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# Cardiac death vs. brain death

Cardiac death is the cessation of heart function, but what's the definition of brain death and how's it determined? We help you understand the difference. By Nichole Miller, MSN, RN, CCRN, PCCN

A 76-year-old female patient is admitted to the ICU post cardiac arrest. The patient arrived to the ED in ventricular fibrillation. CPR and advanced cardiovascular life support (ACLS) were started, and the patient was defibrillated. After defibrillation, a perfusable rhythm was achieved. The patient was intubated, a central line was placed, a norepinephrine drip was started for BP control, and the patient was transferred to the ICU.

On arrival to the ICU, the nurse performed a detailed neurologic assessment and found that, even without sedation, the patient was unresponsive and had no spontaneous movement. She had no response even to painful stimuli. Her pupils were 7 mm, fixed, and unresponsive to light. The patient had no corneal or gag reflexes and required a significant amount of norepinephrine to keep her systolic BP above 90 mm Hg. Concerned about brain

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# did you know?

**CPR** consists of chest compressions to help continue circulation of blood and ventilation with either a bag-valve mask or mouth-tomouth using a barrier. Chest compressions mimic the heart pumping while rescue breathing helps maintain oxygen levels in the blood. CPR may also include the use of an automatic external defibrillator, which provides defibrillation if it recognizes fatal arrhythmias.

ACLS consists of more intense care and can be performed both in the hospital and before the patient arrives at the hospital by trained emergency medical services personnel. ACLS consists of basic CPR, vasoactive medications, manual defibrillation, and advanced airway management. It requires the nurse to be able to recognize basic arrhythmias and know dosages of emergency drugs. Nurses certified in ACLS are also expected to assess for the underlying causes of cardiac arrest.

death, the nurse alerted the team to her findings.

A computed tomography scan showed a large infarct and multiple ischemic areas suggestive of an anoxic brain injury. An electroencephalogram (EEG) was performed and no brain activity was found. The ICU physicians performed a detailed neurologic exam and found the same results that the nurse had reported. More tests were ordered, including an apnea test and a cold caloric test. All tests were negative and continued to support the finding of an absence of brain function. A second EEG was conducted 12 hours after the first and it was also negative.

The team determined that the patient was brain dead. The family was notified that there was no chance of recovery. After all of the family's questions were answered, the patient's ventilator was removed. Due to her age, the patient wasn't a candidate for organ donation. Shortly after removing the ventilator, the patient's heart stopped beating, but official time of death was when brain death was determined.

As nurses, we've always cared for the sick and with that obligation comes providing care for the dying. As technology has advanced, it has created a need for ethical considerations when the lines between life and death become blurred. Injuries and diseases that were once fatal can now be treated or managed, and death may no longer look like what was once expected. Equipment and medications have helped stabilize critical patients in varying states of shock who would've died 30 years ago.

One of the ethical questions raised by these advances is the determination of when death occurs. The most basic definition of death is the cessation of life, but questions remain about when life really ends. In medical terms, there are two ways that death is determined. The most common and accepted form of death is cardiac death—the absence of the heart contracting and pumping blood due to a disturbance in its electrical activity. A less common type of death is brain death-the irreversible absence of all brain activity. The determination of brain death was created after the invention of ventilators and vasoactive medications; before these advances, patients with no brain function quickly succumbed to cardiac arrest and a separate determination wasn't needed.

While preparing to write this article, over 70 nurses, many with ICU experience, were asked if brain death was considered actual death. Surprisingly, 64 of the nurses didn't believe that brain death was actual death and most believed that brain death was reversible. Although this is a small sample, it demonstrates a general lack of knowledge about how catastrophic brain death is and that, even among healthcare professionals, there are misconceptions about what brain death really entails.

The goal of this article is to provide you with a better understanding of the criteria for both cardiac and brain death.

# **Cardiac death**

Cardiac, or circulatory death, is what most lay people think of when they think about the definition of death. It's typically seen when the heart has stopped beating or is beating too irregularly to sustain life. The heart's main function is to pump blood through the lungs for oxygenation and then out to the rest of the body. When the heart stops contracting, tissues are deprived of oxygen and become ischemic. Cardiac arrest causes a generalized lack of perfusion to all organs, anaerobic metabolism, and global cellular death.

Signs and symptoms of acute cardiac arrest (cardiac death) include the absence of all peripheral pulses, cyanosis, and, possibly, apnea. Patients who aren't apneic may present with shallow, irregular, gasping breathing known as agonal respirations. The rhythms that coincide with cardiac arrest are asystole, ventricular tachycardia, and ventricular fibrillation, which may be seen on the ECG. However, a patient may appear to have normal electrical activity but have no pulses. This is called pulseless electrical activity and it may look like a sinus rhythm or sinus bradycardia on the monitor, but no peripheral pulses will be present.

Although cardiac arrest may be reversed with the rapid initiation of CPR and ACLS, most instances aren't reversible. If a perfusable rhythm isn't restored quickly, the risk of permanent damage increases. The sooner circulation is restored, the better the patient outcome. After 3 to 5 minutes, brain cells start to die and this damage is irreversible.

### **Brain death**

Brain death is the cessation of all brain activity, including all of the activity in the brain stem. It's generally caused by blunt head trauma from accidents, falls, or crush

### **Examples of brain** cheat death criteria

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- No spontaneous movements
- No response to painful stimuli
- No brain activity on two EEGs conducted at least 12 hours apart
- GCS score of 3
- Apnea
- Absent cough reflex
- Absent corneal reflex
- Negative cold caloric test
- Negative doll's eye reflex

injuries; thrombotic or hemorrhagic stroke, especially when the infarct causes brain herniation; or an anoxic injury that causes the death of brain cells that don't regenerate. Any injury that causes brain death injures the entire brain and its function. As with our case study, sometimes brain injury is seen in combination with cardiac arrest, which may be the underlying cause of brain death.

Brain death is often confused with a coma or a persistent vegetative state, but they differ greatly. Patients in a coma or persistent vegetative state may have limited brain function, but some areas of the brain still remain intact. These patients often have intact reflexes, take spontaneous breaths, and may respond to stimuli even when higher cognitive functioning is absent. In brain death, there's no function in the brain at all; patients have no respiratory function, no spontaneous movements, and all reflexes are absent. Because the heart isn't controlled by the brain, a patient receiving artificial ventilation may continue to have a heartbeat.

Cardiac death is easily recognized by ECG monitoring, but it takes a combination of several tests to diagnose brain death. Most states require two independent physicians to conduct a detailed neurologic exam before a diagnosis can be made. The process of diagnosis and lack of immediate identification is

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Family members may not understand brain death; be prepared to answer difficult questions with both fact and compassion.

a contributing factor to the confusion about the reversibility of brain death. Other factors include mixed information from team members, depictions of recovery from brain death on TV shows, the denial stage of grief, and emotional shock due to the acuteness of the event.

An EEG is almost always performed when there's a suspicion of brain death. It's used to monitor brain wave activity via electrodes on the scalp to detect electrical patterns in the brain. On the monitor screen, these patterns appear similar to chaotic ECG tracings. Brain wave patterns vary throughout the day and appear different when a person is asleep. However, in brain death, there will be no electrical activity and the wave pattern will appear flat.

When an EEG is performed as a confirmation of death, the patient should be free from sedation and warmed to a normal body temperature. A negative EEG will have flat waves, showing no brain activity. When making a determination about brain death, two EEGs are conducted at least 12 hours apart.

# key points

### **Nursing considerations**

- Brain death is legal death.
- A GCS score of less than 6 should trigger a call to your local organ bank.
- Pastoral care should be consulted for any patient with a risk of imminent death.
- All members of the healthcare team need to be supportive but not provide the family with false hope of recovery.
- The subject of organ donation should be addressed with the family by the organ donation team.
- Basic nursing care (turning, bathing, oral care) should continue until life support is withdrawn.

Other tests that can be used to determine brain activity include the cold caloric test, doll's eyes reflex, cough reflex, and corneal reflex. All of these tests evaluate basic reflexes from different areas of the brain.

The cold caloric test is conducted by instilling cold water into the ear canal and observing if nystagmus (eye movement) occurs. If nystagmus doesn't occur, the test is considered negative and suggests that there's no brain function.

The doll's eyes reflex also tests for eye movements. It's conducted by turning the patient's head from side to side (if the patient's head can be moved safely). If brain function is present, the patient's eyes will move to the opposite side from the direction the head is turned. If negative, the eyes will stay fixed mid orbit.

Attempting to elicit a cough is known as the cough reflex. This is easily accomplished in the intubated patient by inserting a suction catheter into the trachea to the level of the carina and observing for a cough.

The corneal reflex tests the eye's response to a foreign object, usually with a cotton swab. If the cornea is touched, the eye should blink. In brain death, the patient won't blink when the cornea is touched.

The Glasgow Coma Scale (GSC) is often used to help assess the level of disability in individuals with suspected neurologic deficit. The scale looks at level of consciousness, verbalization, and purposeful movement. The highest score obtainable is 15: alert, oriented, verbal, and able to follow commands. The lowest score is a 3: unresponsive to even painful stimuli and no purposeful movement; severe neurologic impairment should be considered. In brain death, the patient's GSC score will be 3.

48 Nursing made Incredibly Easy! March/April 2015

In a patient with brain death, all functions controlled by the brain will no longer work. There will be variations in body temperature, BP, and heart rate due to the inability of the brain to control the sympathetic and parasympathetic feedback loop. Hypotension is often seen from peripheral vasodilation and/or diabetes insipidus.

A patient who's declared brain dead will have no reflexes and no response from any of the cranial nerves. He or she will be completely unresponsive to any stimuli, including deep pain. There will be no voluntary movement, but sometimes uncontrollable muscle twitching or spasms may be seen. Apnea reflexes will be absent, meaning that when the patient is removed from the ventilator and  $CO_2$ begins to rise, he or she will make no attempts to breath independently no matter how high the CO<sub>2</sub> rises. This test is conducted for 8 minutes or greater unless the patient becomes hypotensive or otherwise unstable.

### **Ethical considerations**

There are always ethical concerns surrounding death. No matter the underlying cause of death, it's most often a difficult time for all involved. Brain death often takes time to diagnose, which may give false hope to the family.

Although it may be difficult for the family to process, you shouldn't give the impression that the patient will improve. All team members must be clear about the patient's death so that the family can grieve properly. Family members may not understand brain death. They'll have questions about why their family member's heart is still beating and why he or she isn't being fed. You need to be prepared to answer difficult questions with both fact and compassion. Until life support is withdrawn, it's important to continue to provide support and education when appropriate.

If appropriate, involve the hospital's pastoral care or the patient's own religious

# Tests to determine cheat brain death

- Detailed neurologic exam conducted by two independent physicians
- Two EEGs conducted at least 12 hours apart
- Cold caloric test
- Doll's eyes reflex
- Cough reflex
- Corneal reflex

figure to help the family process the patient's death. Everyone deals with death and dying differently. Brain death cases usually require additional compassion and support.

Another consideration in patients with suspected brain death, especially in a younger person, is the possibility of organ donation. Although bone and corneas can be harvested after cardiac death, most major organs need to be harvested while there's still circulation. Brain death allows for this unique opportunity, but causes added stress for the family members making the decision. Due to the delicate nature and legality of organ donation, there's usually a dedicated team that approaches the family about organ donation.

Clinical nurses caring for the patient aren't often directly involved in the organ donation process, but in most states are encouraged to contact the organ bank if brain death is suspected. A nurse coordinator will often review the patient's chart to see if the patient is an appropriate candidate. Age, infection, and cancer are common reasons that a patient isn't a donation candidate.

There are also religious considerations. Although transplant services have become more common, there are still some religions that don't endorse organ donation. For example, Jehovah's Witnesses and certain Jewish denominations are less likely to donate their organs post brain death.

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## When life ends

Death has always been a difficult topic, but technology has caused us to redefine what it really means. Although most patients experience cardiac death, brain death is an important consideration. There have been several sensational cases that have continued to blur the lines, but life legally ends when the heart stops beating or there's no brain function. Recognizing both forms of death and their signs will help you educate and guide families through an already difficult time.

#### REFERENCES

American Heart Association. ACLS training. http:// www.heart.org/HEARTORG/CPRAndECC, HealthcareProviders/AdvancedCardiovascularLife SupportACLS/Advanced-Cardiovascular-Life-Support-ACLS\_UCM\_001280\_SubHomePage.jsp.

Arbour RB. Brain death: assessment, controversy, and confounding factors. Crit Care Nurse. 2013;33(6):27-48.

Copnell B. Brain death: lessons from the McMath case. Am J Crit Care. 2014;23(3):259-262.

Donor Recovery Network. Understanding brain death. http://www.donorrecovery.org/learn/understandingbrain-death.

Powell T. Brain death: what health professionals should know. Am J Crit Care. 2014;23(3):263-266.

Wijdicks EF, Varelas PN, Gronseth GS, Greer DM, American Academy of Neurology. Evidence-based guideline update: Determining brain death in adults: report of the Quality Standards Subcommittee of the American Academy of Neurology. Neurology. 2010;74(23): 1911-1918

Williams D. Calder S, Cocchi MN, Donnino MW. From door to recovery: a collaborative approach to develop-ment of a post cardiac arrest facility. *Criti Care Nurse*. 2013;33(5):42-55.

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The author and planners have disclosed no potential conflicts of interest, financial or otherwise

DOI-10.1097/01.NME.0000460361.65798.bc

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