



PREDICTION OF RECOVERY FROM COMA AFTER CPR

This summary will provide you with information about tests that help doctors predict poor recovery from coma after CPR. In this case, poor recovery means death, continued coma after one month, or severe disability after six months.

What does it mean to be comatose after successful CPR?

When a person has *cardiac arrest*, the heart stops beating. He or she stops breathing normally and loses pulse and blood pressure. Doctors may use medicine and electric shocks (*cardiopulmonary resuscitation*, or *CPR*) to make the heart start beating again. Even when the pulse and blood pressure return after CPR, the brain may already be damaged. In very serious situations, people may remain *comatose*. These people have their eyes closed; they do not respond to voice or procedures that test for pain.

Recovery from coma

Recovery from coma after CPR depends on the cause of brain damage, where it occurs, and how serious the damage is. Some people recover basic responses while others regain full awareness. Recovery usually occurs slowly over time.

Many people awaken from coma on the same day. In other people, recovery may be delayed. Doctors expect brain damage if the patient does not recover soon after CPR. Patients in a coma for more than one week often have severe brain disability.

A *persistent vegetative state* may develop from a coma after CPR. The eyes may be open and sleep and wake cycles may occur. However, these patients are not aware of their environment. When they remain this way after three months, the vegetative state is almost always permanent. They may recover, but these patients often remain severely disabled and fully dependent on nursing care.

Predictors of poor recovery from coma after CPR

Doctors use the results of clinical exams and laboratory tests to predict recovery from coma. For some tests, the chance of error is very small.

Neurologists from the American Academy of Neurology are doctors who treat diseases of the brain and nervous system. Experts in neurology carefully reviewed all of the available scientific studies about tests that help predict poor recovery from coma after CPR. The research showed that some tests help doctors predict poor recovery after CPR with a high level of certainty.

CLINICAL EXAM FINDINGS

There is **strong** evidence* that the following findings from the clinical exam accurately predict poor recovery from coma after CPR:

- Absent *pupillary reflexes* or *corneal reflexes*. The *pupil* is the black part of the eye. The colored part of the eye is the *iris*. The iris controls the size of the pupil by shrinking and expanding. The pupil usually gets smaller when light is held in front of it. This is known as the *pupillary reflex*. The *cornea* is the clear part of the eye. It covers the iris and pupil. The *corneal reflex* consists of blinking when the cornea is touched with a small piece of cotton or dripping water solution.
- Absent or *extensor motor responses* three days after cardiac arrest. An absent motor response means that there is no movement to pain. An extensor motor response is a reflex movement showing straightening of the arms and legs. This movement happens on its own or in response to pain.

There is **good** evidence* that *myoclonus status epilepticus* within the first day after CPR accurately predicts poor recovery from coma. Myoclonus status epilepticus is a constant twitching of muscles, including the face or eyelids. It may get worse by touching. Myoclonus status epilepticus is due to very severe damage to the brain. It is difficult to treat.

There is **good** evidence* that the following clinical findings **do not** accurately predict poor recovery from coma:

- *The circumstances surrounding CPR*. These include *anoxia time*, duration of CPR, and the type of the cardiac arrest. Anoxia time is the amount of time that passes between cardiac arrest and starting CPR.
- *Hyperthermia*. This is an increase in body temperature (a fever).

ELECTROPHYSIOLOGIC TESTS

Electrophysiologic tests include *somatosensory evoked potential* (SSEP), *electroencephalogram* (EEG), and *evoked/event-related potential* (EP) studies.

An SSEP measures the electrical signals of sensation that travel from the body to the brain. The signals are in response to mild electrical stimulation repeated in different parts of the body. The signals are measured on the left and right sides of the body. The electrical activity is shown as a wave. There are different kinds of peaks in the wave. One peak is called an *N20 component* of the SSEP. There are left and right parts of the N20 component. The N20 component represents the *cortex*. This is the outer layer of the

brain that controls feeling, planned muscle movement, thought, reasoning, and memory.

There is **good** evidence* that an absent N20 component of the SSEP (left and right) within one to three days after CPR accurately predicts poor recovery from coma.

An *EEG* is a test that records electrical activity produced by the brain. The electrical activity of the brain may slow down after a major brain injury.

There is **not enough** evidence* that the results of an abnormal EEG test accurately predict poor recovery from coma after CPR.

BIOCHEMICAL TESTS

Biochemical tests include proteins such as *serum neuron-specific enolase* (NSE), *S100*, and *creatine kinase brain isoenzyme* (CKBB). Other tests may measure *brain oxygenation* and *intracranial pressure*.

Serum NSE is a protein found in the blood after there is damage to the brain cells.

There is **good** evidence* that serum NSE levels greater than 33 micrograms per liter measured one to three days after CPR accurately predict poor recovery.

There is **not enough** evidence* that abnormal findings in the following tests accurately predict poor recovery for a comatose patient after CPR:

- Proteins, such as S100 and creatine kinase brain isoenzyme (CKBB). These are proteins found in brain tissue.
- Monitoring of brain oxygenation. These are tests that measure the levels of oxygen in the brain.
- Monitoring of intracranial pressure. These are tests that measure the pressure of brain tissue.

BRAIN IMAGING STUDIES

Doctors use different methods to take pictures of brain structure and function. Some common imaging techniques include *computed tomography* (CT), *magnetic resonance imaging* (MRI),

and *positron emission tomography* (PET).

There is **not enough** evidence* that abnormal brain imaging tests accurately predict poor recovery for a comatose patient after CPR.

LIFE-SUPPORTIVE CARE AND ADVANCE DIRECTIVES

When poor recovery is expected, family members or caretakers should discuss the need for life support. Fully informed, they can rethink medical orders and adjust the level of care. These decisions should be made after understanding *advance directives*. Advance directives can be stated out loud and/or written earlier by the patient. They tell the doctor what kind of care the patient would like to receive in case he or she cannot actively participate in making medical decisions. For example, a patient in a permanent

coma would not be able to make a medical decision.

Talk to your neurologist

Family members and caretakers of a person in a state of coma should talk with a neurologist. Neurologists can provide correct information about assessment and recovery. They can also discuss levels of care and life support options. Ask your neurologist for more information and available services.

* After the experts review all of the published research studies they describe the strength of the evidence supporting each recommendation:

Strong evidence = More than one high-quality scientific study

Good evidence = At least one high-quality scientific study or two or more studies of a lesser quality

Weak evidence = The studies, while supportive, are weak in design or strength of the findings

Not enough evidence = Either different studies have come to conflicting results or there are no studies of reasonable quality

This is an evidence-based educational service of the American Academy of Neurology. It is designed to provide members and patients with evidence-based guideline recommendations to assist with decision-making in patient care. It is based on an assessment of current scientific and clinical information, and is not intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on the circumstances involved.



1080 Montreal Avenue • St. Paul, MN 55116
www.aan.com • www.thebrainmatters.org
(651) 695-1940