Critical Decisions in Emergency Medicine™

SAMPLE ISSUE

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Contributors

Michael Walters, MD, and **Azita Hamedani, MD, MPH,** wrote **"Advance Directives in the Emergency Department."** Dr. Walters is medical director of Emergency Services, Divine Savior Healthcare, Portage, Wisconsin. Dr. Hamedani is associate professor of medicine and division chief of emergency medicine at the University of Wisconsin School of Medicine and Public Health, in Madison, Wisconsin.

J. Stephen Bohan, MS, MD, FACEP, reviewed "Advance Directives in the Emergency Department." Dr. Bohan is executive vice chair of the Department of Emergency Medicine at Brigham and Women's Hospital and an assistant professor in medicine (emergency medicine) at Harvard Medical School in Boston, Massachusetts.

Mary Mulcare, MD, and **Rahul Sharma, MD, MBA, CPE, FACEP,** wrote **"Abdominal Aortic Aneurysms."** Dr. Mulcare is attending physician in the Emergency Medicine Department at New York-Presbyterian Hospital/Weill Cornell Medical Center, and instructor in medicine at Weill Cornell Medical College in New York, New York. Dr. Sharma is medical director and associate chief of service in the emergency department at NYU Langone Medical Center-Tisch Hospital and assistant professor of emergency medicine at the NYU School of Medicine, in New York.

George L. Sternbach, MD, FACEP, reviewed "Abdominal Aortic Aneurysms." Dr. Sternbach is a clinical professor of surgery at Stanford University Medical Center in Stanford, California, and an emergency physician at Seton Medical Center in Daly City, California.

Frank LoVecchio, DO, MPH, FACEP, reviewed the questions for these lessons. Dr. LoVecchio is research director at the Maricopa Medical Center Emergency Medicine Program and medical director of the Banner Poison Control Center, Phoenix, Arizona, and a professor at Midwestern University/Arizona College of Osteopathic Medicine in Glendale, Arizona.

Louis G. Graff IV, MD, FACEP, is Editor-in-Chief of *Critical Decisions*. Dr. Graff is professor of traumatology and emergency medicine at the University of Connecticut School of Medicine in Farmington, Connecticut.

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Lesson 29

Advance Directives in the Emergency Department

Michael Walters, MD, and Azita Hamedani, MD, MPH

Objectives

On completion of this lesson, you should be able to:

1. Describe the purpose of an advance directive and explain the differences between different types of advance directives.
2. List appropriate triggering conditions for advance directives and other necessary formalities required to make them valid.
3. Discuss the possible courses of action available when various limitations and conflicts arise regarding advance directives.
4. Explain the duties of an emergency physician when presented with a valid advance directive.
5. Explain that laws regarding advance directives can vary by individual states.

From the EM Model

20.0 Other Core Competencies of the Practice of Emergency Medicine

20.4 Systems-based Practice

Advances in medical technology have extended life expectancy in the United States over the past century. As a result, questions have arisen regarding the use of these technologies and the ability of patients to direct their health care at the end of life or when incapacitated. These questions have been addressed more directly by the legal community than by the medical community. Landmark legal cases have focused attention on advance directives as a means of avoiding conflict in end-of-life decision making.

In 1983, Nancy Cruzan was injured in an automobile accident resulting in irreversible brain damage. Medicine's ability to provide nutrition and hydration via a gastrostomy tube resulted in Ms. Cruzan living 8 more years in a persistent vegetative state while the legal battles waged regarding withdrawal of care.[1] Similarly, in a more recent case, Terri Schiavo was kept alive by advances in life-sustaining technology, ultimately resulting in her living almost 15 years after onset of irreversible brain damage. Neither woman had a valid advance directive that gave health care providers evidence of her wishes regarding life-sustaining treatments in the event that she became incapacitated. These cases serve to illustrate the importance and legal backdrop of advance directives. Advance directives are legal documents that convey the wishes and intent of patients to their physicians when they are unable to make these decisions themselves.

Legally, advance directives allow patients to exercise their individual liberty to refuse medical treatment as protected by the Fourteenth Amendment despite a state's compelling interest to preserve life.[2] Ultimately, the US Supreme Court allowed states to set standards regarding requirements necessary to overcome this interest.[3] As a result, each state has unique laws that outline the requirements and limits of advance directives.

In 1990, Congress passed the Patient Self-Determination Act (PSDA) creating federal regulations for Medicare-funded health care organizations in regard to advance directives. In implementing these regulations, the Centers for Medicare and Medicaid Services have included as a condition of participation in the Medicare and Medicaid programs that health care organizations ask patients about advance directives and incorporate that information into the medical record.[4] However, the PSDA does not require a patient to have an advance directive. All states prohibit heath care organizations from requiring an advance directive as a provision of care.

Case Presentations

Case One

A 75-year-old man arrives by ambulance after being found unresponsive outside his home. Due to his condition, the patient is unable to provide any other information. The wife states that he was shoveling snow when he collapsed but that

Critical Decisions

- The patient has an advance directive. What does this mean?
- What conditions must be present before an advance directive becomes operative?
- When presented with a valid advance directive, what are an emergency physician's duties? Are there any consequences for not complying with the directive?
- What are the limitations of a valid advance directive, if any?
- What should an emergency physician do when an incapacitated patient has two advance directives or no advance directive at all, especially when conflicts arise among family members?

otherwise he has been feeling fine recently. His past medical problems include heart disease, chronic obstructive pulmonary disease, and prostate cancer for which he had a prostatectomy.

The physical examination reveals a man appearing his stated age. He has no spontaneous respirations and no palpable pulses. While the patient is being examined, the wife produces a document titled "My Living Will" with the patient's name at the top. She states, "Despite what is written here, I want everything done for my husband. I am his power of attorney for health care."

Case Two

A 65-year-old woman arrives after being found in her group home confused and with a decreased level of consciousness. She has decreased mental capacity normally but is worse than baseline according to caregivers. Her only medical problems are hypertension and diabetes.

On physical examination, vital signs are blood pressure 180/100, heart rate 90, respiratory rate 16, temperature 36.7°C (98°F), oxygen saturation 98% on room air, and a finger-stick blood glucose of 150. There are no signs of trauma. Pupils are mid-range bilaterally. Neck is supple. Respiratory and cardiac examinations are unremarkable. Neurologic examination reveals hemiparesis on the left side.

At the completion of the examination, caregivers state that the patient is a ward of the state and ask that her guardian be notified. However, the patient's sister arrives and states she is the patient's power of attorney for health care.

California enacted the first health care advance directive in 1976, a "Directive to Physicians," more commonly known as a living will. Since then, an estimated 18% to 30% of Americans have executed a living will or power of attorney for health care. Most individuals who have executed an advance directive are

Table 1.
Terms and definitions related to advanced directives[4,6-8]

Term	Definition
Advance directive	Written or verbal communication that indicates a person's health care preferences when he or she is unable to communicate them directly. Typically, a living will or durable power of attorney for health care.
Living will	A written or oral instruction indicating an individual's health care preferences.
Power of attorney	An instrument granting someone authority to act as an agent for the grantor. A power of attorney may be ordinary or durable.
Do-not-resuscitate order	An order that prohibits the use of cardiopulmonary resuscitation in the event of cardiac arrest.
Grantor	One who conveys property or authority to another. A person that creates a power of attorney and grants authority to an agent is the grantor.
Agent	One who is authorized by a power of attorney to act for or in place of another (the grantor).
Surrogate	A substitute for performing some function in place of someone else. For health care decisions, an individual other than an agent or guardian authorized by statute to make health care decisions.
Guardian	One who has the legal authority and duty to care for another's person or property. A guardian is appointed by the courts.
Incapacity	In general, a lack of physical or mental abilities that results in a person's inability to manage his or her own personal care, property, or finances.
Incompetency	As defined in a legal manner, in general, the lack of legal ability or qualifications to do something. For example, the legal inability to make a contract or stand trial.

white, older women who are highly educated and/or from the middle or upper classes.[5] Table 1 is a list of terms and definitions associated with advanced directives.

CRITICAL DECISION

The patient has an advance directive. What does this mean?

Misinterpretation and misunderstanding of advance directives are well documented among physicians.[9,10] Although most physicians view advance directives as medical documents, they are, in fact, legal instruments explaining a patient's wishes about medical treatment in the event that he or she is unable to communicate or is incapacitated.

Four different legal entities satisfy the definition of "advance directive." Living wills and durable powers of attorney for health care are the most common; however, the term also includes out-of-hospital "do not resuscitate" (DNR) orders and physician orders for life-sustaining treatment (POLST).

A living will is an advance directive that is direct instruction from a patient to a physician or health care provider regarding health care wishes. Only three states do not have living will statutes—Massachusetts, Michigan, and New York. Like most legal documents, certain elements are required to make a living will valid. Emergency physicians must familiarize themselves with the required elements (eg, witnesses, date, and signatures) in their states. In general, most states require two disinterested witnesses to sign a living will. "Disinterested" is defined as not related by blood, marriage, or adoption; with no knowledge of any entitlement to a claim on the patient's estate; not having direct financial responsibility for the patient's health care; and not serving the patient as a health care provider, as an employee of a health care provider, or as an employee of the inpatient facility. A few states allow the witness requirement to be waived if the living will is notarized, other states require two witnesses and notarization. Only a few states have no witness requirements.

Most states require the living will to be in writing, although a few allow an oral living will (eg, Alaska, California, Connecticut, Hawaii, Maine, New Mexico, and Tennessee). For an oral living will to be valid, a witness and a health care provider must be present when the oral living will is made.

A living will provides a set of instructions directly to a physician regarding the termination or withholding of life-sustaining treatments; a power of attorney, however, is a more flexible advance directive. In general, a power of attorney is a legal document that grants authority to someone to act as an agent for the person executing the document, the grantor.[6] Furthermore, a power of attorney may be ordinary or durable. An ordinary power of attorney terminates when the grantor becomes incapacitated or incompetent, while a durable one remains in effect when either of these conditions is present. This distinction is vital to understanding powers of attorney and integral to a power of attorney for health care. A durable power of attorney for health care may also be called a special power of attorney (because it only allows the agent to make decisions relating to a specified matter) or termed a health care proxy.

Again, certain requirements must be met for a durable power of attorney for health care to be valid. Unlike living wills, a power of attorney must always be written and must always be signed by the grantor. In most states, the grantor must sign the instrument in the presence of witnesses and/or a notary public. The witness and notary requirements vary by state. Most common is the need for two witnesses that are disinterested, just as described under living wills. Finally, the document must give the agent authority to make health care decisions.

In general, there are no restrictions on the decisions an agent is able to make when authorized by a properly executed general power of attorney. However, this is not true regarding a durable power of attorney for health care. In a durable power of attorney for health care, the authority granted to the agent is specific and limited to decisions regarding the withholding or withdrawing of life-sustaining medical treatment. Ideally, the agent under the durable power of attorney for health care will be well informed of the patient's medical wishes prior to the time the grantor becomes incapacitated. If the agent is not aware of the grantor's desires, then the agent has the duty to act in the grantor's best interest taking into consideration the overall medical condition and prognosis.[11] To avoid conflicts of interest, most states restrict who can be a health care power of attorney. Typically, treating health care providers, employees of treating health care providers, officers of health care facilities, owners of health care facilities, and employees of health care facilities may not be agents.[12] Although there may be some exceptions to these restrictions, a treating physician should never serve as an agent.

In almost all states, EMS personnel are required to attempt resuscitation or other life-sustaining treatment unless a doctor who is physically present instructs otherwise.[13] Even if shown a valid living will rejecting life-sustaining treatments or durable power of attorney for health care, EMS personnel may not be able to dismiss their obligation to treat and transport the patient. To remedy this situation, most states now have enacted out-of-hospital DNR statutes. These statutes permit patients to avoid unwanted resuscitation by EMS personnel.[14] In addition, these statutes detail the formalities required for a valid out-of-hospital DNR order. Most emergency physicians recognize the end result of these formalities, the specially designed out-of-hospital DNR bracelet or card. Besides this very outward

display of the patient's wishes, most states require that the patient and the patient's primary physician sign the order that allows the patient to obtain the bracelet or card. When presented with an out-of-hospital DNR, emergency physicians must remember that, by definition, these DNR orders are for the prehospital setting and EMS personnel. Some states include emergency department personnel in their definition of emergency services personnel. Other states extend "out-of-hospital" to the emergency department setting. Conversely, several states restrict out-of-hospital DNR orders to the prehospital setting but advise emergency department personnel to give them consideration when deciding whether to initiate life-sustaining treatment (Table 2). This issue is important because the emergency physician should respect the wishes of the patient while being mindful of the limitations of this advance directive and the associated immunities.

POSLT represent the newest advance directive now available in a few states. Unlike living wills and durable powers of attorney, which do not require physician participation for creation or validity, a POSLT requires a discussion between the patient and the physician in order to create and make the instrument valid. The result of these discussions is incorporation of a patient's wishes into a set of physician's orders. These orders are then recorded on a brightly colored form kept in a highly visible place within the medical record or with the patient if at home. Transferring the orders with the patient whenever the health care setting is changed ensures continuity in health care decision making. As of 2009, eleven states have adopted some form of POLST.[14]

Just like all other advance directives, POLST also have formalities. The main one consists of form. All states having POLST require a statutory form to be used. Unlike a living will or durable power of attorney for health care, there are no witness requirements. Finally, only physician and patient signatures are needed.

In-hospital DNR orders are not included in the advance directives described above. Unlike these other documents, an in-hospital DNR is simply that, a hospital order. In-hospital DNR orders are written physician orders and are only valid during that specific hospitalization. In particular, these orders are not advance directives, they do not follow the patient from one health care setting to the next, and they terminate once the patient is discharged from the hospital. Advance directives may or may not contain a DNR provision. In addition, a patient does not need an advance directive to have an inpatient DNR order.[4] Knowing this, emergency physicians must not misinterpret former in-hospital DNR orders as an advance directive. Although they may shed light on a patient's past wishes regarding life-sustaining treatment, they are not conclusive.

CRITICAL DECISION

What conditions must be present before an advance directive becomes operative?

Patient incapacity is the common critical trigger for all advance directives. If a patient has the capacity to make health care decisions, then he or she has the right to make these decisions regardless of what is documented in the advance directive. Only when the patient becomes incapacitated does an advance directive become effective. The Uniform Health Care Decisions Act defines capacity as "an individual's ability to understand the significant benefits, risks, and alternatives to proposed health care and to make and communicate a health care decision."[15] However, this definition is not universal, and states may define the term as they choose. For example, in Wisconsin, incapacity is defined as "the inability to receive and evaluate information effectively or to communicate decisions to such an extent that the individual lacks capacity to manage his or her own health care decisions."[16]

Emergency physicians may be required to activate a patient's advance directive and, therefore, need to know how incapacity is determined. The model Uniform Health Care Decisions Act requires only a determination by the "primary" physician.[7] Many states require only one physician to make the determination, but other states have additional requirements such as the requirement that two physicians certify incapacity. Among these states, some allow an advanced nurse practitioner or clinical psychologist to substitute for one of the physicians. Emergency physicians must be aware of the requirements in their particular states.

Confusingly, a few states have different incapacity determination requirements depending on whether a living will or durable power of attorney for health care is being activated. For states with a combined living will and power of attorney statute, determination of incapacity is the same for both. But in states that do not have a combined statute, the requirements may be slightly different. For example, in Indiana, although only a physician can

Table 2.
States extending out-of-hospital DNR orders to the emergency department

AZ, CA,* CO, CT, DE, FL, GA, HI, ID, IL, IA, KY, LA, ME, MD, MI, MO,* MT, NE, NH, NJ, NY, NC, ND, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VT, VA, WA, WV, WI, WY

*Observance in emergency department encouraged.

determine incapacity to activate a living will, a physician, psychologist, or judge may certify incapacity to activate a power of attorney.[17] In total, 24 states and the District of Columbia, have separate statutes for living wills and durable powers of attorney for health care (Table 3). Recall that Massachusetts, Michigan, and New York only have power of attorney statutes and no living will statutes.

Although all advance directives are triggered by incapacity, living wills have additional conditions that must be met before the directive becomes operative. These conditions are defined by each state and usually include a terminal condition, a persistent vegetative state, or permanent unconsciousness. The requirement of a terminal condition is common to the vast majority of states and is defined in each state's statute. Although some small differences may exist, the condition is commonly defined as "an incurable condition caused by injury or illness that reasonable medical judgment finds would cause death imminently, so that the application of life-sustaining procedures serves only to postpose the moment of death." Most states include "assistance in respiration, artificial maintenance of blood pressure and heart rate, blood transfusion, kidney dialysis, and other similar procedures"[18] as life-sustaining procedures, but exclude comfort procedures. Some states specifically equate alleviation of pain by medication or procedure with comfort care, while other states do not define comfort care in as much detail.

A persistent vegetative state or permanent unconsciousness are possible alternative conditions, when coupled with incapacity, that may trigger a living will. The former is defined as a condition that "reasonable medical judgment finds constitutes complete and irreversible loss of all of the functions of the cerebral cortex and results in a complete, chronic and irreversible cessation of all cognitive functioning and consciousness and a complete lack of behavioral responses that indicate cognitive function."[19] Seventeen states use permanent unconsciousness, rather than a persistent vegetative state, as the triggering condition. Although similar, the two conditions have slightly different definitions. A common detailed definition of permanent unconsciousness is "a condition that, to a reasonable degree of medical certainty, will last permanently, without improvement; and in which cognitive thought, sensation, purposeful action, social interaction, and awareness of self and environment are absent; and the condition has existed for a period of time sufficient, in accordance with applicable professional standards, to make such a diagnosis." A more simplified definition is "an irreversible condition in which the individual is at no time aware of himself or herself or the environment and shows no behavioral response to the environment."[20,21] Finally, a few states allow special triggering conditions. For example, Wyoming and Utah allow the patient to define conditions that trigger the living will, while North Carolina includes advanced dementia. Again, emergency physicians have a duty to know the laws in their particular states.

CRITICAL DECISION

When presented with a valid advance directive, what are an emergency physician's duties? Are there any consequences for not complying with the directive?

First and foremost, an emergency physician has the duty to respect the patient's desires regarding health care decisions and life-sustaining treatment. An emergency physician should use good faith and reasonable medical standards. However, an emergency physician's duties are not limited to simply following an advance directive. In most states, the physician is required to also document in the medical record or certify in writing the presence of the triggering condition. One unique situation is Utah's additional requirement that the physician also document the likelihood of the patient's regaining capacity.[22] Importantly, if a physician is unable to comply with the requests outlined in an advance directive, for whatever reason, he or she must make reasonable efforts to transfer the patient to another physician who will.

If a physician performs the duties required by statute, then all states provide immunity from criminal or civil action arising from the withholding or withdrawing of life-sustaining treatments. Most states simply require the physician to act in good faith when carrying out the duties and wishes of the advance directive. A few states add or replace the good faith requirement with the use of reasonable medical standards. Regardless, the immunities are provided so that the physician can carry out the wishes of the patient without fear of reprisal. The one

Table 3.
Combined or distinct statutes

Nature of statute	States
Combined living will/power of attorney statute	AL, AK, CA, DE, HI, ID, ME, MD, MN, MT, NH, NJ, NM, ND, OR, PA, TX, UT, VT, VA, WV, WY
Separate statutes	AZ, AR, CO, CT, DC, FL, GA, IL, IN, IA, KS, KY, LA, MA, MI, MS, MO, NE, NV, NY, NC, OH, OK, RI, SC, SD, TN, WA, WI

limitation to immunity is the transfer requirement. Immunity is lost if a physician fails to make a good faith effort to transfer a patient when he or she cannot comply with the advance directive. Such failure could expose a physician to civil and possibly even criminal litigation.

Emergency physicians may face penalties either for willfully not following a valid advance directive or for failing to make a good faith effort to transfer the patient when they cannot follow it for whatever reason. Penalties can range from criminal prosecution, most commonly as a misdemeanor, to professional misconduct sanctions by a state medical board (Table 4). In some states, physicians may be subject to civil liability, such as a tort, for willfully failing to follow a valid directive. On the other hand, several states have no penalties for not following a directive or failing to transfer a patient (Table 4).

CRITICAL DECISION

What are the limitations of a valid advance directive, if any?

Understanding the limitations of a valid advanced directive is as important as being able to identify an advanced directive and following the patient's wishes. One limitation to an advance directive has already been discussed—out-of-hospital DNRs are usually limited to the prehospital setting. The most important additional limitations involve care for pregnant patients and psychiatric patients. Finally, while not as relevant to emergency physicians, knowledge of the limitations surrounding the withdrawal or withholding of hydration and nutrition is interesting because of the controversies surrounding the issue.

Almost all states impose severe limitations on the implementation of advance directives if the patient is pregnant. Only if the fetus is not viable will a valid living will or durable power of attorney for health care be permitted to dictate care. Otherwise, most states have statutes that make advance directives inapplicable if it is possible that the fetus will develop to the point of a live birth. A few states allow the woman to decide either by placing a special provision in a living will or expressly authorizing an agent to make such decisions (Table 5).

Directing mental health care is another potential limitation of a valid advance directive. Only a few states do not limit mental health decisions in advance directives, otherwise most states place significant limitations on such decisions in general advance directives. Finally, 15 states have separate mental health advance directives for mental health decisions (Table 6). In all situations, an emergency physician must read the advance directive carefully to determine if the patient has placed any limitations on mental health care decisions and know the laws in his or her state.

Although not particularly relevant to the care emergency physicians typically provide, basic knowledge regarding the limitations

Table 4.
Possible physician penalties for willfully not following a valid advanced directive or failing to transfer

Penalty	State
Civil liability	AK, CA, HI, ME, MD, NM, OR, TN,* WY
Criminal liability	AR, MT, NE, NV, OH, VA
Professional misconduct	CO, IL, IN, KS, MO, NJ, OK, RI, TN,* TX, VT, WV, WI
Nothing specific to physicians	AL, AZ, CT, DE, DC, FL, GA, ID, IA, LA, MN, NH, NC, ND, PA, SC, SD, UT, WA

*Both

Table 5.
Advanced directives and pregnancy

Treatment of advance directive in pregnancy	State
Advance directive not valid	AL, AR, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, MI, MN, MO, MT, NE, NH, OH, OK, PA, RI, SC, SD, TX, UT, WA, WI
Statute allows woman to choose	AK, AZ
Statutes silent on issue	CA, DC, LA, ME, MD, MA, MS, NJ, NM, NY, NC, ND, OR, TN, VT, VA, WV, WY

Table 6.
States with separate mental health advance directive statutes

HI, IL, IN, LA, NJ, NM, NC, OH, OK, OR, TN, TX, UT, WA, WY

of withdrawal or withholding of hydration and nutrition is important. For a living will, most states require a person to opt out of receiving hydration or nutrition when a triggering condition arises. Usually, a patient expresses this intent by checking or not checking the appropriate box on the recommended statutory form or explicitly documenting such wishes if using a nonstatutory form. Likewise, a durable power of attorney for health care must specifically grant the agent the authority to make decisions regarding hydration and nutrition.

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What should an emergency physician do when an incapacitated patient has two advance directives or no advance directive at all, especially when conflicts arise among family members?

Unfortunately the best-laid plans can miscarry, and emergency physicians may be presented with conflicting wishes regarding an incapacitated patient's care. Potential conflicts include the existence of more than one valid advance directive, usually a living will and a power of attorney for health care; the existence of an advance directive and a guardian; or the non-existence of an advance directive. Which document governs when both a valid living will and power of attorney for health care are present? Because the living will is a direct instruction from the patient, it has priority in most states. However, the reverse may be true in other states.[23,24] Finally, some states give priority to the most recently dated document. States with a combined living will and power of attorney have attempted to remedy this potential conflict by encouraging use of an optional statutory form that contains both a living will and a power of attorney for health care. The result is harmony between the two advance directives and a unified declaration of intent. As stated previously, emergency physicians need to know the advance directive laws of their state.

Although not a frequent situation, sometimes a patient presents to the emergency department with a "legal" guardian. Guardianship is a legal process in which a court appoints a person to manage the affairs and make decisions for a person who is unable to make his or her own decisions whether because of incapacity, incompetency, or being a minor (Table 1). Unlike an agent, a guardian is not chosen by the patient but rather is nominated, and the courts make the appointment. An advance directive, on the other hand, is a process entirely controlled by the patient prior to incapacity. This concept affects the interaction between a guardian and a valid advance directive. Some states follow the Uniform Health Care Decisions Act and limit a guardian's health care decision-making capabilities in the setting of a valid advance directive. In particular, a guardian should comply with the patient's living will and may not revoke the directive unless the court authorizes such activity. Likewise, a health care decision of an agent takes precedence over that of a guardian unless a court order dictates otherwise. If no advance directive exists or is available, then the guardian is able to make health care decisions for the patient.[7]

Probably a much more frequent problem for emergency physicians is the situation in which a patient has no advance directive. Usually in such situations, emergency physicians turn to family members. Most physicians assume that spouses, adult children, and/or parents of adults have this authority based on medical tradition. However, conflicts among potential decision makers do occur. One has to only recall the case of Terri Schiavo, where conflict between a spouse and the patient's parents resulted in countless legal battles, the enactment of state legislation directed solely at her, and even an executive order from the President of the United States. In an attempt to avoid such conflicts, states have begun to enact statutes specifically authorizing family members and others to consent to or refuse life-sustaining treatment for incapacitated patients. These statutes have been called "family consent statutes." Presently, approximately half of the states have such statutes (Table 7). They create a default surrogate health care decision maker when no directive, agent, or guardian is available. The default designations provide that any member of the patient's family may act as surrogate, in descending order of priority, as follows: spouse (unless legally separated), an adult child, a parent, or an adult brother or sister. If none of these individuals are present, many of these states now also allow "an adult who has exhibited special care and concern for the patient, who is familiar with the patient's personal values, and who is reasonably available" to act as surrogate.[7] Despite this attempt at conflict avoidance, one can envision a situation in which more than one person in an individual class asserts authority. In such an instance, most family consent statutes require either a majority or unanimous decision on a course of action among a class. If a majority or unanimous decision is not achieved then that class, and any lower class, is disqualified from making any health care decisions. One can quickly see that this is less than ideal and confusing. In such situations, an

Table 7.
States with family consent statutes

AK, AZ, AR, CA, DE, FL, GA, HI, IL, IA, KY, LA, ME, MD, MS, NM, NY, PA, TN, TX, VA, WV, WY

emergency physician's only recourse may be an ethics consultation or a petition for court intervention.[13]

Case Resolutions

Case One

In the case of the elderly man with a living will that is contrary to his wife's wishes that "everything" be done, the emergency physician had to proceed cautiously. The living will appeared valid and was quite detailed in the instructions made by the patient. The wife was unable to produce any documentation of a durable power of attorney for health care. The emergency physician was aware that in his state, a living will controls because it represents an individual instruction from the patient to the physician. Rather than ignoring the wife, the emergency physician made time to discuss the matter with her after immediately stabilizing the patient without violating the patient's desires. After this discussion, the wife admitted that the living will represented her husband's wishes and that she was just afraid to lose him. She ultimately agreed with the course of action outlined in her husband's living will.

Case Two

In the case of the confused woman presenting from a group home, the emergency physician was aware that her state had enacted the Uniform Health Care Decision Act. As a result, the health care decisions of an agent appointed by a valid durable power of attorney for health care take precedence over that of a guardian. When the sister arrived, she produced a valid power of attorney for health care form. The emergency physician called the guardian. The guardian expressed understanding and knowledge of the law and expressed confidence that the patient's sister would act in the patient's best interest regarding health care decisions.

Summary

Advance directives allow patients to control decisions regarding their health care in general and end-of-life issues more specifically. Living wills and powers of attorney for health care are the two principal instruments patients have to achieve this goal. Although each state has its own rules governing these instruments, there are constant general themes. A living will is a direct communication from the patient to the doctor, and a durable power of attorney for health care authorizes an agent to make decisions that manifest the desires of the patient. Incapacity is the key trigger for both instruments. As emergency physicians, we must understand the boundaries of each instrument and state law so we can honor the intent and desires of our patients.

Pearls

- There is no universal advance directive law. There are 50 states and the District of Columbia; each has different statutes regarding advance directives. Know the laws regarding advance directives in your state.
- Talk to your patients and their families if a conflict arises. Many times, with a little conversation, all will agree with the patient's wishes as expressed in a living will or power of attorney for health care.
- Talk to your patients regarding advance directives. As emergency physicians, your opinions and attitudes matter. Patients look to you for guidance.

Pitfalls

- Following an advance directive or surrogate's decision when the patient does NOT lack capacity and is able to make decisions.
- Failing to follow a valid advance directive.
- Failing to know the laws of your state.
- Interpreting an in-hospital DNR order from a recent admission as a valid advance directive.

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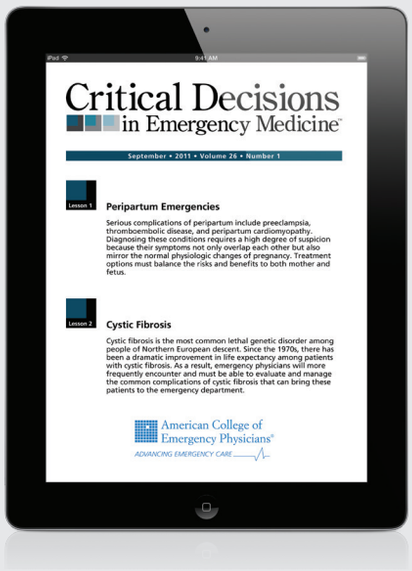

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The LLSA Literature Review

"The LLSA Literature Review" summarizes articles from ABEM's "2013 Lifelong Learning and Self-Assessment Reading List." These articles are available online in the ACEP LLSA Resource Center (www.acep.org/llsa) and on the ABEM Web site.

Article 7

How Common is MRSA in Adult Septic Arthritis?

Reviewed by Jonathan Rogg, MD, and J. Stephen Bohan, MS, MD, FACEP; Harvard Affiliated Emergency Medicine Residency; Brigham and Women's Hospital

Frazee BW, Fee C. Lambert L. How common is MRSA in adult septic arthritis? *Ann Emerg Med.* 2009;54(5):695-700.

Acute monoarticular arthritis is a common emergency department complaint, and the most concerning diagnosis is septic arthritis. With the growth of community-acquired methicillin-resistant *Staphylococcus aureus* (MRSA), it is unknown how often MRSA, as opposed to other pathogens, is responsible for septic arthritis in these patients. This article retrospectively reviewed septic arthritis in two urban academic emergency departments to determine the rate of MRSA infection in septic arthritis.

During the 15-month study period they identified 109 synovial fluid cultures from the emergency department. Of these, 23 (21%) grew bacteria. Nine positive cultures were eliminated because they were thought to be contaminants. Two more were eliminated because on chart review they were not synovial fluid. Of the twelve cases of septic arthritis, ten grew out *S. aureus* and six were MRSA. Interestingly, in four of the five MRSA cases, patients had a leukocyte count of less than 25,000 cells/µL.

Of the six patients with MRSA, five had risk factors for MRSA. Three had hospitalizations within the past year and the other two had a history of injection drug use. Injection drug use was more common in the non-MRSA septic arthritis patients. This study confirms the standard of care, that patients with septic arthritis should be treated with antibiotics that treat MRSA.

Highlights

- MRSA is a common source of septic arthritis—50% of septic arthritis cases in this study. Appropriate antibiotic choices for septic arthritis should include MRSA coverage.
- Septic arthritis with MRSA may present with a low leukocyte count, below 25,000 cells/µL; therefore, culture of the aspirate should always be done, regardless of the cell count.

Lesson 30

Abdominal Aortic Aneurysms

Mary Mulcare, MD, and Rahul Sharma, MD, MBA, CPE, FACEP

Objectives

On completion of this lesson, you should be able to:

1. Describe the pathophysiology of an abdominal aortic aneurysm (AAA).
2. Discuss the populations at higher risk for developing an AAA.
3. Describe the complaints and conditions that can bring a patient with an AAA to the emergency department.
4. Explain the emergent management issues for patients with an AAA and order the appropriate diagnostic imaging studies.
5. Discuss the various treatment pathways for a patient with an AAA depending on the patient's workup in the emergency department and consultation with specialists.

From the EM Model

3.0 Cardiovascular Disorders

3.3 Disorders of Circulation

Abdominal aortic aneurysms (AAA) continue to be a significant medical and surgical problem with a high associated mortality rate.[1] AAAs affect 4% to 9% of individuals over the age of 60, with a predilection for men between 65 and 79 years of age, and cause approximately 15,000 deaths annually.[2] The mortality rate associated with elective operative repair is 2% to 6%, and there is a significant risk of major complications; higher complication rates are associated with emergent repair.[2] The dreaded complication of an AAA is aortic rupture, which has a death rate of 80% for all patients reaching the hospital alive. The mortality rate is 50% for those patients able to undergo the emergent surgery necessary for vessel repair.[3] Given these mortality rates, there has been increased emphasis on screening high-risk populations.[2]

Emergency physicians should be comfortable diagnosing AAAs and be able to implement appropriate emergent intervention or followup as warranted. These patients can be difficult to identify as they often present with nonspecific abdominal pain or, in the case of rupture, hypotensive and unresponsive. Thus it requires a high degree of clinical suspicion, a thorough physical examination, and appropriate diagnostic testing to secure the diagnosis.

Case Presentations

Case One

A 65-year-old man with a 65-pack-year smoking history, previous brain aneurysm repair, coronary artery disease, and hypertension arrives complaining of bilateral flank pain that has been present for the past 2 months. The pain had been intermittent and growing progressively worse; for the past 2 days it had become unremitting. The pain radiates from his flank to the groin bilaterally, left worse than right. He took 400 mg of ibuprofen for the pain with little relief. He reports some nausea, but no vomiting, fever, diarrhea, hematuria, dysuria, testicular pain, or early satiety. He has been urinating normally, with slightly decreased oral intake secondary to pain.

On examination, the patient is afebrile, with blood pressure 193/98, heart rate 78, respiratory rate 20, and oxygen saturation 96% on room air. The abdomen is soft, and a pulsatile mass is noted in the midabdomen. There is no costovertebral angle tenderness. The extremity examination is unremarkable, with equally palpable pulses bilaterally. No testicular tenderness is noted, and anatomy appears normal. The neurologic examination is unremarkable.

Case Two

An 85-year-old man is brought in by EMS from a local store where he had collapsed. Witnesses told EMS responders that the patient had

Critical Decisions

- What clinical signs and symptoms should lead the clinician to consider AAA in the differential diagnosis?
- What are the critical interventions? What imaging studies should be ordered and when?
- When is it appropriate to call for a surgical consultation?
- Should emergency physicians initiate blood pressure control or other medical interventions while the patient awaits disposition?
- When is it safe to send a patient with an AAA home?

been shopping when he suddenly complained of abdominal pain and then collapsed to the floor. He was unconscious for several minutes. When EMS arrived, the patient was moaning and minimally responsive to pain.

On arrival in the emergency department, the patient's vital signs are blood pressure 80/40, heart rate 124, respiratory rate 14, temperature 37°C (98.6°F), and oxygen saturation 93% on room air. He is moaning, with localized response to pain, but he does not open his eyes. The remainder of his examination is unremarkable.

Case Three

A 74-year-old woman presents complaining of abdominal pain and fever that has been present for the past 2 days. She describes the pain as dull, 3/10, in the left lower quadrant. She reports having a temperature of 100°F at home yesterday. She had two episodes of nonbloody diarrhea and mild nausea but no vomiting or chills. The patient denies dysuria, hematuria, cough, chest pain, difficulty breathing, changes in diet, and any sick contacts.

On examination, vital signs are blood pressure 146/78, heart rate 88, respiratory rate 18, temperature 37.6°C (99.6°F), and oxygen saturation 98% on room air. She has mild tenderness to palpation in the left lower quadrant without rebound or guarding. The rest of the examination is unremarkable.

Pathophysiology

An arterial aneurysm is defined as a permanent localized enlargement of an artery to more than 1.5 times its expected diameter. The normal abdominal aorta is 2 cm or less in diameter, and thus an abdominal aortic aneurysm is present once the aorta dilates to a diameter of 3 cm or more.

As with all the major arteries, the aorta comprises three layers: intima, media (largest layer), and adventitia. There is a gradual reduction of medial elastin fibers and thinning of collagen within the media as the aorta descends from the thoracic to the abdominal region, with a thickening of the intima. The location of the aneurysm is classified primarily based on how far it extends cephalad. Ninety-five percent of all AAAs are infrarenal, with or without iliac involvement as this is where these changes in the aortic wall are most pronounced.[4]

True aneurysms involve all three layers of the arterial wall. There are two types of aneurysms: fusiform and saccular. Fusiform aneurysms are symmetrical dilations of the arterial wall, while saccular aneurysms are asymmetrical, with a localized out-pouching of the arterial wall. Pseudoaneurysms (false aneurysms) can be a point of confusion. A pseudoaneurysm is a collection of flowing blood that has violated the intima and sometimes the media, but is contained by the adventitia. It may slowly dilate over time, but rarely ruptures or dissects.

Risk factors for developing an AAA include a combination of genetic, metabolic, and structural components as follows: age over 60 years, male sex, tobacco use, familial history of AAA, history of heart disease or peripheral vascular disease, and atherosclerotic disease. Hypertension, diabetes, and hyperlipidemia contribute to atherosclerosis, which has traditionally been taught as the most significant risk factor for developing an AAA. However, recent studies have shown that genetics are more indicative of risk.[5] The Aneurysm Detection and Management Veterans Affairs Cooperative Study Group (ADAM) has identified smoking as the strongest modifiable risk factor for the development of an aneurysm.[6] Structural disorders, including increased levels of elastase and collagenase, loss of blood vessel elastin, and copper deficiency affect the integrity of the media of the aorta wall. Additional insults such as infection and inflammatory disorders further reduce medial elastin fibers and can infiltrate the adventitia.

Aneurysms can also develop at sites of previous vascular reconstruction or grafts, referred to as para-anastomotic aneurysms. These are an infrequent but very important complication of a graft repair and can present as either true or false aneurysms.[7] The reported prevalence ranges from 2% to 29%, with false aneurysms being two to three times more common; rupture rates of up to 55% are reported.[8] Thus, continued monitoring of AAAs is important after repair as well.

The rate at which aneurysms expand is variable. The Laplace law demonstrates that as the aorta dilates, the force on the aortic wall increases, therefore causing further dilation [wall tension = (pressure × radius)].[9] The average rate of increase is 0.25 to 0.5 cm per year.[10] The most important factor determining the risk of rupture

is the size of the aneurysm.[11] Most ruptures occur once the aorta's diameter is more than 5 cm. The rate of growth (0.5 cm or greater over 6 months is high risk)[12-14] and the patient's sex (women are at greater risk than men)[15,16] also have a role in risk of rupture.

CRITICAL DECISION

What clinical signs and symptoms should lead the clinician to consider AAA in the differential diagnosis?

Pain is the most common presenting complaint for a symptomatic AAA. The patient may have abdominal, back, or flank pain. Pain associated with a stable, intact aneurysm is gradual in onset, vague and dull in quality, and may be described as colicky or throbbing. Severe pain is ominous for rupture, whether imminent or actual.[11] If the patient has flank pain, it often is radiating to the groin and, with associated hematuria, mimics nephrolithiasis, the most common misdiagnosis. Typical constitutional symptoms include nausea and vomiting.[9]

Ruptured AAA likewise usually presents with severe abdominal pain and/or back or flank pain, with abdominal tenderness to palpation. The pain is typically abrupt in onset and severe. Approximately 50% of patients describe the pain as ripping or tearing,[4] which can be confused with an aortic dissection. Those patients presenting with syncope and hypotension in addition to abdominal pain have signs and symptoms highly suggestive of an abdominal catastrophe.[17] If the patient is not hemodynamically stable, it can be much more difficult to make this diagnosis. Most AAA ruptures are retroperitoneal given the anatomic position of the aorta. However, sudden death most commonly occurs with intraperitoneal rupture.

Unruptured AAAs are typically asymptomatic and usually an incidental finding on imaging. There has been debate around whether to screen for AAA as part of routine medical evaluations. The most recent recommendation from the US Preventive Services Task Force is for screening men aged 65 to 75 years who have a history of smoking.[2]

Physical Examination

The findings on physical examination are variable. The sensitivity of a palpable abdominal mass in making the diagnosis is directly related to the size of the aneurysm and the girth of the patient's abdomen.[5,18] A pulsatile mass is palpable in the epigastric area in 77% of patients with a ruptured AAA. Aneurysms that are still intact are less frequently detected because they are smaller. According to published reports, 30% to 60% of unruptured aneurysms measuring 3 to 3.9 cm by ultrasound can be detected by palpation; 50% to 70% of aneurysms 4 to 4.9 cm and 75% to 85% of those 5 cm or larger can be palpated.[18,19] Obesity and guarding (voluntarily or involuntarily) because of abdominal pain decrease the sensitivity of the physical examination. A tender mass is highly suggestive of a rapidly expanding or recently ruptured AAA. Abdominal bruits are found in 5% to 10% of patients with AAA but are nonspecific.[20] Distal pulses may be asymmetric or weakened with an AAA, as well.

It is important to do a rectal examination with guaiac testing of the stool when examining these patients. Patients with an AAA can develop aortoenteric fistulas, especially as a late complication of graft repair.[21,22] A gastrointestinal bleed in a patient with a known AAA or aortic graft is assumed to have fistula until it is proved otherwise, especially in the high-risk population without another explanation for the bleed.[11] The bleed may start slowly, with erosion of vessels in the bowel wall, and then become rapid as the aorta ruptures into the intestinal lumen.[22] Patients with a ruptured native AAA without fistula formation can have blood in their stool as well.

Large AAAs also have the potential to rupture into the inferior vena cava if there are significant inflammatory changes, creating continuous arteriovenous communication (aortocaval fistula). These typically do not leak externally.[23,24] Patients will present with signs and symptoms of high-output congestive heart failure, including dyspnea, pulmonary edema, jugular venous distention, lower extremity edema, and often times an abdominal bruit.[23,24]

CRITICAL DECISION

What are the critical interventions? What imaging studies should be ordered and when?

The management and desired diagnostic tests for patients with an AAA depend on the initial presentation. All patients with a suspected symptomatic AAA should have two large-bore intravenous lines started and blood typed and cross-matched for the operating room, in addition to basic laboratory studies, an ECG, and immediate surgical consultation. Those patients who are unstable and considered highly likely to have an expanding or ruptured AAA (especially those triaged with pain and hypotension and found to have a pulsatile mass) may be taken immediately to surgery without imaging. Any delay increases the risk of death from hemorrhage.

Primary Diagnostic Modalities

Ultrasonography is close to 100% sensitive in detecting AAAs when appropriate images are obtained and is typically the initial diagnostic modality of choice.[25] For those patients who are hemodynamically unstable, ultrasonography has the advantage of being a rapid bedside test. Obesity and bowel gas patterns can interfere with the examination. If a normal aorta is visualized along the entire course of the vessel, then the diagnosis of AAA is not viable.[26] Of note, ultrasound is not good at detecting whether an AAA has ruptured.

If the diagnosis is less clear or the ultrasound is equivocal and the patient is hemodynamically stable,

further diagnostic workup may be entertained. A computed tomography (CT) scan of the abdomen with intravenous contrast is the most appropriate imaging study. CT scans take longer than ultrasonography and require moving the patient to a setting with reduced monitoring and access, so they should be reserved for stable patients.

Abdominal CT with intravenous contrast is nearly 100% accurate in assessing the aorta, determining whether there is an AAA, and providing accurate measurements of its dimensions. In addition to providing a diagnosis, CT is often helpful in planning elective surgical repairs.[27,28] AAAs typically rupture into the retroperitoneum and are best diagnosed with a CT scan. Intravenous contrast is helpful but not mandatory when primarily looking for an AAA. Acute hemorrhage can likewise be visualized without contrast, although contrast is usually preferred by radiologists.[29-31] Other findings such as intramural thrombus or periaortic fibrosis may be harder to identify without contrast.[32] In addition, CT scans are the best modality by which to evaluate for fistula formation.

As always, it is important to continually follow the clinical examination because a hemorrhage can be missed on imaging or happen immediately after the CT scan is completed.

Additional Imaging Options

Abdominal radiographs may show suspicious findings in someone with an AAA. These findings include aneurismal calcification, soft-tissue mass, loss of renal shadow, renal displacement, and/or change in the retroperitoneal flank stripe. However, these findings are nonspecific except for the aneurismal calcification, making abdominal films minimally useful.[33]

MRI is an excellent imaging modality for the aorta, particularly when evaluating branching vessels. However, it is a time-consuming study and often not readily available; it is most useful for evaluation of asymptomatic aneurysms on an outpatient basis.[33]

Angiography is an older modality largely made obsolete by CT scans with intravenous contrast. Angiography is likewise time consuming, requiring specially trained personnel, and has a high false-negative rate for AAA with minimal utility in measuring the diameter of an AAA. Thus, this is not a test of choice in the emergency setting.[33]

CRITICAL DECISION

When is it appropriate to call for a surgical consultation?

Patients with a known AAA and a presentation concerning for rupture or rapid expansion should have an immediate surgical consultation. These patients usually require emergent surgical intervention. The outcome of surgery depends on the presenting features and the patient's overall health.[12,34]

For intact AAAs, aneurysms greater than 5.5 cm in diameter warrant surgery.[35] Those less than 4 cm are followed with regular imaging. The AAAs that are between 4 cm and 5.5 cm in diameter are in an ambiguous zone for surgical intervention[36] and thus need urgent evaluation by a vascular surgeon. Many institutions use a cut-off of 5 cm for vascular surgery evaluation in the emergency department; it is important to know the standards in use at a specific facility. These measurements are guidelines based on the available data and do not exclude the possibility of a smaller aneurysm rupturing or a larger aneurysm remaining asymptomatic.

CRITICAL DECISION

Should emergency physicians initiate blood pressure control or other medical interventions while the patient awaits disposition?

There is no specific medical therapy that has been shown to reduce the rate of expansion or risk of rupture among patients with asymptomatic AAAs.[34,35] There has been a significant amount of research on patient-specific biomechanical profiling of AAA development and rupture.[37] The amount of wall stress encountered by the aorta appears to be superior to diameter in differentiating which patients are more susceptible to rupture.[38] Blood pressure is an important component of wall stress calculations, and overall wall stress does increase with increased blood pressure. Higher levels of wall stress are correlated with increased rates of rupture.[39,40] However, the stress on the aortic wall remains equally distributed over the given area of the vessel, regardless of the pressure. When isolating for the blood pressure variable, the highest systolic pressures are still below the failure strength of the normal aorta. Thus blood pressure alone is not responsible for ruptured AAAs and does not require acute intervention. Long-term management is important.

The primary role of the emergency physician beyond making the initial diagnosis in a symptomatic AAA is monitoring hemodynamic stability, providing crystalloid and blood products as warranted, and preparing the patient for the operating room. Lowering the blood pressure artificially is typically not recommended as it can confound the interpretation of the patient's hemodynamic stability. These patients also tend to be hypotensive in the acute phase rather than hypertensive. As above, the surgery and anesthesia team should be notified immediately on suspecting the diagnosis. Pain control is also important, preferably in a manner that does not cause hypotension or altered mental status in itself.

The patient's blood should be typed and cross-matched, and 6 to 10 units of RBCs should be requested to be on call for the operating room. The patient should be transferred to the operating room as soon as possible and not held in the emergency department for ongoing hemodynamic stabilization as that

wastes valuable time.[11]

Over the long term, behavior modification is the primary therapy for managing AAA, with smoking cessation being the most important. Blood pressure control as part of a larger health maintenance plan is likewise important.

CRITICAL DECISION

When is it safe to send a patient with an AAA home?

If an AAA is discovered incidentally on evaluation and is less that 5 cm in diameter (although this cut-off can vary slightly by institution), the patient may be discharged home to follow up with the primary doctor and a vascular surgeon for elective repair and ongoing management. These patients require a complete vascular examination because there are often other lower extremity arterial aneurysms associated with the AAA.[41,42] Discharge is only advisable if the patient's symptoms are clearly not associated with the AAA, blood work and diagnostic test results are not concerning, and followup is secured.

Symptomatic AAAs require hospital admission and urgent or emergent repair. The repair may be an open repair or an endovascular procedure, depending on the surgeon's preference.

Of note, a patient with a history of AAA repair and unexplained fever, abdominal pain, or gastrointestinal bleed may be suffering a complication of the graft or repair, and thus needs inpatient evaluation.[11] Patients who have had aortic repairs can still have an AAA and rupture. These patients can require additional laboratory evaluation, including blood cultures, WBC counts, and an erythrocyte sedimentation rate to evaluate for an infected or inflamed aneurysm.[43]

Pearls

- AAAs can present with abdominal, flank, or back pain and have variable findings on clinical examination—a high degree of suspicion for the diagnosis is important, especially in the elderly male population.
- Abdominal pain accompanied by syncope or hypotension is highly suggestive of an abdominal catastrophe such as a ruptured AAA.
- Gastrointestinal bleeding in a patient with a known AAA or aortic graft should be assumed to be caused by a fistula until it is proved otherwise.
- Ultrasonography and abdominal CT scan (preferably with intravenous contrast) are the imaging modalities of choice depending on availability and the stability of the patient.
- AAAs larger than 5 cm in diameter and/or those that are symptomatic require surgical consultation.
- Patients with acutely symptomatic (pending rupture) or ruptured AAAs must be moved to the operating room without delay.

Pitfalls

- Forgetting that an AAA can masquerade as renal colic, musculoskeletal pain, acute myocardial infarction, or other causes of an acute abdomen.
- Failing to transfer even hemodynamically unstable patients with a ruptured AAA to sites of definitive care; prolonged management in the emergency department increases mortality.
- Failing to ensure appropriate vascular followup for ongoing management if a patient with an asymptomatic AAA is discharged home.

Case Resolution

■ Case One

In the case of the 65-year-old man with bilateral flank pain, because of the pulsatile mass, the physician immediately performed an ultrasonographic examination, which revealed an 8-cm to 9-cm aortic aneurysm. Given the patient's stable vital signs, he was sent for a CT scan of the abdomen with intravenous contrast to facilitate pre-operative planning. The patient's laboratory test results were unremarkable.

The CT scan demonstrated a large, contained AAA measuring up to 8.4 × 7.9 cm in transverse and anteroposterior dimensions and extending at least 10 cm in craniocaudal dimension. The true lumen of this aneurysm measured up to 5.1 × 4.4 cm, surrounded by clot and hyperdense material. There was no evidence of mesenteric inflammatory stranding or hemoperitoneum; however, there was a rim of probable inflammatory thickening peripherally around the aneurysm, concerning for a contained rupture of the aneurysm.

The patient was taken emergently to the operating room for an open repair. The AAA was successfully repaired with a Dacron tube graft. The patient was discharged from the hospital three weeks after his initial visit to the emergency department. At his one-month followup, the patient was doing well.

■ Case Two

The 85-year-old man who had collapsed while shopping was emergently intubated for airway protection. Two large-bore intravenous lines were placed peripherally, and 2 liters of normal saline were given. Bedside ultrasonography was negative for free fluid in the abdomen but, despite poor image quality because of bowel gas patterns, did show a dilated aorta, measuring approximately 5.5 cm in diameter. Surgery and ICU teams were called to the bedside. The patient was given 2 units of uncross-

matched packed RBCs, and his hemodynamic status stabilized while he was being prepared for surgery.

The patient was transferred to the operating room, where an exploratory laparotomy revealed a fusiform aortic aneurysm extending into the right iliac vessel, with retroperitoneal rupture. The team was unable to control the bleeding, and the patient died on the operating room table.

Case Three

Given a concern for diverticulitis, the physician ordered a CT scan with contrast and basic laboratory studies for the woman who presented with abdominal pain and fever. She had a slightly elevated WBC count but otherwise normal findings. The CT scan of the abdomen and pelvis with contrast demonstrated mild diverticulitis as well as an AAA measuring 4.4 cm in diameter.

A review of the patient's electronic medical record revealed that she had had an AAA measuring 4.2 cm in diameter on an abdominal ultrasound done 6 months previously. Because of the clinical presentation and impression of diverticulitis and because the growth of the AAA was consistent with the anticipated expansion over the given time period, the patient was discharged home with antibiotics and close followup with her primary care provider and vascular surgeon within two weeks for re-evaluation. She was also given strict return precautions.

Summary

Symptomatic AAAs can present in a variety of ways and are an important part of the differential for predisposed patients presenting with abdominal, back, or flank pain, and/or hypotension and syncope. The physical examination will be of varying utility but may identify a pulsatile abdominal mass, signs of bleeding, or abnormal pulses distally. Ultrasonography and CT scans are the diagnostic modalities of choice, and the choice is dictated by the patient's hemodynamic state and clinical suspicion. Early surgical intervention for symptomatic or ruptured AAAs is essential.

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The Drug Box

Prasugrel

Oriana Chen, MD; Summa Health System Emergency Medicine Residency

Prasugrel is a newer antiplatelet agent for patients with acute coronary syndrome (ACS), post-percutaneous coronary intervention (PCI), unstable angina (UA), non-ST-segment elevation myocardial infarction (NSTEMI), and patients with ST-segment elevation myocardial infarction (STEMI) when managed with primary or delayed PCI. A relatively quick onset of action makes it valuable for patients undergoing emergent PCI, but it is irreversible, and the risk of major bleeding (including fatal bleeding) is increased with prasugrel compared to clopidogrel.[1]

Mechanism of Action	A prodrug that is metabolized through CYP450 in the liver to an active metabolite; inhibits platelet aggregation by irreversibly binding to ADP receptors on the platelet, prevents activation of GPIIb/IIIa complex, reduces platelet activation and aggregation. Onset <30 minutes; peak effect at 4 hours; duration >3 days; baseline 5 to 9 days. Elimination half-life about 7 hours (range 2-15 hours)
Indications	ACS, UA, NSTEMI, and STEMI
Dosing	Loading dose: 60 mg orally Maintenance dose: 10 mg orally every 24 hours (consider 5 mg orally every 24 hours for patients weighing less than 60 kg) Patients should also take aspirin (75 mg to 325 mg) daily. Prasugrel comes in 5-mg and 10-mg tablets
Side Effects	Bleeding: patients older than 75 years, weighing less than 60 kg, or with a history of stroke or TIA are at greatest risk. Thrombotic thrombocytopenic purpura; hypersensitivity—including angioedema
Estimated Cost	$5 to $10 per tablet
Contraindication/ Precautions	Do not use in patients with active pathological bleeding, intracranial hemorrhage, active or history of TIA or stroke. Use with caution in patients with bleeding or clotting disorders (eg, hemophilia); those taking other anticoagulants (eg, warfarin, heparin) or daily NSAIDs; those with recent trauma or surgery, stomach ulcers, or liver disease, and just before or after coronary artery bypass graft (CABG). Must hold 5 to 7 days prior to CABG. Safety and effectiveness in pediatric patients not established. Pregnancy category B. It is not known whether prasugrel is excreted in human milk (metabolites were found in rat milk).

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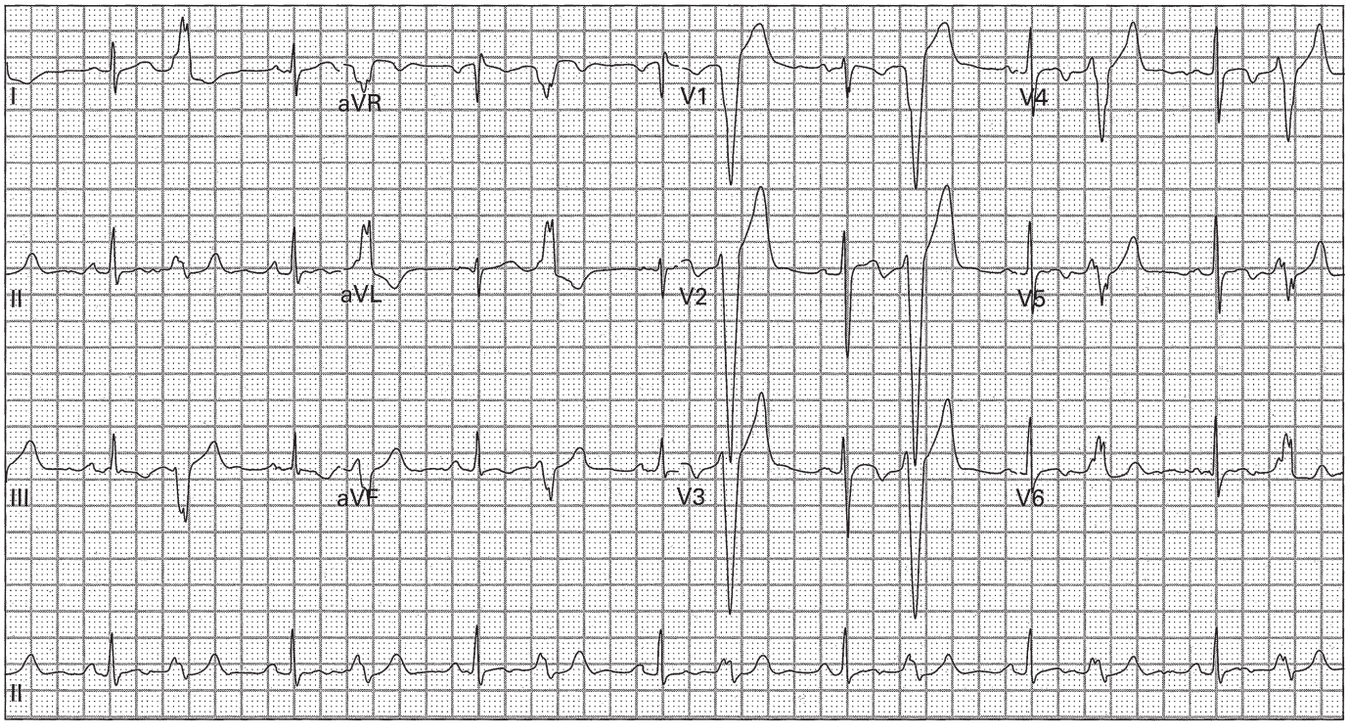
Feature Editors: Michael S. Beeson, MD, MBA, FACEP; Amy Niertit, MD

The Critical ECG

A 35-year-old man with chest pain and palpitations.

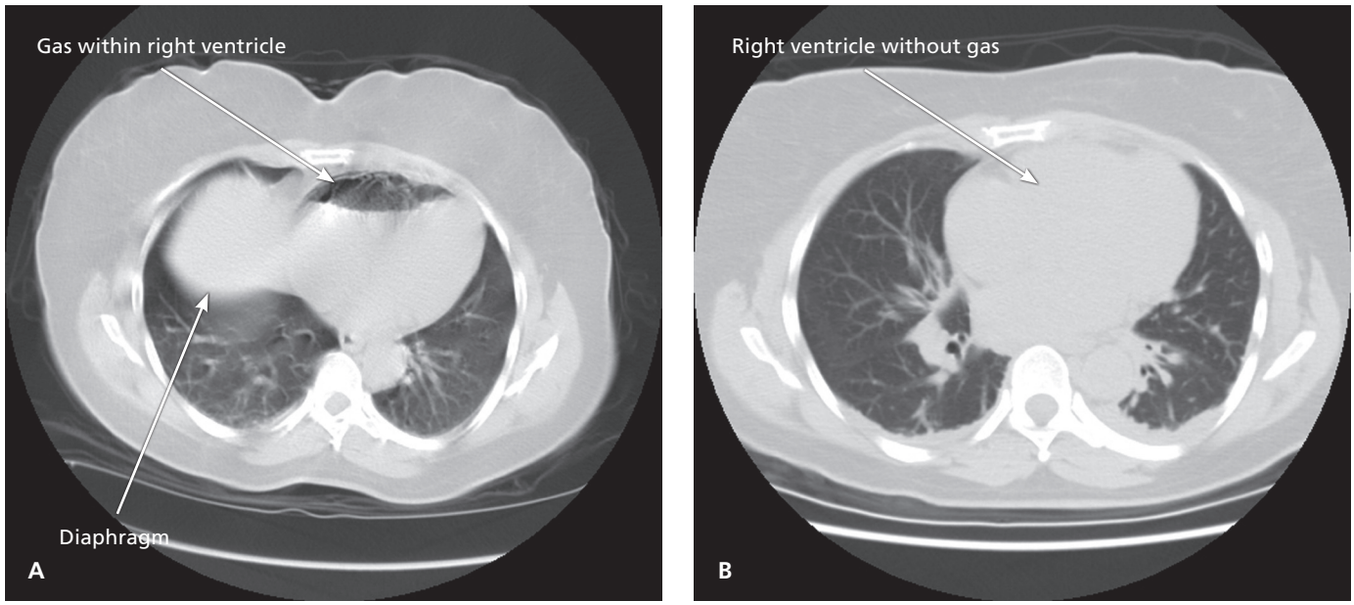


Sinus bradycardia with frequent premature ventricular contractions in a pattern of ventricular bigeminy, rate 90, T-wave abnormality consistent with inferior and anterior ischemia. The sinus rate is 45/minute. Ventricular bigeminy is present. Close attention to the T waves that are associated with the normal QRS complexes reveals T-wave inversions in the inferior and anterior leads. These T-wave inversions resolved after the patient was treated with nitroglycerin. A stress test performed later demonstrated cardiac ischemia.

Feature Editor: Amal Mattu, MD, FACEP. From: Mattu A, Brady W. *ECGs for the Emergency Physician.* London: BMJ Publishing; 2003:120,148. Available at www.acep.org/bookstore. Reprinted with permission.

The Critical Image

A 56-year-old woman presenting with epigastric pain. Vital signs are temperature 36.9°C, heart rate 106, blood pressure 141/89, respiratory rate 20, and oxygen saturation 97% on room air. The patient's examination revealed epigastric tenderness. Abdominal CT with intravenous and oral contrast was obtained to evaluate the etiology of the patient's abdominal pain. Immediately following the CT, the patient was transferred to another hospital for definitive therapy. Following that therapy, CT was repeated.



A. Initial axial CT image, viewed on lung windows. Abdominal CT is usually performed from the cephalad-most portion of the abdomen, and therefore includes the dome of the diaphragm and a caudad segment of the thorax containing sections of both lungs and heart. In this image, gas is visible in the anterior portion of the heart, representing gas in the right ventricle. This is presumably iatrogenic; the remainder of the patient's CT (not shown) demonstrated no intravenous contrast, suggesting that the contrast power injector was accidentally filled with air.

B. Repeat CT image following hyperbaric oxygen therapy. The diaphragm is not visible because of phase of respiration. The intracardiac air has resolved.

Air appears black on CT using all window settings; however, a bone or lung window setting can help differentiate air from other tissues, since all other tissues appear much brighter on these window settings.

Because its density is so much lower than all other body tissues, air provides intrinsic contrast and can be recognized without the addition of extrinsic contrast agents.

Right ventricular air embolism can occur during rapid decompression from SCUBA diving. Outside of that setting, it is a known complication of iatrogenic inadvertent intravenous introduction of air.[1,2] Quantities of air around 100 mL can impair right ventricular filling resulting in cardiac arrest. Embolization to the lungs can result in ventilation-perfusion mismatch as with thrombotic pulmonary embolism. The inflammatory cascade can be activated by intravascular air, and delayed development of ARDS is another potential complication. If a right-to-left cardiac shunt such as a patent foramen ovale or ventricular septal defect is present, air may enter the systemic circulation and cause stroke or ischemia of other organs.[3]

Treatment includes immediate left lateral decubitus positioning in an attempt to trap the embolus in the right ventricle, preventing further embolization. Definitive therapy is hyperbaric oxygen, allowing the air embolism to diminish in size and ultimately be absorbed into solution. The patient had no other abnormal findings on her abdominal CT. She underwent hyperbaric therapy and recovered uneventfully.

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Thanks to Andrew Parker, MD, for assistance with this case.

Feature Editor: Joshua S. Broder, MD, FACEP. See also *Diagnostic Imaging for the Emergency Physician* (winner of the 2011 Prose Award in Clinical Medicine, the American Publishers Award for Professional and Scholarly Excellence) by Dr. Broder, available from the ACEP Bookstore, www.acep.org/bookstore.

Sample CME Questions

1. Which of the following conditions or issues creates the most severe limitations on an otherwise valid advance directive in most states?
   A. dementia
   B. mental health
   C. persistent vegetative state
   D. pregnancy

2. In most states, in addition to incapacity, which of the following is the most common condition that must be present to trigger a living will?
   A. dementia
   B. permanent unconsciousness
   C. persistent vegetative state
   D. terminal condition

3. Which of the following is most commonly considered a life-sustaining treatment?
   A. antibiotics
   B. invasive blood pressure monitoring
   C. pain medications
   D. ventilator assistance

4. Regarding advance directives, it is imperative that emergency physicians:
   A. always assume a durable power of attorney for health care takes precedence over a living will
   B. ignore a patient who has capacity to make decisions when a valid living will is present in the medical record
   C. ignore a valid advance directive if a family member is present
   D. know the laws of his or her state

5. In order for a physician to be eligible for immunity when honoring an advance directive, he or she must:
   A. act in good faith
   B. always notify the family of medical decisions
   C. contact the patient's attorney
   D. verify each witness on the directive form

6. After a spouse and adult children, someone in the following relationship with the patient is usually the next default surrogate based on "family consent laws":
   A. close family friend
   B. cousin
   C. parent
   D. sibling

7. Which document authorizes an agent to make health care decisions for an incapacitated grantor?
   A. family consent law
   B. living will
   C. physician order for life-sustaining treatment
   D. power of attorney for health care

8. In order of priority, which of the following most commonly control when conflicts arise?
   A. default surrogate, valid living will, guardian
   B. guardian, valid living will, default surrogate
   C. valid living will, default surrogate, guardian
   D. valid living will, guardian, default surrogate

9. Which of the following is needed to make an advance directive valid?
   A. patient signature only
   B. physician's signature
   C. signature of attorney and physician
   D. signature of witness or notary and patient

10. The primary reason for an advance directive is:
    A. to allow family members to have access to a patient's medical information
    B. to convey patients' wishes regarding medical care if they become incapacitated
    C. to make money for attorneys
    D. to protect physicians when they withhold or withdraw care

11. Which of the following is the best diagnostic modality for assessing a suspected abdominal aortic aneurysm (AAA) in a hemodynamically unstable patient?
    A. abdominal radiograph
    B. CT scan of abdomen without contrast
    C. magnetic resonance imaging of the abdomen
    D. ultrasonography

12. Which of the following patients requires an emergent surgical consultation in the emergency department prior to imaging?
    A. a 65-year-old woman with a history of coronary artery disease presenting with left-sided chest pain, noted to have a nontender pulsatile abdominal mass on examination
    B. a 70-year-old man with hypertension and a significant smoking history presenting with one month of bilateral flank pain, acutely worsening over the past day
    C. a 74-year-old woman with a known AAA presenting with throat pain for two days and a low-grade fever
    D. an 85-year-old man with no known medical history presenting with sudden-onset abdominal pain followed by a syncopal event with an abdominal mass noted on examination

13. Which of the following patients is better served by bedside ultrasonography for assessment of possible AAA than by a CT scan?
    A. a 65-year-old woman presenting with right lower quadrant pain and fever and a palpable abdominal mass, with stable vital signs
    B. a 75-year-old man presenting with hypotension and syncope with indolent abdominal pain over the past week
    C. a 80-year-old woman with a history of hypercholesterolemia, hypertension, and diabetes, presenting with acute-onset left flank pain 6 hours prior and stable vital signs
    D. an obese 70-year-old man with abdominal pain and a known AAA presenting with sinusitis

14. What diameter of an asymptomatic AAA is an indication for emergency surgical consultation?
    A. 2 cm
    B. 3 cm
    C. 4 cm
    D. 5 cm

15. What rate of growth for an AAA is considered concerning for potential path to rupture and need for preemptive surgical intervention?
    A. 0.25 cm over 6 months
    B. 0.5 cm over 6 months
    C. 0.5 cm over 1 year
    D. 1 cm over 3 years

16. Which features of an AAA contribute to an increased potential for rupture?
    A. female sex, aneurysm larger than 5 cm, and rapid rate of growth
    B. female sex, aneurysm larger than 3 cm, and presence of pseudoaneurysm
    C. male sex, aneurysm larger than 5 cm, and rapid rate of growth
    D. male sex, aneurysm larger than 3 cm, and rapid rate of growth

17. Acute management of patients with a symptomatic AAA should include which of the following combinations of interventions?
    A. surgical consultation, blood cultures, bedside ultrasonography, and acute lowering of blood pressure to a systolic pressure below 120 mm/Hg
    B. type and cross-match, bedside ultrasonography, acute lowering of blood pressure to a systolic pressure below 120 mm/Hg, and surgical consultation
    C. type and cross-match, blood cultures, bedside ultrasonography, and acute lowering of blood pressure to a systolic pressure below 120 mm/Hg
    D. type and cross-match, blood cultures, bedside ultrasonography, and surgical consultation

18. The mortality rate for patients with a ruptured AAA who undergo emergent surgery is approximately:
    A. 5%
    B. 25%
    C. 50%
    D. 99%

19. A 70-year-old man presents with dark stools for the past 48 hours that are increasing in frequency; he reports feeling weak. He has a history of a graft repair for an AAA 3 years ago. Which of the following is correct regarding evaluation of this patient for an aortoenteric fistula?
    A. aortoenteric fistulas must be considered in all high-risk patients with a GI bleed
    B. aortoenteric fistulas only present as rapid GI bleeds, so this patient is not likely to have one
    C. a bedside ultrasound will be sufficient to rule out an aortoenteric fistula
    D. in order for GI bleeding to be secondary to an AAA, there must be an aortoenteric fistula

20. Which of the following patients can be safely discharged home with vascular followup as an outpatient?
    A. a 60-year-old man presenting with abdominal pain, found to have a tender pulsatile mass in his abdomen on examination and an AAA on bedside sonogram of the aorta measuring 4 cm in the short axis
    B. a 60-year-old man presenting with syncope, found to be hypotensive with a 5-cm AAA on beside ultrasound
    C. a 60-year-old woman presenting with left flank pain, found to have a 4.5-cm AAA on abdominal CT and no signs of other pathology
    D. a stable 50-year-old woman presenting with left lower quadrant pain, with a stable 2.5-cm AAA on abdominal CT scan and mild diverticulitis of the sigmoid colon

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