

## CME ARTICLE

# Recognition and Treatment of Patients in the Persistent Vegetative State

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*This activity is designed for primary care physicians, especially those in chronic care facilities.*

### GOAL

To describe the clinical features, prognosis, and management considerations for patients who have entered the persistent vegetative state.

### OBJECTIVES

1. Describe the diagnostic criteria for the persistent vegetative state.
2. Review the neurologic injuries that cause the persistent vegetative state.
3. Present the prognoses for children and adults and for the main etiologic categories—traumatic and nontraumatic.
4. Outline treatment decisions and dilemmas.

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The Long Island Jewish Medical Center, the Long Island campus for the Albert Einstein College of Medicine, designates this continuing medical education activity for 1 credit hour in Category 1 of the Physician's Recognition Award of the American Medical Association.

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The persistent vegetative state (PVS) is a chronic, complex neurologic condition characterized by loss of cognitive and voluntary motor function. Despite widespread neurologic impairment, basic (vegetative) functions persist, allowing the person to be awake, free of pain, and able to live seemingly endlessly.

Described by Jennett and Plum in 1972,<sup>1</sup> the PVS has been estimated to effect 10,000 to 25,000 adults and 4000 to 10,000 children.<sup>2</sup> Although relatively common, the PVS is restricted to certain groups and medical settings. In most instances, because PVS entails loss of bodily function, patients generally are cared for in skilled nursing facilities or, with elaborate arrangement, in their own homes. Physicians based in acute care hospitals or medical offices may have few encounters with patients in the PVS.

Patients in the PVS, who may be children or adults, present a diagnostic challenge and have heart-wrenching prognoses. Once the diagnosis is established, care of these patients necessitates a myriad of difficult management decisions. Moreover, unlike other complex medical problems, many aspects of the PVS are inextricably linked to ethical, legal, and administrative rules. These social rules may themselves be in conflict. This article reviews the diagnosis of the PVS, which rests on a neurologic assessment, the prognoses among adults and children and for traumatic and nontraumatic causes, and the medical care of patients in the PVS.

### **Neuroanatomic Features of the Persistent Vegetative State**

Brain injuries that lead to the PVS are those that devastate the cerebral cortex but spare the brainstem. The cortex, which is the foundation of cognitive and language function, is particularly vulnerable to anoxia, trauma, degenerative disease, and other common insults. The brainstem, which contains the cranial nerve nuclei, autonomic nervous system, respiratory

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drive centers, and other basic, vegetative functions, is shielded from injury and illness because it is situated deep underneath the brain, largely encased by the skull, and is well-perfused by the cerebral blood flow. Injuries that cause the PVS strike the cerebral cortex and typically leave patients in a partially or totally decorticate (fetus-like) posture. However, these injuries have little or no effect on ocular motility, lower cranial nerve reflexes, autonomic function, or breathing.

### Causes of the Persistent Vegetative State

Causes of the PVS are customarily divided into traumatic and nontraumatic. Occasional cases among infants are caused by severe congenital developmental disorders, such as anencephaly. Almost all patients' prognoses hinge on whether the cause is traumatic, nontraumatic, or congenital and whether the patient is a child or an adult. For prognostic purposes, the exact causation is less important than the general type. For example, the prognosis would be relatively unaffected by whether the head trauma sustained by a patient in the PVS was caused by a gunshot wound or a motor vehicle accident. Likewise, the prognosis would be similar for patients in a PVS who had Alzheimer disease, multi-infarct dementia, or anoxia.

**Traumatic Causes.** A PVS from head trauma is usually the result of a single insult. The most common causes are motor vehicle accidents, other closed head injuries, gunshot wounds, or nonaccidental injuries to children,<sup>2</sup> that is, child abuse. When head trauma results in the PVS, patients generally have been in a coma for several days to several weeks before entering the PVS. In other words, the sequence is head trauma, coma for several weeks, and the PVS.

**Nontraumatic Causes.** Frequent nontraumatic causes of the PVS include cerebral hypoxia, cerebrovascular accidents, and degenerative conditions. Causes of hypoxia severe and prolonged enough to lead to the PVS are prolonged cardiac arrest, attempted suicide (usually by means of carbon monoxide poisoning or strangulation), and near drowning.<sup>2</sup> Degenerative disorders that lead to the PVS are Alzheimer disease, multi-infarct dementia, and related disorders. Many of these patients have dementia and physical impairments before the insult that caused the PVS. In Kaufman and Lipton's series,<sup>3</sup> for example, before entering the PVS, 35% of adult patients in the PVS had had dementia and almost 50% needed partial or complete help. The course of nontraumatic PVS differs somewhat from that of traumatic PVS. In non-

traumatic PVS, with the exception of hypoxic insults, there is usually no single, particular event that immediately precedes the PVS. Patients with multi-infarct dementia typically have stepwise decrements in their neurologic illness. Those with Alzheimer disease gradually slip into the PVS. In both situations, a patient's condition may deteriorate rapidly because of an intercurrent medical problem, such as pneumonia or dehydration.

**The Persistent Vegetative State Among Children.** Infants and children are susceptible to congenital malformations, including microcephaly, hydrocephalus, and anencephaly, and to birth injuries with or without anoxia.<sup>2</sup> Children's nervous systems also are subject to degenerative conditions, metabolic disorders, and mitochondrial encephalopathies.<sup>2</sup> Of course, they also are susceptible to traumatic and other nontraumatic causes. Although teenagers have a fully developed nervous system and are subject to the same brain injuries as adults, they usually enter the PVS through notoriously tragic circumstances. As a group, teenagers are particularly prone to brain injury from motor vehicle accidents, drug overdoses, and attempted suicide.

Karen Ann Quinlan, one of the first nationally known patients in the PVS, was a young woman who, after an intoxication, lapsed into a coma that evolved into the PVS. For the years when she was in the PVS, her breathing seemed to depend on a respirator. Numerous ethical, legal, and medical opinions were offered to define her status and determine who was entitled to make medical decisions on her behalf. One medical issue, albeit a narrow one, was whether the respirator was obligatory from medical and ethical perspectives. After years of legal proceedings, use of the respirator was discontinued. As could have been predicted with today's knowledge, Quinlan continued to breathe and lived several more years.<sup>4</sup>

Another tragic example was Nancy Cruzan. This young woman remained in the PVS for 8 years after a motor vehicle accident. The United States Supreme Court was asked to designate Cruzan's healthcare proxy, who would be permitted to let her die by removing her feeding tube. These court cases, and other factors, led the neurologic community to establish diagnostic criteria and management guidelines for patients in the PVS.

### Diagnostic Criteria for the Persistent Vegetative State

The American Academy of Neurology defines the *vegetative state* as "a clinical condition of complete unawareness of the self and the environment accom-

panied by sleep-wake cycles with either complete or partial preservation of hypothalamic and brainstem autonomic function." The *persistent* vegetative state (PVS) is persistence of this condition for 1 month.<sup>2</sup> The *permanent* vegetative state is persistence of this condition for 3 months after a nontraumatic injury and 1 year after a traumatic injury. The diagnostic criteria for the PVS are the following:

1. Lack of awareness of self or environment and inability to interact with others. Patients in the PVS have lost cognitive, emotional, and other human qualities. Patients in the PVS, who may be awake, are not conscious (aware) of the environment, able to interact with other persons, perform cognitive processes, or possess feelings or emotions.
2. No sustained, reproducible, purposeful, or voluntary behavioral responses to visual, auditory, tactile, or noxious stimuli. Clinical examinations, underlying neuroanatomic findings, positron emission tomographic (PET) studies,<sup>5</sup> and other tests indicate that patients in the PVS have no sense of pain and do not have the capacity to suffer. That patients in the PVS do not have the perception of pain and do not suffer is a crucial concept in the treatment of patients who have entered the PVS. It also plays a role in legal and ethical considerations.  

In the PVS, the brain injury is so extensive and profound that patients lose their strength and motor skills. In general, patients in the PVS are bedridden, where they tend to assume a decorticate posture with the torso and limbs flexed.<sup>6</sup> Rudimentary reflex functions may persist, such as a withdrawal to noxious stimulation and a facial grimace.

Patients in the PVS characteristically have bowel and bladder incontinence, which is a special problem. Patients can neither perceive distended sphincters nor, even if their sensations were preserved, control their movements. The incontinence necessitates extraordinary nursing care. Patients in the PVS are unlike patients with other neurologic injuries, such as paraplegia, who are able to notify the nursing staff of their needs and sometimes can assist with catheterization and other nursing care. The combination of incontinence and paralysis carries the potential for decubitus ulcers, foul odors, and urosepsis.
3. No language comprehension or expression. Patients in the PVS cannot communicate. They have lost their ability to speak and comprehend

speech, and they cannot communicate by means of facial or hand gestures.

4. Function of basic or vegetative neurologic processes despite widespread neurologic injury. Patients continue to breathe, swallow, glance reflexively at visually attractive objects, and sweat. They usually can breathe without a respirator, but a tracheostomy often is necessary to maintain a patent airway.
5. Sufficient hypothalamic and brainstem autonomic functions to allow survival with medical and nursing care. Patients in the PVS with static neurologic injuries who are given enough medical and nursing support, which might have to be aggressive and invasive, can survive indefinitely. The PVS is not itself a fatal condition.
6. Intermittent wakefulness manifested by the persistence of a sleep-wake cycle. In another manifestation of preserved brainstem function, patients in the PVS also have some semblance of sleep-wake cycles. They may seem to be awake, alert, and attentive.
7. Variably preserved cranial nerve and spinal reflexes. Most patients in the PVS can breathe without a respirator and have preserved cough and corneal reflexes. Some patients even seem to grimace. However, all these pharyngeal and facial movements are brainstem reflexes. Similarly, patients in the PVS withdraw a limb that is given noxious stimulation or have minor repositioning movements. These movements, which are likely to be misinterpreted as a sign that the patient can perceive pain or that voluntary movement is possible, are merely preserved spinal cord reflexes. None of these movements is "human."

#### Conditions That Must Be Differentiated from the Persistent Vegetative State

A distinction must be drawn between *coma* and the PVS. In both conditions patients are unconscious, have no voluntary activity, and are unresponsive. A simple difference is that patients in a coma, unlike those in the PVS, do not open their eyelids. Patients in a coma also do not have normal sleep-wake cycles, breathing, or vegetative functions. They almost always need a respirator and often have impaired brainstem reflexes. The course of coma is different from that of the PVS. Coma begins abruptly, usually after head trauma or a severe metabolic insult. It rarely evolves slowly. The duration of coma is limited—patients either recover, die, or enter the PVS within 3 to 4 weeks.

Patients with *brain death* have neither cerebral nor brainstem function. Most autonomic functions are impaired. Although there is no respiratory drive, which is a brainstem mechanism, the heart continues to beat. Patients with brain death are considered dead for legal and medical purposes, including transplantation.

Patients with the *locked-in syndrome* might be mistaken for those in a coma or the PVS. The locked-in syndrome, which usually results from a lesion in the ventral surface of the lower brainstem, renders patients unable to move, breathe, or speak. These patients are able to comprehend verbal and visual information and are cognizant of their surroundings. They are able to express themselves only by voluntary eyelid closure and eyeball movement. Given appropriate cues, their sleep-wake cycle and autonomic functions are relatively normal. Most important, they have full cognitive capacity and are able to make their own healthcare decisions.<sup>6</sup>

The distinction between *severe dementia* and the PVS is less obvious. Patients with advanced Alzheimer disease, for example, may slip into a PVS. Moreover, some patients seem to vacillate for weeks between dementia and a vegetative state. Thus there is a requirement that the vegetative state be present for 1 month before the diagnosis of PVS can be applied.

### Laboratory Data

The diagnosis of PVS is predominantly clinical in that it is based on the history, previous diagnoses, such as Alzheimer disease, findings at neurologic examination, and duration of the condition. When the PVS results from trauma, strokes, or anoxia, computed tomography (CT) and magnetic resonance imaging (MRI) may show abnormalities that these insults have generated. In PVS resulting from degenerative conditions, such as Alzheimer disease, these studies typically show no definitive abnormality. CT and MRI abnormalities, however, do not allow the clinician to differentiate between PVS, coma, the locked-in syndrome, or severe dementia. On the other hand, in PVS an electroencephalogram (EEG), regardless of the cause, reveals diffusely slow rhythms.<sup>2</sup> This EEG pattern is a definite, although nonspecific abnormality.

PET shows a markedly diminished glucose metabolic rate in the cerebral cortex. Although this study is unavailable outside a few large medical centers, the findings of PET in PVS are distinctly different from findings among controls and in the locked-in syndrome.<sup>3</sup>

### Prognosis Among Patients in a Persistent Vegetative State

*Immediate Prognosis and Quality of Life.* Patients in the PVS depend on mechanical devices for life support. In Kaufman and Lipton's series, approximately 40% of patients in the PVS needed three types of mechanical devices for life support: a respirator; a nasogastric tube, percutaneous endoscopic gastrostomy, or gastrostomy tube; and intravenous lines. About 50% of patients needed two types. Less than 5% of patients needed one, and no patients were independent.<sup>3</sup> Although a patient's nutrition can be "natural" in that it consists of blenderized food, most patients receive "artificial" nutrients, such as Ensure<sup>®</sup>. In either case a mechanical device such as a nasogastric tube is needed.

In addition to needing mechanical devices for life support, patients in the PVS are subject to several serious medical complications of being unresponsive and immobile. In Kaufman and Lipton's series, all patients had incontinence, and most had pneumonia, decubitus ulcers, and urinary tract infections.<sup>3</sup>

*Status One Year After Diagnosis.* The prognosis for patients in the PVS depends on whether the cause is traumatic or nontraumatic and, within each etiologic category, whether the patient is a child or an adult (Table 1). The duration of the PVS also relates to the prognosis.<sup>2</sup> Nevertheless, by any measure, 1 year after the diagnosis of PVS, the chances of regaining a social or occupational role are grim. The prognosis is even more grim if the patient has dementia before the onset of the PVS. Among adults who enter the PVS after a traumatic brain injury, 95% show a moderate to severe neurologic disability, remain in the PVS, or die within 1 year. Almost no adult recovers when the PVS is caused by a nontraumatic insult.

Among children the prognosis might be variable because of the different types of neurologic insults that led to the PVS.<sup>7</sup> For example, children are more likely than adults to survive a single injury or an episode of hypoxia. Although they are less likely to die, children are more likely than adults to remain in the PVS or in a severely disabled condition. Heindl and Laub found that only 4% of children in a PVS from hypoxic brain injury were eventually able to attain independence in everyday life.<sup>7</sup>

*Survival.* Survival through the first year of the PVS is likely for most patients, depending on age group, original neurologic insult, and the measures used by physicians and the patients' families. Overall, life expectancy is markedly shortened by the PVS. It ranges from 2 to 5 years for adults and 6 to 9 years for 7- to 18-year-old children.<sup>2</sup> The chance for surviving longer than 15 years is less than 1 in 10,000.<sup>2,8</sup>

### Responsibilities of Primary Care Physicians

*Anticipate That Some Patients Will Enter the Persistent Vegetative State.* Before the onset of any illness, perhaps as part of a medical check-up, primary care and other physicians should assure that patients have a designated healthcare proxy, composed a living will or signed a standard version, or completed another advanced directive regarding their healthcare in the event that they are unable to make the required decisions. The development of the PVS is possibly the paramount reason why every adult should complete an advanced directive. This dictum is particularly important for elderly patients and those with the onset of Alzheimer disease.

*What to Do When a Patient Seems to Have Entered the Persistent Vegetative State.* After 1 month of continued (persistent) loss of consciousness after head trauma or with progression of nontraumatic neurologic illnesses, such as Alzheimer disease or multiple strokes (multi-infarct dementia), the diagnosis of PVS should be considered by the primary physician. The condition can be considered permanent after 3 months for nontraumatic brain injury and after 1 year for head trauma. The actual diagnosis should be made in conjunction with a neurologist. In certain instances, in addition to soliciting a consultation from a colleague neurologist, obtaining a consultation with a neurologist from an unrelated institution might be advisable. The physicians should address the prognosis for death, permanent PVS, and recovery, although it would be recovery with persistent, extensive, residual neurologic disabilities.

Once the diagnosis and prognosis of PVS have been established, they can be shared with the patient's family. The patient's family must be made aware of the likely outcomes established in the medical literature for patients in the PVS.

One potential problem throughout the course of the illness is that family members and casual observers might overestimate the neurologic function of a patient in the PVS. That the patient is awake does not mean he or she is conscious. In particular, withdrawal of limbs or a facial grimace is a reflex and does not mean at the patient perceives pain or is suffering. While being supportive and compassionate, the physicians must be realistic. Being in the PVS is not living in "a state of suspended animation" or as a "sleeping beauty." The facts, however grim, must be understood.

The diagnosis and prognosis must be made clear to colleagues, medical staff, and others who are entitled to know. Similarly, the medical staff caring for the patient might enlist help from psychiatrists, social workers, and hospital administrators. Individually and

together these healthcare workers might ease the burden on the family, provide individualized services, and help with administrative and legal policies.

*Establishment of Medical Guidelines.* The provisions of a patient's living will usually are implemented. When there are no specific guidelines, one hopes that a health proxy is identifiable. (For the purposes of this article, we assume that a proxy is identifiable and is a family member and that there is agreement among family members.) The decisions of the proxy may have to be postponed until the need arises, but at some time, the medical staff must establish clear-cut, individualized guidelines for the care of patients in the PVS. Decisions that can be anticipated include the desirability of administering antibiotics and other medications, oxygen, and blood transfusions. The proxy, with the guidance of the physicians, must confront the desirability of invasive procedures and the

**Table 1.** Status of Patients in the Persistent Vegetative State One Year After Diagnosis

Adults	Percentage of Patients*
Traumatic	
Death	35
Continued PVS	15
Moderate to severe disability	45
Good recovery <sup>†</sup>	5
Nontraumatic	
Death	55
Continued PVS	30
Moderate to severe disability	15
Good recovery	0 <sup>‡</sup>
Children	Percentage of Patients*
Traumatic	
Death	10
Continued PVS	30
Moderate to severe disability	50
Good recovery	10
Nontraumatic	
Death	20
Continued PVS	65
Moderate to severe disability	5
Good recovery	5

PVS = persistent vegetative state.

\*Rounded to nearest 5%. Thus some sets do not add to 100%.

<sup>†</sup>Possible persistent physical or neurologic deficits but ability to resume some social or occupational roles

<sup>‡</sup>Actually 1%

Adapted from reference 2

use of mechanical devices for breathing assistance (ventilators, tracheostomy, insertion of an endotracheal tube), nutrition (gastrostomy or intravenous lines), and urinary and fecal drainage (catheters). Similarly, the proxy must indicate the desirability of performing cardiopulmonary resuscitation.

The physicians and the proxy explore the limits of treatment during an initial meeting, and they should reevaluate the situation every 3 months. Perceptions and expectations of family members change. Certain treatments may be reconsidered. As the situation becomes permanent, the physicians and family are more likely to accept the situation as futile and agree that cardiopulmonary resuscitation is not indicated.

Physicians should discourage the proxy and family members from interventions that are fruitless, such as "sensory stimulation." Unproved techniques, which abound, often are time consuming, expensive, and possibly deleterious. On the other hand, some physicians can be callous about the prognosis for patients in the PVS. In one survey of neurologists, almost 90% of respondents believed that ethical behavior would include withdrawal of artificial hydration and nutrition from patients in the PVS; about 66% believed it would include transplanting vital organs from them; and 20% believed it would include hastening death by means of lethal injection.<sup>9</sup>

### Physicians' Goals

Oftentimes, medical ethics, hospital regulations, laws, and religious practices coincide. Sometimes, however, physicians find themselves in uncharted territory, as when there is discord among the many forces that might dictate the care of a patient in the PVS. The desires of the patient's proxy might not coincide with the wishes of the family. Medical ethics, legal regulations, hospital administrative policies, and religious beliefs each may provide different guidelines or requirements.

Despite complex, potentially conflicting expectations, the medical care of patients in a PVS is straightforward. It entails supportive measures, intervention (if desired) for intercurrent illnesses, and routine nursing care. Restorative services, such as rehabilitation, speech therapy, and occupational therapy, are not warranted, except for the rare patient who seems to have

begun a recovery from a traumatic injury. Medical care can be administered in a skilled nursing facility, nursing home, or, with extensive support and assistance, in the patient's home. Treatment in acute care facilities is not warranted.

As a rule, physicians might simplify the patient's care through several strategies. Attempts should be made to reduce the number and complexity of mechanical devices and invasive lines. For example, nutrition can be provided through a percutaneous endoscopic gastrostomy rather than attempts to feed a patient and risk aspiration. If a ventilator is in place, periodic attempts can be made to discontinue ventilation, because it is usually unnecessary, is cumbersome, and is likely to interfere with medical and nursing care. However, urinary catheters should remain in place to prevent renal obstruction and to avoid incontinence and the associated decubitus ulcers and foul odors. Seemingly mundane medical conditions such as bedsores, aspiration pneumonia, and contractures are serious and life threatening.

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**CME QUESTIONS: TEST #039712**

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**Instructions**

After reading the article, "Recognition and Treatment of Patients in the Persistent Vegetative State," select the best answer to each of the following questions. In order to receive 1 CME credit, at least 7 of the 10 answers must be correct. Estimated time for this activity is 1 hour. CME credits are distributed on a yearly basis.

**1. A patient in the persistent vegetative state is least likely to have which one of the following?**

- a) recognizable sleep-wake cycles
- b) preserved oculocephalic and pupillary reflexes
- c) electrocerebral silence on an EEG
- d) bilateral Babinski signs
- e) respirations sufficient for survival

**2. Which patient is the least likely to be alive 1 year after the diagnosis of the persistent vegetative state?**

- a) a 65-year-old man with severe head injury from a motor vehicle accident
- b) a 55-year-old woman with Alzheimer's disease
- c) a 5-year-old child with head injury from child abuse

**3. A 27-year-old woman survived a motor vehicle accident in which she sustained serious closed head trauma. She was in a coma for 4 weeks and then gradually entered a PVS. After 1 month she continues to receive intravenous nutrition, is given artificial ventilation through an endotracheal tube, and has a urinary catheter in place. Testing shows that she has weakness of her nasopharyngeal muscles but that her respiratory drive and associated muscles are normal. Assuming the healthcare proxy agrees to invasive procedures, which of the following plans would be the best management strategy?**

- a) Perform a tracheostomy and install a gastrostomy tube for nutrition. Discontinue use of the intravenous

- lines and probably the ventilator.
- b) Maintain the current management protocol because she probably could not tolerate reduction in mechanical life support.
- c) Switch to intravenous hyperalimentation, but leave other lines in place.
- d) Over 1 month, discontinue use of the endotracheal tube, intravenous lines, and urinary catheter.

**4. A 35-year-old woman survived severe head trauma from a motor vehicle accident 2 months before the evaluation. She had been in a coma for 3 weeks before she seemed to awaken. She is unresponsive, virtually mute, and immobile. She remains in a fetal position. One family member, who has been talking to the patient every day, asks for a reevaluation because of several of the patient's actions: she began to move her hand when it was pinched, she moans, and her eyes seem to fix momentarily on visitors. What do these actions indicate?**

- a) They show that she is no longer in a vegetative state
- b) They are merely reflex movements that do not alter the diagnosis or prognosis.
- c) Given the lack of cerebral cortical function, the reevaluation indicates that she has entered the permanent vegetative state.
- d) The daily personal contact has improved the patient's condition.

**5. In describing the situation of patients in the persistent vegetative state, which of the following complications are present?**

- a) always incontinence and usually pneumonia, decubitus ulcers, and urinary tract infections
- b) need for artificial ventilation
- c) perception of pain on the spinal cord level
- d) capacity to suffer

**6. A 70-year-old woman lingers in the persistent vegetative state from Alzheimer's disease. Two of her three children have always disagreed with her healthcare directive ("living will") that instructed her caregivers to provide her with nutrition and analgesics, but not antibiotics, blood transfusions, or surgery. When she developed an intestinal obstruction that requires surgery, the conflict caused the nursing home to consult with its lawyers. What is the most likely outcome?**

- a) The caregivers would be advised to comply with the living will and not perform surgery or administer antibiotics despite the probability that the decision would be fatal.

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<p><b>CME TEST FORM</b> AJMC Test #039712</p> <p>Recognition and Treatment of Patients in the Persistent Vegetative State</p> <p><i>Application for 1 Credit Hour of AMA Category I</i></p> <p>(Test valid through December 15, 1998. No credit will be given after this date.)</p>	<p>Please circle your answers:</p> <p>1. a b c d e</p> <p>2. a b c</p> <p>3. a b c d</p> <p>4. a b c d</p> <p>5. a b c d</p> <p>6. a b c d</p> <p>7. a b c d</p> <p>8. a b c d</p> <p>9. a b c d</p> <p>10. a b c d</p>	<p>(PLEASE PRINT CLEARLY)</p> <p>Name _____</p> <p>Address _____</p> <p>City _____</p> <p>State/Zip _____</p> <p>Phone # _____</p>
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- b) Because the patient's life is paramount, surgery should be undertaken.
- c) Because at least one family member insisted on a life-saving measure, her caregivers are obligated to perform the surgery.
- d) As always, the physicians would have to go to court for a judge to decide.

**7. Another 70-year-old woman lingers in the persistent vegetative state from Alzheimer's disease. Likewise, two of her three children have always disagreed about her health-care. She too develops an intestinal obstruction that requires surgery. In her case, she had not composed a living will nor designated a healthcare proxy. What should her caregivers do?**

- a) Refuse to perform the surgery because it is in the patient's best interest.
- b) Perform the surgery because it is in the patient's best interest.
- c) Abide by a vote of the children.
- d) Seek ethical and legal counsel.

**8. Another 70-year-old woman lingers in the persistent vegetative state from Alzheimer's disease. She has a living will, a designated healthcare proxy, and three children. Her living will indicates that she should be fed and that minimally invasive surgical procedures are desirable. Her healthcare proxy and children agreed with this provision. What is the best way to provide long-term nutrition to patients in the persistent vegetative state?**

- a) Attempt normal oral feedings.
- b) Insert a nasogastric tube (NGT).
- c) Perform a percutaneous endoscopic gastrostomy (PEG)
- d) Use balanced intravenous alimentation.

**9. In cases of Alzheimer's disease, which is the least reliable test to confirm the presence of the persistent vegetative state?**

- a) computed tomography
- b) positron emission tomography
- c) electroencephalogram
- d) a second neurologic examination

**10. A 35-year-old man has been in a persistent vegetative state for 2 years after sustaining major head injury in a motor vehicle accident. His eyes rove in a conjugate manner and seem to momentarily fix on visitors. His pupils are round, equal, and reactive. His family requests a reevaluation. A consultant confirms the diagnosis of the persistent vegetative state. Which is the best explanation of the ocular movements?**

- a) The ocular movements are governed by the brainstem and are spontaneous.
- b) He has cortical blindness
- c) Dementia prevents the patient from correlating visual and cognitive activity.
- d) The ocular movements are determined by the cerebral cortex.