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What EMS Practitioners Need to Know about Pharmacology

The 3rd edition *Advanced Medical Life Support (AMLS)* textbook was just published, featuring new chapters covering critical illnesses EMS practitioners often encounter in the field. NAEMT News will run a series of articles focusing on the new and enhanced content.

In this issue, we feature “pharmacology for EMS” with Dr. Stein Bronsky, an emergency physician and medical director for the Colorado Springs Fire Department and American Medical Response (AMR) in El Paso County, Colorado. Bronsky is a contributing author of the new AMLS chapter on pharmacology.



you may go off the edge of the cliff. A bus driver saw us swerve. He sped up, swung wide and hit us to plow us up against the canyon wall and keep us from falling off the edge. I don't remember a lot, but I remember having to be extricated.

I had a lot of broken bones. I almost lost my lower leg, and I had a head injury.

I didn't have any internal organ damage, but my passenger did. The emergency crews knew how to handle the situation, and it was really impressive. I became an EMT shortly after that, and worked as a ski patroller in Utah while I was in college.

Before we talk about pharmacology, can you tell us what got you interested in EMS?

When I was 17 years old, I got in a car accident – a bad car accident. I was driving and I fell asleep on a really narrow, canyon road, the kind where if you swerve

Did you always plan on becoming a doctor?

No. My dad is a pediatric immunologist, and I wanted to do something different. So I went to Israel to study Middle Eastern studies.

But while I was there, I became a paramedic. During the late 80s and early 90s, there was a lot of trauma there. There were an unbelievable number of car accidents. They didn't have traffic police, so there was nobody stopping anyone from speeding or driving poorly. There were also terrorist attacks – mostly suicide bombers and backpacks left in crowded tourist areas, loaded with explosives. They would just wait for somebody to pick up the backpack, and boom.

Israel got very, very good at MCI triage and treatment. One thing they learned is that people will not stick around and wait to be triaged or wait for an ambulance. If they can get up and physically move away from a scene, they will get as far away as possible. It's human nature. If they are too injured, the people around them will pick them up and extricate them out of that circumstance.

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Israel learned emergency crews will not get there in time to treat the majority of patients. There may be somebody who freezes up and doesn't move, or who looks dead but is not quite dead and so people left them. But it is single digit percentages of people who are still at the scene when EMS arrives, and who are still alive so you can do anything to try to save them. Nearly all of the action is at the nearest hospital – not a trauma center, and not the place best equipped to help them. Whichever hospital happens to be the closest. After my time in Israel, I knew I wanted to go to medical school and become an ER doctor.

What do EMS practitioners need to learn about pharmacology?

Pharmacology is the study of interactions between a medication and the human body. As an EMT or first responder, you learn practically nothing about pharmacology. When we get to paramedic school, we learn more. But what we don't really learn is the 10,000-foot view – what are the different classes of medications, why do we use them, what are our expectations when using one, and what are the effects, wanted and unwanted.

Opioids are a perfect example. We want to alleviate the person's pain, but there are other effects, including depressing respiration and lowering blood pressure. Those are consequences we have to know about.

Typically, as field providers, we receive a cache of drugs. You are taught about those specific drugs and when to give them. But what happens if you don't have one of those drugs because there is a shortage? How can providers make decisions about what to give when the situation requires critical thinking?

For example, let's say you have a patient who has broken their leg versus one who has a huge, penetrating exsanguinating injury and their blood pressure is low. You have to be able to use critical thinking – what is unique about this patient's physiology and pathology? The drug I'm about to give for pain has some good effects and some bad. Is one of those bad effects something I need to worry about?

Let's say you have morphine, fentanyl and ketamine. Which one would you give to a patient who is elderly, hypotensive, has an unstable pelvis after a fall and is in a lot of pain, vs. somebody who is young, healthy, with a pinned limb who needs to be extricated?



I may give ketamine to somebody who is young, healthy and needs pain management during a prolonged extraction. You may have difficulty getting to them. Fentanyl is short-acting and you may need to multi-dose the patient and monitor their respiratory drive or give supplemental oxygen, which may not be possible. Ketamine would manage their pain and be a hemodynamically stable drug that does not affect the respiratory drive. Ketamine lasts longer and the dissociative affects of ketamine may be a good thing if you have to do an amputation.

But for an elderly patient who is hypotensive with a broken pelvis, we want to use a pain medicine that will not lower blood pressure. Morphine and hydromorphone (Dilaudid) are not the preferred options. Could I use ketamine? I could, but ketamine has unpredictable side effects in elderly patients. Sometimes it works fabulous, but occasionally patients become unresponsive even with a small dose. So we need to be very, very cautious and use critical thinking to assess which drugs are best in a given situation.

What steps can EMS practitioners take to avoid medication errors?

Dosing errors are the most common errors made on patients outside and inside the hospital. To reduce these errors, we need good, systematic communication, and methods of organizing our system. Hospitals have set up extremely elaborate programs to make sure you are giving the right dose, and the right medication, to the right person. In the field, we don't necessarily have those systems in place yet.

In Colorado Springs, we've taken some steps to mitigate that, such as standardized doses. We have also gone to volume-based dosing for pediatrics so you don't have to do the math. Math is not most people's strong point, especially not at 3 a.m. when you're exhausted. We also ask everybody at our agency to tell us when there is a medication error. This is a non-punitive process. We want to understand how we set you up for that failure and change our system so it doesn't happen again.

There's a lot of concern about opioid addiction and the overuse of opioids. In the EMS setting, is there a greater risk of EMS overtreating pain or undertreating pain?

We have gone from potentially overtreating pain, to now potentially undertreating pain because of concerns about opioids. Today we have a greater recognition of the potentially harmful side effects of the acute use of opioids, as well as the addictive properties. One positive change coming out of this is that we have started to think about other possibilities for pain management, such as acetaminophen (oral and intravenous), NSAIDs (nonsteroidal anti-inflammatory drug) and ketamine.

We also need to consider the hazards of opioid medication diversion. Traditionally there isn't a great chain of custody for controlled substances in the EMS system. It behooves everybody to ensure they have systems to track these medications so we can reduce diversion, and if diverted, have a better chance of figuring out how it was diverted. Access to controlled substances is a risk factor for addiction.

How can bias impact pain management decisions?

Bias can be on opposite ends of a spectrum. Some providers may say, 'I believe it's our priority to make sure that every person who is experiencing pain is completely out of pain.' Or you can have the opposite bias where you'd say, 'I understand this person is in a lot of pain, but pain isn't going to kill you. No way am I going to give an opiate medication. They can get opioids at the hospital.'

Cultural biases based on gender, socioeconomics, and race are also well-documented in the prehospital administration of pain medication. Medics may be less likely to offer pain relief to a homeless person, or somebody they believe meets the picture of a drug-seeking person.

I don't claim to have all the answers. But overcoming bias requires taking a really hard look at your personal beliefs and recognizing bias. Although most people don't self-reflect on this topic – they see their beliefs as facts and they don't see another way of looking at it.

Are there pain management medications that you think are underused in the prehospital setting?

I think there are several medications that are underused. As a culture in medicine, we think of opiates as the answer to pain management in emergency situations. Almost all other medications and all other classes of medications are systematically and historically ignored as a possibility for treatment.

We need to do everything we can to broaden that view and determine when it is appropriate to use opiates and when it's appropriate to use other types of medications. Often in the prehospital environment, if a patient is deemed to be in tremendous pain they get an opiate, and if they're not in that much pain, they don't get anything. But we can do better.

Say somebody has severe strep laryngitis (strep throat). We don't think of that as a life-threatening emergency, but it can cause a lot of pain. It's hard to swallow, so they don't want to put anything in their mouth and they can become dehydrated. Does this kid or adult deserve pain management in the prehospital environment? Yes they do. We could use topical medications, such as topical or nebulized lidocaine, which would provide tremendous relief. Tylenol or an NSAID would also help.

Even for bone fractures, not everybody needs an opiate, especially kids who respond very, very well to acetaminophen and NSAIDs. Adults do too, although they are more mentally inclined to think over-the-counter medication isn't going to help, whereas kids haven't formed those beliefs yet.

Studies show that anaphylaxis (a severe allergic reaction) is under-recognized and potentially undertreated in the prehospital setting. What does EMS need to recognize about anaphylaxis and the use of epinephrine to treat it?

The emphasis on recognizing anaphylaxis has traditionally centered around airway issues – if your throat is closing up, you can't swallow and you're having a hard time breathing, you're

having a bad allergic reaction and we want the provider to use epinephrine.

Anaphylaxis is a systemic process that can manifest in different ways – and not always with throat swelling. If you're thinking only about the respiratory system, you may be missing other systemic effects, such as a full body rash or hives. GI issues are common – people who ingest an allergen may have nausea, vomiting or abdominal cramping. Wheezing may make EMS practitioners think more about albuterol than epinephrine, but wheezing may be part of an anaphylactic reaction.

Hives, GI issues, wheezing, hypotension – these kinds of symptoms should trigger using more aggressive treatments, including epinephrine, as well as histamine-blockers such as diphenhydramine (Benadryl) and famotidine (Pepcid).

From an educational standpoint, we need to do a better job explaining what is happening in the body during anaphylaxis, so EMS practitioners are not just focused on the airway.

Some of this also involves changing the culture at EMS agencies. EMS practitioners are often taught to only give epinephrine when you are sure somebody is in anaphylaxis. If the symptoms aren't exactly what they were taught, they are afraid if they give epinephrine they will get into trouble. That environment impedes people from using their brains to work through a situation. In our system in Colorado, we promote the idea that if you think it's the right thing to do, even though it doesn't check all the little boxes, you write down your reasoning and the thought process you went through. Even if you're wrong, you're not in trouble. Guess what? Doctors get it wrong at times too. We want you to think critically. Sometimes you will be wrong, but a lot of times you will be right.



Welcome New NAEMT Agency Members!

- Bryan County EMS, Durant, OK
- Cavalier County Memorial Hospital and Clinics, Langdon, ND
- Moundville Fire Department, Moundville, WV
- Plymouth Community Ambulance Association, Plymouth Meeting, PA
- Survival Team EMS, Riyadh, Saudi Arabia