

Potential Pitfalls in the Diagnosis of Brain Death

Give Life

Outline

- **Conditions that mimic brain death**
- **Motor movement consistent with brain death**
- **Pupillary and eye movement examination**
- **False positive respiratory efforts**
- **Patients with abnormal CO₂ response**
- **Other signs consistent with brain death**

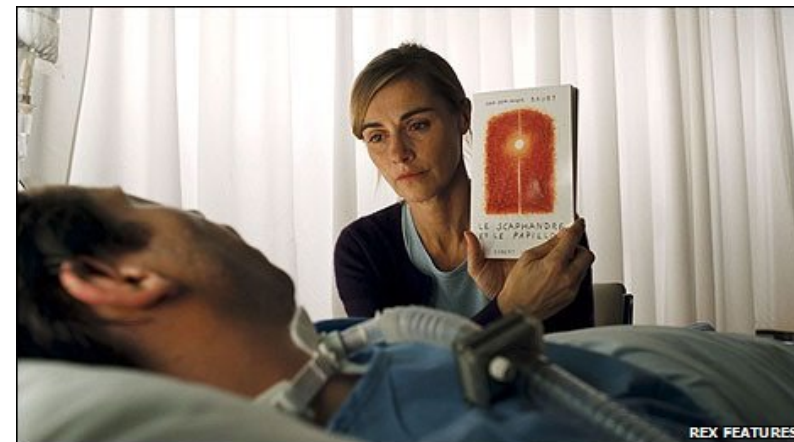
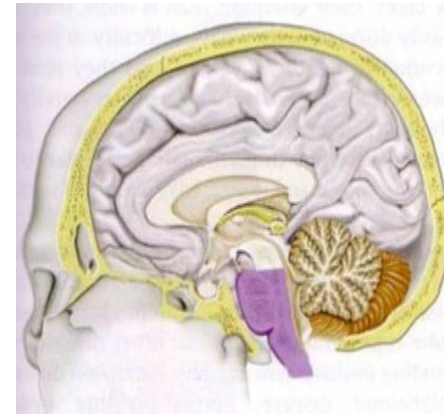
Brain Death Mimics

Misdiagnosis of brain death has been reported in the following clinical scenarios:

- Locked-in Syndrome
- Persistent Vegetative State (VS)
- Minimally Conscious State (MCS)
- Neuromuscular paralysis, as found in severe, acute polyneuropathies (some may also have autonomic dysfunction, including pupillary areflexia) or with neuromuscular blocking agents
- Hypothermia
- Drug intoxication: lidocaine toxicity, baclofen overdose
- Organophosphate intoxication
- Fulminant Guillain-Barré syndrome

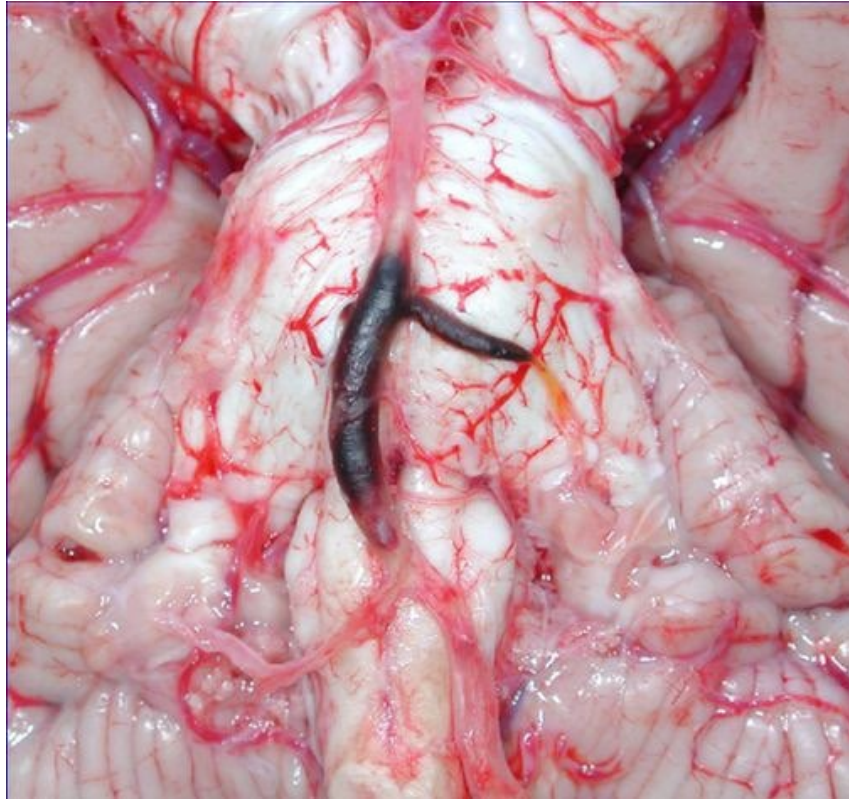
Locked-in Syndrome

- The locked-in syndrome is a consequence of a focal injury to the base of the pons, usually by embolic occlusion of the basilar artery.
- Preserved Consciousness
- Complete Paralysis except that voluntary blinking and vertical eye movements remain intact.
- Patients with this syndrome have been mistakenly believed to be unconscious .

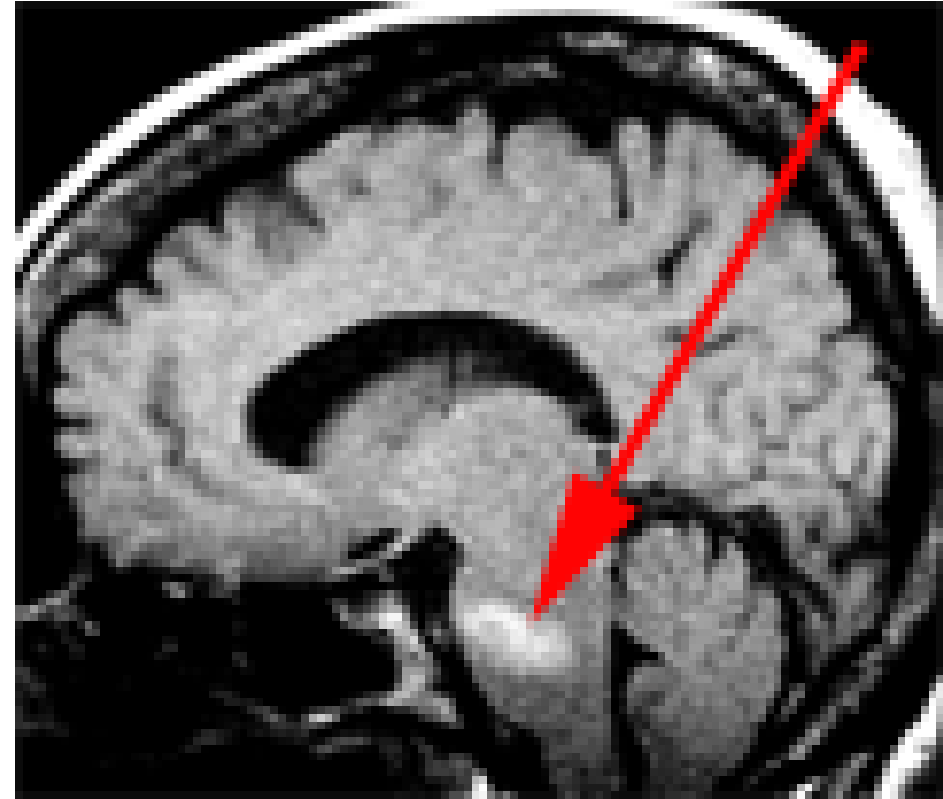


Locked-in syndrome

Basilar artery thrombosis

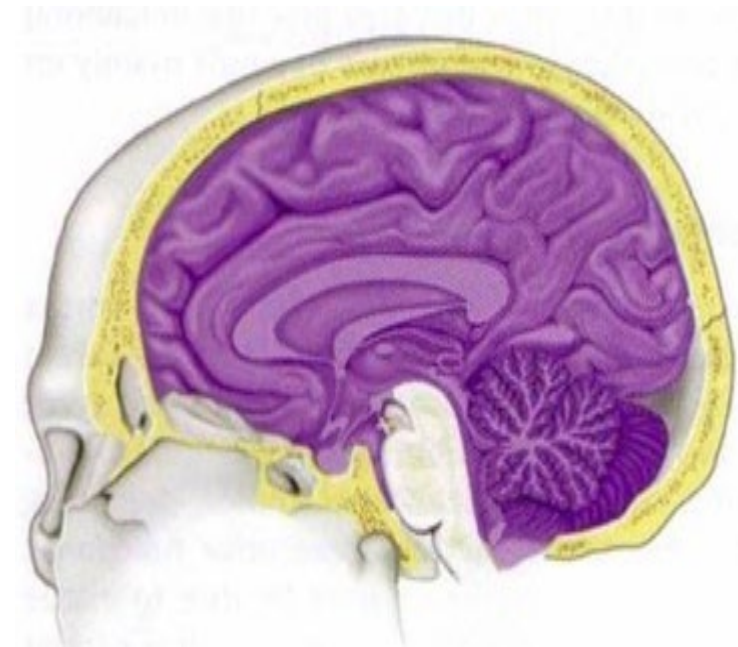


Ventral Pontine Infarct



Persistent Vegetative State (Cerebral Death)

- Diffuse Brain Injury with Preservation of Brain Stem Function
- Normal Sleep-Wake Cycles
- No Response to Environmental Stimuli



The Minimally Conscious State (MCS) (Static Encephalopathy)

- Diffuse or Multi-Focal Brain Injury
- Preserved Brain Stem Function
- Variable Interaction with Environmental Stimuli and presence of specific behavioral features
- This condition is often transient but may also exist as a permanent outcome.

Simulation of Brain Death from Fulminant De-efferentation.

- Fulminant cases of GBS have been reported in which a rapid deterioration evolves to a clinical state resembling "brain death" through diffuse de-efferentation.
- Two patients that presented with a rapid course of neurological deterioration, lapsing into what resembled a "clinically brain-dead" state that was subsequently ascribed to a fulminant polyneuropathy.
- Investigations (electrophysiological, pathological) and the clinical course suggested an axonal neuropathy.

Spinally Mediated reflexes:

- Subtle, semi-rhythmic movements of facial muscles can arise from the denervated facial nerve: facial myokemia.
- Finger flexor movements.
- Tonic neck reflexes — Passive neck displacements, especially flexion, may be accompanied by complex truncal and extremity movements, including adduction at the shoulders, flexion at the elbows, supination or pronation at the wrists, flexion of the trunk ("sitting up" type movements), and neck-abdominal muscle contraction or head turning to one side. These might be quite dramatic, often called a "Lazarus sign."
- Triple flexion response with flexion at the hip, knee, and ankle with foot stimulation, eg, testing for a Babinski sign.
- Other truncal movements including asymmetrical opisthotonic posturing of the trunk and preservation of superficial and deep abdominal reflexes.
- Alternating flexion-extension of the toes with passive displacement of the foot (undulating toe sign), or flexion of the toes after foot percussion, or a Babinski sign.
- Widespread fasciculations of trunk and extremities.

Motor Movement Consistent with Brain Death

- Facial myokymia
- Transient bilateral finger tremor
- Repetitive leg movements
- Ocular microtremor
- Cyclical constriction and dilatation of light fixed pupils (hippus)
- Muscle stretch reflexes in the limbs and superficial abdominal reflexes
- Rapid flexion of arms
- Raising of all limbs off the bed
- Grasping movements
- Spontaneous jerking of one leg
- Movement of the arms up reaching the ETT “Lazarus sign”

Lazarus Sign



Spinal Reflex Movements



Pupillary and Eye Movement Examination

- **Absence of pupillary light reflex:**
 - Topical use of drugs
 - Trauma to cornea or bulbus
- **Abolishment of caloric response**
 - Meds: sedatives, aminoglycosides, tricyclic antidepressants, anticholinergic medications, anticonvulsant, and chemotherapeutic agents
- **Facial or ocular trauma (orbital fracture or hematoma): restrict eye movement**
- **Impairment of corneal reflex**
 - Trauma
 - Drug intoxication

False Positive Respiratory Efforts

- Auto cycling: sensing small changes in tubing pressure related to heartbeats
- Respiratory-like movements that are reflexive (not associated with tidal volume):
 - Shoulder elevation
 - Adduction
 - Back arching
 - Intercostal expansion

Patients with Abnormal CO₂ Response

CO₂ level that represent maximal brain stem stimulation may be very different in patients with:

- Chronic hypercapnia
- Severe sleep apnea

Other Signs Consistent with Brain Death

Brain dead patient can develop:

- Intermittent hypertension
- Sweating
- Cutaneous flushing
- Tachycardia
- Erection

Conclusion

Thank You