Chapter 32

APPROACH TO THE EMERGENCY PATIENT

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INTRODUCTION

Military medical providers (MMPs) face numerous challenges in both stateside and deployed medical practice. One of the most daunting and time-sensitive challenges is managing a patient with an acute life-threatening illness or injury. Patients with anaphylaxis, severe hemorrhage, unstable cardiac dysrhythmias, or intractable seizures need the *right care, right away*. Many practitioners do not encounter these types of patients in their normal practice, and therefore lack a conceptual framework and organized approach to handle an unexpected emergency. Regardless of their medical background, a practitioner can apply fundamental concepts that will benefit patients in these types of high-pressure situations. For students and providers of all levels, this chapter will provide the approach of a specialty-trained emergency physician (EP) to the fundamentals of assessing and treating severely ill and injured patients.[1]

This chapter will introduce readers to the concepts of simultaneous diagnosis and treatment, working with imperfect or limited information, and operating in resource-constrained environments. This approach is critically important to the MMP who confronts the challenges of a deployed environment with limited access to specialty consultants, including EPs. The chapter also touches on a variety of core emergency patient presentations. While it is not intended to be a definitive clinical reference, it will inform readers about "red flags" and key features of assessing and managing these patients.

Beyond the normal challenges of civilian emergency medical practice, in which patients are primarily treated in designated emergency departments (EDs), military practitioners may find themselves in hostile locations with scarce resources. Mental preparation for emergency practice in these settings is essential for all MMPs.

WHY EMERGENCY MEDICINE IS DIFFERENT

Emergency medicine is complaint driven. When a patient presents to an outpatient orthopedics department, for example, the patient's issue is often focused and within a limited subset of diagnoses, such as fractures or joint pain. The same applies to many other fields in medicine, where presenting problems are often *diagnoses* rather than *symptoms*. For example, a patient visits their primary care doctor for diabetes management, and the goals of the visit and expected outcomes are anticipated and often predictable. Emergency patients typically present with symptoms or a chief complaint. These symptoms could represent a benign or life-threatening condition, and the EP must rapidly and efficiently make this distinction. Thus, practitioners must shift their mindset to "complaint-based" or "symptom-driven" evaluations of patients. Not all evaluations will lead to a definitive diagnosis, and providers working in an emergency setting may end up "diagnosing" their patient with "chest pain" or "abdominal pain" after having excluded life-threatening conditions during their workup process.[2]

Emergency patients are often scared. There have been numerous poorly informed popular media reports about patients using EDs for non-urgent issues and EDs primarily serving the uninsured. However, multiple studies have shown that nonacute issues do *not* constitute the majority of ED visits, and that many ED users are indeed insured and have a primary care provider.[3–6] When a patient presents to the ED, they are concerned enough about their symptoms to seek emergency care, and their complaints are often high risk. Emergency patients often believe their symptoms are life threatening or warrant immediate evaluation. An emergency practitioner must recognize and acknowledge this worry. Sometimes patients only need reassurance and education, and then they can be safely discharged to their home or returned to duty. It is important to remember that even patients with benign conditions require respect and a thorough evaluation of their complaint by an experienced provider.

EPs have unique doctor-patient relationships. EPs face the need to form an immediate rapport with patients, with whom they have no prior patient-doctor relationships, in a high-stress environment. The EP must rapidly earn the patient's trust so he or she will feel comfortable disclosing personal details. In a deployed setting, EPs also care for unique populations, such as local nationals and enemy prisoners of war, which makes establishing rapid rapport and an effective treatment relationship even more complex.

EPs operate in an environment of uncertainty. Test results are often not available in time to make crucial treatment information. Patients can arrive obtunded and unable to provide a history. EPs often cannot follow up with patients after discharge. These are just a few examples of uncertainty emergency providers will face. These situations can be uncomfortable, but mental preparation for these realities can help non-emergency specialists succeed.

EMERGENCY DEPARTMENT CONCEPTS AND PROCEDURES

Prehospital Arrivals

Few non-EPs interact routinely with prehospital providers. Prehospital crews transport most emergently ill or injured patients, whether deployed or stateside, for emergency care. In the United States, patient transport is done by a combination of paramedics and emergency medical technicians in ambulances and helicopters. In a deployed setting, transport is done by military medics with varying skill sets and in a multitude of platforms, such as helicopters, armored vehicles, or vehicles of opportunity. Depending on the training and equipment of these providers, the arriving patient may already have had interventions and diagnostics performed, such as venous access, an electrocardiogram, or a blood glucose measurement. Most often, the prehospital providers will call and report to the EP, allowing the ED to prepare for the patient's arrival. For example, if an urgent surgical patient is inbound, the EP can prepare and gather all necessary equipment, have blood prepared to transfuse, and summon any needed help or consultants prior to the patient's arrival. Preparation is even more important in mass casualty events when a large number of patients arrive at the same time.

The Initial Assessment

MMPs caring for emergency patients should hone their ability to perform a "doorway assessment" for a quick evaluation of the patient's condition. Simple observations by a well-trained eye are crucial to gathering information and starting rapid treatment. Here are questions to consider when evaluating a patient on arrival:

- Did the patient arrive via ambulance or come into the waiting room?
- Did the patient walk into the room or arrive via wheelchair or stretcher?
- Does the patient walk without assistance? With a steady gait?
- What is the patient doing? Writhing in pain? Lying motionless? Talking on a cell phone?
- What is the patient's work of breathing? Are they gasping for air, wheezing, or breathing comfortably?
- What is the patient's level of pain? Are they holding a particular area, grimacing, or moaning?
- Is the patient actively vomiting?
- What is the patient's mental status? Do they acknowledge you walking in the room and make appropriate eye contact, or is their mental status altered?
- Is the patient morbidly obese, normal, or cachectic?
- What about the skin: does the patient appear pale, mottled, cyanotic, jaundiced, burned, or covered in a rash? Do you see hemodialysis access in their arm?
- What is the patient's hygiene? Clean? Disheveled? Neglected?
- What does the room smell like? Alcohol? Gangrene?
- Is family, battle buddy, or a caretaker at the bedside, or did the patient arrive alone?

All the above questions, and many more, can be answered in seconds. Practitioners should be mindful of all available information when seeing emergently ill or injured patients. This review, combined with vital signs, and very brief historical information can yield important information needed to begin an emergency assessment and stabilization.

Sick Versus "Not Sick"

EPs use the term "sick" to refer to seriously ill or injured patients. While the vast majority of ED patients have some degree of illness or injury, most will not be critically ill. Determining "sick" from "not sick" sounds simple, but is in reality a challenging skill that must be developed by anyone providing emergency care. Some patients' situations are fairly obvious—in clear respiratory distress, unconscious, or with hemorrhaging wounds. These conditions should be immediately stabilized. The more challenging patients are the ones who are not overtly sick, but have characteristics that make them high risk and more likely to decompensate.

A blunt trauma patient (eg, someone who had a fall) can initially appear well with no significant overt signs of trauma, a fairly benign exam, and stable vitals. However, they may decompensate as internal injuries, such as a lacerated spleen, worsen. Knowing that this patient has a high-risk history should prompt the emergency practitioner to continue to monitor and reevaluate the patient (see below for a list of key chief complaints and tips for spotting "sick" patients).

The Safety Net

EPs use the term "safety net" in one of two ways. A civilian ED is the safety net of the medical community. An ED is the only medical facility open 24 hours a day, 7 days a week, 365 days a year. When a patient's primary care physician's office is closed, or if they do not have a primary care doctor or are visiting from out of town, the emergency room may be the only option. The ED may be the only option for the uninsured, under-insured, homeless, and mentally ill. In a policy statement, the American College of Emergency Physicians wrote:

> Having the only universal mandate for providing health care—the Emergency Medical Treatment and Labor Act (EMTALA)—the nation's more than 4,000 hospital emergency departments are a portal for as many of three out of four uninsured patients admitted to US hospitals, making them a vital, although often unrecognized, component of the safety net.[3]

The safety net concept also refers to an initial series of steps designed to stabilize patients. Once a sick patient is identified, emergency providers must rapidly establish the safety net. While most emergency patients will not rapidly decompensate during their initial ED course, sick patients might. A mantra often cited by medics and EPs alike is, "IV, O_2, monitor, advanced airway equipment." These procedures—establishing intravenous (IV) access, placing the patient on oxygen and a cardiac monitor, and ensuring advanced airway equipment is readily available at the bedside—are the foundation of the safety net.

The safety net should be started immediately. On entering the room of a sick patient, emergency providers should order the team to initiate safety net procedures while rapidly anticipating next steps. Will the patient require fluids (blood or crystalloid)? Should antibiotics be started? Does the patient require intubation or additional venous or intraosseous access? The key to establishing the safety net is preparedness, and becoming comfortable starting treatment while performing diagnostic studies. An elderly, hypotensive, tachycardic patient with altered mental status is sick. If the provider waits for all imaging and lab tests to return, the patient may not survive. Additionally, a patient may need immediate fluid resuscitation, antibiotics, or cardioversion prior to performance of any labs or additional diagnostic testing. These rapid steps may be uncomfortable for many MMPs but may save an emergency patient's life.

The Emergency Department Workup

The focus of an emergency patient's workup and care is based on the chief complaint. Patients may have many ongoing medical issues at a given time and present with multiple complaints. However, one acute issue typically prompts the ED visit, and it should be the focus of the provider's history, physical exam, and diagnostic testing. As in other areas of medicine, patient history and physical examination provide most of the needed information to drive any necessary testing to diagnose and indicate appropriate disposition the patient.

Unlike in some other areas of medicine, emergency providers need to think in a *worst first* mentality. Medical students are typically trained to take a history and perform a physical exam, generate a differential diagnosis, and then consider which diagnosis is most likely. Emergency providers follow these steps as well; however, instead of considering which diagnosis is most likely, they must consider which is most lethal—the worst first. As described above, patients presenting for emergency care often have emergency problems and are at higher risk than those seen in outpatient clinics. This does not mean that all patients require exhaustive testing to exclude emergency diagnoses; rather, it is imperative that an emergency provider *consider* these diagnoses and exclude them by history, physical examination, or testing if indicated.

For example, when a 30-year-old asthmatic patient presents to an ED with a chief complaint of "shortness of breath," the diagnosis is most likely an asthma exacerbation. However, a pulmonary embolus is a more lethal diagnosis. If the provider does not consider and at least mentally address this possibility, he or she might miss an important emergency condition. Knowing the potentially fatal diagnoses for each patient complaint and focusing a workup to exclude them are key knowledge and skills for emergency providers.

Again, testing should be focused on the patient's chief complaint. MMPs should consider available resources and choose tests that will *change* management of their patient. An example of a widely available test that can rapidly change management is a pregnancy test in a woman of childbearing age with an abdominal or pelvic complaint. This one simple qualitative answer can drastically change the direction of diagnostics and treatment. On the other hand, an example of an often unnecessary test is a rib x-ray series. For a patient with mild chest trauma who is suspected of having either a rib fracture or rib contusion, rib x-rays are usually not indicated. Rib fractures and contusions are treated

with the same conservative care; there is no difference in the treatment. A chest x-ray may be indicated to exclude pneumothorax or another abnormality, but identifying specific rib fractures will likely not change emergency management or patient disposition or follow-up. Management is the same—pain management and prevention of atelectasis or pneumonia with incentive spirometry.

PATIENT ISSUES AND CHALLENGES SPECIFIC TO THE EMERGENCY DEPARTMENT

Most EDs have individual patients who frequently use the ED for care. Sometimes derogatorily called "frequent fliers," these patients use the ED repeatedly and often for similar presentations. They are usually older, have chronic medical conditions such as coronary artery disease or asthma, and can be a source of frustration to the staff. Some assume that these patients use the ED as their only source of care, but studies have shown that they are also likely to utilize outpatient clinics and have high rates of hospital admission.[4–6] As with other patients, the challenge is to know when their issues are acute and life threatening. They must be evaluated during each encounter with the same thoughtful approach as any other patient. Additional resources, such as social worker consultations, should also be considered to help address other factors of their frequent ED utilization.

EPs play a crucial role in detecting signs of abuse in patients—ranging from infant/child abuse, to intimate partner violence, to elder abuse and neglect.[7] Patients presenting with multiple visits and various injuries, along with stories inconsistent with injury patterns, should raise suspicion of abuse. In addition, concern should be raised if the patient seems evasive or inappropriately frightened, or if an overbearing and perhaps defensive partner or family member is in the room.[8] In children, bruises in various stages of healing as well as fractures or injuries not consistent with their age or mobility should all be red flags for the EP.[9] Often the ED may be the only healthcare setting these victims visit, and having reasonable suspicion with at-risk patients with concerning injuries could be the intervention that saves their life.

CHALLENGES IN DEPLOYED EMERGENCY MEDICINE

Deployed MMPs face additional challenges in the operational environment. Depending on the setting, personal safety can be a concern. During deployment, MMPs are far from loved ones and may have limited ability to communicate with them. Additionally, practitioners may be working outside their normal comfort zone in their patient care duties. Several challenges for emergency providers follow.

Caring for unique populations. MMPs will almost certainly care for more than American troops when deployed. They may treat contractors, local nationals, third-country nationals, enemy prisoners of war, and a host of other individuals. Caring for these populations may involve certain rules and unique challenges, but the basic principle remains that MMPs provide a baseline standard of care to every patient, regardless of background. Department of Defense Directive 2310.01E, which covers the Defense detainee program, mandates "humane treatment," which includes "appropriate medical care and attention required by the detainee's condition, to the extent practicable."[10] As in caring for diverse patients stateside, this may require a language interpreter and adaptation to cultural concerns. It is important that each MMP is aware of the unique populations in their deployed setting, the resources available to help care for these patients, and the specific guidelines directing care at each facility.

Mass casualty care. Military emergency providers will likely see mass casualties that are more significant in scope than those typically seen during stateside duty. This book covers mass casualty in a separate chapter (Chapter 34, Mass Casualty Preparedness and Response), but it is important for emergency providers to develop or understand their facility's contingency plan during a mass casualty event.

Resource availability and utilization. The resources available will vary dramatically depending upon the practice environment. Section II of this book, Operational Health Service Support, covers this topic in more detail. The military designates various levels of care based on availability of resources, ranging from first responder care to large stateside medical treatment facilities. MMPs at a Role 1 setting, such as a battalion aid station, do not have the ability to admit patients or perform advanced diagnostics. Those at a Role 3 facility, such as an Air Force theater hospital, will likely have computed tomography (CT) scanners, a host of medications, and access to operative care with surgical subspecialists. While MMPs should still consider tests that would change patient management, their options may be significantly different than when practicing at home.

SPECIFIC CHIEF COMPLAINTS AND RED FLAGS

This section consists of case scenarios focusing on several common patient complaints. It is not meant to be a complete list of chief complaints seen in the ED; rather, it is designed to help MMPs learn the process of evaluating a patient from an emergency medicine perspective. The scenarios and workups described include some repetition, partly because emergency medicine providers approach many patients in a similar way. As discussed previously, the EP will ask, "is the patient sick or not sick?" and then proceed to a more thorough history and exam as appropriate. For any given complaint, specific "red flags" indicate a more serious problem. These flags might be something the patient reports in the history, a physical exam finding, a vital sign, a lab result, or an imaging study. Some may seem obvious, such as a patient who is unconscious, but others are subtler. The scenarios that follow also take into account some of the unique challenges of military medicine: austere locations, limited resources, long transport times, and a diverse patient population.

Abdominal Pain

You are working sick call at a remote forward operating base. Your next patient is a 22-year-old female active duty soldier with a chief complaint of abdominal pain. Your medical technician provides a set of vital signs: blood pressure (BP) 90/60, heart rate (HR) 110, respiratory rate (RR) 18, temperature (T) 98°, oxygen saturation (Spo_2) 98% on room air. You walk into the exam room and see the patient sitting on the exam table, awake and alert, and in mild distress secondary to pain. In the 10 to 15 minutes that you have with the patient, what are your priorities? What important questions do you need to ask? What will you look for on physical exam? What is the most important test you need to order for this patient?

Abdominal pain can be a complex and frustrating chief complaint for the EP. A recent study showed that 6.5% of ED patients have abdominal pain as their presenting complaint, and of these, 21% were not discharged with a specific diagnosis, and were instead recorded as having undifferentiated "abdominal pain."[11] A focused history and physical exam can narrow the differential diagnosis and quickly identify those patients who need further testing.

Even before the EP sees the patient, her vital signs indicate she has tachycardia and borderline hypotension, and is potentially sick. The patient should be asked more history about her abdominal pain: When did it start? Where is it located? What makes it better or worse? Are there associated symptoms such as nausea, vomiting, changes in bowel movements, changes in urination, anorexia, or vaginal bleeding? Does she have a history of chronic abdominal problems such as gastrointestinal reflux, gallstones, or inflammatory bowel disease? Has she had prior abdominal surgeries? When was her last menstrual period?

All women and girls of childbearing age, even in the deployed setting, should be assessed for pregnancy. A pregnancy test is the most important test to order for this patient because the results will direct further imaging studies and disposition. A pelvic exam can be considered if there is concern for pelvic pathology. Abnormal vital signs must be addressed. If the patient is dehydrated, she should receive oral (PO) or IV fluids. If she is in pain, she may need either PO or IV pain medication. Most abdominal pain patients should initially be kept NPO (nil per os, or nothing by mouth) until a surgical emergency is excluded.

The patient is initially reluctant to talk to you, but eventually confides that her last menstrual period was 6 weeks ago. Her pain started last night, is located in her right lower quadrant, and is steadily worsening. She has also had a small amount of vaginal bleeding. On physical exam, she is tender in the right lower quadrant with voluntary guarding but no rebound tenderness. Pelvic examination shows a closed cervix with a small amount of dark red blood in the vaginal vault and right adnexal tenderness. Her urine pregnancy test comes back positive. What are your next steps in management?

This patient must be worked up for ectopic pregnancy, a potentially life-threatening condition in which the fetus implants outside of the uterus, usually in the ovarian tube. The patient should be kept NPO. Appropriate labs to consider include complete blood count to evaluate for anemia given her history of vaginal bleeding, basic metabolic panel, quantitative human chorionic gonadotropin (HCG), and blood type and screen. She should be started on IV fluids and given IV pain medications. A pelvic ultrasound should be performed, which can be used not only to identify an ectopic pregnancy, but also to evaluate other serious causes of abdominal pain such as an ovarian torsion or tuboovarian abscess (Exhibit 32-1). A skilled EP may be able to perform this test at the bedside. Depending on the facility's resources, ultrasound technicians and radiologists may be available to perform and interpret the study.

While waiting for her ultrasound, the patient begins to complain of severe pain. Her BP drops to 70/40 and her HR increases to 130. She now has guarding and has rebound tenderness on her exam. What are your next steps in management?

EXHIBIT 32-1

ABDOMINAL PAIN: CAN'T-MISS DIAGNOSES

- perforated ulcer
- cholecystitis
- pancreatitis
- ischemic bowel
- diverticulitis
- appendicitis
- pyelonephritis
- ectopic pregnancy
- ovarian torsion
- testicular torsion
- tuboovarian abscess
- pelvic inflammatory disease
- myocardial infarction
- bowel obstruction
- volvulus
- gastrointestinal bleed
- abdominal aortic aneurysm

This exam is concerning for a ruptured ectopic pregnancy: a surgical emergency. The patient may be losing a significant amount of blood into her abdomen. A bedside FAST (focused abdominal sonographic study for trauma) ultrasound exam can confirm free fluid in the abdomen (Figure 32-1). A FAST exam is a rapid, bedside test that can be used to evaluate for the presence of free fluid in the abdomen or around the heart

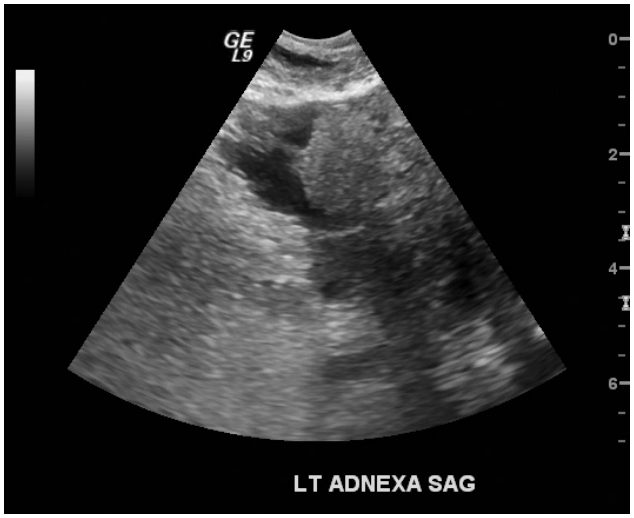

Figure 32-1. Ultrasound showing ruptured ectopic pregnancy.

(blood, in the setting of trauma).The patient should be aggressively fluid resuscitated with blood products, if available, or fluids if not. If the treatment facility has the capability, the patient should go to the operating room with a gynecologist for surgical repair. If those resources are not available, she should be immediately transferred to the nearest facility with surgical capability, which may include transfer to a general surgeon if a gynecologist is unavailable.

There are several red flags in this patient's case. The presence of abnormal vital signs, and especially worsening vital signs throughout a patient's visit, should warn the EP there might be a life-threatening problem. Rebound and guarding on physical exam are concerning for a ruptured viscus. In this case, the patient had a ruptured ectopic pregnancy. In a different clinical scenario, rebound tenderness may be a sign of appendicitis, cholecystitis, diverticulitis, perforated peptic ulcer, ruptured abdominal aortic aneurysm, or other serious conditions. These patients all need prompt surgical consultation.

Significant lab abnormalities, such as electrolyte problems, acidosis, and severe anemia may also prompt admission or transfer. Stable abdominal pain patients with normal vital signs and reassuring physical examinations, who are able to tolerate PO fluids, and with non-concerning labs and imaging studies (as indicated), may possibly be safely discharged to quarters or full duty. Discharged patients with abdominal pain should have a repeat abdominal exam in 24 to 48 hours if the pain continues, as well as specific instructions to return sooner for worsening or concerning symptoms. These return precautions may include worsening pain, persistent vomiting, high fevers, or other new concerns. If the patient is unable to follow up with their primary care physician, it is reasonable to have them return to the ED.

Chest Pain

You are working in the ED at a deployed Air Force base. Your next patient is a 55-year-old obese male contractor who presents complaining of chest pain. His vital signs are BP 150/80, HR 95, RR 16, T 97°, and SpO_2 98% on room air. What additional history will help you determine if this patient is at high risk for a life-threatening condition? What are the top "can't-miss" chest pain diagnoses? What is the most important test you need to order for this patient?

Chest pain accounts for 3% of ED visits and can range from common active duty problems such as muscle strains, costochondritis, and viral syndromes to truly life-threatening etiologies.[12] Six life-threatening causes of chest pain a provider should consider in every chest pain patient are acute coronary syndrome,

pulmonary embolus, aortic dissection, hemothorax, pneumothorax, esophageal rupture, and pneumonia (Exhibit 32-2). Before any chest pain patient can leave the ED, these diagnoses should be ruled out, either by history and physical exam or with diagnostic testing.

The patient should be asked to describe his chest pain: when did it start? What does it feel like? What makes it better or worse? Are there associated symptoms such as shortness of breath, nausea, diaphoresis, or cough? He should be questioned about his risk factors for acute coronary syndrome, such as smoking, family history, hypertension, hyperlipidemia, and diabetes. He should also be questioned about risk factors for a pulmonary embolus: smoking, prolonged immobility, leg swelling, family history, and known hypercoaguable disorder. In any chest pain patient, it is important to conduct a thorough review of systems and inquire about recent fevers, coughing, or other illness, as well as recent cardiac or esophageal procedures.

Physical exam should focus on cardiopulmonary and abdominal exams, as well as assessing the extremities for peripheral edema and distal pulses, and the neck for jugular venous distension. All chest pain patients should quickly have an electrocardiogram (ECG) performed and interpreted by an EP. The American College of Emergency Physicians and the American College of Cardiology recommend that an ECG be performed within 10 minutes of arrival for all patients with chest pain.[12] Most EDs have quality standards that require an ECG to be performed and interpreted by an EP within 10 to 15 minutes of a patient's arrival.

Your patient reports that he "doesn't go to the doctor" but has been told he has high blood pressure. He has a 40-pack-a-year smoking history, and his father died from a myocardial infarction (MI), or heart attack, at age 45. On physical exam, the patient appears sweaty and uncomfortable, but the exam is otherwise unremarkable. The nurse hands you the ECG (Figure 32-2). What are your next steps in management?

EXHIBIT 32-2

CHEST PAIN: CAN'T-MISS DIAGNOSES

- acute coronary syndrome
  - o unstable angina
  - o ST elevation myocardial infarction
  - o non-ST elevation myocardial infarction
- aortic dissection
- pulmonary embolism
- pneumothorax
- hemothorax
- pneumonia
- esophageal rupture

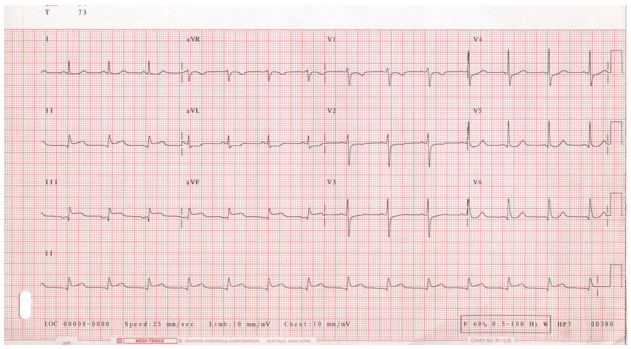

Figure 32-2. Twelve-lead electrocardiogram with ST segment elevation in leads II, III, and aVF for an inferior acute myocardial infarction. April 12, 2005.
Reproduced from: https://en.wikipedia.org/wiki/File:ECG_001.jpg

The ECG shows an ST-elevation myocardial infarction (STEMI)—a true cardiac emergency. ST elevation on ECG indicates that damage (infarction) is occurring throughout all layers of the heart muscle. A thrombus (clot) has occluded blood supply to part of the heart, and heart muscle tissue is dying.[13] Once this is diagnosed, the EP must immediately initiate treatment, potentially before a full history or physical exam can be obtained. The patient should be placed on oxygen and should receive aspirin. He should receive nitroglycerin for ongoing pain. However, nitroglycerin can drop a patient's blood pressure and should be used judiciously once IV access has been obtained (allowing fluid resuscitation if the patient becomes hypotensive).

In many stateside military and civilian facilities, STEMI patients are taken immediately to the cardiac catheterization lab to undergo an invasive procedure to open the blocked artery. In the deployed setting, this resource is usually not available. Instead, patients can be given thrombolytics, which are IV medications that help break up the clot. These medications all carry risks of bleeding complications, and the patient should be counseled about their risks and benefits. After receiving thrombolytics, the patient will likely require transport to a higher level of care for cardiology consultation and intensive care management. In this case, the STEMI seen on ECG makes the patient's disposition easy for the EP. But what if his ECG had been normal or shown nonspecific changes?

There are many other life-threatening causes of chest pain that can present with a normal or nonspe-

cific ECG. The patient should have additional blood work and imaging performed. A chest x-ray can be useful in showing a definitive diagnosis such as pneumothorax or pneumonia. If there is a high suspicion for an aortic dissection or pulmonary embolus, a CT of the chest with IV contrast should be obtained, because they are not readily diagnosed with a standard chest x-ray. Elevated cardiac enzymes may clinch the diagnosis of MI in a patient with a borderline ECG.

Many patients who present to the ED with chest pain are admitted to the hospital, especially those who are older and have risk factors for acute coronary syndrome. It is difficult to exclude many of the life-threatening causes of chest pain without a period of observation. Patients with potential cardiac risk factors and no etiology of their chest pain found in the ED require observation, repeat exams, repeat ECGs, and serial cardiac enzyme screens in addition to some form of stress test. According to the resources at a facility, this process may be done in the ED, a chest pain observation unit, or an inpatient ward, or via a coordinated outpatient approach. All patients who are discharged with a diagnosis of chest pain should have close follow-up with their primary care physician or appropriate specialist and should be given clear return precautions.

Headache

You are working in a stateside military ED and your next patient is a 45-year-old woman with a history of migraines, who presents with a chief complaint of a severe headache. The nurse pulls you aside and says, "This patient is here all the time. Just give her some pain meds for her headache and send her home." What additional history do you need to obtain before treating the patient? What key questions can you ask to avoid missing any red flag headache diagnoses?

Three-quarters of Americans experience a headache each year, and headaches account for 2 million ED visits.[14] Most of these patients have a primary headache disorder such as migraines, cluster headaches, or tension-type headaches, and can be treated symptomatically and discharged. However, a subset have a "secondary" headache: a pathologic process such as a tumor or vascular event in which head pain is the presenting symptom. To help distinguish between a regular migraine headache and a headache with a potentially more serious cause (Exhibit 32-3), the patient should be asked additional questions. How did the pain start? What does it feel like? Does anything make the pain better or worse? Where is it located? What time of day is it worse? What medications are you taking? Are there associated symptoms such as fever, nausea, vomiting, photophobia, or neck stiffness?

EXHIBIT 32-3

HEADACHE: CAN'T-MISS DIAGNOSES

- intracranial hemorrhage
- meningitis
- intracranial mass
- cerebrovascular accident
- acute angle closure glaucoma
- hypertensive encephalopathy

If the patient endorses fever and neck stiffness, this is concerning for meningitis, a life-threatening infection of the fluid around the brain and spinal cord. Many medications such as nitroglycerin, calcium channel blockers, and estrogen can have a side effect of headache, and many recreational drugs can cause headaches as well. If the patient has recently decreased her intake of caffeine, she may have a withdrawal headache. Multiple members of a family with new headaches, especially in the winter months, should raise suspicion for carbon monoxide poisoning.[14] New headaches that worsen over a period of weeks, especially headaches that are worse in the morning, are concerning for elevated intracranial pressure from a mass lesion or neoplasm.

The patient states that pain started suddenly 30 minutes ago. She describes the headache as diffuse, severe, and nothing like her previous migraines. The patient rated her pain as 10/10 on a pain scale since the headache started. She feels dizzy and nauseated but has not vomited.

There are many red flags in this patient's history. Pain that is abrupt and maximal at onset is concerning for a subarachnoid hemorrhage.[14] The patient will need IV access, a careful neurological exam, and immediate non-contrast head CT. Except for glaucoma patients, virtually all patients presenting with headache should receive analgesia and should be kept in a quiet, dark area.

All patients with headaches also require a thorough neurological exam. Tenderness over the sinuses or purulent drainage from the nose could indicate sinusitis. In elderly patients, the temporal arteries should be palpated to evaluate for temporal arteritis. Acute angle closure glaucoma can present with headache in addition to visual changes, conjunctival injection, and pupillary changes. If this diagnosis is suspected, patients should have their intraocular pressures checked. Any new deficit on neurological exam is an indication for further imaging. Patients with altered mental status or new onset seizures also require further imaging.

On exam, the patient appears in severe pain and mildly disoriented. The neurological exam is otherwise normal. The CT head scan is shown in Figure 32-3. What are your next interventions?

The patient's CT scan shows a subarachnoid hemorrhage—a neurosurgical emergency. In the ED, the initial management involves resuscitation, reversal of any coagulopathies, and stabilization. The patient should be attached to a cardiac monitor and her BP should be carefully monitored. She will need frequent neurological exams, and if her neurological status deteriorates further, she will require intubation for airway protection. She will require neurosurgical consultation and will be admitted, likely to the intensive care unit (ICU), to be monitored for additional bleeding, vasospasm, and other complications. Nonsteroidal antiinflammatory drugs, aspirin, and other blood-thinners should be avoided when treating her pain.

In managing headaches, special care should be given to certain populations. The elderly are unlikely to develop new onset migraines, and are at much higher risk for chronic subdural hematomas that can present with only mild headaches. Physicians should have a low threshold to order a CT scan on elderly patients with new onset headaches.[14] In pregnant patients, a headache can be the first sign of preeclampsia. If untreated, this condition can progress to eclampsia, cerebral hemorrhage, or both. Most headache patients with stable vital signs, a normal neurological exam, and no red flags, and who improve with ED treatment, can be safely discharged without a specific diagnosis.

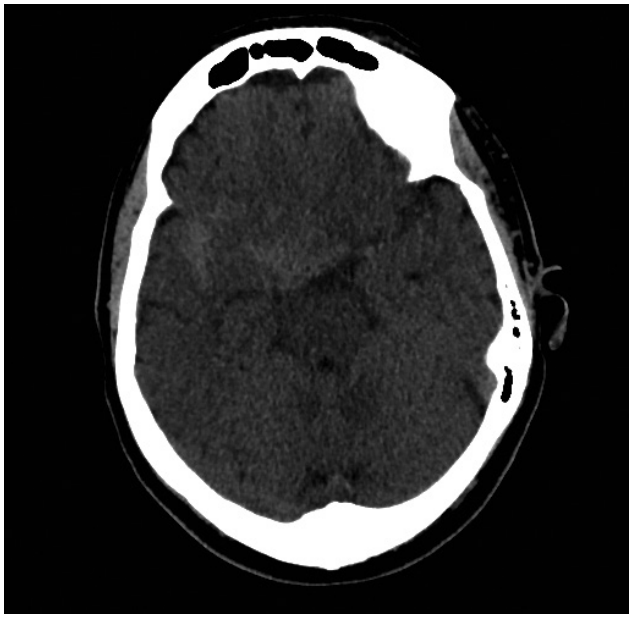

Figure 32-3. Computed tomography head scan showing subarachnoid hemorrhage.

Trauma

You are working in the ED at deployed multinational hospital. You receive a trauma alert. The incoming patient is a 22-year-old male enlisted soldier injured in an improvised explosive device (IED) blast. The medic at the scene reports that the patient has altered mental status, bruising over his right chest and abdomen, and a right below-the-knee amputation. His prehospital vitals are HR 130, BP 80/60, RR 30, and Spo_2 85% on room air. How will you systematically manage this patient when he arrives to the ED? What key interventions in the field could potentially save his life?

According to the Joint Theater Trauma Registry (JTTR), most combat-related injuries in Operation Enduring Freedom and Operation Iraqi Freedom occurred as a result of injury from explosions (78%), usually IEDs. Due to improvements in body armor, there was a low rate of thoracic injuries. The highest rate of injury was to the extremities (54%), followed by the abdomen, face, and head. JTTR statistics show that hemorrhage is the leading cause of potentially preventable combat-related death. Tactical Combat Casualty Care (TCCC) principles and practice have greatly reduced mortality from hemorrhage, along with damage control resuscitation and surgery, rapid patient evacuation, and sophisticated patient transport mechanisms.[15]

Initial stabilization of trauma patients in the deployed setting may depend on self-care or a combat lifesaver or combat medic. Most medics and physicians in the deployed setting have been trained in TCCC (discussed in Chapter 33, Tactical Medicine), and the EP will likely also have been trained in Advanced Trauma Life Support. Both of these courses provide a standard, algorithmic approach to managing trauma that focuses on immediate stabilization of the patient's life-threatening injuries. The pneumonic "XABCDE" can be used to remember the sequence of care in a trauma patient: first treat exsanguinating hemorrhage, then move on to airway, breathing, and circulation, followed by disability and exposure. When a threat to survival is found, it must be rapidly addressed and stabilized before moving on to the next letter.

The patient arrives with a tourniquet in place at his right lower extremity amputation. He is immediately attached to a cardiac monitor and placed on supplemental oxygen. Bleeding is controlled and rapid assessment of his extremities shows no additional hemorrhage. His airway is intact and he is able to speak in short sentences, although

he is tachypneic, with decreased breath sounds on his right side. Vitals are HR 145, BP 80/40, RR 35, and Spo_2 80% on supplemental oxygen.

This collection of vital signs and physical exam findings is concerning for a tension pneumothorax, a respiratory emergency and form of obstructive shock. Air has built up in the pleural cavity and is putting pressure on the lung, preventing inflation and leading to hypoxia and hypotension from decreased venous return and pressure on the heart. The patient should undergo immediate needle decompression with a 14-gauge needle followed by chest tube insertion.

After these procedures, the patient's hypoxia improves and you continue the primary survey.

Circulation can be assessed quickly by palpating pulses. A palpable radial pulse indicates a systolic BP of at least 80, and a palpable femoral or carotid pulse indicates a BP of at least 60. Tachycardia and hypotension can be signs of shock, but it is important to remember that these may be late findings, especially in a healthy, active duty population. Certain trauma patients, such as the elderly, those in neurogenic shock, and those taking beta-blocker medications, may not be able to mount a tachycardic response. In any case, hemorrhagic shock should be treated aggressively with blood products, or fluids if blood is unavailable.

The patient should have a quick evaluation of his mental status (D for disability). This can be performed using the pneumonic "AVPU": alert/awake, verbal, painful, or unresponsive (Exhibit 32-4). Is the patient fully awake? Does he only respond to voice? Does he only respond to painful stimuli, or is he completely unresponsive? Also, he should be exposed from head to toe to evaluate for any additional injuries.

At this point in evaluation, additional studies are often performed as adjuncts to the primary survey. A positive FAST exam in an unstable patient is an indication for operative intervention. Trauma x-rays (usually with portable chest x-ray and portable pelvis x-ray devices) are also performed at this point. A CT scan may be performed to further evaluate for specific injuries (Exhibit 32-5).

EXHIBIT 32-4

"AVPU" SCALE FOR CONSCIOUSNESS ASSESSMENT

- **Alert.** The patient is alert and awake.
- **Verbal.** The patient responds to verbal stimuli.
- **Pain.** The patient responds to painful stimuli.
- **Unresponsive.** The patient is unresponsive.

EXHIBIT 32-5

TRAUMA: CAN'T-MISS DIAGNOSES

- shock
- airway compromise
- tension pneumothorax
- massive hemothorax
- open pneumothorax
- flail chest
- cardiac tamponade
- brain herniation
- aortic disruption
- spinal injuries
- pelvic ring disruption
- hemoperitoneum

Once the XABCDEs have been performed and immediate life threats addressed, the patient should be asked additional history and should undergo a head-to-toe secondary survey. A pneumonic to guide the additional history is "AMPLE": allergies, medications, past illnesses, last meal, and events involved in the trauma. The secondary survey consists of a systematic assessment of the patient, inspecting and palpating all body parts for injuries while also performing a more thorough neurological exam. As these steps are performed, a nurse or tech should send a panel of blood work to the lab. Depending on the nature and severity of the trauma, these may include a type and cross for blood, complete blood count, basic metabolic panel, lactate, coagulation panel, urinalysis, alcohol level, and drug screen. After these steps are completed, additional imaging can be ordered based on the results of the secondary survey and suspected injuries. This may include extremity x-rays, a retrograde urethrogram or cystogram, and CT scans of the head, spine, chest, abdomen, and pelvis.[16]

Your patient's vitals stabilize after needle decompression, chest tube placement, and blood transfusion. Initial portable chest x-ray shows a pneumothorax and right-sided pulmonary contusions (Figure 32-4). The FAST exam is negative. The secondary survey shows bruising and tenderness over the right side of the head but no ongoing bleeding at the amputated right lower leg with the tourniquet secured. The patient is sent for additional imaging. A CT head scan (Figure 32-5) shows a right-sided subdural hematoma, and x-rays of the right leg are consistent with a traumatic below-the-knee amputation. What are your next steps in management?

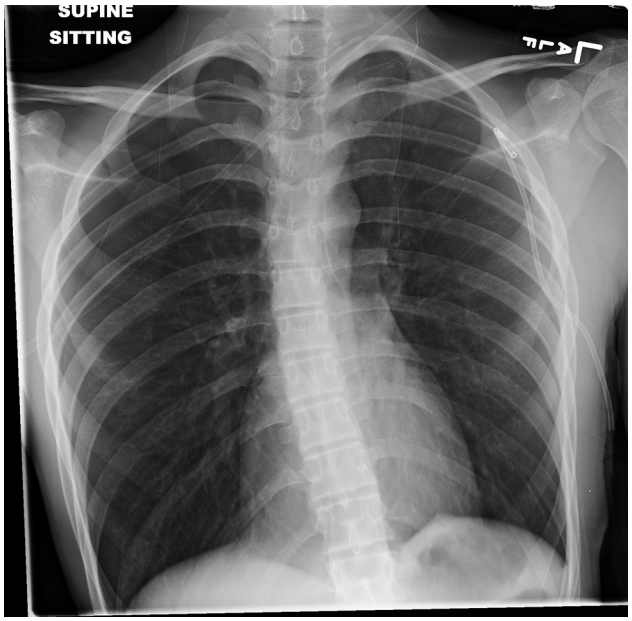

Figure 32-4. Chest x-ray showing right-sided pneumothorax.

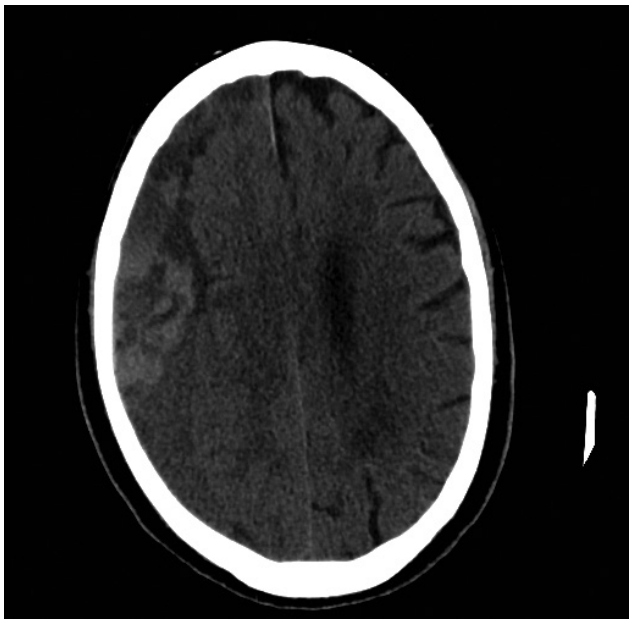

Figure 32-5. Computed tomography head scan showing subdural hematoma.

The patient's subdural hematoma will require urgent neurosurgical evaluation and possible surgery if his neurological status deteriorates. This is a case in which the deployed environment provides unique challenges. The patient presented to the ED at a multinational hospital, where a neurosurgeon is likely available. If he had presented further forward, he would have required evacuation, possibly by a critical care air transport (CCATT) or tactical critical care evacuation (TCCET) team, to get him to neurosurgical care in an expeditious manner. He will need to be admitted to the hospital, likely to an ICU setting, for continued management of his chest tube, neurosurgical evaluation of his subdural hematoma, and orthopedics, trauma, and/or vascular evaluation of his amputation. Once these conditions have stabilized to the point where he is deemed safe for flight, he will require transport out of theater by a CCATT team.

Shock

You are working in a stateside military ED. Your next patient is a 22-year-old male who collapsed after his physical fitness test (PFT) and is carried in by his friends. His skin is warm and flushed and he appears confused. His is tachycardic, with HR 138 and BP 70/40. Your colleagues begin to attach the patient to monitoring devices and start two large-bore IV lines. You know minimal history at this point, but the patient's vital sign abnormalities are concerning for shock.

Shock refers to a state of hypoperfusion in which oxygen delivery to the tissues is inadequate to meet the metabolic demands of the body. Broadly speaking, it is defined as a mismatch between tissue oxygen demand and supply that results in cellular death.[17] If shock is not rapidly treated, it leads to end-organ failure and death. There are four broad categories of shock: hypovolemic, cardiogenic, distributive, and obstructive (Table 32-1).[17]

Hypovolemic shock is the most common, especially in the deployed environment. It is defined as a loss of circulatory volume, most commonly from hemorrhage or dehydration. Treatment focuses on volume expansion with blood, crystalloid, or both as indicated.[18] Cardiogenic shock is caused by cardiac dysfunction, usually from an MI, and the heart pump is unable to meet the demands of the body's tissues. Treatment involves judicious use of fluids, inotropes for pump support, and reperfusion therapy for MI. Obstructive shock involves some blockage of blood leading into or out of the heart, either from a physical blockage such as a massive pulmonary embolus, or a pressure-gradient blockage caused by a tension pneumothorax or cardiac tamponade. The causes of obstructive shock may all present as pulseless electrical activity (PEA) and should all be considered when working through the "H"s and "T"s during a code (see the Cardiac Arrest section below). Lastly, distributive shock results in vasodilatation caused by the release of inflammatory

TABLE 32-1

CATEGORIES AND CAUSES OF SHOCK

Category	Causes
Hypovolemic	Trauma
	Gastrointestinal bleeding
	Severe dehydration (gastroenteritis, burns)
Cardiogenic	Acute myocardial infarction
	Rate problems: bradycardia or tachycardia
	Toxins
	Cardiomyopathy
Distributive	Sepsis
	Anaphylaxis
	Neurogenic
	Toxins
Obstructive	Pericardial tamponade
	Pulmonary embolism
	Tension pneumothorax

mediators and cytokines, which leads to a decrease in systemic vascular resistance and a compensatory increase in cardiac output. Sepsis is the most common cause, but anaphylaxis, neurological injuries, and certain toxins can also cause this presentation.[17]

Patients with shock require the EP's immediate attention. Often the EP must begin treatment simultaneously with the history and exam, and before diagnosing the shock state's etiology. The EP should rapidly assess the patient's general appearance and vital signs. Patients in shock will often be hypotensive, tachycardic, and tachypneic. If the patient has respiratory distress or is unable to protect his airway secondary to confusion, he may require intubation. Supplemental oxygen should be considered for all patients, and most patients will benefit from two large-bore IVs and fluids.

Patients in septic shock in particular may require large volumes of crystalloid fluid. If the blood pressure does not improve after 1 to 2 L of crystalloid, or if the patient is unable to tolerate large volumes of fluid (particularly the elderly and patients with heart failure), vasoactive medications, such as norepinephrine or dopamine, may be required to increase blood pressure and improve tissue perfusion. All patients presumed to be in septic shock should have labs ordered to look for the source of infection (blood cultures, urinalysis, urine cultures, cerebrospinal fluid tests, etc) and be started on early, broad-spectrum antibiotic therapy. As the patient is stabilized, the EP can obtain a more detailed history and perform a full physical exam.

Your patient continues to be hypotensive, tachycardic, and tachypneic. He is able to speak in short sentences, but has swelling to his face and airway. You noticed diffuse urticaria all over his body, and wheezing on lung exam. His friends state that they saw him get stung by a bee after the PFT, so they brought him to the ED.

In this case, a more thorough history and exam points to a clear etiology for the patient's symptoms: distributive shock secondary to anaphylaxis from a bee sting. The mainstay of treatment for anaphylaxis is aggressive fluid resuscitation and epinephrine to counteract vasodilation and bronchospasm. Epinephrine is typically given subcutaneously initially, but may also be given via an IV route.[18]

The patient receives a 2-L normal saline bolus, 0.3 mg of 1:1,000 subcutaneous epinephrine, 50 mg of IV diphenhydramine, and 125 mg of IV methylprednisolone and albuterol given via nebulization. He remains slightly tachycardic, but has gradual normalization of his blood pressure. His wheezing and airway edema improve after the epinephrine and nebulizer treatment. During a repeat exam, he is awake, alert, oriented appropriately, able to speak in full sentences, and in no respiratory distress. He is discharged from the ED after 6 hours of observation, with an EpiPen (Mylan Inc, Hatfield, Hertfordshire, United Kingdom), clear instructions to carry it with him at all times, and a follow-up referral to his primary care manager.

Patients with this type of shock may sometimes be discharged from the ED. Patients with anaphylaxis who are asymptomatic after one dose of epinephrine can be observed for 4 to 6 hours and, if they remain asymptomatic, safely discharged. Observation is necessary because some patients may require a repeat dose of epinephrine. Nearly all other patients who present in shock will require admission, often to the ICU, for continued fluid resuscitation and hemodynamic monitoring. In the deployed setting, patients in shock are stabilized and then transported out of theater by CCATT, whose staff are able to continue treatment with vasoactive medications, blood products, antibiotics, and fluids en route to the next level of care. Indicators that shock has resolved include normalization of vital signs, improved urine output, down-trending lactate, and normal volume status.[18]

It is important to remember that certain special populations will present differently. In pediatrics, the most common causes of shock are dehydration secondary to infectious gastroenteritis and hemorrhagic shock secondary to trauma.[17] Pediatric patients are able to compensate for a large amount of volume loss with minimal change in vital signs. Thus, they can appear

well even in the early stages in shock. When these compensatory mechanisms fail, they will deteriorate rapidly, and the EP must be ready to intervene. In contrast, the elderly have limited reserves and are often unable to tolerate the hemodynamic changes of shock. The elderly are more susceptible to infectious diseases and are also more likely to present with cardiogenic shock. Underlying comorbidities such as cardiac or renal disease may make them unable to tolerate aggressive fluid resuscitation. The EP may need to treat these patients with small fluid boluses and monitor them closely for the development of complications such as pulmonary edema.

Poisoning

You are working in the ED in a forward deployed location. Your next patient is a 22-year-old female brought in by her roommates. They state, "We found her in her bed, acting confused. We're worried that she took something. She's been really sad lately." What are key questions to ask the patient and her roommates? What are your initial orders to your nurse? What further tests will you order to work up her possible ingestion?

Poisonings, whether from an accidental or intentional ingestion, are a common ED complaint. The field of toxicology is a subspecialty of emergency medicine. It is estimated that at least 5 million poisonings occur in the United States each year, although the actual number may be even higher due to underreporting.[19] The poisoned ED patient can present in conditions ranging from completely awake, alert, and asymptomatic to completely obtunded with unstable vital signs. As with any ED patient, assessment begins as soon as the EP looks at the patient and continues with the ABCs.

Initial priorities are securing the patient's airway and treating potentially reversible causes of her altered mental status. These treatments, often referred to as the "coma cocktail," include 100% oxygen to treat hypoxia, a finger-stick glucose test to evaluate for hypoglycemia (followed by the administration of dextrose if glucose is low), and naloxone to reverse an opioid overdose. If chronic alcoholism is suspected, thiamine can be given before glucose. If the patient is obtunded, the airway should be secured with intubation. Many toxins can affect breathing. Opioids will decrease the respiratory rate, salicylates can increase the respiratory rate and cause pulmonary edema, and various inhalants may cause bronchospasm. As the ABCs are addressed and concerning conditions stabilized, the EP must also remember to place the patient on "suicide watch" with a sitter in the room who can provide 1:1 supervision.[20]

If the patient is able to talk, or if there are others who can provide the history, it is important to ask the following questions: What was ingested? How much was ingested? When did this occur? Why? (Was it an accidental or intentional overdose?) A head-to-toe physical exam should be performed on all patients, paying particular attention to vital signs, mental status, pupils, skin, and presence of track marks or other evidence of drug use. Some poisonings cause common, recognizable "toxidromes," described in Exhibit 32-6.[20]

The patient is sleepy and reluctant to answer your questions, and protecting her airway. Physical exam is remarkable only for mild right upper quadrant tenderness. On further questioning, her friends report that they last saw her 4 hours ago. When they found her in her dorm room, there was an empty bottle of acetaminophen next to her bed. When confronted, the patient is unable to tell you exactly how many she took. She states that she "just wanted to sleep and not feel sad anymore."

Although additional history has helped identify the patient's likely ingestion, she should still undergo a broad workup to look for complications of her ingestion and to identify any possible co-ingestions. Most acutely poisoned patients are worked up with cardiac

EXHIBIT 32-6

POISONING "TOXIDROMES"

Anticholinergic
- mad as a hatter (altered mental status)
- blind as a bat (mydriasis)
- hot as Hades
- red as a beet
- dry as a bone

Cholinergic
- salivation
- lacrimation
- urination
- defecation
- gastrointestinal upset
- excessive bradycardia

Sympathomimetic
- tachycardia
- hypertension
- mydriasis
- diaphoresis
- hyperthermia
- agitation

Opioid
- miosis
- apnea
- hypoxia
- flash pulmonary edema (rare)

monitoring; an ECG; complete blood count; comprehensive metabolic panel, acetaminophen, salicylate, and ethanol levels; urinalysis; and urine or serum drug screen. Females of childbearing age should be tested for pregnancy. If the patient has metabolic acidosis, a serum osmolality may help further narrow the differential. Other than acetaminophen, salicylates, and ethanol, tests for specific levels of a toxin (eg, methanol) are usually sent to a lab, but results take several days. The EP must treat presumptively based on the history, exam, and other lab findings.

In treating the poisoned patient, the EP must consider methods of preventing absorption or aiding elimination of the toxin. These include activated charcoal, whole bowel irrigation, and gastric lavage. Activated charcoal is given PO or via nasogastric tube to absorb toxins still in the gastrointestinal tract. It is most effective if given within 1 hour of toxin ingestion, but is occasionally given later for extended-release toxins or potentially lethal ingestions.[21] It does not bind metals, alcohols, or hydrocarbons and should be used cautiously in patients with altered mental status, who are at increased risk for aspiration.

Whole bowel irrigation is infrequently utilized and involves giving the patient polyethylene glycol solution (eg, GoLytely [Braintree Laboratories; Braintree, MA]) to flush out the bowel and prevent the absorption of a toxin. It is occasionally used for patients who have ingested extended-release preparations and patients with illicit drug packet ingestions ("body packers"). Gastric lavage is seldom performed due to a high risk of aspiration and questionable benefits. However, if a patient presents immediately after a lethal ingestion, it may be attempted. It involves a very large orogastric tube that is instilled with water to flush and remove pill fragments from the stomach.[19]

Your patient confesses that she took the acetaminophen about 4 hours ago, placing her outside the window for gastric lavage or activated charcoal. She denies co-ingestions. While in the ED, she begins to have nausea and several episodes of non-bloody, non-bilious emesis. Her labs are unremarkable, other than an acetaminophen level of 240. What are your next steps in management?

Acetaminophen is one of the most common and most dangerous ingestions seen in the ED. Because an acute ingestion will often have minimal symptoms, and because the potential for long-term liver damage is high, the EP should consider checking acetaminophen levels for every poisoned patient. In overdose, acetaminophen is metabolized to *N*-acetyl-p-benzoquinone imine (NAPQI), which causes liver damage. Levels can be plotted on Rumack-Matthew nomogram. A level of 150 or greater at 4 hours is considered toxic. Patients with a toxic ingestion should be started on the antidote, *N*-acetylcysteine. Starting this antidote promptly after ingestion can prevent liver damage and death.

The patient is started on N*-acetylcysteine and admitted to the ICU for monitoring. Once she is medically cleared, she is given a psychiatric evaluation and transported back to the United States for continued psychiatric treatment.*

Most poisoned patients are admitted to the hospital, often to the ICU, for close cardiopulmonary monitoring. If a poisoned patient is asymptomatic after several hours of observation in the ED, they may possibly be safe for discharge after psychiatric evaluation. Consultation with a poison control center, if available, is recommended. In the deployed setting, patients who present with an intentional ingestion as a suicide attempt will likely need to be removed from theater and transported back to the United States for psychiatric treatment.

Cardiac Arrest

You are working in a stateside military ED. You receive a 911 call stating that a 65-year-old male collapsed on the golf course and became unresponsive. The medical technicians that you sent to the scene report that the patient is pulseless and apneic. Basic life support (BLS) has been started. How will you manage this patient in the ED? What instructions should you give your technicians as they are en route to the hospital?

An estimated 250,000 Americans die each year from unexpected cardiac arrest. Many of these cases occur outside of a hospital, and most occur in men aged 50 to 75 who have underlying heart disease.[22] In a way, the cardiac arrest patient is the quintessential emergency medicine patient: obviously sick and in need of rapid assessment and interventions that, if performed correctly, may make the difference between life and death. Managing a cardiac arrest and its aftermath can be an intellectually stimulating yet emotionally draining experience for the EP. In an arrest, the EP will end up treating not only the patient, but also his or her family, who will require extensive explanation and support, whatever the outcome.

The initial goals in managing a cardiac arrest include the principles of BLS: to "support or restore effective oxygenation, ventilation, and circulation until return of spontaneous circulation or until ACLS [advanced cardiac life support] interventions can be initiated."[23] BLS focuses on early defibrillation and effective chest compressions. The old pneumonic "ABC" has been altered to "CAB" for these patients to shift focus to early, effective chest compressions. First responders should check for a carotid pulse for no more than 10 seconds. If no pulse is present, responders should

start cardiopulmonary resuscitation (CPR), pushing hard and fast, 100 to 120 compressions per minute, and allowing full chest recoil between compressions. The patient should receive two rescue breaths with a pocket mask or bag valve mask between compressions. The airway should be opened with a head tilt, chin lift technique, or jaw thrust technique in the setting of trauma. An automated external defibrillator should be attached to the patient as soon as possible, and the patient should be shocked as recommended by the defibrillator.[23]

As more advanced practitioners arrive on scene, and once the patient arrives in the ED, more advanced resuscitation techniques can be started. The ACLS process continues to emphasize early, effective CPR, but also includes advanced airway techniques, such as intubation, and IV medications such as epinephrine and amiodarone. End-tidal capnography can be a useful adjunct to evaluate the effectiveness of compressions and the correct placement of the endotracheal tube.

The patient arrives in the ED pulseless and apneic. CPR and bag valve mask ventilation are in process. He is attached to a cardiac monitor, which shows ventricular fibrillation (Figure 32-6).

Cardiac arrest from a primary cardiac disorder often presents with this rhythm or with pulseless ventricular tachycardia, which is treated in the same manner. In these patients, early defibrillation has been shown to increase survival. If defibrillation is performed within the first minute or two of an arrest, as many as 90% of patients return to their baseline neurological status.[23] The ACLS algorithm involves defibrillation followed by 2 minutes of CPR, defibrillation, IV epinephrine, and IV amiodarone. IV access should be obtained as quickly as possible, and if IV access is not immediately available, an interosseous line should be placed instead. Many ACLS medications can also be given via the endotracheal tube, but given the widespread availability of interosseous lines and their ease of insertion, the endotracheal tube method is being used less frequently. A finger-stick glucose screen should be rapidly obtained because hypoglycemia can be a rapidly reversible cause of altered mental status and cardiac arrest.

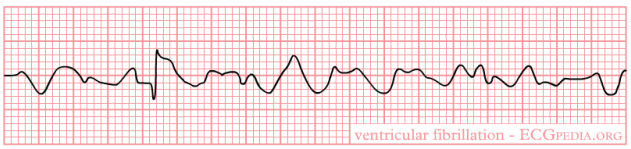

Figure 32-6. Rhythm strip showing ventricular fibrillation.
Reproduced from: https://commons.m.wikimedia.org/wiki/File:De-Rhythm_ventricular_fibrillation_(CardioNetworks_ECGpedia).png.

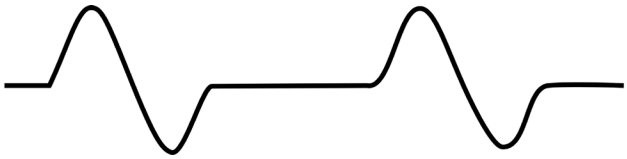

Figure 32-7. Rhythm strip showing pulseless electrical activity.
Reproduced from: https://en.m.wikipedia.org/wiki/Pulseless_electrical_activity.

The patient receives two shocks and two rounds of IV epinephrine and IV amiodarone. He remains pulseless and apneic. On the next rhythm check, the cardiac monitor shows PEA (Figure 32-7).

PEA is defined as cardiac electrical activity without associated mechanical pumping.[23] Successful resuscitation of a patient in PEA should be focused on rapidly identifying and treating the cause. The EP may think of the "H"s and "T"s (Exhibit 32-7) to remember all the potential causes of PEA. All patients in PEA should be treated with oxygen and ideally intubated to correct for hypoxia. As discussed previously, a finger-stick glucose screen can rapidly identify hypoglycemia. Blood that is rapidly run through an i-STAT machine (Abbott Laboratories, Chicago, IL) can be used to identify hypokalemia or hyperkalemia and acidosis. Patients in PEA should be kept warm. A bedside ultrasound can be performed to evaluate for cardiac tamponade and to evaluate the right side of the heart for changes consistent with a large pulmonary embolus. Based on the clinical scenario, the patient may require an emergent pericardiocentesis to treat a tamponade,

EXHIBIT 32-7

CARDIAC ARREST "H"S AND "T"s

- hypovolemia
- hypoxia
- hydrogen ion (acidosis)
- hyper/hypokalemia
- hypoglycemia
- hypothermia
- toxins
- tamponade (cardiac)
- tension pneumothorax
- thrombosis (acute coronary syndrome and pulmonary embolism)

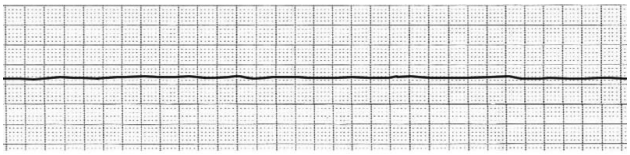

Figure 32-8. Rhythm strip showing asystole.
Reproduced from: https://commons.m.wikimedia.org/wiki/File:EKG_Asystole.jpg.

needle decompression for tension pneumothorax, or IV thrombolytics for suspected pulmonary embolus or MI. The patient should continue to receive high-quality CPR and IV epinephrine every 3 to 5 minutes. If a reversible cause of PEA is not rapidly discovered and corrected, the patient's prognosis is extremely poor. Only 1% to 4% of patients with PEA survive to hospital discharge[24] (see Exhibit 32-7).

After several rounds of epinephrine, intubation, IV fluids, and a normal blood glucose level, the patient remains pulseless. His rhythm strip shows asystole (Figure 32-8).

Asystole has a very poor prognosis because even minutes without oxygen to the brain portends very poor functional outcomes. For patients in asystole, treatment should still be focused on restoring perfusion with high-quality CPR and identifying a reversible cause. After 20 minutes of combined BLS and ACLS, resuscitation is unlikely to be successful. Bedside ultrasound can be a useful adjunct in evaluating for cardiac activity. If the patient has been in asystole for 20 minutes and shows no cardiac activity on ultrasound, it is reasonable to stop resuscitative efforts. The EP must then ensure that the patient's family is updated and their questions are answered. If possible, the patient's primary care doctor should be contacted as well.

Only a small percentage of resuscitated cardiac arrest patients survive to hospital discharge, and of those that do survive, many suffer from anoxic brain injury. If the patient regains a pulse but does not regain consciousness, the EP should initiate targeted temperature management. Randomized control trials do not show any benefit of therapeutic hypothermia versus targeted temperature management. Maintaining a constant temperature between 32° and 36°C for at least 24 hours postarrest is the current recommendation, and this has been shown to improve both survival rates to hospital discharge and neurological outcomes.[24] The procedure is usually started in the ED and continued in the ICU once the patient is admitted. If acute coronary syndrome is suspected, the postarrest patient should be strongly considered for emergent cardiac catheterization.

Case-Based Approach Summary

The above cases are only a sample of the life-threatening chief complaints an EP may encounter. They are meant to emphasize the common processes in the approach to the emergency medicine patient, regardless of initial patient complaint. In these cases, the EP must quickly determine whether the patient is "sick or not sick." Another key skill is the ability of the EP to simultaneously obtain history and diagnoses, while starting to treat the patient. Unlike the orderly, thorough approach to the patient history taught in medical schools, the EP must quickly obtain basic history while simultaneously relaying orders to nurses and technicians and rapidly thinking through a list of "can't miss/worst case scenario" diagnoses. This is often done with incomplete records and potentially no help from the patient themselves if they are in extremis. These cases also emphasize the challenges in diagnosis and treatment based on the EP's practice environment: forward deployed location, theater hospital, or stateside medical facility. Once initial patient stabilization is complete, the EP can focus on the next phase of patient care: disposition.

DISPOSITION

Potential dispositions from the ED include admission to the hospital for observation, additional workup, or directly to the operating suite; transfer to a different facility with a higher level of care; discharge home or to self-care; and of course, unfortunately, transfer to the morgue. The EP must consider numerous factors to determine the most appropriate place for disposition. For example, considering a terminal patient whose primary issue is managing pain and maintaining quality of life, sending them home may be the best course. Their terminal disease will not be cured by a hospital admission, and admission can in fact be detrimental (the hospital can expose patients to numerous nosocomial infections and be less comfortable). Discharge home is appropriate as long as pain medications can be administered at home.

The decision to admit or discharge a patient is one of the unique challenges of emergency medicine. The EP must make this decision in a timely manner, often with an incomplete history of present illness, minimal to no knowledge of the patient's past medical history, and equivocal testing. Although this can seem daunting at first, the skilled EP can often make a disposition decision after their first interaction

with a patient. Performing serial examinations and discussing the case with a consultant can help the EP decide.

When collaborating with consultants, it is essential that the EP remain an advocate for the patient. Consultants generally prefer brief presentations with specific requests or questions. In the case of the previous chest pain patient, a consulting cardiologist might expect to hear, "I have a 55-year-old man with multiple cardiac risk factors who presents with a STEMI on ECG. We have treated him with aspirin, nitroglycerin, and heparin, and would like him to go to the cath lab. Could you come evaluate him in the ED? Are there any other treatments you would like us to start?" Depending on the case and resources at the facility, a consultant may evaluate the patient in the ED and ultimately discharge him, admit the patient primarily, or manage the patient alongside another service (usually internal medicine). When possible, it is always better for a patient if the consultant examines them in person rather than providing advice over the phone. In many EDs, and especially in austere or forward deployed settings, this is often not possible. Specialist consultants may be in other parts of the country or region, or stateside. In these cases, sending pictures of ECGs and other images to the consultant may be the next best course of action. Some hospitals have telemedicine services, in which a consultant (often a neurologist for a stroke patient), can evaluate the patient via a video monitoring system.

When patients require admission, the EP must determine if they can be admitted to the current facility or if they require a transfer. In the stateside military setting, patients requiring admission may need transfer to a higher level of care; many stateside military hospitals do not provide neurosurgical capabilities. The patient presenting with a subarachnoid hemorrhage might require transfer to a civilian facility for further care. In the deployed setting, transfer becomes an even larger challenge. The deployed patient presenting with a ruptured ectopic pregnancy would certainly require transfer to a higher level of care for surgical treatment.

If transfer is required, the EP's next question is how to most safely transport the patient: by air or by ground. This decision will rely on a multitude of factors including the stability of the patient, the resources of the facility, weather conditions, and the location of the accepting hospital. This decision will often be made in consultation with the accepting provider at the next level of care.

If the patient is admitted to the same facility, the EP may need to write admission orders for the inpatient unit. These should be done in consultation with the admitting physician and should make clear that the admitting physician should be contacted for any change in the patient's status. Admitting the patient may require phone calls to multiple consultants to coordinate care.

Many patients can be safely discharged from the ED. However, the decision to discharge can produce anxiety for the EP and for the patient, especially if the patient is being discharged without a clear diagnosis. As discussed throughout the chapter, the purpose of an evaluation in an ED is to recognize and stabilize life-threatening conditions. Often, a skilled EP is able to determine that there is no life-threatening condition present and no reason for admission, but the cause of the patient's chest pain, abdominal pain, or other symptom, is still unclear. In these circumstances, the EP must have a discussion with the patient about what has been done in the ED, what the next steps should be (primary care follow-up, outpatient follow-up with a specialist, further testing as an outpatient, trial of medication, etc), and any reasons to return to the ED.

Patients should be told what they should do to improve their condition, for example, ice, rest, elevation, and antiinflammatory medication for an ankle sprain. What the patient is NOT allowed to do should also be clearly written in the discharge instructions. For example, a patient presenting with a first-time seizure may be stable for discharge with outpatient neurology follow-up, but should be counseled not to drive or engage in other high-risk activities. In the military setting, particularly the deployed setting, patients with mild traumatic brain injury/concussion may be in a condition to be discharged, but should be counseled to avoid all strenuous physical activity until headache and other symptoms completely resolve and they have been cleared by their primary care doctor or neurologist.

Patients should be told when and where to follow up. For high-risk patients such as infants, pregnant women, and the elderly, and for high-risk complaints such as abdominal pain and chest pain, it is preferable if the EP can arrange a specific appointment for the patient to follow up, ideally in 24 to 48 hours, for a repeat evaluation. If this is not possible and the EP is truly concerned for the patient, the best option may be to have the patient return to the ED in 24 to 48 hours for a recheck. This procedure has often been used for undifferentiated abdominal pain in which appendicitis has not been ruled out.

SUMMARY

The approach to the emergency medicine patient, though different from other fields in medicine, should involve fundamentals of emergency care during evaluation and treatment of acute conditions. Perform rapid "doorway" assessments, determine whether the patient is sick or not sick, establish a safety net, check for red flags, and provide resource-appropriate diagnostics and treatment. Utilizing lessons in this chapter can help non-emergency MMPs provide better patient care.

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