



MUERTE ENCEFÁLICA

Dr. Perfecto Oscar González Vargas

Neurólogo

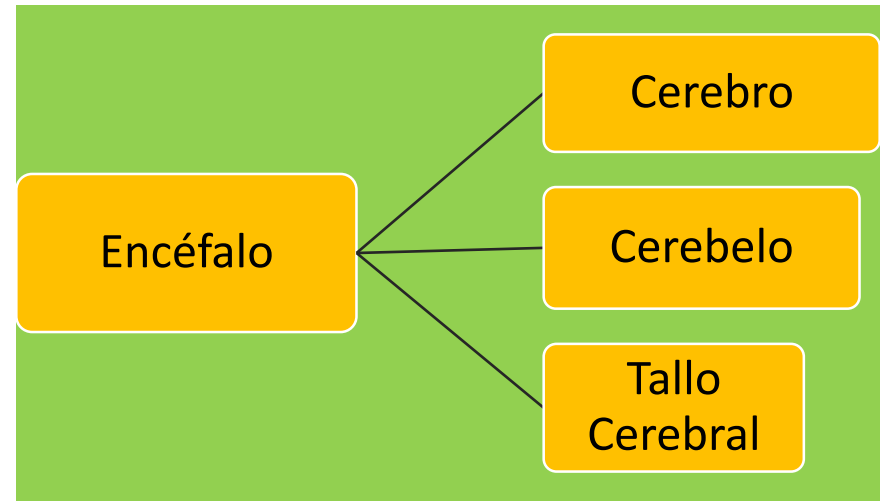
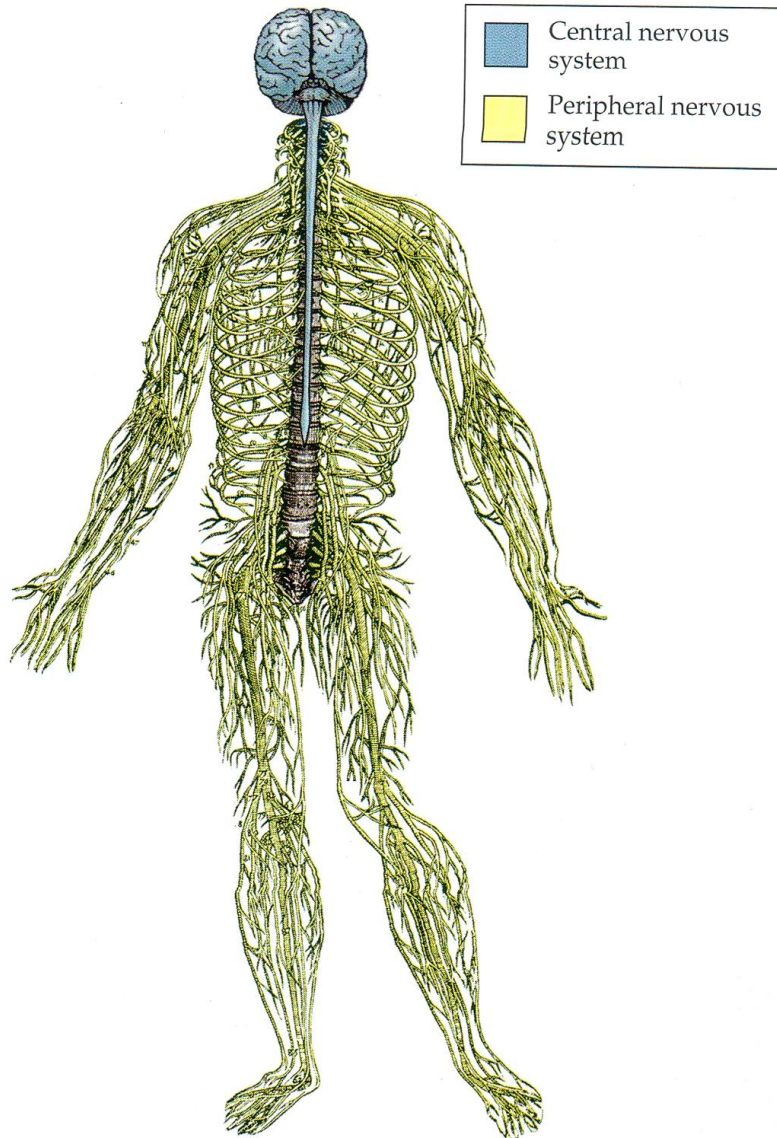
INNN-HMP MP- MDS- SOMENE



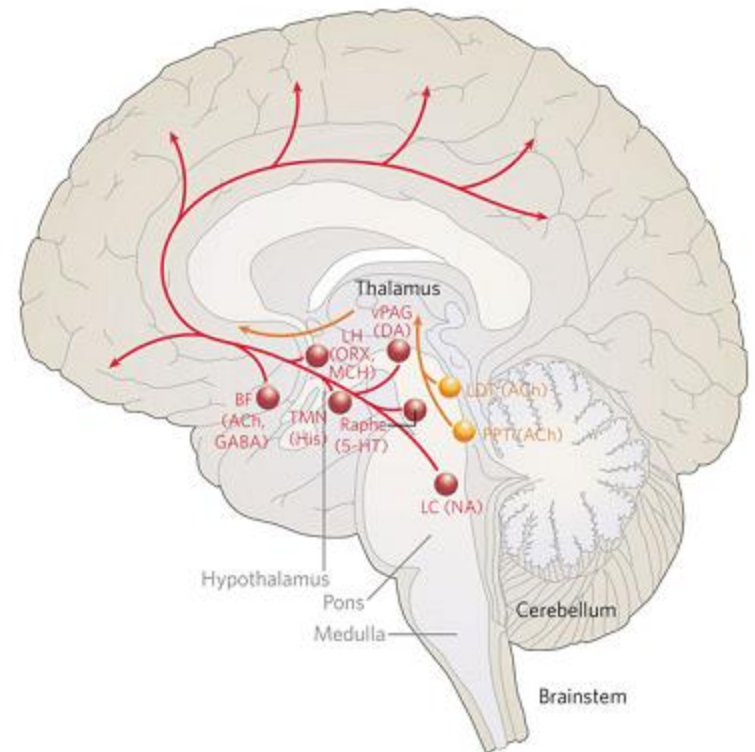
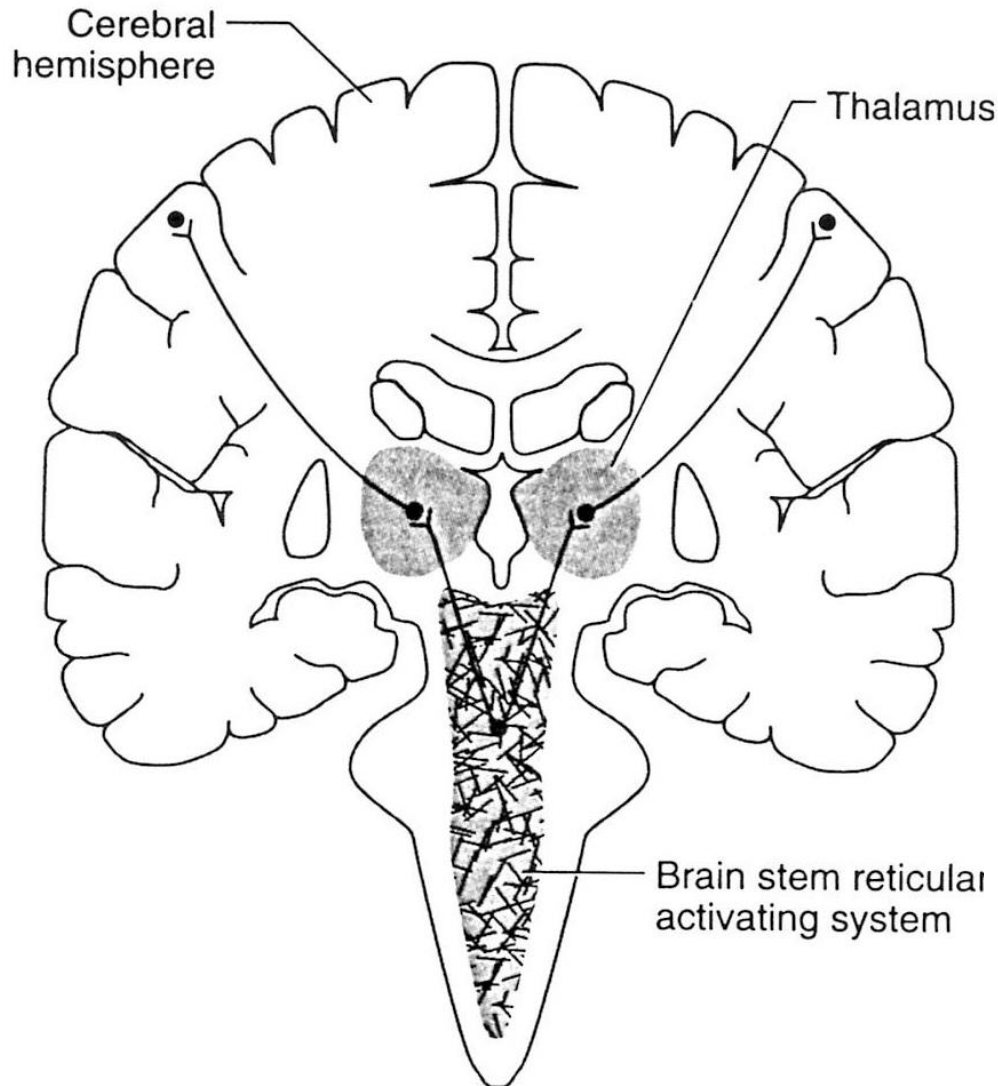
CAMELICE



Conceptos Anatómicos

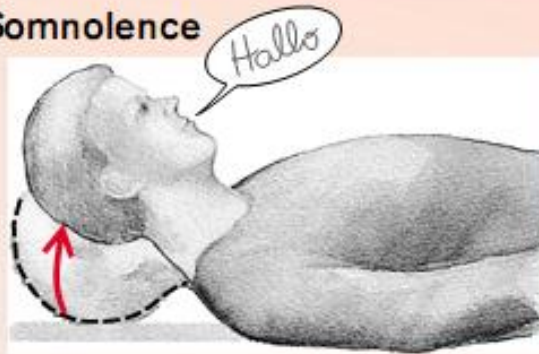


Anatomic basis of **coma** (results from lesions that affect either the RAS or both hemispheres)

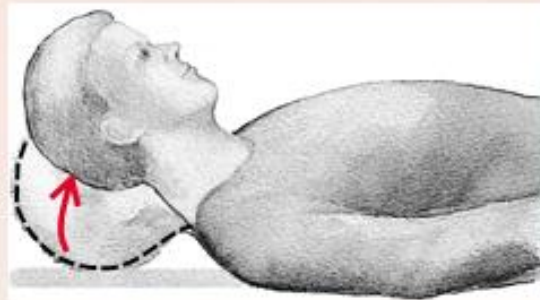


Unconsciousness

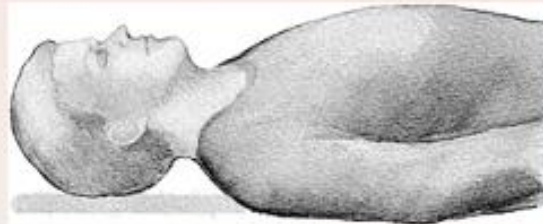
Somnolence



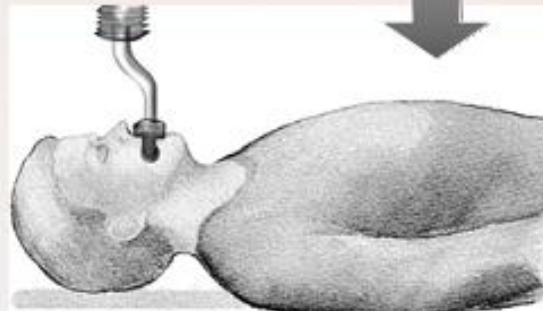
Stupor

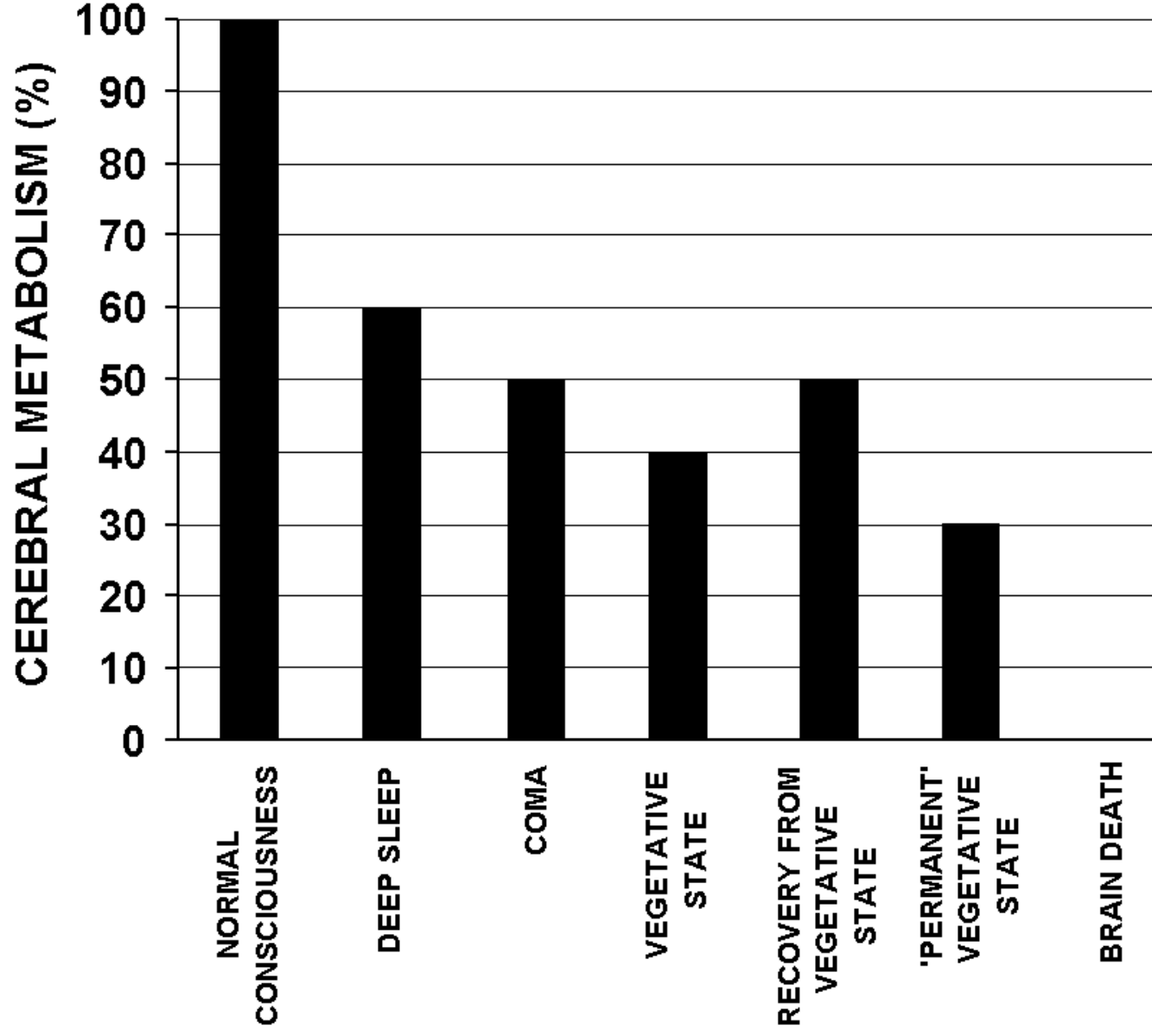


Coma



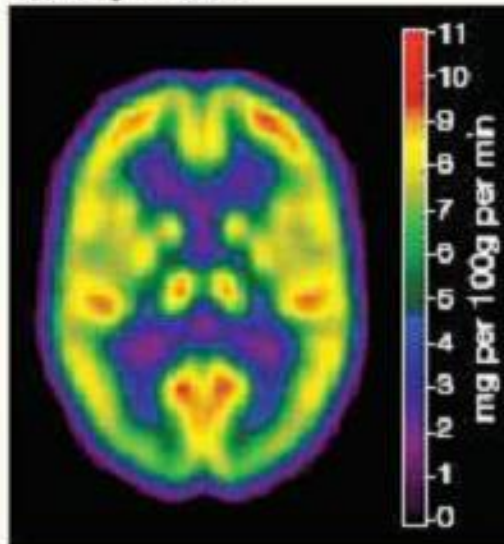
'coma dépassé'



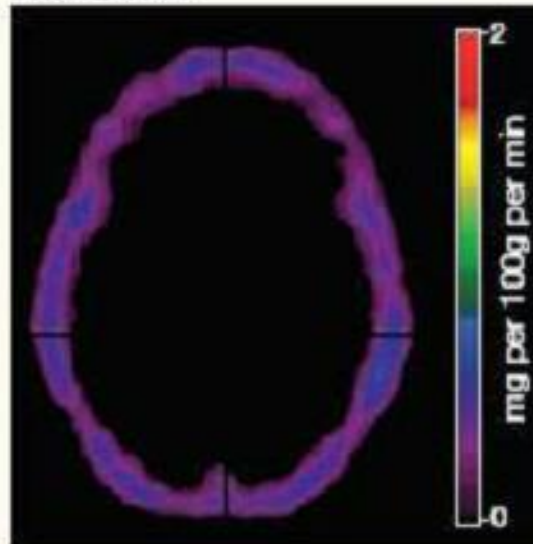


Differences in resting brain metabolism in brain death, and in the vegetative state, compared with controls

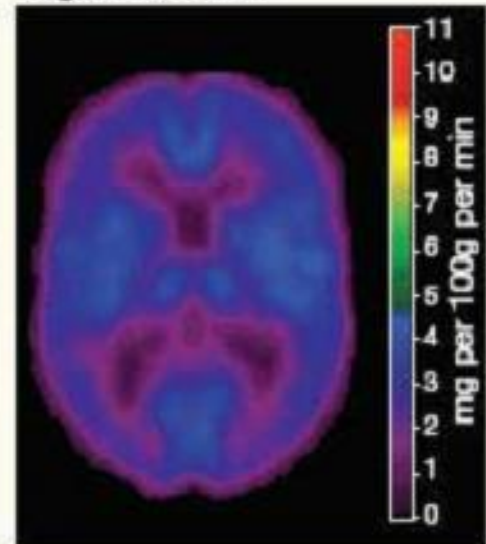
Healthy control



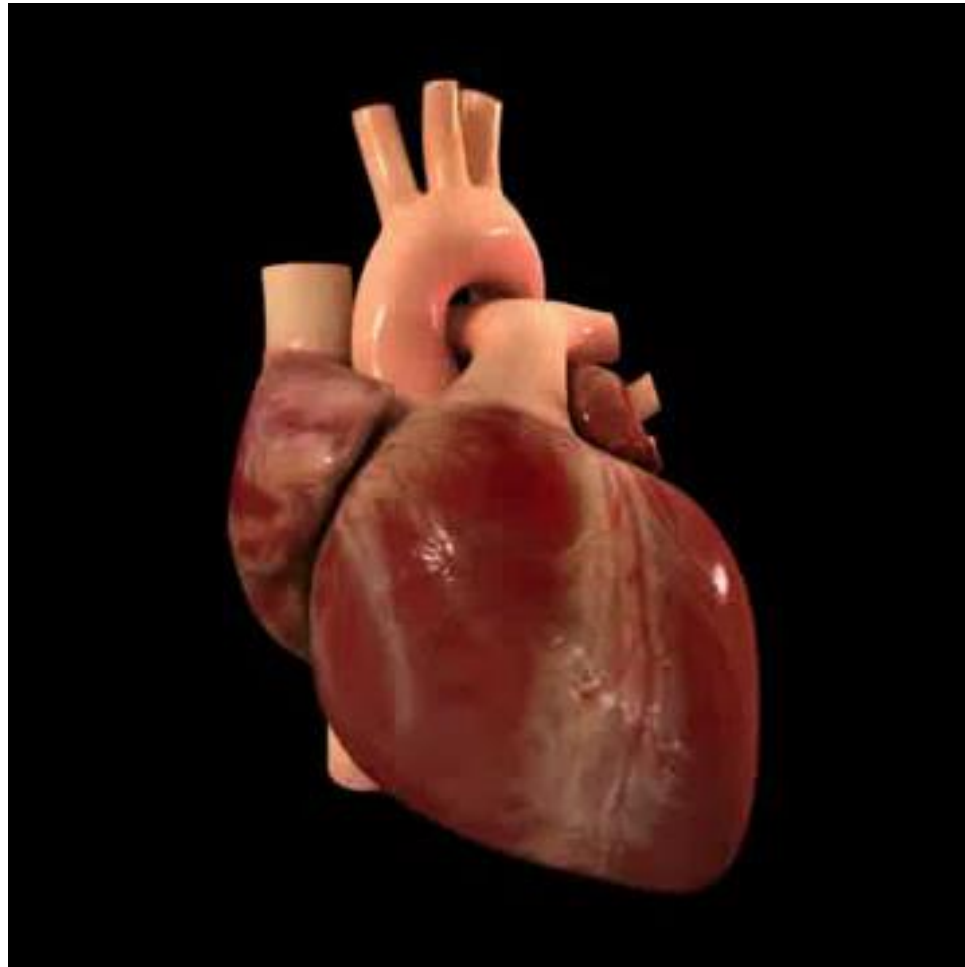
Brain death



Vegetative state



Definición Tradicional de Muerte: Asistólica y Apnea



REVUE NEUROLOGIQUE

RECUEIL SPÉCIAL D'ANALYSES DES TRAVAUX CONCERNANT
LE SYSTÈME NERVEUX ET SES MALADIES

DIRECTION :

E. BRISSAUD ET **P. MARIE**

PROFESSEURS AGREGÉS A LA FACULTÉ DE MÉDECINE DE PARIS
MÉDECINS DES HÔPITAUX

RÉDACTION :

D^r H. LAMY

Secrétaire de la Rédaction : **D^r HENRY MEIGIE**

TOME V. — ANNÉE 1897

MASSON ET C^{ie}, ÉDITEURS
LIBRAIRES DE L'ACADÉMIE DE MÉDECINE
120, BOULEVARD SAINT-GERMAIN, 120

PARIS

MASSON ET C^{ie}, ÉDITEURS

LIBRAIRES DE L'ACADÉMIE DE MÉDECINE

120, BOULEVARD SAINT-GERMAIN, 120

1897

Mollaret P and Goulon M.
Le coma dépassé.
Rev Neurol 1959;101:3-15



A lo largo de la historia, varios criterios
diagnósticos: Harvard, Comité Presidencial, etc

“Criterios de Harvard”

Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death. A definition of irreversible coma.

JAMA 1968;205:337-340

- Propósito: *"... para definir coma irreversible como un nuevo criterio de muerte."*
"Hay dos razones por las cuales hay necesidad de una definición:

A Definition of Irreversible Coma

Report of the Ad Hoc Committee of the Harvard Medical School
to Examine the Definition of Brain Death

Characteristics of irreversible coma

A patient in this state appears to be in deep coma. The condition can be satisfactorily diagnosed by points 1,2, and 3 to follow. The electroencephalogram (point 4) provides confirmatory data, and when available it should be utilized.

1. Unreceptivity and unresponsivity
2. No movements or breathing
3. No reflexes
4. Flat electroencephalogram

The Ad Hoc Committee includes Henry K. Beecher, MD, *chairman*; Raymond D. Adams, MD; A. Clifford Barker, MD; William J. Curran, LL.M., SMHyg; Derek Denny-Brown, MD; Dana L. Farnsworth, MD; Jordi Folch-Pi, MD; Everett I. Mendelsohn, PhD; John P. Merrill, MD; Joseph Murray, MD; Ralph Potter, MD; Robert Schwab, MD; and William Sweet, MD.
Reprint requests to Massachusetts General Hospital, Boston 02114 (Dr. Henry K. Beecher).

response to stimuli such as pain, touch, sound, or light. After the patient is on a mechanical respirator, the total absence of spontaneous breathing may be established by turning off the respirator for three minutes and observing whether there is any effort on the part of the subject to breathe



special article

NEUROLOGY 1995;45:1012-1014

Practice parameters for determining brain death in adults

(Summary statement)

Report of the Quality Standards Subcommittee of the American Academy of Neurology

1995



Update: Determining Brain Death in Adults 2010

Report of the Quality Standards Subcommittee of
the American Academy of Neurology

Eelco F. M. Wijdicks, MD, PhD, FAAN; Panayiotis N. Varelas, MD,
PhD; Gary S. Gronseth MD, FAAN; David M. Greer, MD, MA

Practice parameters for determining brain death in adults: (summary statement). NEUROLOGY 1995;45:1012-1014:

I. **Criterios Diagnósticos**

■ A. “Pre-requisitos”

- ☐ 1. Evidencia clínica o de neuroimagen de una catástrofe aguda al SCN
- 2. Exclusión de una condición médica sistémica (electrolitos, ácido-base, endócrino)
- ☐ 3. No intoxicación o envenenamiento
- ☐ 4. Temperatura $\geq 32^{\circ}\text{C}$ (90°F)



Practice parameters for determining brain death in adults: (summary statement)
NEUROLOGY 1995;45:1012-1014:

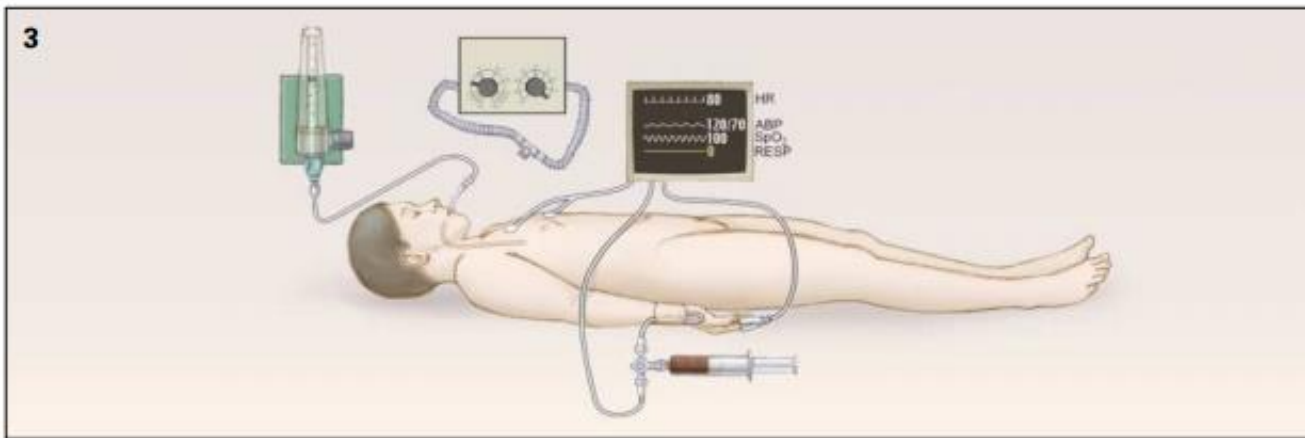
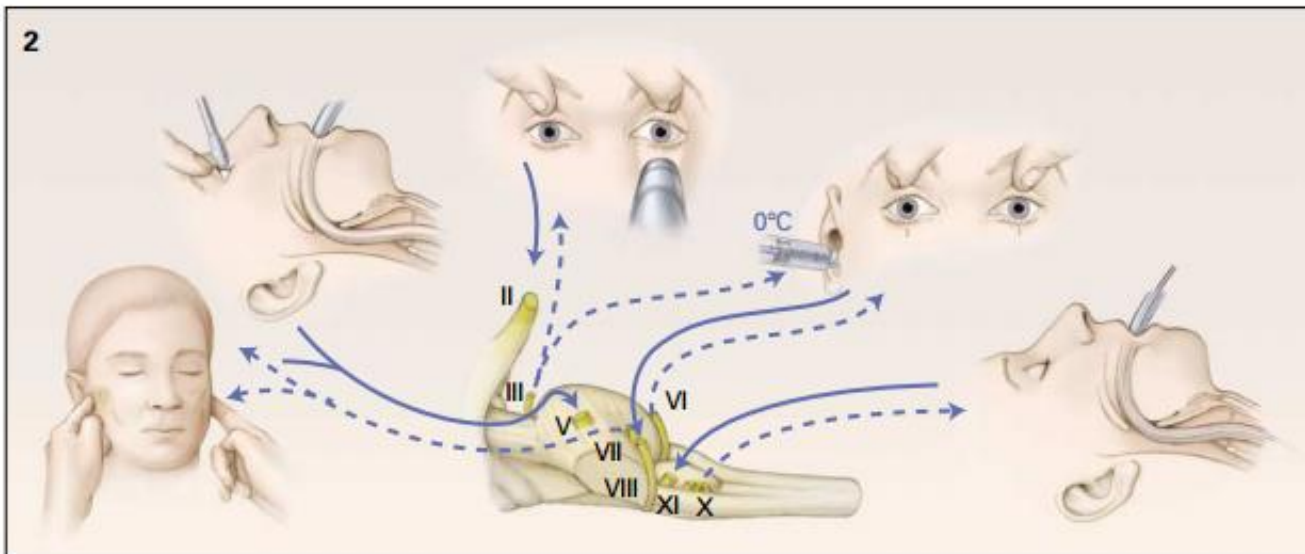
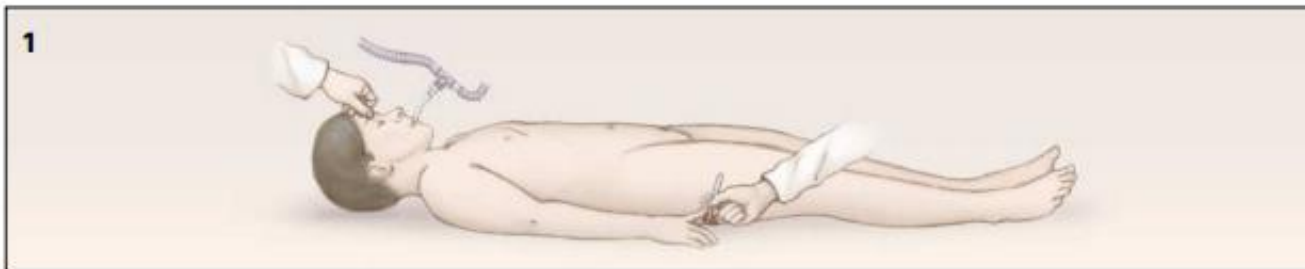
I. Criterios Diagnósticos

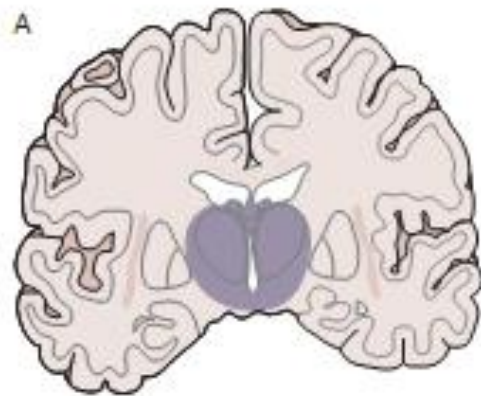
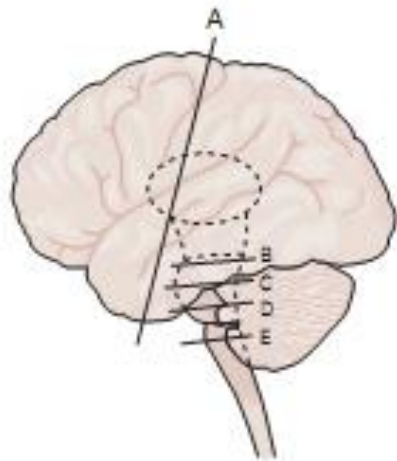
- ☐ A. Coma
- ☐ B. Ausencia de Reflejos de Tallo Cerebral
- ☐ C. Prueba de Apnea



Apnea Test

- $P_a\text{CO}_2$ levels greater than 60 mmHg, ≥ 20 mmHg over baseline
- Technique:
 - Pre-oxygenate with 100% oxygen several min
 - Allow baseline $P_a\text{CO}_2$ to be ~ 40 mmHg
 - Place pt on CPAP or bag-ETT
 - Observe for respirations for **8-10** minutes
 - Get ABG to determine $P_a\text{CO}_2$





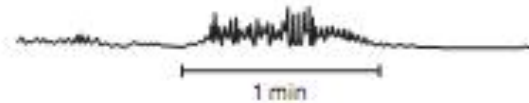
B



C

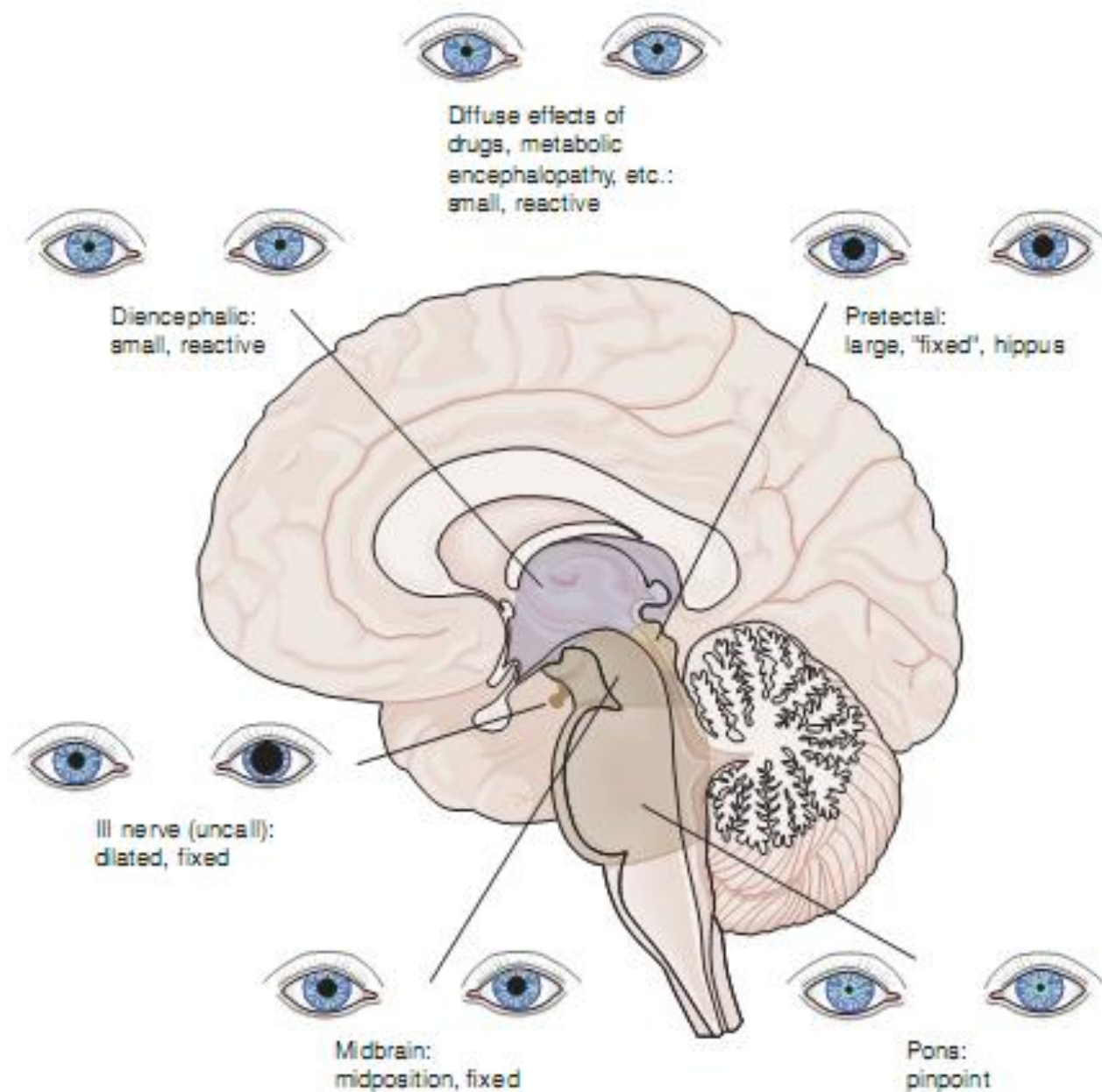


D

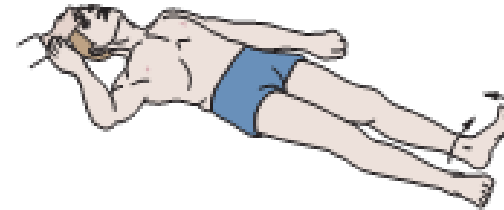
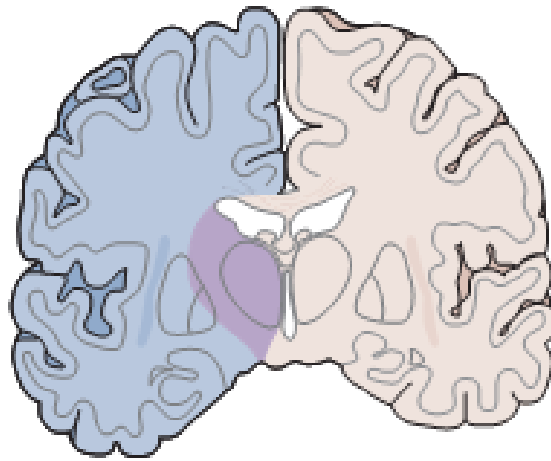


E

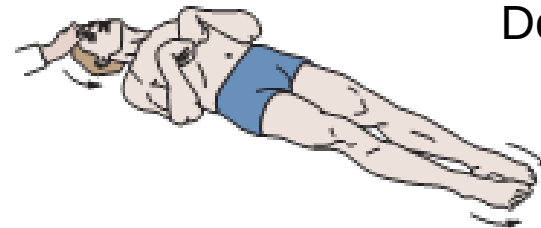
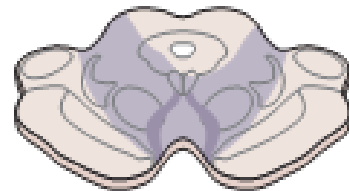




A Metabolic encephalopathy

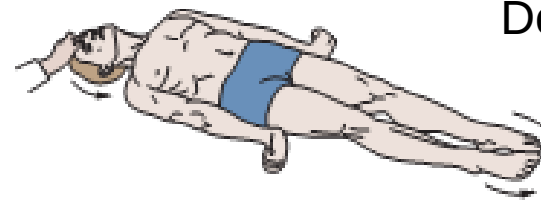
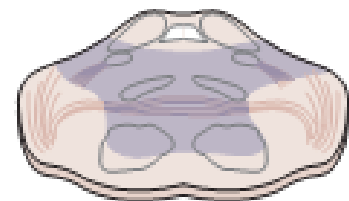


B Upper midbrain damage



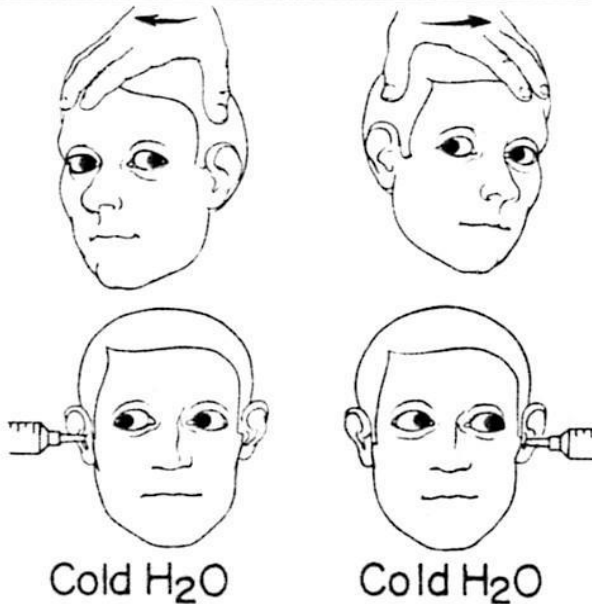
Decorticación

C Upper pontine damage



Descerebración

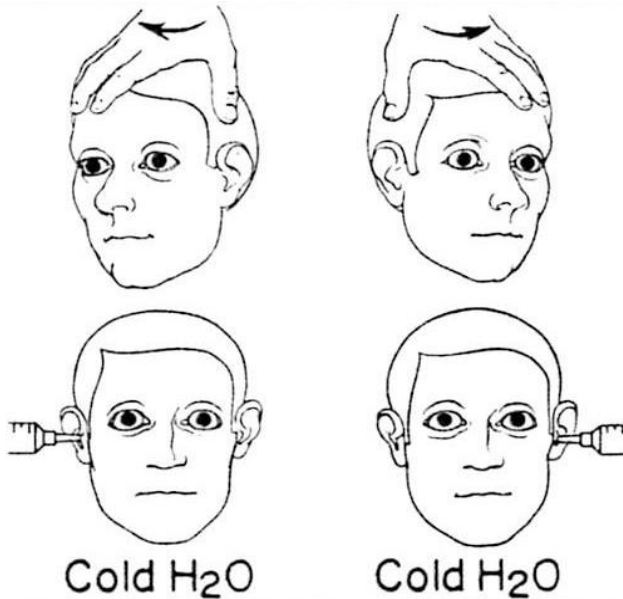
Brainstem
Intact



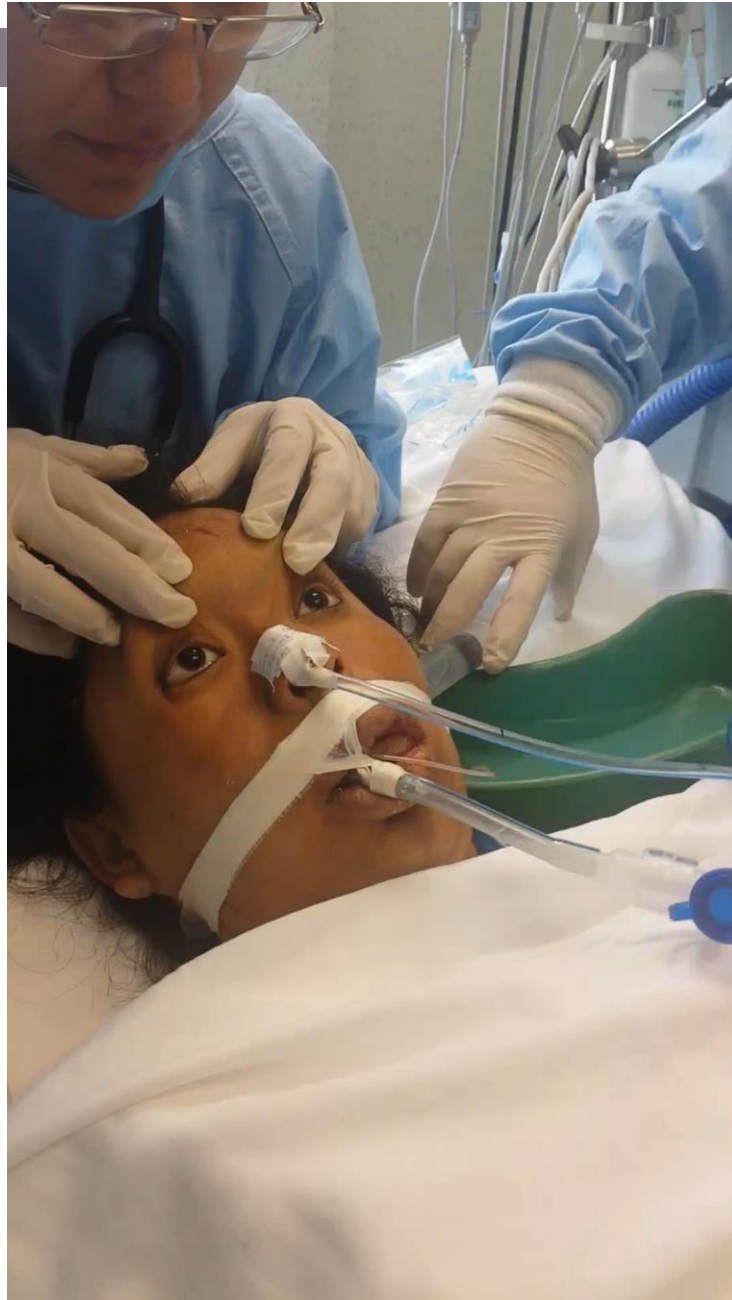
Reflejo
Oculocefálico y
Reflejo
Oculovestibular

NORMAL

Low
Brainstem
Lesion



ANORMAL







Practice parameters for determining brain death in adults: (summary statement)
NEUROLOGY 1995;45:1012-1014:

III. Observaciones Clínicas compatible con el diagnóstico de MC

■ A. Movimientos espontáneos

The Lazarus Sign







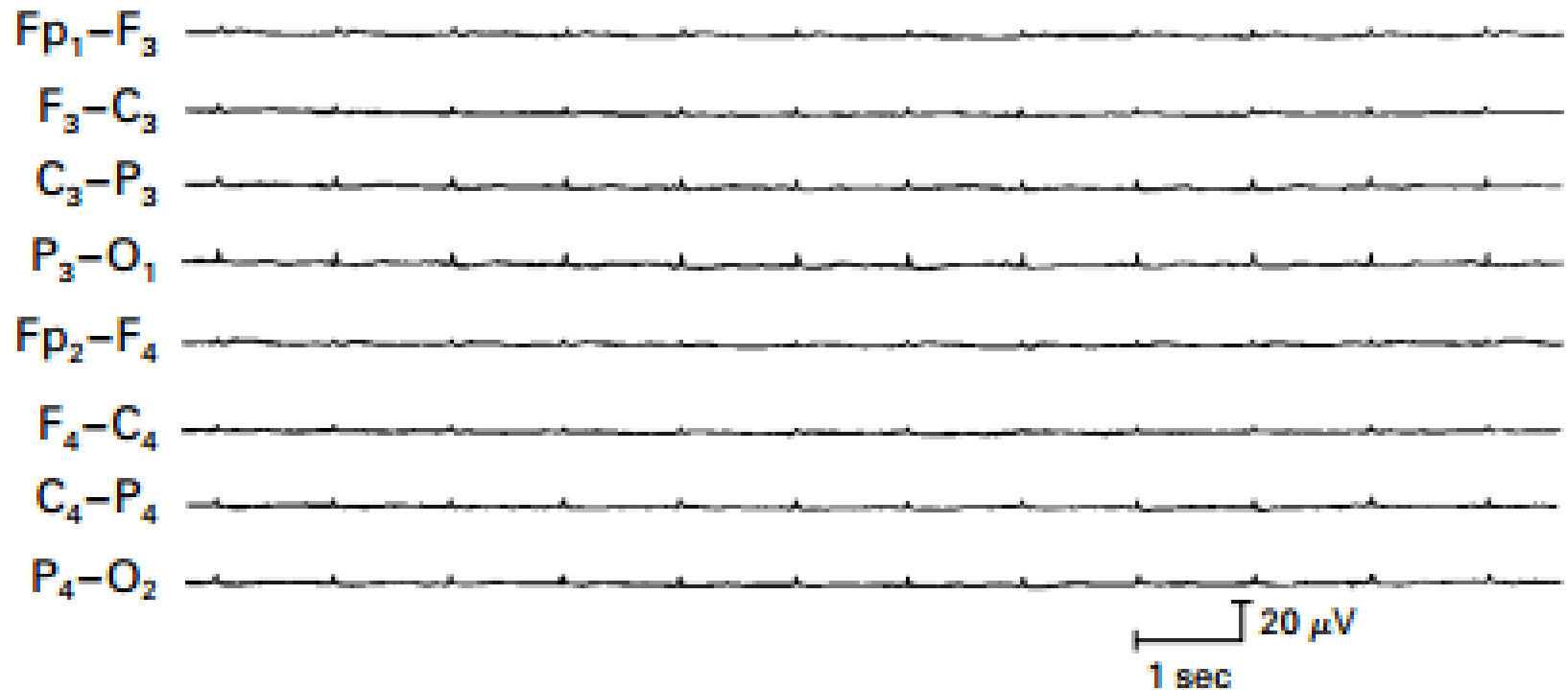
Practice parameters for determining brain death in adults: (summary statement)
NEUROLOGY 1995;45:1012-1014:

IV. Confirmatory laboratory tests (Options)

- A. Angiografía convencional
- B. EEG: sin actividad electrical $\geq 30'$
- C. DopplerTranscraneal
- D. Tecnesio-99m HMPA
- E. Potenciales evocados somatosensoriales

EEG

CURRENT CONCEPTS



Accepting Brain Death

David C. Magnus, Ph.D., Benjamin S. Wilfond, M.D., and Arthur L. Caplan, Ph.D.

Two cases in which patients have been determined to be dead according to neurologic criteria ("brain death") have recently garnered national headlines. In Oakland, California, Jahi McMath's death was determined by means of multiple independent neurologic examinations, including one ordered by a court. Her family refused to accept that she had died and went to court to prevent physicians at

Children's Hospital and Research Center in Oakland from discontinuing ventilator support. Per a court-supervised agreement, the body was given to the family 3 weeks after the initial determination. The family's attorney stated that ventilatory support was continued and nutritional support added at an undisclosed location.

In Fort Worth, Texas, Marliese Muñoz's body was maintained on mechanical ventilation for 8 weeks

1. Absence of neurologic function with a known irreversible cause of coma
2. Correction of conditions affecting evaluation of brain death (performed before neurologic evaluation):
 - hypotension
 - hypothermia
 - metabolic disturbances
3. Discontinuation of medications affecting the neurologic examination (performed before neurologic evaluation):
 - sedatives
 - neuromuscular blockers
 - anticonvulsants
4. Timing of neurologic evaluation should be more than 24 to 48 hours after cardiopulmonary resuscitation or other severe acute brain injury
5. Duration of observation (pediatric cases):
 - 24 hours for neonates (37 weeks of gestation to 30 days after birth for term infants)
 - 12 hours for infants and children (>30 days to 18 years of age)
6. Clinical evaluation:
 - absence of pupillary response to a bright light
 - absence of movement of bulbar musculature
 - absence of gag, cough, sucking, and rooting reflexes shown by examining the cough response to tracheal suctioning
 - absence of corneal reflexes demonstrated by touching the cornea; no eyelid movement should be seen
 - absence of oculovestibular reflexes shown by irrigating each ear with ice water; movement of the eyes should be absent during 1 minute of observation
7. Apnea testing:
 - Pretest: confirmation of complete absence of spontaneous respiratory effort — preoxygenate with 100% oxygen, maintain core temperature above 35°C, normalize pH, blood pressure, and arterial blood gas (partial pressure of carbon dioxide [P_{aCO_2}])
 - Test: demonstration of increase in arterial P_{aCO_2} of at least 20 mm Hg above baseline and of a total P_{aCO_2} of at least 60 mm Hg, with no observed respiration
 - Ancillary study: indication to perform if there is a medical contraindication to the apnea test, hemodynamic instability, desaturation to less than 85%, or the inability to reach a P_{aCO_2} of at least 60 mm Hg
 - Evidence of any respiratory effort is inconsistent with brain death, and the apnea test should be terminated
8. Ancillary studies:
 - electroencephalography
 - radionuclide cerebral blood flow
 - spinal cord reflexes if abnormal movements present

N ENGL J MED 370:10 NEJM.ORG MARCH 6, 20

The New England Journal of Medicine

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Accepting Brain Death

David C. Magnus, Ph.D., Benjamin S. Wilfond, M.D., and Arthur L. Caplan, Ph.

Two cases in which patients have been determined to be dead according to neurologic criteria at Children's Hospital and Research Center in Oakland from discontinuing ventilator support. Per a court-

5. Duration of observation (pediatric cases):

- 24 hours for neonates (37 weeks of gestation to 30 days after birth for term infants)
- 12 hours for infants and children (>30 days to 18 years of age)

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N ENGL J MED 370:10 NEJM.ORG MARCH 6, 20

The New England Journal of Medicine

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Views & Reviews

Brain death worldwide

Accepted fact but no global consensus in diagnostic criteria

Eelco F.M. Wijdicks, MD

From the Department of Neurology, Neurological and Neurosurgical Intensive Care Unit, Mayo Medical Center, Rochester, MN.

Address correspondence to: Eelco F.M. Wijdicks, MD, Department of Neurology, Mayo Medical Center, 200 First Street, SW, Rochester, MN 55905; e-mail: wijdicks@mayo.edu

Objective: To review the current state of brain death diagnosis worldwide.

Background: Brain death is a controversial topic. The diagnosis of brain death is not systematically investigated. The current state of brain death diagnosis worldwide is reviewed. Declaration of brain death is a prerequisite for organ donation. The current state of brain death diagnosis worldwide is reviewed.

Methods: Brain death guidelines in adults in 80 countries were obtained through review of literature and legal standards and personal contacts with physicians.

Results: Legal standards on organ transplantation were present in 55 of 80 countries (69%). Practice guidelines





LXI
Legislatura



Cámara de Diputados
H. Congreso de la Unión

Bicentenario de la Independencia y Centenario de la Revolución

20 de septiembre de 2010 Diputados Información Parlamentaria Acuerdos Transparencia Comunicación Mensajería

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LEY General de Salud

Últimas reformas publicadas el 27 de abril de 2010

Texto Vigente:

| [PDF](#) [WORD](#) [ZIP](#) |

Publicación Original:

| DOF 07-02-1984 | [Imagen](#) |

Fe de erratas | DOF 06-09-1984 | [Imagen](#) |

Fe de erratas | DOF 23-07-1986 | [Imagen](#) |

Decretos de Reforma:

- 47 **DECRETO** por el que se reforma el artículo 464 Ter de la Ley General de Salud.
| [DOF 27-04-2010](#) | [Word](#) |
- 46 **DECRETO** por el que se reforma el artículo 222 de la Ley General de Salud.
| [DOF 27-04-2010](#) | [Word](#) |
- 45 **DECRETO** por el que se reforman los artículos 77 Bis 12 y 77 Bis 13 de la Ley General de Salud.
| [DOF 30-12-2009](#) | [Word](#) |
- 44 **DECRETO** por el que se reforman, adicionan y derogan diversas disposiciones de la Ley General de Salud, del Código Penal Federal y del Código Federal de Procedimientos Penales.
| [DOF 20-08-2009](#) | [Word](#) | [Proceso Legislativo](#) |
- 43 **DECRETO** por el que se reforma, adiciona y deroga diversas disposiciones de la Ley General de Salud en materia de trasplantes y donación de órganos.
| [DOF 11-06-2009](#) | [Word](#) | [Proceso Legislativo](#) |
- 42 **DECRETO** por el que se adiciona un artículo 222 Bis a la Ley General de Salud.

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■ 2010 | [Ene-Sep](#) |

En México. Ley General de Salud

- **Artículo 345.** **No existirá impedimento** alguno para que a solicitud y con la autorización de las siguientes personas: el o la cónyuge, el concubinario o la concubina, los descendientes, los ascendientes, los hermanos, el adoptado o el adoptante; conforme al orden expresado; **se prescinda** de los medios artificiales cuando se presente la muerte encefálica comprobada y se manifiesten los demás signos de muerte a que se refiere el artículo 343.



Table 8–3 **Most Common Etiologies of Brain Death**

1. Traumatic brain injury
 2. Aneurysmal subarachnoid hemorrhage
 3. Intracerebral hemorrhage
 4. Ischemic stroke with cerebral edema and herniation
 5. Hypoxic-ischemic encephalopathy
 6. Fulminant hepatic necrosis with cerebral edema and increased intracranial pressure
-



THE PONTIFICAL
ACADEMY
OF SCIENCES

EXCERPT
OF SCRIPTA VARIA 110



Why the Concept of Brain Death is Valid as a Definition of Death

*Statement by Neurologists and Others
and Response to Objections*

..... pp. 5 & 14

NEUROLOGY 1998;51:1538-1545

American Academy of Neurology

Chronic "brain death"

Meta-analysis and conceptual consequences

D. Alan Shewmon, MD From the Department of Pediatrics, Division of Neurology, UCLA Medical School, Los Angeles, CA.

Results: Survival probability over time decreased exponentially in two phases, with initial half-life of 2 to 3 months, followed at 1 year by slow decline to more than 14 years. Survival capacity correlated inversely with age.

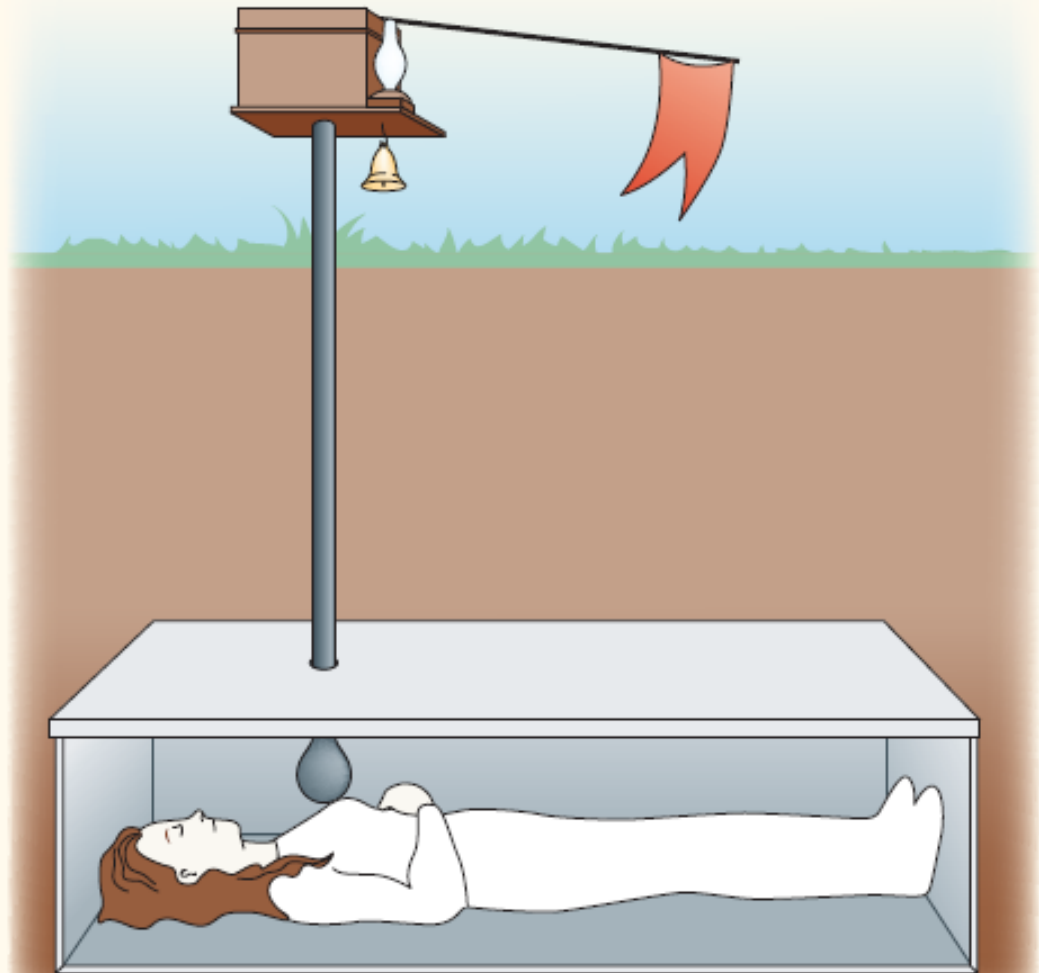
Independently, primary brain pathology was associated with longer survival than were multisystem etiologies.

Initial hemodynamic instability tended to resolve gradually; some patients were successfully discharged on ventilators to nursing facilities or even to their homes.

Conclusions: The tendency to asystole in BD can be transient and is attributable more to systemic factors than to absence of brain function per se.

If BD is to be equated with death, it must be on some basis more plausible than loss of somatic integrative unity.

Miedo al Mal Diagnóstico



SITIOS DE YAHOO!

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HOY - septiembre 27, 2011



Médico la dio por muerta; aún respiraba

"Fui a besar a mi madre por última vez. Grité, ¡está viva! Y todos me miraron como si estuviera loca. [La historia >>](#)

- Hombre en Texas incendió una casa para volver a la prisión



Conclusiones

- La muerte encefálica existe
- Debe hacerse en forma escrupulosa y metódica
- Debemos apegarnos a las guías establecidas
- Los **errores** diagnósticos existen. Deben evitarse
- Respetar los principios éticos