SPECIAL ARTICLE

MEDICAL ASPECTS OF THE PERSISTENT VEGETATIVE STATE

(Second of Two Parts)

THE MULTI-SOCIETY TASK FORCE ON PVS*

PROGNOSIS FOR RECOVERY

There are two dimensions of recovery from a persistent vegetative state: recovery of consciousness and recovery of function. Recovery of consciousness can be verified by reliable evidence of awareness of self and the environment, consistent voluntary behavioral responses to visual and auditory stimuli, and interaction with others. Recovery of function is characterized by communication, the ability to learn and to perform adaptive tasks, mobility, self-care, and participation in recreational or vocational activities. Recovery of consciousness may occur without functional recovery, but functional recovery cannot occur without recovery of consciousness. In some instances, during the early stages of recovery of consciousness, external manifestations may not be immediately apparent. Repeated examinations over time are necessary to ensure the consistency and accuracy of signs of recovery.

The prognosis for cognitive and functional recovery depends on the cause of the underlying brain disease. The Glasgow Outcome Scale classifies outcome in five categories: good recovery, moderate disability, severe disability, persistent vegetative state, and death.[108] Patients with a good recovery have the capacity to resume normal occupational and social activities, although there may be minor physical or mental deficits or symptoms. Patients with moderate disability are independent and can resume almost all activities of daily living. They are disabled to the extent that they can no longer participate in a variety of social and work activities. Patients with severe disability are no longer capable of engaging in most previous personal, social, and work activities. Such patients have limited communication skills and abnormal behavioral and emotional responses. They are partially or totally dependent on assistance from others in performing the activities of daily living.

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This statement has been approved by the American Academy of Neurology, Child Neurology Society, American Neurological Association, American Association of Neurological Surgeons, and American Academy of Pediatrics. The literature search, correspondence, and other documents generated by the task force are available through the American Academy of Neurology in Minneapolis.

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Acute Traumatic and Nontraumatic Injuries

Recovery of consciousness after 12 months is unlikely in adults and children who have had traumatic injuries. Recovery of consciousness after three months is rare in adults and children with nontraumatic injuries (Fig. 1 and Tables 3 and 4).

Traumatic Injuries in Adults

For patients in a vegetative state as a result of traumatic brain injury, the prognosis for recovery remains unfavorable. Recovery of consciousness and function was determined by reviewing data from previously described series of patients rather than individual case reports. Data were available on 434 patients in a vegetative state one month after a severe head injury (Fig. 1 and Table 3)[47,49,50,106,109,110] (and Tillet JA: personal communication). Recovery of consciousness varied with time. Three months after injury, 33 percent of the patients had recovered consciousness; 67 percent had died or remained in a vegetative state. Recovery had occurred in 46 percent of the patients at 6 months and in 52 percent at 12 months. Recovery after 12 months was reported in only 7 of the 434 patients.[47,49] One patient recovered consciousness 30 months after injury and remained severely disabled.[47,111] The Traumatic Coma Data Bank study reported that 6 of 93 adult patients in a vegetative state recovered consciousness one to three years after injury.[49] Four of these six patients had severe disability, and one had moderate disability; the status of the sixth patient could not be determined. Five of the six patients were under 30 years of age. There have been no other well-documented reports of recovery of consciousness in patients in a persistent vegetative state more than 12 months after a traumatic injury.

Good recovery of function is also unlikely. Among the 434 patients in a vegetative state, the outcome at one year, according to the Glasgow Outcome Scale, was as follows: 33 percent had died, 15 percent were in a persistent vegetative state, 28 percent had severe disability, 17 percent had moderate disability, and 7 percent had a good recovery. Of the 7 percent of patients who had a good recovery, over half showed signs of improvement within three months after injury, and almost all within six months after injury. For the entire group of 434 patients, the incidence of a good recovery beginning 6 to 12 months after injury was less than 0.5 percent. No patient had a good recovery that began after 12 months. Among patients

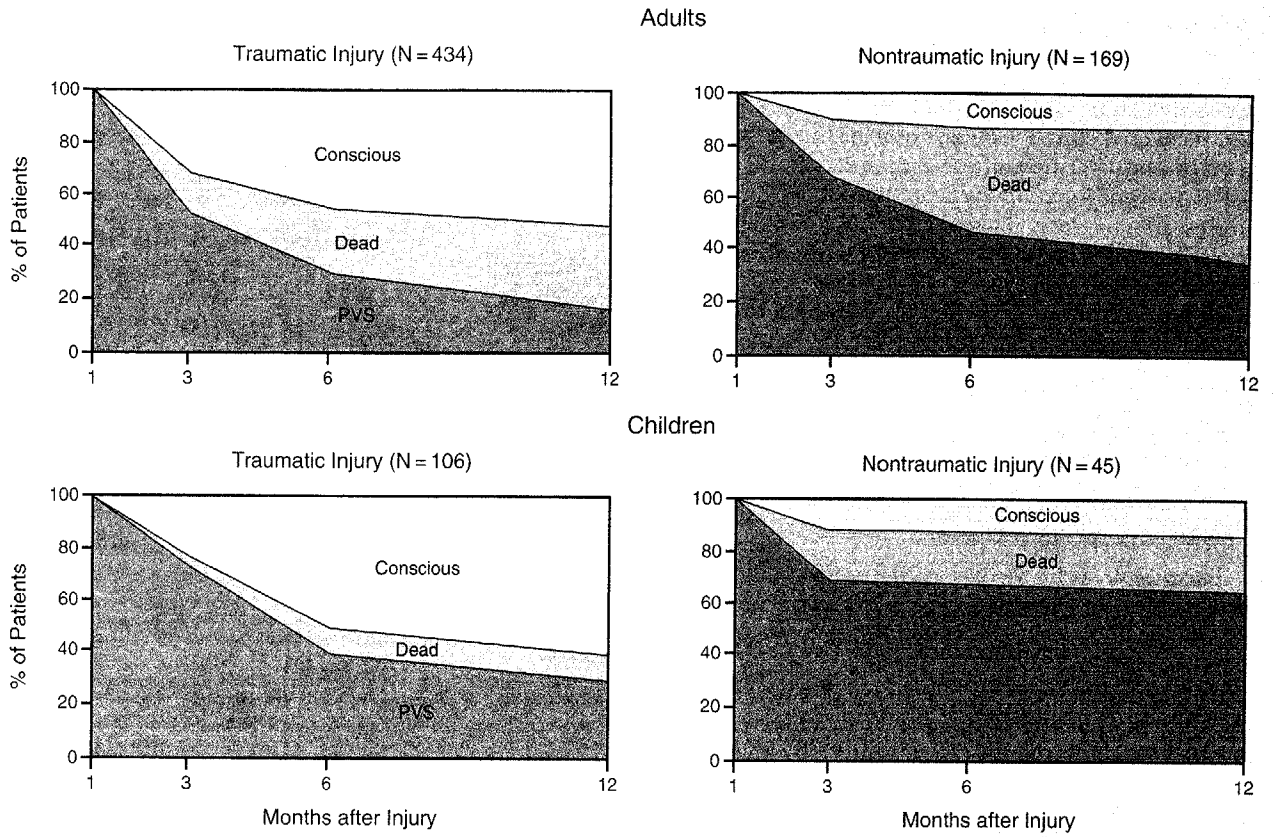

Figure 1. Outcome for Patients in a Persistent Vegetative State (PVS) after a Traumatic or Nontraumatic Injury.
Fifty-two percent of adults and 62 percent of children who are in a PVS one month after a traumatic injury recover consciousness within one year. The majority recover within the first six months; recovery after six months is unusual. In contrast, for patients in a PVS one month after a nontraumatic injury, recovery of consciousness is much less frequent (15 percent of adults and 13 percent of children) and is extremely unlikely after three months. Approximately 5 percent of patients in a PVS 1 month after injury were lost to follow-up at 12 months.

who recovered with moderate or severe disability, almost all showed signs of improvement within six months after injury. A later recovery was almost invariably associated with severe disability.

Age is an important factor affecting outcome. Among patients who have had traumatic injuries, those over the age of 40 years have a smaller chance of improvement than those who are younger; recovery without severe disability is rare, especially after three months.[47] Ventilatory dysfunction, lack of early motor reactivity, late-onset epilepsy, or the development of hydrocephalus may also indicate a poorer prognosis for recovery of awareness.[55,112]

Nontraumatic Injuries in Adults

Adults in a coma immediately after a nontraumatic injury have a poorer prognosis than those in a coma after a traumatic injury, with 85 percent or more dying within the first month after the insult or remaining in a vegetative state.[52,56] Later recovery of consciousness and function was determined by reviewing data from previously described series consisting of 169 patients who were in a vegetative state one month after a nontraumatic injury (Fig. 1 and Table 3).[37,42,43,51] Recovery of consciousness after a nontraumatic injury is unlikely. Of the 169 patients with such injuries, only 11 percent had recovered consciousness three months after injury; 89 percent remained in a vegetative state or had died (Fig. 1 and Table 3). Six months after injury, only two additional patients had recovered consciousness. One year after injury, 15 percent of the 169 patients had recovered consciousness, 32 percent were in a persistent vegetative state, and 53 percent had died.

Recovery of function in the 15 percent of patients who regained consciousness was extremely poor. Only one patient had a good recovery. Two additional reports of individual patients with good functional recovery after nontraumatic injury have been published. In both patients, improvement began within two months after a hypoxic injury.[78,113] There have been reports of five other patients who began to recover from a vegetative state more than six months after a nontraumatic injury. Two had moderate disability, and three had severe disability (Table 5).

Traumatic Injuries in Children

Recovery of consciousness and function in children after a traumatic injury was determined by reviewing data on 106 patients in previously reported series (Fig. 1 and Table 3)[49,110,117-119] (and Tillet JA: personal communication). The prognosis for recovery of consciousness after a traumatic injury is slightly better in children than in adults (Fig. 1). Of the 106 children in a

vegetative state one month after a severe head injury, 24 percent had regained consciousness within three months. At one year, only 29 percent remained in a vegetative state, 9 percent had died, and 62 percent had recovered consciousness. None of the children recovered consciousness after 12 months.

Recovery of function was comparable to that in the adults. At one year, 35 percent of the children had severe disability, 16 percent had moderate disability, and 11 percent had made a good recovery. As in adults, if recovery of consciousness from the posttraumatic vegetative state began before six months, a higher functional grade of recovery was likely.[118] However, some children had a good recovery at six months or had only moderate disability at one year, whereas in adults recovery after six months was usually associated with severe disability.

Nontraumatic Injuries in Children

The prognosis for recovery after nontraumatic injuries in children appears to be similar to the prognosis for adults. However, the available data are limited, since previously described series total only 45 patients (Fig. 1 and Table 3).[44,66,86] Recovery of consciousness in children, as in adults, was primarily observed within the first three months after injury. By that time, 11 percent of the patients had regained consciousness; by one year, only an additional 2 percent had recovered consciousness. At one year, the majority of the children remained in a vegetative state (65 percent) or had died (22 percent). Apparent recovery of consciousness after one year has been reported in several children in a vegetative state after a hypoxic–ischemic injury.[119] However, these children recovered a level of function described as socially responsive, meaning that they smiled in response to the presence of other people but without other evidence of awareness. The prognosis for recovery from a vegetative state in young infants with birth injuries and perinatal asphyxia is more variable than in older infants and children.[3,4,58,66]

The prognosis for recovery of function in children with a nontraumatic injury is somewhat better than that for adults. Of the 13 percent of children who recovered consciousness, 6 percent had a good recovery, and the other 7 percent had severe disability; there were no reports of moderate disability.

Table 3. Incidence of Recovery of Consciousness and Function in Adults and Children in a Persistent Vegetative State (PVS) after Traumatic or Nontraumatic Brain Injury.*

Outcome and Functional Recovery†	3 Months	6 Months	12 Months
		% of patients	
Adults			
Traumatic injury (n = 434)			
Death	15	24	33
PVS	52	30	15
Recovery of consciousness	33	46	52
Severe disability			28
Moderate disability			17
Good recovery			7
Nontraumatic injury (n = 169)			
Death	24	40	53
PVS	65	45	32
Recovery of consciousness	11	15	15
Severe disability			11
Moderate disability			3
Good recovery			1
Children			
Traumatic injury (n = 106)			
Death	4	9	9
PVS	72	40	29
Recovery of consciousness	24	51	62
Severe disability			35
Moderate disability			16
Good recovery			11
Nontraumatic injury (n = 45)			
Death	20	22	22
PVS	69	67	65
Recovery of consciousness	11	11	13
Severe disability			7
Moderate disability			0
Good recovery			6

*Data were collected from series of patients in a PVS one month after injury and do not include individual case reports. Some patients who recovered consciousness died within 12 months after injury or were lost to follow-up. The data for nontraumatic injuries reflect all causes, not just postanoxic injury; for this category alone, the prognosis is poorer than that suggested by the data.

†Data on functional recovery are for patients who had recovered consciousness within 12 months after injury.

Table 4. Probability of Recovery of Consciousness and Function at 12 Months in Adults and Children in a Persistent Vegetative State (PVS) Three or Six Months after Traumatic or Nontraumatic Injury.*

Outcome	Adults		Children	
	Traumatic injury (N = 434)	Nontraumatic injury (N = 169)	Traumatic injury (N = 106)	Nontraumatic injury (N = 45)
	% of patients (99% confidence interval)			
Patients in PVS for 3 months†				
Death	35 (27–43)	46 (31–61)	14 (1–27)	3 (0–11)
PVS	30 (22–38)	47 (32–62)	30 (13–47)	94 (83–100)
Severe disability	19 (12–26)	6 (0–13)	24 (8–40)	3 (0–11)
Moderate disability or good recovery	16 (10–22)	1 (0–4)	32 (15–49)	0
Patients in PVS for 6 months‡				
Death	32 (21–43)	28 (12–44)	14 (0–31)	0
PVS	52 (40–64)	72 (56–88)	54 (30–78)	97 (89–100)
Severe disability	12 (4–20)	0	21 (1–41)	3 (0–11)
Moderate disability or good recovery	4 (0–9)	0	11 (0–26)	0

*Conditional probabilities were determined from data in Table 3. The numbers of patients given in parentheses refer to the numbers of patients who were in a vegetative state one month after injury.

†A total of 218 adults with traumatic injuries, 77 adults with nontraumatic injuries, 50 children with traumatic injuries, and 31 children with nontraumatic injuries.

‡A total of 123 adults with traumatic injuries, 50 adults with nontraumatic injuries, 28 children with traumatic injuries, and 30 children with nontraumatic injuries.

Degenerative and Metabolic Diseases

Patients in a vegetative state due to degenerative or metabolic diseases have no possibility of recovery. Some patients may temporarily lapse into a vegetative state when systemic illness causes a reversible depression of neurologic function. This possibility must be considered before determining that a patient's vegetative state is irreversible.

Developmental Malformations

Infants and children with brain malformations severe enough to cause a developmental vegetative state are unlikely to become conscious; those who do are in

Table 5. Verified Reports of Five Patients with a Late Recovery from a Persistent Vegetative State (PVS).*

Report	Age (yr)/Sex of Patient	Cause of PVS	Duration of PVS (mo)	Outcome
Arts et al.[111]	18/F	Trauma	30	Severe disability
Rosenberg et al.[115]	43/M	Anoxia	17	Severe disability
Higashi et al.[42]	61/F	Subarachnoid hemorrhage	36	Moderate disability
	26/M	Anoxia	8	Moderate disability
Snyder et al.[116]	36/M	Anoxia	22	Severe disability

*These are published cases in which sufficient information was available to conclude that late recovery of awareness occurred. Late recovery from a PVS was defined as recovery of consciousness more than 12 months after a traumatic injury or more than 3 months after a nontraumatic injury. The exact duration of the vegetative state in the patients reported by Higashi et al. is uncertain. An additional patient reported by Tanhehco and Kaplan[114] was said to be in a PVS for six years; the clinical data were insufficient to include in this table.

most cases severely disabled. Anencephaly is the only malformation for which it is clear at birth that there is no possibility of recovery of consciousness. The complete absence of the cerebral cortex in anencephalic infants precludes consciousness.[20]

Other malformations diagnosed at birth may result in a vegetative state. If the patient remains in a vegetative state at three months of age, the prognosis for any improvement is quite poor.[10,66] Lack of evidence of consciousness in such infants by the age of six months almost completely precludes the potential for future improvement.

Verified and Unverified Late Recovery

Few patients in a persistent vegetative state have undergone a verified recovery of consciousness more than 12 months after a traumatic injury or more than 3 months after a nontraumatic injury (Table 5). One patient recovered 30 months after a traumatic brain injury; four patients recovered 8 to 22 months after a hypoxic–ischemic or cerebrovascular injury. An additional six patients, described in the study by the Traumatic Coma Data Bank, were reported to have recovered consciousness beginning one to three years after injury. Further investigation of these six patients suggests that only half recovered awareness after one year; one was moderately disabled, and the others had severe disabilities.[49] Two recent studies in adults and children have also reported that a few patients with traumatic and nontraumatic injuries recovered consciousness after the expected intervals.[119,120] The task force knows of no other cases of verified late recovery.

Several reports in the popular media have described dramatic recovery from a persistent vegetative state. In most reports, recovery of consciousness and function occurred within the time frames noted above.[121] Unusual cases in the medical literature or popular media are poorly documented, the nature of the patients' neurologic condition is unclear, or the timing of the entry into the vegetative state is extremely atypical.[114,122] A tabular summary of these cases is available from the task force. Several of these reports have been investigated by members of the task force, and it appears likely that, although the patients were not directly examined, a late recovery of consciousness did occur. The total number of such patients is extremely small, however, considering the estimated prevalence of the persistent vegetative state, and all were apparently left with severe disability.

Probability of Recovery

On the basis of the data in the series noted above, we have estimated the probability of recovery of consciousness in adults and children who were in a vegetative state one month after an acute traumatic or nontraumatic injury (Table 4). The outcome probability at 12 months was determined in patients who remained in a vegetative state at 3 months and at 6 months. In addition, the probability of functional recovery was determined for two possible outcomes: good recovery or recovery with moderate disability, and recovery with severe disability. On the basis of these probabilities, a persistent vegetative state can be judged to be permanent 12 months after a traumatic injury in adults and children; recovery after this time is exceedingly rare and almost always involves a severe disability. In adults and children with nontraumatic injuries, a persistent vegetative state can be considered to be permanent after three months; recovery does occur, but it is rare and at best associated with moderate or severe disability.

Survival

Despite the preservation of hypothalamic and brain-stem function, the severe neurologic injury necessary to produce the vegetative state in adults and children reduces the average life expectancy to approximately two to five years. Survival beyond 10 years is unusual. As shown in Figure 1 and Table 3, within one year after a traumatic injury, 33 percent of adults in a vegetative state had died, and 53 percent of those in a vegetative state after a nontraumatic injury had died. Among children with traumatic and nontraumatic injuries, 9 and 22 percent, respectively, had died within one year.

Overall, the available data (based on 251 patients in four large series) indicate that the mortality rate for adults in a persistent vegetative state after an acute brain injury is 82 percent at three years and 95 percent at five years[33,42,51,112] (tabular data are available from the task force). In a study of 110 patients, the mortality rate increased from 65 to 73 percent between 3 and 5 years, and 90 percent of the patients had died within 10 years; the average life expectancy of the 71 patients who died was 38.4 months.[42] Another study of 53 patients in a persistent vegetative state six months after an acute injury reported a mortality rate of 47 percent at three years, 76 percent at six years, and 78 percent at eight years.[33] The mean duration of survival was 4.4 years; five patients survived longer than 10 years.

Other investigators studying somewhat different populations of patients in a persistent vegetative state have reported similar estimates of survival. For example, in a study by Tresch and colleagues, the mean (±SD) survival of 51 patients in a persistent vegetative state in nursing homes was 3.3±0.5 years.[39] Among adults with degenerative diseases who enter a

vegetative state, survival ranges from 3.5 to 7 years.[57] In all these, a few patients lived for periods as long as 10 to 16 years.

Estimates of the survival of infants and children in a persistent vegetative state, based on the clinical experience of pediatric neurologists, were published recently.[10] These estimates range from 4.1±0.7 years, for infants up to 2 months of age, to 7.4±1.8 years, for children 7 to 18 years old. A large population-based study examining 847 children and adults considered to be in a persistent vegetative state reported approximately the same duration of survival among older children but a much shorter survival among children under the age of one year.[40] Rare cases of survival as long as 10 to 20 years were also noted in the survey of pediatric neurologists.[10]

A very small number of well-described patients in a persistent vegetative state have survived for more than 15 years (data available from the task force), including three patients who survived for more than 17, 37, and 41 years.[29,123,124] Considering the small total number of patients in a persistent vegetative state, the probability that an individual patient will have such a prolonged survival (i.e., over 15 years) is exceedingly low, probably less than 1 in 15,000 to 75,000 (calculations available from the task force).

The shortened life expectancy of patients in a persistent vegetative state is due to several factors. Reported causes of death (based on data from 143 patients) include infection, usually of the pulmonary or urinary tract (in 52 percent of patients); generalized systemic failure (in 30 percent); sudden death of unknown cause (in 9 percent); respiratory failure (in 6 percent); and other disease-related causes, such as recurrent strokes or tumors (in 3 percent).[23,37,112] Age is also an important factor; both young infants and children and the elderly have a shorter life expectancy than do young or middle-aged adults. Whether this is related to the cause of the vegetative state or to the risks of subsequent medical complications is unknown. In addition, there have been no formal studies of the effect of the level of care on the life expectancy of patients in a persistent vegetative state.

The costs of caring for patients in a persistent vegetative state are difficult to estimate. The cost of hospital care for the first three months is estimated to be $149,200.[125] The estimated cost of long-term care in a skilled nursing facility ranges from approximately $350 per day ($126,000 per year) to approximately $500 per day ($180,000 per year).[124] For children in a persistent vegetative state, the estimated annual cost of care at home is $129,000 (±$51,000) for the first year and $97,000 for subsequent years.[126] A rough approximation of the total annual costs in the United States for the care of adults and children in a persistent vegetative state is $1 billion to $7 billion.

Pain and Suffering

The question has been raised whether patients in a persistent vegetative state can experience pain and suffering. These terms refer to the unpleasant experiences that occur in response to stimulation of peripheral nociceptive receptors and their peripheral and central afferent pathways or that may emanate endogenously from the depths of human self-perception.[127]

The term "nociceptive" refers only to the response to noxious stimuli, not to the experience of pain. Nociceptive responses, which can be elicited at every level of the nervous system, from the spinal cord to the thalamus, are behavioral responses governed by functional motor systems. Such responses consist of flexor spasms at the spinal level, flaccid lower extremities and extended upper extremities at the lower level of the brain stem, extensor spasms of all extremities at the upper level of the brain stem, and flexor responses in the upper extremities and extensor responses in the lower extremities at the thalamic level. None of these responses necessarily reflect the perception of pain. Nociceptive stimulation elicits well-known, unconscious postural responses, as well as other motor, autonomic, and endocrinologic reflexive responses. None of these, however, can evoke the experience of pain and suffering if the brain has lost its capacity for self-awareness. The perceptions of pain and suffering are conscious experiences: unconsciousness, by definition, precludes these experiences.

Four levels of neurologic responses to nociceptive stimuli, from unconscious responses to the experience of pain and suffering, can be recognized on the basis of current anatomical knowledge. First, monosynaptic reflex responses occur at the level of the spinal cord through synapses connecting incoming nociceptive impulses with motor responses programmed at that level. Second, simple nociception occurs at the level of the thalamus with the reception of nociceptive impulses. Third, subcortical nociceptive responses produce patterned behaviors, such as grimace-like or crying-like behavior similar to that accompanying conscious emotional responses. These responses, commonly seen in patients in a persistent vegetative state, are probably mediated at subcortical levels through synaptic connections between the thalamus and limbic system. Finally, conscious awareness of pain or the experience of suffering occurs at a cortical level through synapses connecting parietal cortical neurons with other areas of the cerebral cortex. Conscious (i.e., learned) responses to pain differ measurably from the reflexive decorticate or decerebrate postural responses that usually characterize a persistent vegetative state.

As noted in the first part of this article, extensive clinical experience, the results of positron-emission tomographic (PET) studies, and neuropathologic examination support the belief that patients in a persistent vegetative state are unaware and insensate and therefore lack the cerebral cortical capacity to be conscious of pain. Almost all such patients have some degree of motor activity and eye movement that would be capable of signaling conscious perception of pain or suffering if such existed. In rare cases, it may be difficult to distinguish a persistent vegetative state from a severe locked-in state. Under such unusual cir-

cumstances, a patient may not be able to express behavioral responses to painful stimuli or the responses may be extremely difficult to detect; the absence of a response cannot be taken as proof of the absence of consciousness.[21,128]

Because the pain response is functional at all levels up to the cerebrum, but not necessarily the cortex, at birth, children of all ages are capable of responding to noxious stimuli.[129,130] Newborns may have the potential to experience pain and suffering. Infants over several months of age are consciously aware and capable of suffering. Children in a vegetative state may react to noxious stimuli, but for the same reason as in adults, they cannot experience pain or suffering. Such children may have involuntary responses to noxious stimuli, including alerting behavior, grunting, or grimace-like or crying-like behavior. The elicitation of these responses is unlikely to be evidence of conscious awareness of pain or suffering unless they are consistent, sustained, and definitive in nature.

Treatment

Therapy aimed at reversing the persistent vegetative state has not been successful.[131,132] There have been occasional reports of a benefit from dopamine agonists or dextroamphetamine, but the benefit has been modest at best, and there have been no placebo-controlled or double-blind studies.[133] Direct electrical stimulation of the mesencephalic reticular formation, nonspecific thalamic nuclei, or dorsal columns has been attempted experimentally in patients in a vegetative state, with claims of recovered consciousness in a few instances.[134-136] The quality of the recovered state was not described in detail, however, and these approaches remain experimental. Reports of improvement with coma stimulation programs have been published, but there are no verified controlled studies reported in peer-reviewed journals.[132,137-142] Overall, there is no published evidence that coma sensory stimulation improves the clinical outcome in patients in a persistent vegetative state.

Determining the Level of Treatment

When the diagnosis of a persistent vegetative state has been properly established, physicians have the responsibility of discussing with the family or surrogate decision makers the probability that the patient will recover or remain in a vegetative state. Physicians should also work closely with the family to determine the appropriate level of medical treatment. There are four levels of treatment: high-technology "rescue" treatments, such as mechanical ventilation, dialysis, and cardiopulmonary resuscitation; medications and other commonly ordered treatments, including antibiotics and supplemental oxygen; hydration and nutrition; and nursing or home care to maintain personal dignity and hygiene.[143]

When there is agreement on the appropriate level of treatment, the physicians should provide nurses, family members, or others caring for the patient with explicit written instructions about which treatments can be administered and which should be withheld. At all times, the patient's dignity and hygiene must be maintained.

If the decision is to treat the patient aggressively, diligent medical treatment and nursing care are required to prevent and treat the complications that are likely or inevitable in states of severe brain damage.[131] The survival of patients in a persistent vegetative state is, to some degree, related to the quality and intensity of the medical treatment and nursing care that they receive.

Preventive care is foremost. Daily exercises in a range of movements slow the formation of limb contractures, which otherwise become particularly severe in patients in a persistent vegetative state. Daily skin care and frequent repositioning of the patient prevent decubitus ulcers. A tracheostomy may be required to maintain airway patency and prevent aspiration pneumonia. Bladder and bowel care is desirable for hygienic reasons. Since pulmonary and urinary tract infections are common, appropriate monitoring and, if necessary, treatment with antibiotics are required. Placement of nasogastric, gastrostomy, or jejunostomy feeding tubes is usually necessary to maintain adequate nutrition and hydration.

Several medical societies and interdisciplinary bodies have asserted that surrogate decision makers and patients acting through advance directives have the right to terminate all forms of life-sustaining medical treatment, including hydration and nutrition, in adult patients in a persistent vegetative state.[2,8,11,16-18,41] These organizations include the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research (1983), the Hastings Center (1987), the American Academy of Neurology (1989), the American Medical Association (1990), and the United Kingdom Institute of Medical Ethics Working Party on the Ethics of Prolonging Life and Assisting Death (1991). Surrogates and families should be given appropriate psychosocial and religious counseling as they face decisions about termination of treatment. Specific clinical guidelines are available for physicians terminating treatment in adult patients in a persistent vegetative state.[8,14,18,143] There are no well-accepted clinical guidelines for withdrawing nutrition and hydration from children in a persistent vegetative state or from adults in such a state who have never been competent. It should be emphasized that confirmation of a persistent vegetative state is not the only criterion that can or should be considered in decisions concerning life support in newborns, infants, children, or adults. Numerous judicial decisions over the past two decades have also addressed this issue, and the process of surrogate decision making may be limited or affected by the statutes of a particular state.[11,12,144-149]

Few data have been collected concerning the care given to patients in a persistent vegetative state and whether the care they receive affects the incidence of medical complications or their life expectancy. An epidemiologic study of patients in a persistent vegetative

state living in nursing homes found that each received an average of 3.7 prescribed medications daily and had an average of 1.2 hospitalizations during their stay in the nursing home.[39] Less than half the patients had do-not-resuscitate orders written in their charts.

Withdrawing Artificial Nutrition and Hydration

When artificial nutrition and hydration are withdrawn, patients in a persistent vegetative state usually die within 10 to 14 days.[150] The immediate cause of death is dehydration and electrolyte imbalance rather than malnutrition; patients in a persistent vegetative state cannot experience thirst or hunger.[151] Some patients die from intercurrent acute illnesses, such as pneumonia. Others may die from underlying cardiac or renal disease when medications are also discontinued.

Appropriate nursing care can prevent the most common signs of acute dehydration, such as dryness of the skin and mucous membranes of the mouth and eyes.[152] Facial swelling from prolonged administration of artificial nutrition and hydration decreases as the patient becomes progressively dehydrated; during the last few days of life, facial features may assume a more normal appearance. When dehydration leads to systemic hypotension, some patients in a vegetative state slip into a coma, whereas others continue to have periods of wakefulness and sleep–wake cycles until they die. Except for dryness of the skin and mucous membranes, it is not readily apparent to family or health care professionals that a patient in a vegetative state is dying of acute dehydration. Such patients also do not manifest the characteristic signs of malnutrition after depletion of nutrients over a prolonged period.

Future Directions

Although investigators have learned much about the persistent vegetative state over the past two decades, several areas deserve additional study. In the area of epidemiology, improved data on the incidence, prevalence, and natural history of the persistent vegetative state would be available if health authorities recorded such a state in patients, in addition to its underlying cause. More careful clinical studies of individual patients could provide data to determine which clinical findings are critical for the diagnosis of a persistent vegetative state. Future PET studies should measure regional cerebral blood flow or glucose metabolism in response to visual, auditory, and somatosensory stimulation, to determine whether depressed cortical regions in patients in a persistent vegetative state can be activated by peripheral sensory stimuli. A confirmation of the absence of evoked activity on the PET scan would help defend the assertion that patients in a persistent vegetative state are completely unaware and insensate.[21] Single-photon-emission computed tomography (SPECT) may be used to study changes in blood flow. SPECT findings generally parallel PET findings, but SPECT units are less expensive and more widely available. Finally, studies should include larger numbers of patients in a persistent vegetative state to establish clinical predictors of recovery of consciousness, other neurologic functions, and survival based on age, cause of the vegetative state, and other comorbid factors. Outcome studies should determine the degree of disability in patients with a late recovery of consciousness. Studies of children with developmental disorders causing a persistent vegetative state may show how they differ from patients in a vegetative state as a result of injuries or degenerative or metabolic disorders.

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