla, Alaska. Her adventures started on the East Coast, where she spent the last 27 years serving as a paramedic, educator and supervisor in Newark, NJ. She is also a member of the EMS World editorial advisory board.
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1. Data contained in, and/or calculated from: T.K. Fredericks, S.E. Butt, K.S. Hamrs, J.D. Burns, (2013) *Evaluation of Medical Cot Design Considering Biomedical Impact on Emergency Response*

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