

# PROLONGED COMA MINIMALLY CONSCIOUS STATE

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## ABSTRACT

With increasing refinements in the treatment of severe systemic diseases and cerebral injury, more and more patients who formerly would have died have survived for indefinite periods without regaining any meaningful mental function. These patients are wakeful and arousal but regain neither awareness nor purposeful behavior of any kind. If lasting, this syndrome is most appropriately called *Persistent Vegetative State*.

We can not demonstrate with absolute assuredness the irreversibility of these cases. The clinic examination is the most important in estimation of this state. However, legally, socially and judicial it is considered irreversible the nontraumatic injuries/postanoxic ischemia, vascular injuries, toxic-metabolic injuries after three months; the traumatic injuries in patients under 45 years old must be evaluate after one year.

The Persistent Vegetative State must be clearly distinguished from *The Locked-in Syndrome* or *The De-afferented State* in which there is little or no disturbance of awareness (consciousness) but the patient is not capable to respond adequately and from *Akinetic Mutism* – the patient is akinetic (motionless) and mute (doesn't speak).

Technological progresses in intensive care must be doubled by a compelling, continues and consumptive nursing, from the intensive care team and the family. The alternance between disciplinary methods and the privilege to treat such case with unexpected successes after months or years, are two elements that must be used with great diplomacy and experience.

**Key words:** Vegetative state, Locked-in syndrome, Akinetic Mutism, neurological reanimation

**Consciousness:** represents the summated activity of the cerebral cortex. It is characterized by awareness and the ability to respond to environmental and intrinsic stimuli. Plum and Posner differentiated between two aspects of consciousness: arousal and content. The first is linked to wakefulness and alertness, whereas the second represents the sum of cognitive and affective mental function. A variety of insults can cause impairment of one or both aspects of consciousness. Among other causes these include structural brain lesions, metabolic disturbances, hypoxia or hypoperfusion and traumatic brain injury.

The patient who appears to be asleep and is at the same time incapable of being aroused by external stimuli or inner need is in a state of coma.

There are different degrees of coma:

- *deep coma:* no reaction of any kind is obtainable: corneal, pupillary, pharyngeal, tendon, and plantar reflexes are in abeyance, and tone in the limb muscles is diminished.
- *moderate coma:* pupillary reactions, reflex ocular movements and corneal reflex are preserved. Muscle tone in the limbs may be increased. Respiration may be slow or rapid, periodic, or deranged in other ways.
- *superficial coma:* sometimes referred to by the ambiguous term *semicoma*, most of the

above reflexes can be obtained, and the plantar reflexes may be either flexor or extensor (Babinski sign). Moreover, vigorous stimulation of the patient or distention of the bladder may cause a stirring or moaning and a quickening of respiration. These physical signs vary somewhat depending on the cause of coma.

For example, patients with alcoholic/toxic coma may be areflexic and unresponsive to noxious stimuli, even when respiration and other vital functions are not threatened.

The repeated evaluation of the coma degree is most useful in assessing the direction in which the disease is evolving. Glasgow Coma Scale published by Teasdale and Jennett in 1974, is probably the most familiar scale used in neurology, intensive care and emergency medicine. The scale was created to be a simple and reliable instrument in consciousness level evaluation. It is easy to learn, understand and apply.

The way that Glasgow Coma Scale is evaluated and the practitioner's experience may give different results with different prognostic effects.

We must inventorize and compare daily, on the medical history, the reactions to nursing and minor surgical manoeuvres, and to aspiration manoeuvres of airways secretions. These are very important

elements in outcomes and prognosis of these patients. The assessment of those cases must include the transfer after 5-10 days into special neuro-rehabilitation clinics, with dedicated personnel, independent and separately paid by the assurance systems. Theoretically in this clinics the patients are treated maximally 5 weeks. After that, they are transferred in chronic disease hospitals where they get the same neurological rehabilitation treatment, this time using the family support trained “under way”. There are many studies that are proving a great neuroplasticity and axonal regeneration with reafferentation effect.

Glasgow Outcome Scale was elaborated by Jennett and Bond in 1975, in order to assess the long term prognosis in posttraumatic cerebral lesions.

### **THE PERSISTENT VEGETATIVE STATE, LOCKED-IN SYNDROME, AND AKINETIC MUTISM**

With increasing refinements in the treatment of severe systemic diseases and cerebral injury, more and more patients who formerly would have died have survived for indefinite periods without regaining any meaningful mental function.

Before the neuroanimation age it was very simple: the patients with severe cerebral lesions used to die in more than 90% of cases; the rest used to recover with various degree of neurological deficit.

In present many efforts are made to precociously remove all survival devices that are used in the intensive care unit: ventilatory weaning, gastric and urinary tube removal.

For the first week or two after the cerebral injury, these patients are in a state of deep coma. Then they begin to open their eyes, at first in response to painful stimuli and later spontaneously and for increasingly prolonged periods. The patient may blink in response to threat or to light and intermittently the eyes move from side to side, seemingly following objects or fixating momentarily on the physician or a family member and giving the erroneous impression of recognition. Respiration may quicken in response to stimulation and certain automatisms may be observed:

- swallowing
- moaning
- grunting
- grimacing

However, the patient remains totally inattentive, doesn't speak, and shows no signs of awareness, spontaneously or to environmental stimuli;

responsiveness is limited to primitive postural and reflex movements of the limbs.

In brief, there is arousal or wakefulness and alternating arousal-nonarousal cycles may be established, but the patient regains neither awareness nor purposeful behavior of any kind. This state is characterized by a number of EEG abnormalities. After global anoxic injury, the EEG tends to display the most profound abnormalities, even to the point of being isoelectric.

If lasting, the above described syndrome is most appropriately referred to as the persistent vegetative state (PVS) (Jennett and Plum). This term has gained wide acceptance and applies to the clinical situation whatever the underlying cause.

The most common pathologic bases of this state are diffuse cerebral injury due to head trauma, widespread laminar necrosis of the cortex after cardiac arrest, and thalamic necrosis from a number of causes. Occasionally, the most prominent changes are in the thalamic and subthalamic nuclei. It is noteworthy that a persistent vegetative state may also be the terminal phase of progressive degenerative processes such as Alzheimer disease and of Creutzfeldt-Jakob disease. The profound and widespread dysfunction of the cerebrum is reflected by extreme reductions in cerebral blood flow and metabolism, measured with positron emission tomography (PET) and other techniques.

On the PET studies in a patient with carbon monoxide poisoning, Laureys and colleagues observed that the main difference between the PVS and the recovered state was the presence of hypometabolism in the parietal lobe association areas in the former. However, it is quite clear that the neuroanatomic basis of the vegetative state is far more complex.

Additional terms that have been used to describe this syndrome of preserved autonomic and respiratory function without cognition include: apallic syndrome and neocortical death.

Recently, a commission has codified the features of PVS and suggested dropping a number of related ambiguous terms although some, such as akinetic mutism have a more specific neurologic meaning and still find use.

It is difficult to predict which patients will fall permanently into the PVS category. We can not demonstrate with absolute assuredness the irreversibility; the clinic examination is the most important in estimation of this state. However, legally, socially and judicial it is considered irreversible the nontraumatic injuries\ postanoxic ischemia, vascular injuries, toxic-metabolic injuries

after three months; the traumatic injuries in patients under 45 years old must be evaluated after one year.

Plum and Posner have reported that of 45 patients with signs of the vegetative state at 1 week, 13 awakened and 5 had satisfactory outcomes; after being vegetative for close to 2 weeks, only one recovered to a level of moderate disability. After two weeks the prognosis was inconclusive. Larger studies by Higashi and colleagues have given similar results.

As a guide to prognosis in head injury, Braakman and colleagues found that among a large group of comatose patients, 59 percent regained consciousness within 6 hours; of those in a vegetative state at 3 months, none became independent. At no time after the onset of coma was it possible to distinguish patients who would remain in a vegetative state from those who would die. In some cases the diagnosis of vegetative state can be applied soon after the onset of coma, rather than requiring coma to persist for several months, but fewer cases would be “persistent”. For this reason and because of the anxiety created for families by such a final diagnosis, it has been suggested that the term be abandoned.

It is useful to maintain a critical view of news reports of remarkable recuperation from prolonged coma or the vegetative state. When the details of such cases become known, it is evident that recovery might reasonably have been expected.

There are, however, numerous reported instances of partial recovery in patients, particularly children, who display vegetative features for several weeks or even several months after injury.

Such observations cast doubt on unqualified claims of success with various therapies such as sensory stimulation. Nevertheless, the occurrence of rare instances of very late recovery in adults must be acknowledged.

The decision “do not resuscitate” must be inventoried through the level of medical knowledge of those who are taking on the risk to make this call. Actual technologies such as “functional ” MR are trying to evaluate the chances of recovery from Vegetative State or Minimally Conscious State. For example: telling a pleasant story to the patient opens certain neuronal circuits, inversely, an unpleasant story does not open those circuits.

## NEUROREHABILITATION

Technological progresses in intensive care must be doubled by a compelling, continues and consumptive nursing, from the intensive care team

and the family. The alternance between disciplinary methods and the privilege to treat such case with unexpected successes after month or years, are two elements that must be used with great diplomacy and experience.

The intensity of intensive care manoeuvres must be adapted to each and every case:

1. in intensive care units for the 5-10 days
2. in specialized neurorehabilitation units, after the intensive care period, for maximum 5 weeks
3. in clinics or hospitals for chronics specialized in that kind of pathology.

The neurorehabilitation teams, independent and coordinated with other specialists from intensive care unit, will adapt the manoeuvres to patients tolerance. Those are patients with hemodynamic instability, treated with complex therapy sometimes excessively sophisticated: extrarenal purification, hypothermia, high-tech artificial ventilation modes, cardiac drugs.

For the first 5-10 days from the accident, neuro-rehabilitators will create a positive, encouraging psychoemotional contact with the patient and his family.

The rehabilitation scores are depending sometimes of the position of the patient during examination: for example in sitting position the patient awakens frequently; this is not always happening in the other positions. The repeated stimulation at short intervals may create the fatigability phenomenon with inexact conclusions about the condition and evolution of the patient.

Reestablishment and stimulation by any means of visual, tactile, auditory, musculoskeletal, vibrating receptors and continuous verbal communication, has a primordial role rehabilitation of these cases.

## LOCKED-IN SYNDROME

The states of coma and the PVS, described above, must be clearly distinguished from a clinical state in which there is little or no disturbance of awareness (consciousness) but the patient is not capable to respond adequately. This state is called the locked-in syndrome or the de-afferented state. The term pseudocoma as a synonym for this state is best avoided, since it is used by some physicians to connote the feigned unconsciousness of the hysteric or malingerer. The de-afferented syndrome is due most often to a lesion of the ventral pons (basis pontis), in some cases as a result of basilar artery occlusion. Such an infarction may spare both

the somatosensory pathways and the ascending neuronal systems that are responsible for arousal and wakefulness as well as certain midbrain elements that allow the eyelids to be raised and give the appearance of wakefulness.

The lesion interrupts the corticobulbar and corticospinal pathways, depriving the patient of speech and the capacity to respond in any way except by vertical gaze and blinking.

Severe motor neuropathy (Guillain-Barré syndrome), pontine myelinolysis, tumors, encephalitis, pontine infarction or recurrent paralysis may have a similar effect. Such patients appear comatose but are awake and alert although mute and quadriplegic. Decerebrate posturing or flexor spasms may be seen. The patient opens the eyes voluntary, and vertical eye movements may be seen. The EEG is normal.

This state was called by Cairns and colleagues akinetic mutism: the patient is akinetic (motionless) and mute (doesn't speak). They described a patient who appeared to be awake but was unresponsive. Following each of several evacuations of a third ventricular cyst, the patient would become aware and responsive but would have no memory for any of the events that had taken place when she was in the akinetic-mute state. This rare state of apparent vigilance in an imperceptive and unresponsive patient has been referred to by French authors as "coma vigile".

The term akinetic mutism has been applied to yet another group of patients who are silent and inert as a result of bilateral lesions of the anterior parts of the frontal lobes, leaving intact the motor and sensory pathways; the patient is profoundly apathetic and abulic and unlike Cairns's patient, registers most of what is happening about him and forms memories. Patients with this syndrome are immobile and will usually lie with their eyes closed. Sleep-wake cycles exist.

Outcome is variable and related to the underlying cause and the extent of the brainstem lesions. Mortality usually from pneumonia is approximately 70% when the cause is a vascular disturbance and about 40% in nonvascular cases. Survivors may recover partially or completely over a period of weeks to months. Consider reevaluation to 6 months and to 2 years.

The psychiatric patient with catatonia appears unresponsive, simulating stupor, light coma, or the akinetic mute state. There are no signs of structural brain disease such as pupillary or reflex abnormalities. Oculocephalic responses are preserved as in the awake state; the eyes move concurrently as the head is turned. There is usually resistance to eye opening, and some patients display a waxy flexibility of passive limb movement that gives the examiner a feeling of bending a wax rod (*flexibilitas cerea*). There is also the retention for a long period of seemingly uncomfortable limb postures (*cataplexy*).

In conclusion, from personal experience and from literature dates, in present it is impossible to determine with precision the prognosis in every case; the emotional, financial and social effort is disproportionately big comparing to final results. However the prognosis must be adapted and realized according to some medical, social and family rules.

This situation determines the necessity to adapt the assistance systems so that after 7-14 days of intensive care the patient is transferred to neuro rehabilitation supraspecialized for vegetative state clinics and after 4-5 weeks of rehabilitation the patients are transferred into asylum-hospitals or at home where treatment conditions are assured.

It must be mentioned that in those cases 30-80% recover with variable and unforeseeable neuropsychiatric deficit. The reevaluation must be obtained at 6 months and at the end at 2 years from the beginning; albeit there are cases of late recovery after 6 years or more.

In Romania there are approximately 12000 cases every year, most of them treated in intensive care units, for more than 14 days. They are blocking hospital beds with high prices and results disproportionately low.

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