Brain Death and Disorders of Consciousness

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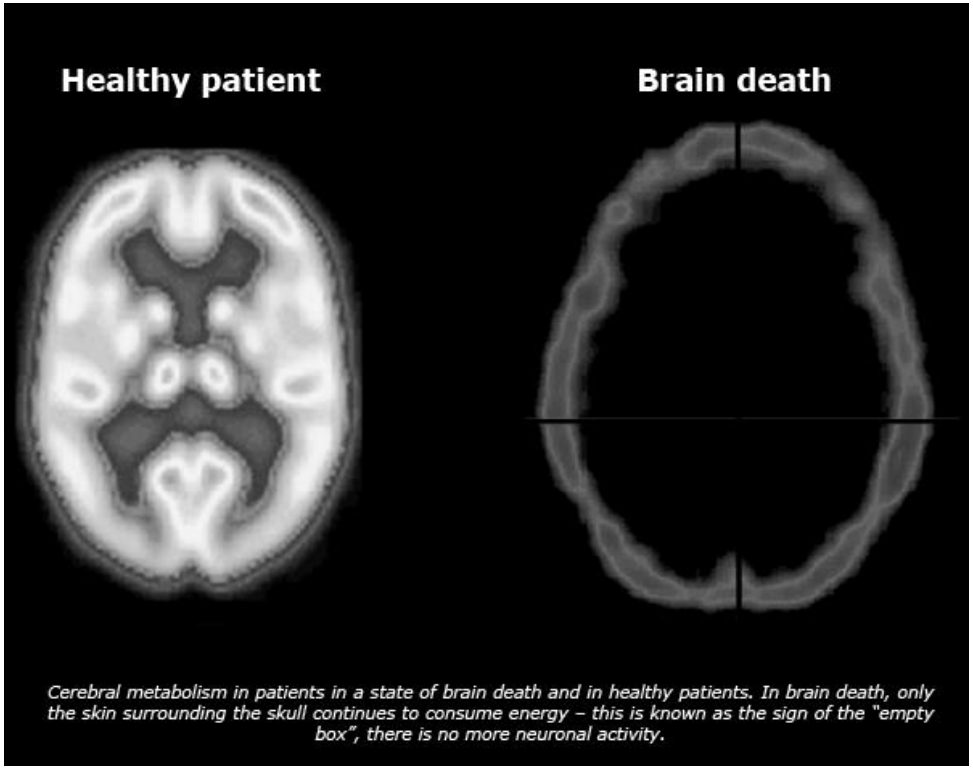
Five kinds of catastrophic neurological injury

- Minimal Responsiveness
- Persistent Vegetative State
- Coma
- Brain Death
- Locked-In

Disorders of Consciousness, however, include…

- Coma
- Persistent Vegetative State (Awake and Unaware)
- Minimally Responsive State
- Persons who are brain dead do not have disordered consciousness; they have no consciousness; they are dead
- Persons who are locked-in have unimpaired consciousness or awareness
- Moral: Disorders of consciousness are disorders of awareness

Brain Death



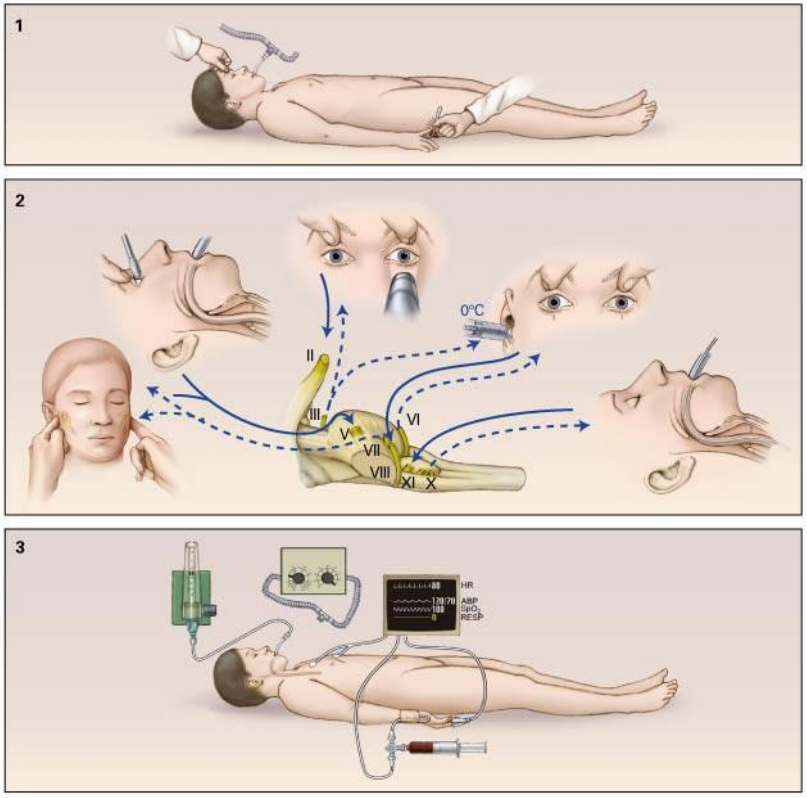
Cerebral metabolism in patients in a state of brain death and in healthy patients. In brain death, only the skin surrounding the skull continues to consume energy – this is known as the sign of the "empty box", there is no more neuronal activity.

- Total unresponsiveness to painful stimuli in all extremities
- Absent brainstem reflexes (no pupillary response to light; no ocular movement to stimuli; no corneal, jaw, or grimace reaction to stimuli; no gag reflex or cough response)
- Apnea: no spontaneous breathing after disconnection from AV
- Definition: The cessation of all brain functioning of the entire brain

Why Brain Death Criteria?

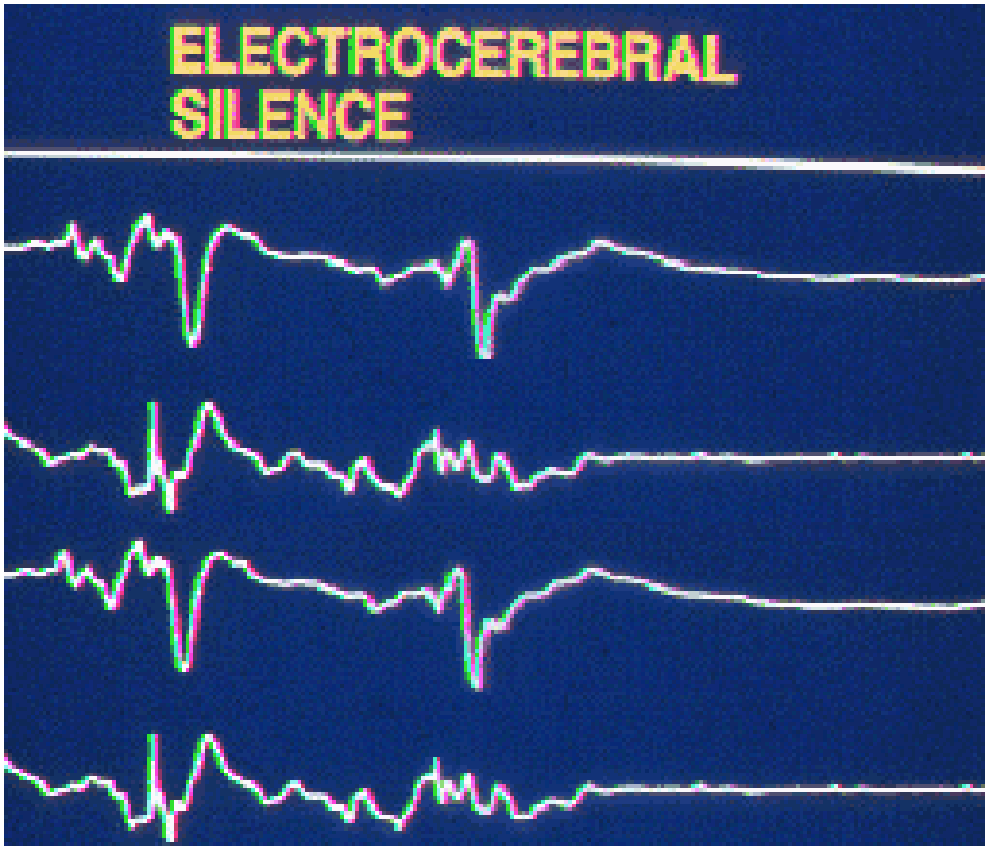
- Appearance of ICUs: BD patients can be sustained for very long periods of time
- Organ donation: BD patients in the ICU, as dead, meet the “dead donor rule” but their organs are alive and usable
- Homicide: Who “killed” the patient?

Brain Death Tests



- Evidence of catastrophic central nervous system damage
- Rule out complicating co-morbidities
- No drug intoxication or poisoning
- Core temperature at or greater than 32 C or 90 F
- No pain response in any extremity
- No pupillary response to light

Continued



- Pupils are in midposition and dilated
- No oculocephalic reflex or deviation
- No corneal, jaw, or grimace reflex to sensation
- No gag reflex or cough response
- No respirations after disconnection from the ventilator (for a period long enough to allow the partial pressure of carbon dioxide in arterial blood to rise above 60 mm Hg and the pH to fall below 7.28 (usually 10 minutes)

So, what's the problem with BD?

- BD patients can meet the test criteria as they are neurologically determined (no motor response, no brain stem reflexes, etc.) yet still have pockets of electrical activity in their brains, e.g., hormone secretion like arginine vasopressin which is synthesized in the hypothalamus; their EEGs can show activity; spike in heart rate and blood pressure upon surgical incision for organ procurement
- Point: Even though they meet the brain death criteria, they don't fulfill the brain death definition: cessation of all brain activity of the entire brain. In other words, the test criteria are flawed—they don't satisfy the definition of BD.
- Jahi McMath: https://www.youtube.com/watch?v=jsSeM0RVKuA
- https://www.youtube.com/watch?v=yh4YC-XjG9k
- Caplan and Toobin: https://www.youtube.com/watch?v=u32Uzdxynpk

The second problem: BD patients can maintain their own …..

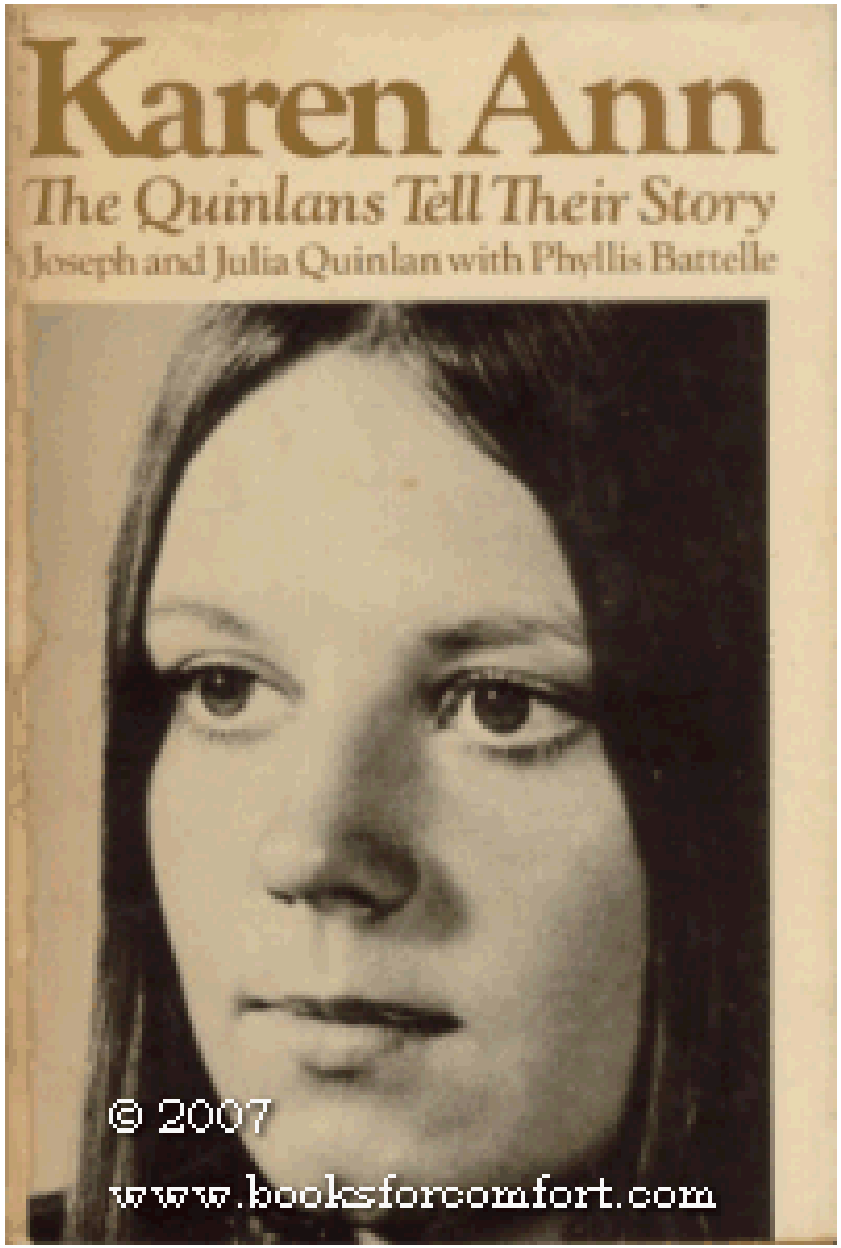
- Circulation
- Digestion
- Food metabolism
- Excretory functions
- Hormonal balance
- Growth
- Sexual maturation
- Gestation of a fetus
- Wound healing
- Fever

- "Patients who fulfill all of the diagnostic criteria for brain death remain alive in virtually every sense except for the fact that they have permanently lost the capacity for consciousness." (Miller and Truog, HCR, 2008)
- Consequently, the use of the word "death" in connection with brain death may be ungrammatical.

Coma

- Absent/No:
  - Self-awareness
  - Eye opening
  - Permanently unconscious
  - Sleep-wake cycles
  - Pain perception
  - Purposeful movements
  - Spontaneous respiration
- Impaired brain stem activity
- Was once a terminal diagnosis

Persistent Vegetative State

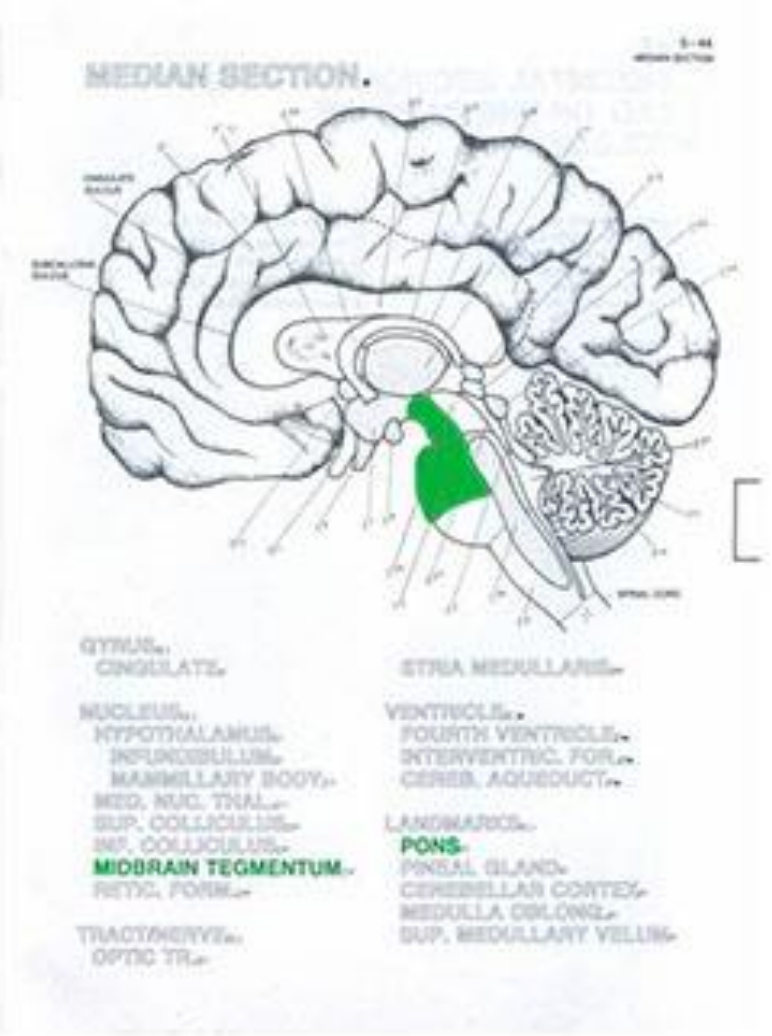


- Sleep-wake cycles; absent self-awareness; permanently unconscious; no meaningful interactions with others (e.g., no speech or purposeful movements); no response to deep pain stimuli; sometimes require AV (e.g., Karen Quinlan early on, Helga Wanglie) sometimes don't (Karen Quinlan later on, Terri Schiavo); usually require artificial nutrition and hydration
- Fairly well preserved brain stem functions; devastated cortical function
- Sometimes hard to diagnose: Coma or PVS or minimally responsive?: High end or low end to each state

“Locked-In” Syndrome

Plum & Posner (1966)

- Quadriplegia
  - Paralysis of Limbs
  - Anarthria
    - Loss of Articulate Speech
  - Aphonia
    - Loss of Vocalization
- Full Consciousness
  - Preserved Auditory, Visual Function
    - Startle, Orienting
    - Localization, Fixation, Pursuit
  - Preserved Communication
    - Blinking, Vertical Eye Movements
  - Preserved Emotional Response
- Anterior Brain Stem
  - Pons
  - Excludes Reticular Formation



Locked-in Syndrome:

Trapped in Silence

Lisa Sato, Luciana Branco, Shabrina Khanam, Stiliani Drimousis and Suzanna Azevedo

Definition of the Locked-In Syndrome or Locked-In State (LIS)

However, we need to distinguish between different degrees of severity

Complete/Total LIS

Classical LIS
+ eye movement

Residual LIS
+ eye movement
+ few residual muscles

Quadriplegia
paralysis of limbs & torso
facial muscles and speech intact

Anarthria

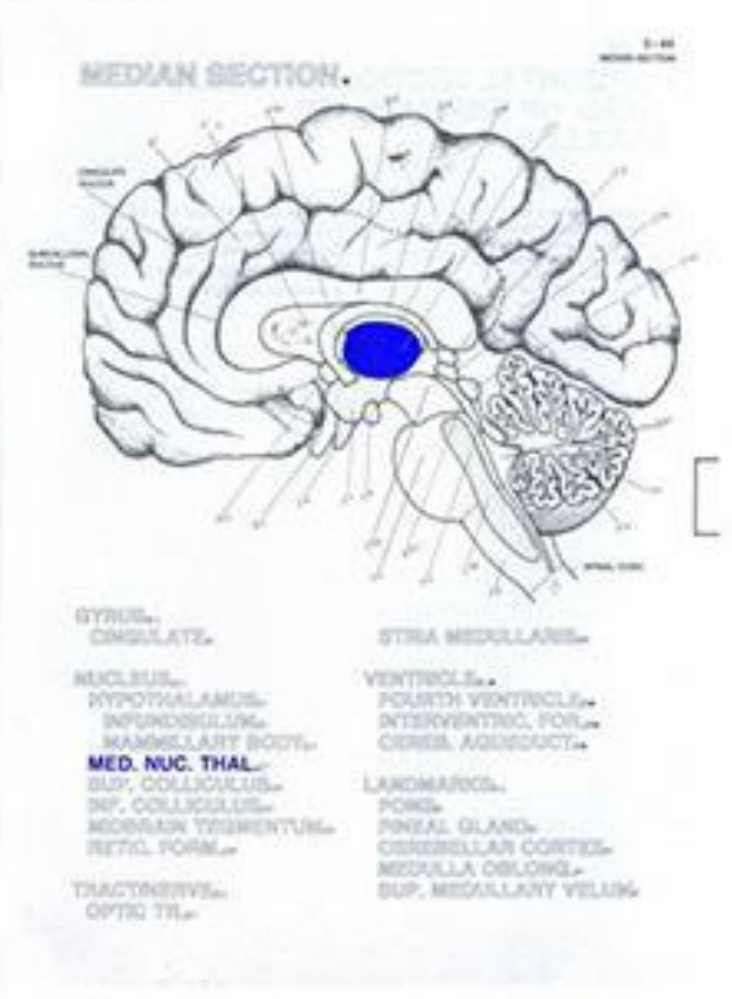
Minimal Responsiveness

- Sleep-wake cycles; “consistently inconsistent” responses to simple commands or questions; register reactions (grunts of approval or discomfort); visual tracking; feels pain; usually require 24 hour nursing care (severe movement impairments, usually require gastric feeding)

Minimally Conscious State

Giacino et al. (2002)

- Minimal but Definite Evidence of Awareness
  - Self, Environment
  - Inconsistent
- Cognitively Mediated Behavior
  - Follow Commands
  - Vocal/Gestural Yes/No
  - Intelligible Vocalization
  - Appropriate Response to Objects
    - Reaching
    - Touching, Holding
  - Eye Movements
    - Pursuit, Fixation



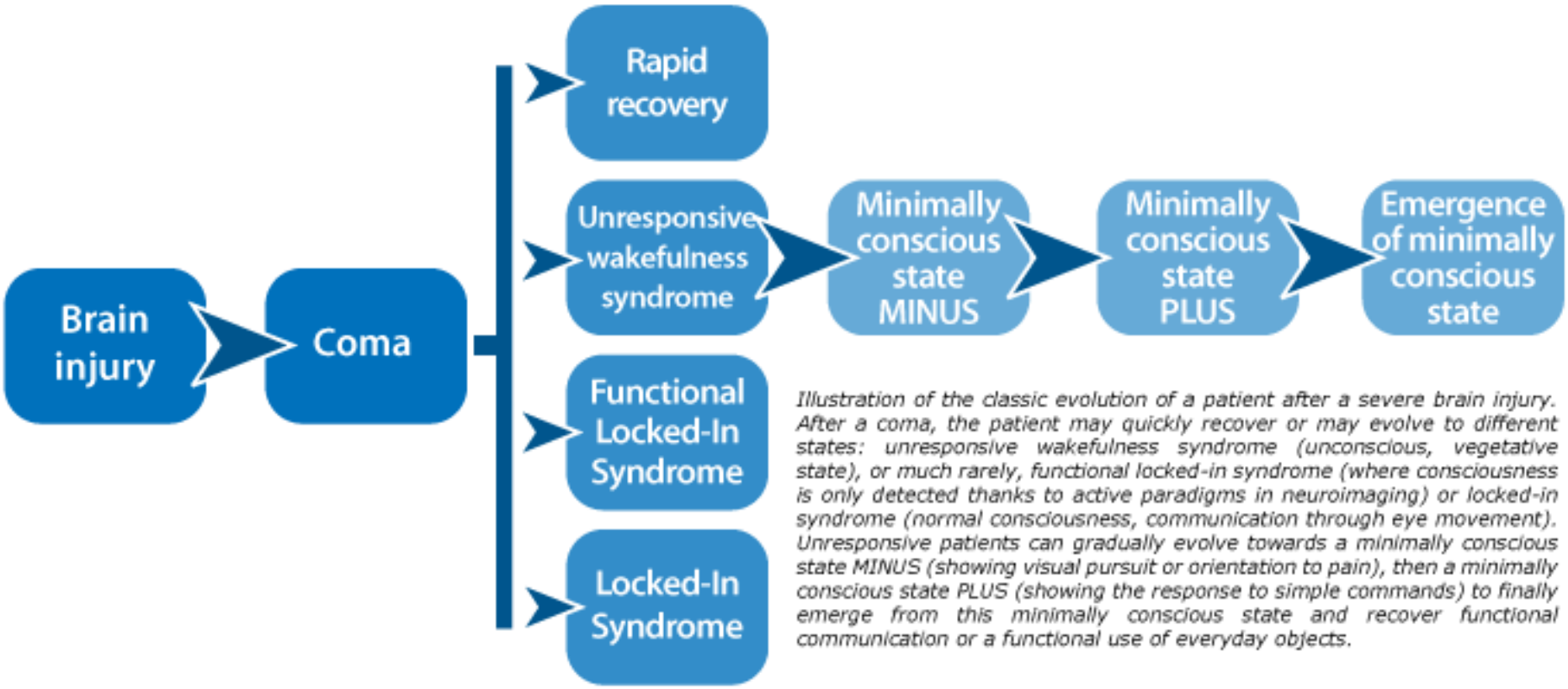


Illustration of the classic evolution of a patient after a severe brain injury. After a coma, the patient may quickly recover or may evolve to different states: unresponsive wakefulness syndrome (unconscious, vegetative state), or much rarely, functional locked-in syndrome (where consciousness is only detected thanks to active paradigms in neuroimaging) or locked-in syndrome (normal consciousness, communication through eye movement). Unresponsive patients can gradually evolve towards a minimally conscious state MINUS (showing visual pursuit or orientation to pain), then a minimally conscious state PLUS (showing the response to simple commands) to finally emerge from this minimally conscious state and recover functional communication or a functional use of everyday objects.

What's the ethical problem?

- MCS+
  - These individuals can evince behavioral signs of a degree of consciousness
  - The problem they pose is whether or not they'd want to live in a state of diminished consciousness; some appear to suffer, while others do not; they tend to be "consistently inconsistent" so it is hard to ascertain their desires or interests unless they've made an advance directive, and even then their directive might be vague
- MCS-
  - These individuals evince no behavioral signs of consciousness, even though they are
  - The problem they pose is the difficulty of distinguishing them from persons who are in PVS; presumably misdiagnosis occurs in 40% of cases.
  - PVS patients are familiar candidates for withdrawal of LST; have we withdrawn such treatments from MCS- patients who would have preferred to live?
  - How to elicit the wishes of MCS patients?

Adrian Owen

- http://www.bbc.com/news/health-20268044

Terry Wallis
presumed to be PVS for 19 years

The Problem of Advance Directives in MCS

- Applicability and Specificity: If an individual has an advance directive, does the directive:
  - Apply to or envision minimal consciousness, rather than PVS or coma?
  - Specify that the individual wouldn't want gastric feeding?

Can you do a competency evaluation among persons who are MCS?

- How would you know if they really understand the question? And if they can convince you they do, then they're probably not MCS
- How reliable do their answers need to be?
- If they can only respond yes or no, how do you fashion typical competency questions: What year is it? Who is the President? Tell me what you understand by…….?

And that raises the last question

- Precedent autonomy:
  - We should respect the individual's wishes
  - But suppose the individual didn't want to live in a very compromised state, but now seems to tolerate it fairly well?
  - Are we talking about the same person who didn't want to live that way? Or are we talking about two different people, where the former pre-morbid self no longer has authority for the disabled self?

Robert Wendland

- Suffered brain damage in a car accident in 1993
- Was diagnosed as MCS: could respond to simple commands
- Wife and children claimed he never recognized them
- Mother claimed he would cry and kiss her hand during visits
- Left no advance directive
- Said he wouldn’t want to live like a “vegetable”
- Court denies request: Ruled that Wendland is not in a vegetative state; therefore previous declarations do not apply to his current circumstances

The window of opportunity in vegetative state brain injury: first 1-3 months

- The window of opportunity:
  - Deciding to discontinue LST: You feel the person would not want to live that way, but you don't know if they'll proceed to MCS, but you'll live with that question for the rest of your life
  - You continue treatment and either the person improves or doesn't: If they don't improve, and remain vegetative, you still don't know if they'd want to live that way, but you might feel more comfortable discontinuing LST; if they proceed to MCS, they might recover even more or not. If they stay in MCS, the road might be a long one. And you still don't know if they'd want to live like that.

The solution

- Precedent autonomy's force seems to be a function of the foresight and precision with which the individual executes an advance directive. Did you envision MCS? Do you want artificial nutrition and hydration? Would you explicitly empower a significant other to make these decisions for you?

Otherwise……

- Family members will be persuaded by physicians—often in the first 72 hours following injury—that LST should be foregone, and then wonder about their decision forever
- Go for years wondering if enabling their loved one to live was the right thing to decide, i.e., would he or she want it?
- Suffering and wondering: Either if their loved one dies or lives for a long time with some diminished state of consciousness

But then……

The End

Society needs a concept of death

Regulate grieving, stopping LPT, procuring organs, execute a will, determining burial, begin receiving life insurance benefits

- The pronouncement of “death” enables a society’s members to act in accord with that society’s death rituals; behaviors become comprehensible and are reliably performed
- All 50 states including the Vatican accept brain death
- Medical treatment ceases for the dead because no treatment is “reasonable or necessary”

Death Definitions

- Traditional: Irreversible cessation of respiration and circulation
- Brain Death: The irreversible cessation of all brain functions of the entire brain: Coma/unresponsive-ness + no brainstem reflexes + apnea.