Centro Nazionale Trapianti
ISTITUTO SUPERIORE DI SANITÀ

Rete Nazionale Trapianti

TPM Transplant Procurement Management

Transplant Procurement Management

Diagnosi di Morte

Diagnosi di morte con criteri neurologici

Carlo Alberto Castioni

Anestesia e rianimazione, IRCCS - Bologna

Obiettivi

- Comprendere che la morte è sempre quella dell'encefalo
- Conoscere la corretta sequenza che porta a formulare la diagnosi di morte con criteri neurologici
- Conoscere la fisiopatologia al fine di poterla spiegare in modo semplice
- Conoscere la differenza tra la morte enecefalica e altre neurolesioni

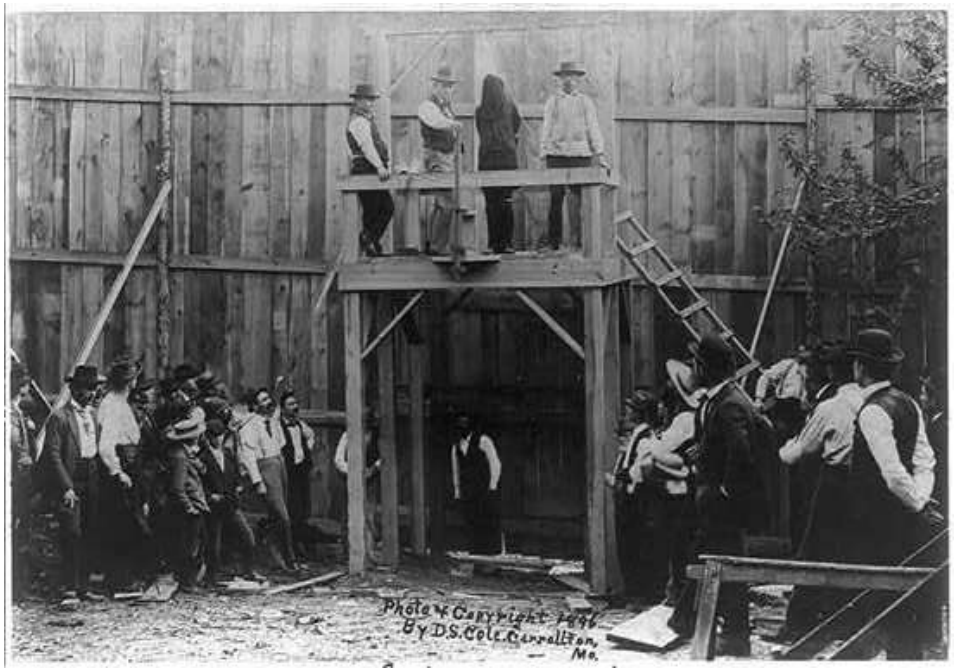
La storia di James Magge, 25 Giugno 1858

Condannato a morte e a pubblica dissezione

Dichiarato morto dopo 14 minuti dall'impiccagione

Alla apertura del torace l'auricola di destra si contrasse ancora per 5 ore e 18 minuti

La diagnosi di morte era corretta?



TWENTY-SIX WEEKLY NUMBERS—FEBRUARY TO AUGUST, 1858

THE

BOSTON

MEDICAL AND SURGICAL

JOURNAL.

EDITED BY

W. W. MORLAND, M.D., AND FRANCIS MINOT, M.D.

VOLUME LVIII.

Boston:

DAVID CLAPP, PUBLISHER AND PROPRIETOR,

CORNER OF WASHINGTON AND FRANKLIN STREETS.

1858.

Reports of Medical Societies.

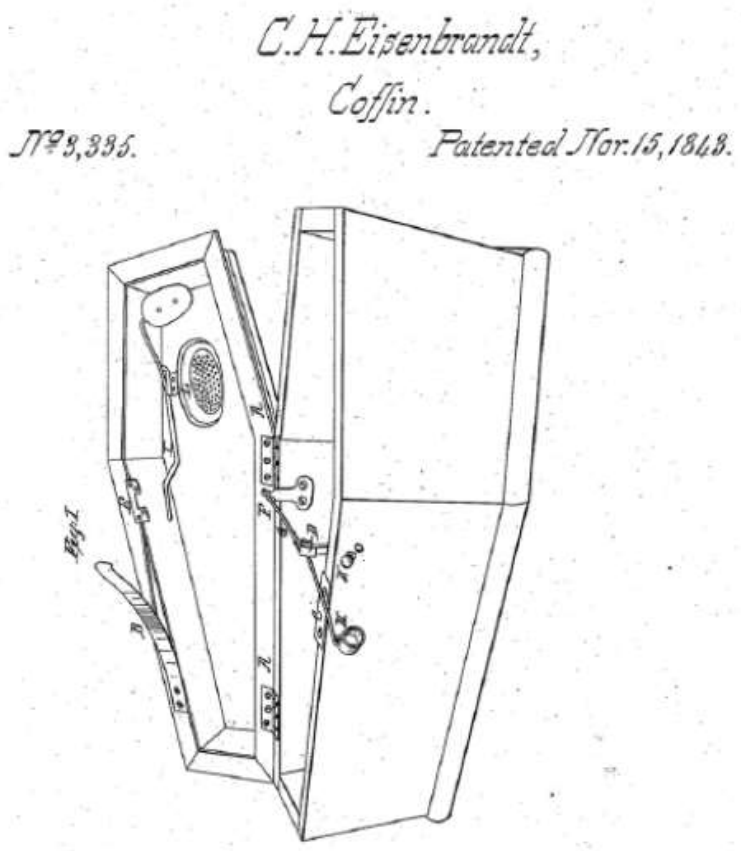
EXTRACTS FROM THE RECORDS OF THE BOSTON SOCIETY FOR MEDICAL IMPROVEMENT. BY F. E. OLIVER, M.D., SECRETARY.

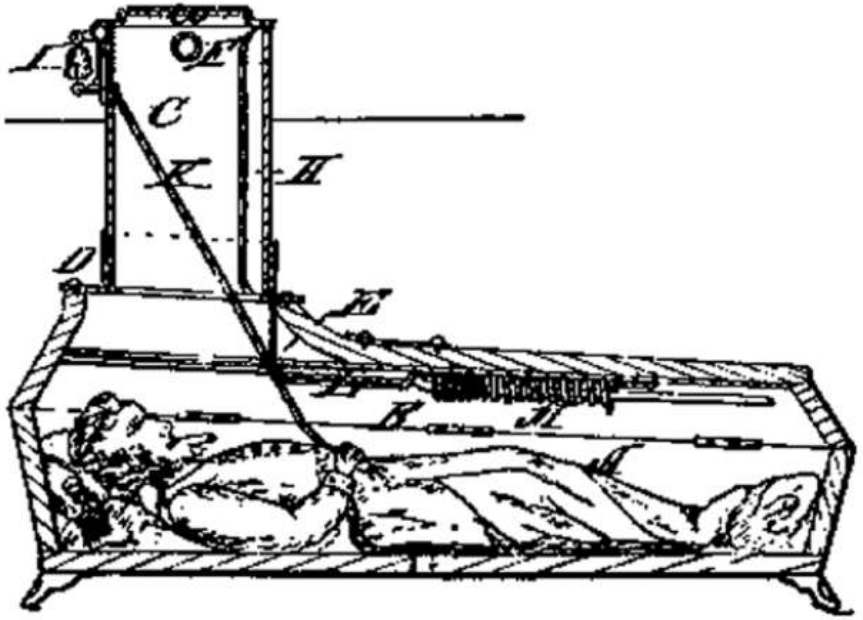
JUNE 28th.—*Execution of Magee. Post-mortem Appearances.* Reported by Dr. HENRY G. CLARK.

Dr. H. J. BIGELOW considered the motions of the heart to be solely due to local irritability.

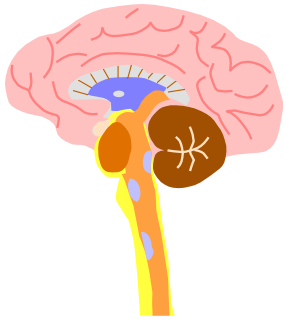
Taphophobia and 'life preserving coffins' in the nineteenth century

Marco Cascella
National Cancer Institute "G. Pascale" Foundation, Naples, Italy

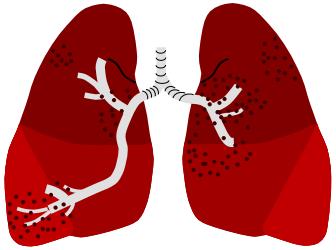




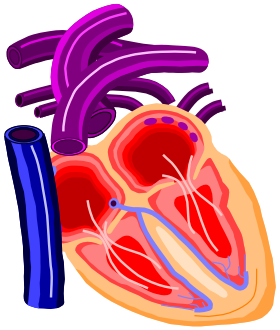
History of Psychiatry, 2016



Assenza di risposta agli stimoli



Assenza del respiro



Assenza del battito cardiaco

TRAITÉ

DES

SIGNES DE LA MORT

ET DES MOYENS DE PRÉVENIR

LES ENTERREMENTS PRÉMATURÉS

PAR E. BOUCHUT,

Docteur en médecine,

ancien interne lauréat, médaille d'or des hôpitaux,

lauréat de la Faculté de médecine de Paris (prix Montyon),

chef de clinique médicale à l'Hôtel-Dieu.

Ouvrage couronné par l'Institut de France.

PARIS,

CHEZ J.-B. BAILLIÈRE,

LIBRAIRE DE L'ACADÉMIE NATIONALE DE MÉDECINE,

RUE DE L'ÉCOLE-DE-MÉDECINE, 17.

A LONDRES, CHEZ H. BAILLIÈRE, 219, REGENT-STREET.

A MADRID, CHEZ CH. BAILLY, LIBRAIRE.

1849

Source gallica.bnf.fr / Bibliothèque nationale de France

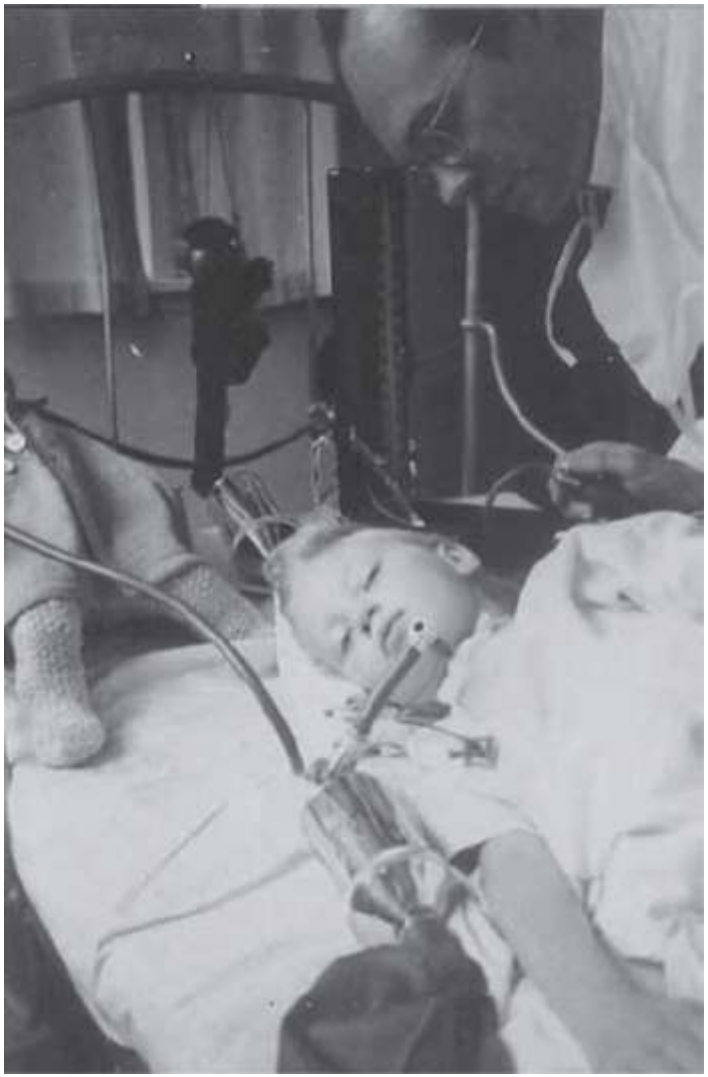
British Medical Journal.

SATURDAY, SEPTEMBER 28TH, 1895.

THE SIGNS OF DEATH.

To avoid the possibility of hasty interment of the living as dead no burial should be allowed to take place until after the lapse of twenty-four hours at least from the time of the supposed death, and only then upon the certificate of a medical practitioner who has examined the body.

NASCITA DELLE TERAPIE INTENSIVE



REVUE NEUROLOGIQUE

1959

MÉMOIRES ORIGINAUX

LE COMA DÉPASSÉ
(MEMOIRE PRÉLIMINAIRE)

PAR MM.

P. MOLLARET et M. GOULON

Après quatre années de réflexion, nous croyons venu le moment d'ajouter un chapitre nouveau au domaine traditionnel des comas.

Précisons de suite que ce problème du coma dépassé a été mis, l'année dernière, au programme de la prochaine Journée de Réanimation de l'Hôpital Claude-Bernard du 7 octobre 1959, en vue d'une mise au point intégrale.

La présente communication, qui n'a ainsi qu'une valeur préliminaire, peut être offerte, peut-être, en hommage à la XXIIIe Réunion Neurologique Internationale, qui a accepté de tenir une de ses séances dans le Centre de Réanimation où fut élaboré ce travail. Précisons également que le coma dépassé a déjà conquis droit de cité dans l'important volume qui vient de paraître de H. Fischgold et P. Mathis (*Obnubilations, comas et stupeurs*, Masson édit., Paris, 1959, p. 5 et pp. 51-52) ; nous remercions ces auteurs d'être venus se faire présenter les premiers malades et d'avoir donné place à quelques-uns de nos documents.

Il sostegno artificiale respiratorio e circolatorio consentiva a pazienti con *«stato di coma estremamente profondo»* e in assenza di:

- riflessi dei nervi cranici
- respiro spontaneo
- attività elettrica cerebrale

di conservare temporaneamente l'attività cardiaca spontanea.

1968

HARVARD MEDICAL SCHOOL
MASSACHUSETTS GENERAL HOSPITAL

HENRY K. BEECHER, M.D.
Dorr Professor of Research in Anaesthesia

PLEASE REPLY TO
DEPARTMENT OF ANAESTHESIA
Massachusetts General Hospital
Boston, Massachusetts 02114

Meeting of ad hoc Committee on Brain Death

Tuesday, May 7 at 3 p.m., Ware Room, Countway Library

These coming: H.K. Beecher

✓ R.D. Adams
✓ A.C. Barger
✓ W. Curran
✓ D. Denny-Brown
~~D.L. Farnsworth~~
J. Folch-pi
✓ J. Murray
✓ R. Potter
~~R. Schwab~~ JLL → Robt. Young

Not coming:

E.I. Mendelsohn (faculty meeting)
J.P. Merrill (out of town)
W. Sweet (probably not back from Italy)

Wijdicks EFM. Neurology 2003;61:970–976

Special Communication

1968

A Definition of Irreversible Coma

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

Our primary purpose is to define irreversible coma as a new criterion for death. There are two reasons why there is need for a definition: (1) Improvements in resuscitative and supportive measures have led to increased efforts to save those who are desperately injured. Sometimes these efforts have only partial success so that the result is an individual whose heart continues to beat but whose brain is irreversibly damaged. The burden is great on patients who suffer permanent loss of intellect, on their families, on the hospitals, and on those in need of hospital beds already occupied by these comatose patients. (2) Obsolete criteria for the definition of death can lead to controversy in obtaining organs for transplantation.

Irreversible coma has many causes, but *we are concerned here only with those comatose individuals who have no discernible central nervous system activity*. If the characteristics can be defined in satisfactory terms, translatable into action—and we believe this is possible—then several problems will either disappear or will become more readily soluble.

More than medical problems are present. There are moral, ethical, religious, and legal issues. Adequate definition here will prepare the way for better insight into all of these matters as well as for better law than is currently applicable.

The Ad Hoc Committee includes Henry K. Beecher, MD, *chairman;* Raymond D. Adams, MD; A. Clifford Barger, MD; William J. Curran, LLM, 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, ThD; Robert Schwab, MD; and William Sweet, MD.

Reprint requests to Massachusetts General Hospital, Boston 02114 (Dr. Henry K. Beecher).

Characteristics of Irreversible Coma

An organ, brain or other, that no longer functions and has no possibility of functioning again is for all practical purposes dead. Our first problem is to determine the characteristics of a *permanently* nonfunctioning brain.

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. In situations where for one reason or another electroencephalographic montioring is not available, the absence of cerebral function has to be determined by purely clinical signs, to be described, or by absence of circulation as judged by standstill of blood in the retinal vessels, or by absence of cardiac activity.

1. *Unreceptivity and Unresponsitivity.*—There is a total unawareness to externally applied stimuli and inner need and complete unresponsiveness—our definition of irreversible coma. Even the most intensely painful stimuli evoke no vocal or other response, not even a groan, withdrawal of a limb, or quickening of respiration.

2. *No Movements or Breathing.*—Observations covering a period of at least one hour by physicians is adequate to satisfy the criteria of no spontaneous muscular movements or spontaneous respiration or 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

- Il soggetto non dà nessun segno di responsività.
- Non presenta alcun movimento.
- Non respira spontaneamente una volta deconnesso dal respiratore.
- Non conserva alcun riflesso.
- L'EEG non deve dimostrare alcuna attività elettrica.
- I segni sopra elencati devono mantenersi invariati per un periodo di 24 ore.

1968

HARVARD MEDICAL SCHOOL
MASSACHUSETTS GENERAL HOSPITAL

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Wijdicks EFM. Neurology 2003;61:970–976

DISCUSSION

read "death"

The primary purpose has been and is to define irreversible coma. number of secondary issues flow from this. They will be discussed.

Irreversible coma poses a serious problem for hospitals. Inevitably,

Under what circumstances, if ever, shall extraordinary means of support be terminated, with death to follow? [Answer: When the criteria of irreversible coma described above have been fulfilled.]

death

Wijdicks EFM. Neurology 2003;61:970–976

1981

THE REPORT OF THE PRESIDENT'S COMMISSION

Defining Death in Theory and Practice

by JAMES L. BERNAT, CHARLES M. CULVER, AND BERNARD GERT

In July 1981, the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research published its first report, *Defining Death: Medical, Legal, and Ethical Issues in the Determination of Death.*[1] The Commission made this subject one of its first studies primarily because of a legal interest: there has been recent disagreement about how best to translate the current physiological understanding of death into acceptable statutory language. But the Commission was also interested in reviewing the dispute between "whole brain" and "higher brain" formulations of death and appraising currently used brain-based tests for death, which have become increasingly varied and sophisticated.

During its meetings, the Commission heard testimony from a variety of experts. Philosophers testified on the conceptual issues involved in defining death; theologians spoke about traditional religious concepts; and neurologists described the most valid tests for determining cessation of functioning of the brain.

Much of the Commission's report consists of a thorough summary of current knowledge of the physiology of death and how this knowledge has altered understanding of the concept of death itself. Although this presentation is excellent, we believe the model statute that the Commission recommends should not be adopted because there are significant flaws in it, as well as in the Commission's supporting arguments.

JAMES L. BERNAT, M.D., *is on the staff of the division of neurology of the department of medicine, Dartmouth Medical School, and of the Medical Service, Veterans Administration Hospital, White River Junction, Vermont.*

CHARLES M. CULVER, M.D., Ph.D., *is on the staff of the department of psychiatry, Dartmouth Medical School.*

BERNARD GERT, Ph.D., *is on the staff of the department of philosophy, Dartmouth College.*

There are two distinct, though related, problems in constructing a statutory definition of death. The first is a theoretical concern—providing the correct physiological standard. The second is the practical difficulty of reconciling this standard, which includes a new understanding of death, with the more popular conception of death.

The new understanding of death is largely a consequence of technological advances in life-support systems. Some severely brain-injured patients who have suffered permanent cessation of functioning of the entire brain can be given circulatory and respiratory support such that:

> . . . their appearance resembles that of the dead as traditionally perceived: they no longer respond to their environment by sensate and intellectual activity. But their appearance also differs from that traditionally associated with the dead because mechanical support generates breathing, heartbeat, and the associated physical characteristics (e.g., warm, moist skin) of life (p. 21).*

These patients present problems of labeling, for they have some, but not all, of the traditional characteristics that lead one to call a person "dead." Until recently this was rarely, if ever, the case: patients who had some of these characteristics also had all the others. It is not that new technology has changed the concept of death; rather, this technology has made it apparent that previously there had been no clear, precise definition of death.

In his book *Pragmatism*, William James provided a useful example of this kind of definitional problem with regard to the phrase "going around." A squirrel was on the trunk of a tree, and a hunter was on the opposite side. Wishing to see the squirrel, the hunter proceeded to go around the tree; the squirrel, not wishing to be seen, also went around the tree, always facing the hunter but keeping the trunk between them. Had the hunter "gone around" the squirrel or not? James correctly noted that the phrase "going around" was ambiguous; in one sense (going around from north, to west, to south, to east, and back to north) the hunter did go around the squirrel, and in the other sense (going around from front, to left, to back, to right, and to front again) he did not. The old sense of "going around" was gone forever. Indeed, there never really was an old, unambiguous sense.

Similarly, one regarded a man as dead if the organism as a whole had permanently ceased to function, if he had permanently stopped breathing, and if his heart had permanently stopped beating. All these usually happened at the same time or within a few minutes of one another, so that people did not consider how they would describe the person if one phenomenon occurred but the other two did not. However, because of modern technology, there are patients whose organism as a whole has permanently ceased to function, but whose respiration and circulation do function through mechanical support systems.

In James's case, there seems no reason for choosing either sense of "going around" as the more important and basic. However, in the case of death clearly the permanent cessation of the organism as a whole is far closer to what has always been meant by death than is permanent absence of breathing and heartbeat. Recognizing this point, the Commission states:

> Although absence of breathing and heartbeat may often have been spoken of as "defining" death, review of history and of current medical and popular understanding makes clear that these were merely evidence for the disintegration of the organism as a whole as discussed in Chapter Three (p. 58).

Thus, the Commission defined the concept of death as the permanent cessation of functioning of the organism as a whole, and developed a statutory definition or standard of death on this basis. We believe that this is the correct approach,[2] and that the report should be judged on how well it has carried out this intention.

The second, practical problem that a new statutory definition must confront results from the rapid increase in the medical understanding of the physiology of death.

*Page references herein refer to the *Defining Death* report.

Un individuo che ha subito la cessazione irreversibile delle funzioni respiratoria e circolatoria o la cessazione irreversibile di tutte le funzioni dell'intero encefalo, incluso il tronco (Whole Brain Death) è morto.
La determinazione di morte deve essere fatta secondo gli standard medici accettati

President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioural Research. Defining death: a report on the medical, legal and ethical issues in the determination of death. 1981, U.S. Government Printing Office, Washington, D.C.

LEGGE 29 DICEMBRE 1993, n. 578

(G.U. del 8-1-1994, n. 5)

NORME PER L'ACCERTAMENTO E LA CERTIFICAZIONE DI MORTE

La Camera dei deputati ed il Senato della Repubblica hanno approvato;

IL PRESIDENTE DELLA REPUBBLICA
Promulga

la seguente legge:

Art. 1 *Definizione di morte*

1. La morte si identifica con la cessazione irreversibile di tutte le funzioni dell'encefalo.

Arresto cardio-respiratorio

Lesione cerebrale devastante

Perdita irreversibile di tutte le funzioni dell'encefalo

Criteri cardio circolatori

Criteri Neurologici

Morte

Infarto Cerebrale
Assenza di Flusso Ematico Cerebrale

Il termini «morte encefalica» e «morte cardiaca» dovrebbero essere aboliti e sostituiti con:

morte determinata con criteri neurologici

morte determinata con criteri cardiocircolatori

LEGGE 29 DICEMBRE 1993, n. 578

(G.U. del 8-1-1994, n. 5)

NORME PER L'ACCERTAMENTO E LA CERTIFICAZIONE DI MORTE

La Camera dei deputati ed il Senato della Repubblica hanno approvato;

IL PRESIDENTE DELLA REPUBBLICA
Promulga

la seguente legge:

Art. 2 - Accertamento di morte

1. La morte per arresto cardiaco si intende avvenuta quando la respirazione e la circolazione sono cessate per un intervallo di tempo tale da comportare la perdita irreversibile di tutte le funzioni dell'encefalo e può essere accertata con le modalità definite con decreto emanato dal Ministro della sanità.

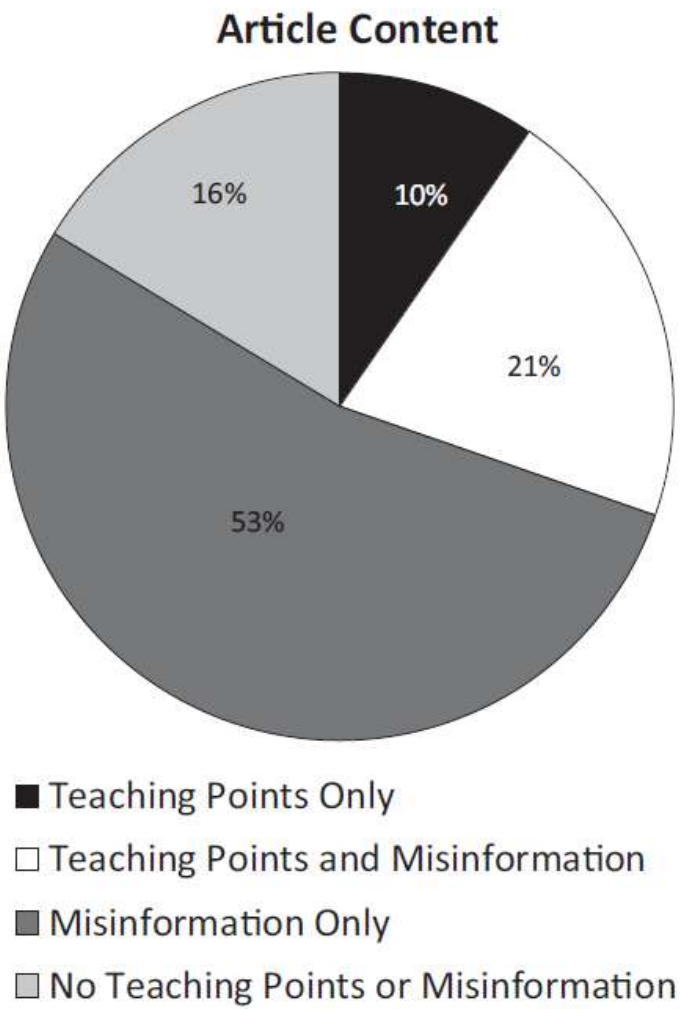
2. La morte nei soggetti affetti da lesioni encefaliche e sottoposti a misure rianimatorie si intende avvenuta quando si verifica la cessazione irreversibile di tutte le funzioni dell'encefalo ed è accertata con le modalità clinico-strumentali definite con decreto emanato dal Ministro della sanità.

MORTE DETERMINATA CON CRITERI NEUROLOGICI

La certezza della morte prima della donazione è il fattore che per molti cittadini influisce maggiormente sulla scelta a favore o contro la donazione.

Public education and misinformation on brain death in mainstream media

Ariane Lewis[1] | Aaron S. Lord[1] | Barry M. Czeisler[1] | Arthur Caplan[2]



Clin Transplant, 2016

Mail Online 17 October 2012

The girl who wouldn't die: Incredible story of the 19-year-old who woke up as doctors were preparing to harvest her organs

il Giornale.it cronache

Home Politica Mondo Cronache Blog Economia Sport Cultura Milano LifeStyle S

Condividi:

Commenti: 16

In coma e senza speranze, 17enne si sveglia di colpo prima dell'espianto degli organi

La storia di Lorenzo, che i medici avevano dato per spacciato dopo l'incidente in motorino: è miracolosamente tornato alla vita

Pina Francone - Mar, 14/05/2019 - 12:51

PSEUDOGIORNALISMO

IL RAGAZZO ERA IN COMA, LA DONAZIONE ORGANI SI FA IN CASO DI MORTE CEREBRALE, NON ERA QUESTO IL CASO, SOSTENERE CHE FOSSE A UN PASSO DALL'ESPIANTO È DIRE UNA BUGIA

Centro Nazionale Trapianti

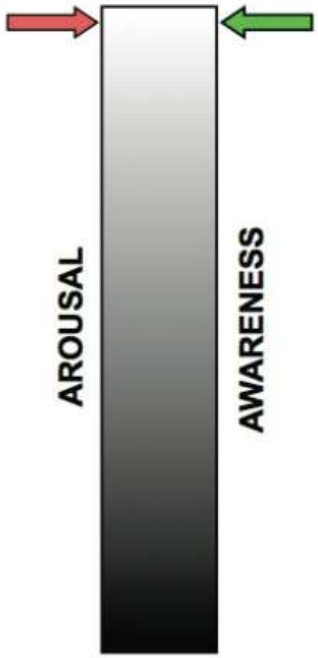
Centro Nazionale Trapianti

TPM Transplant Procurement Management

Brain function in coma, vegetative state, and related disorders

Steven Laureys, Adrian M Owen, and Nicholas D Schiff

NORMAL CONSCIOUSNESS



The Lancet, 2004

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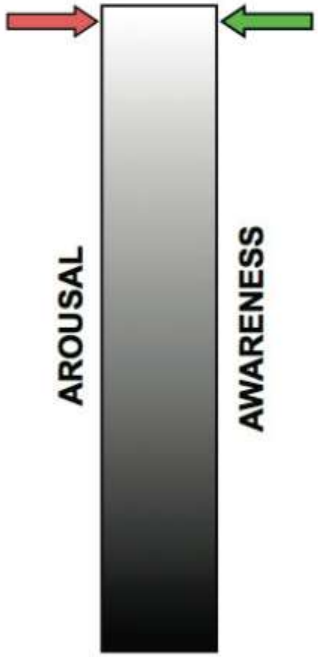
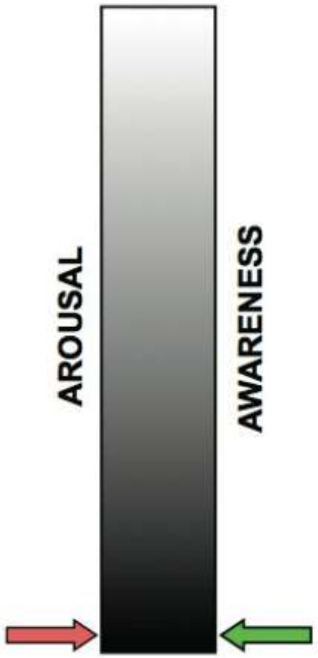


COMA

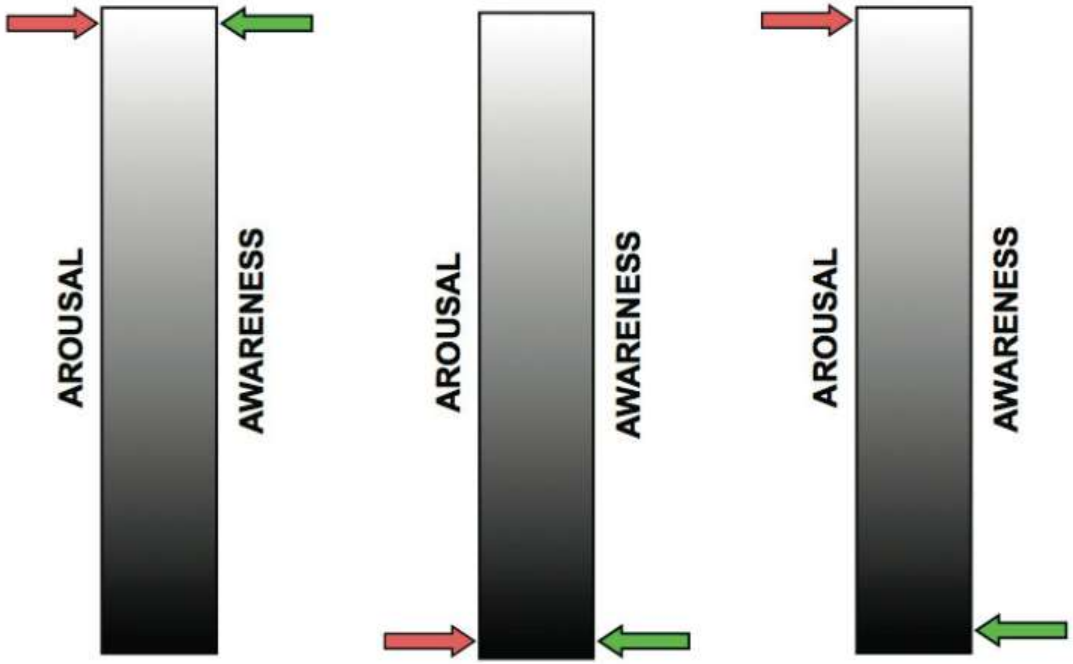


The Lancet, 2004

Brain function in coma, vegetative state, and related disorders

Steven Laureys, Adrian M Owen, and Nicholas D Schiff

NORMAL CONSCIOUSNESS | **COMA** | **VIGILANZA NON RESPONSIVA**



The Lancet, 2004

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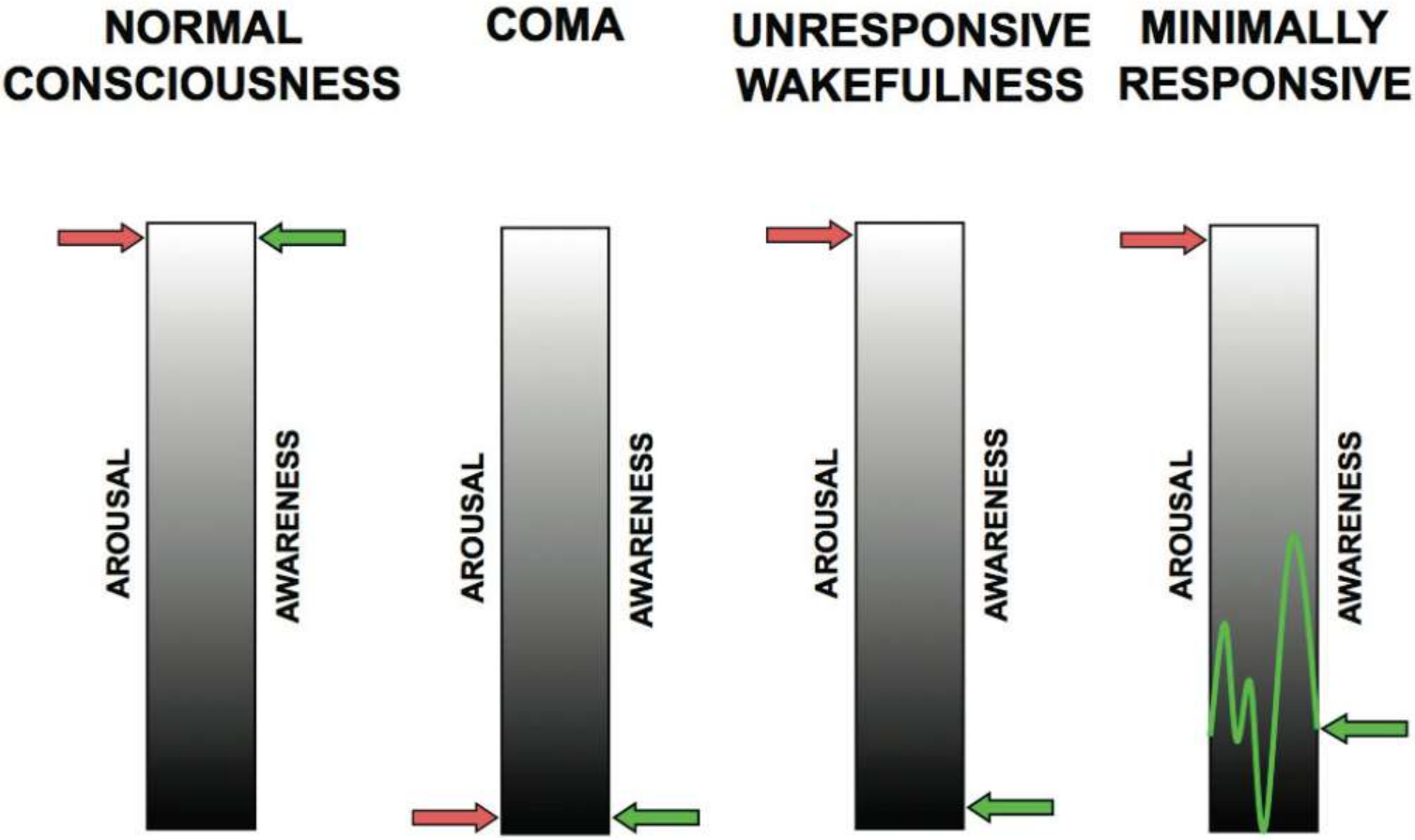

The Lancet, 2004

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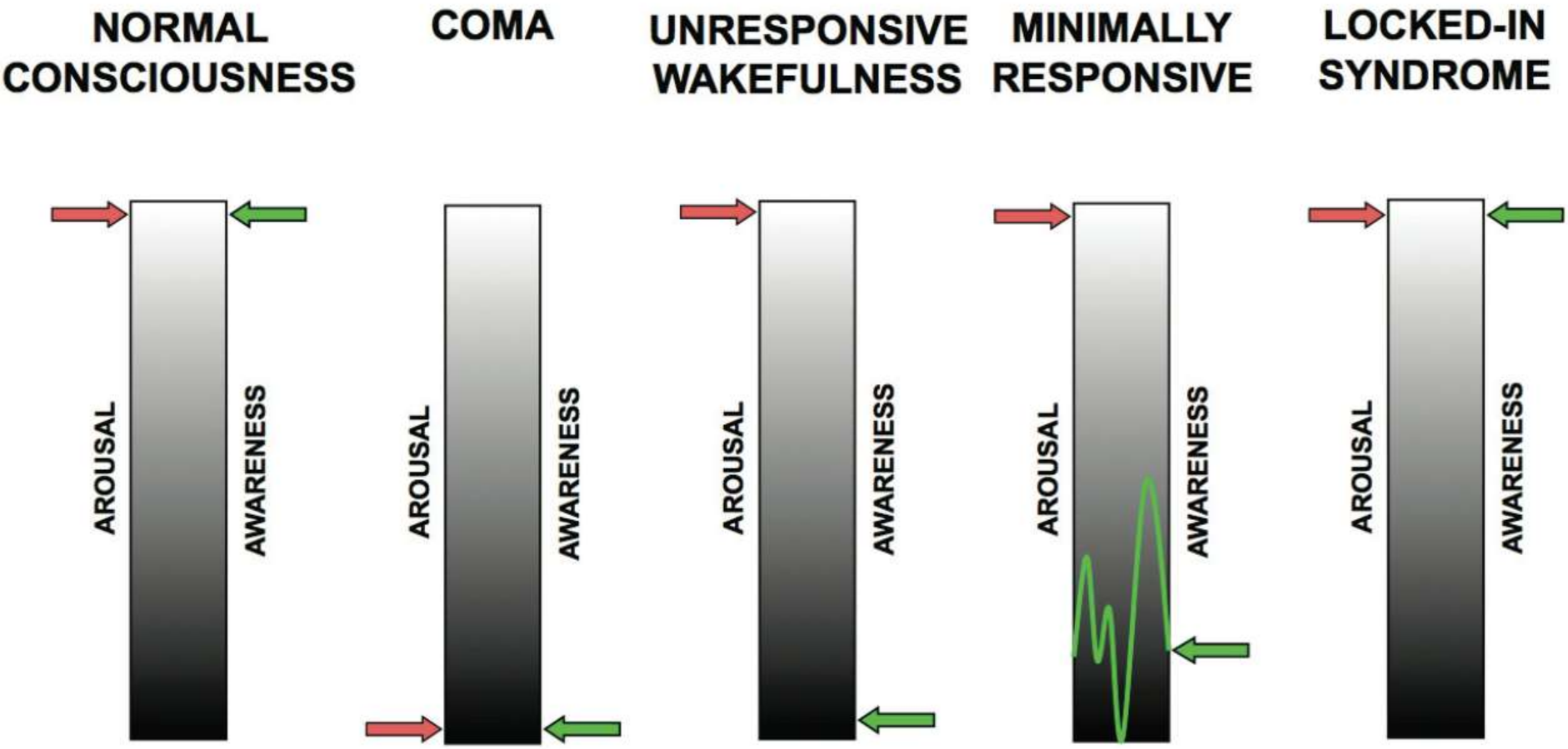


The Lancet, 2004

Transplant Procurement Management

TPM

Recommendations for the Critical Care Management of Devastating Brain Injury: Prognostication, Psychosocial, and Ethical Management

A Position Statement for Healthcare Professionals from the Neurocritical Care Society

Michael J. Souter[1] · Patricia A. Blissitt[2,3] · Sandralee Blosser[4,5] · Jordan Bonomo · David Greer[8] · Draga Jichici[9] · Dea Mahanes[10] · Evie G. Marcolini[11] · Charles Miller[12] · Kiranpal Sangha[13] · Susan Yeager[14]

Neurocritical Care, 2015

Management of perceived devastating brain injury after hospital admission: a consensus statement from stakeholder professional organizations

D. Harvey[1,*], J. Butler[2], J. Groves[3], A. Manara[4], D. Menon[5], E. Thomas[6] and M. Wilson[7]

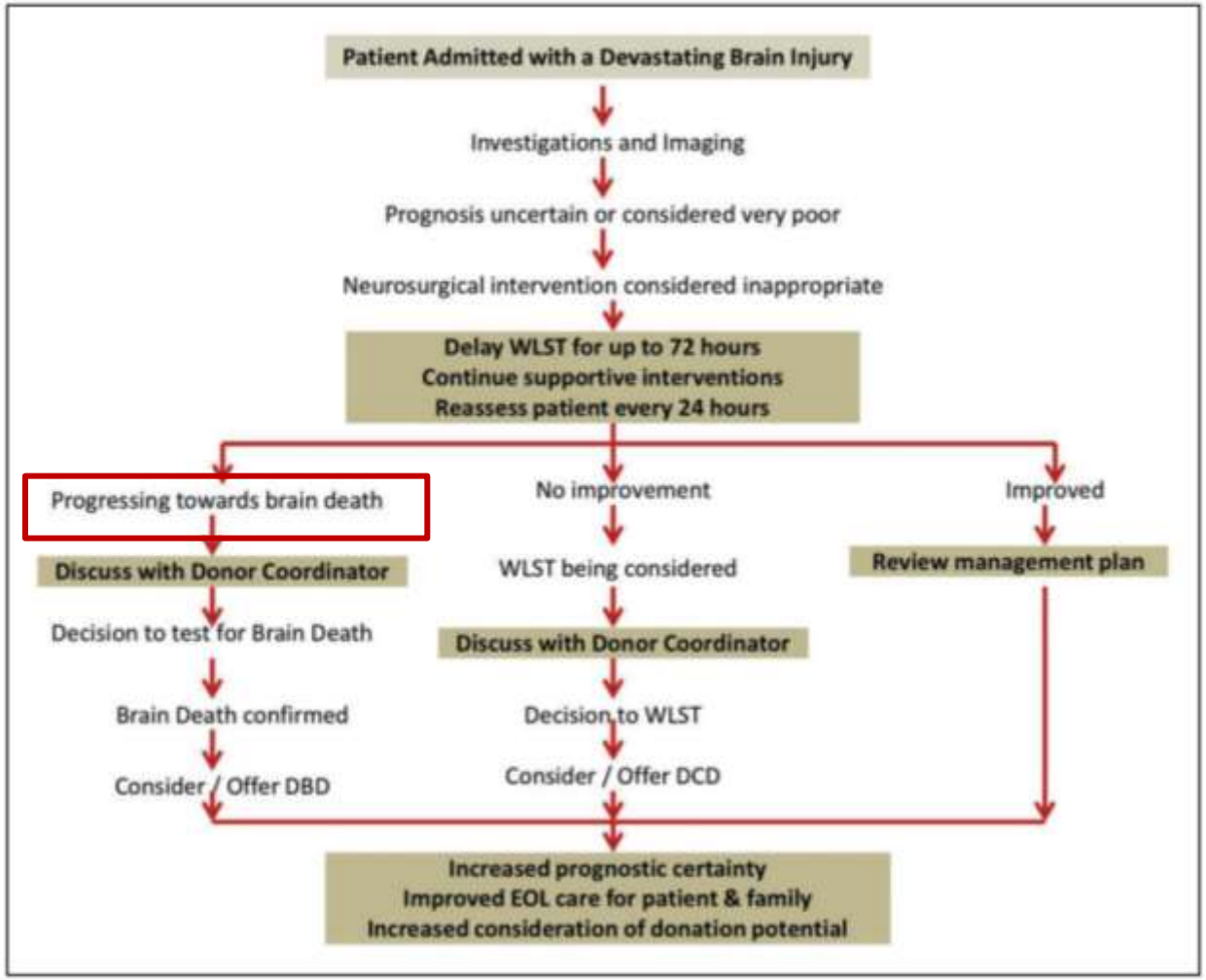
BMJ, 2018

Rete Nazionale Trapianti

TPM Transplant Procurement Management

A case for stopping the early withdrawal of life sustaining therapies in patients with devastating brain injuries

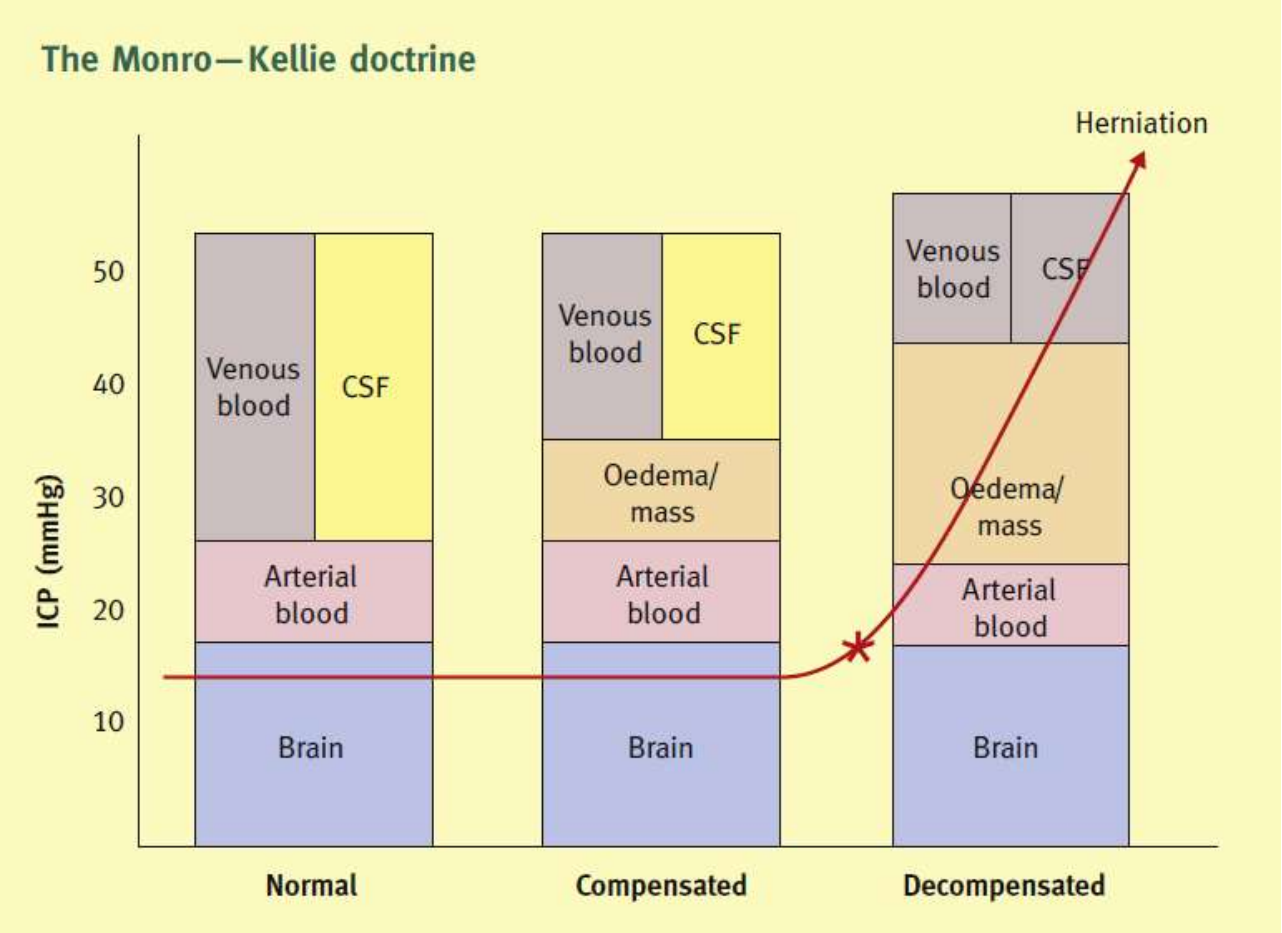
Alex R Manara[1], Ian Thomas[1] and Richard Harding[2,3]



JICS, 2016

Intracranial pressure, cerebral blood flow and brain oedema

Victoria Wykes
Raghu Vindlacheruvu

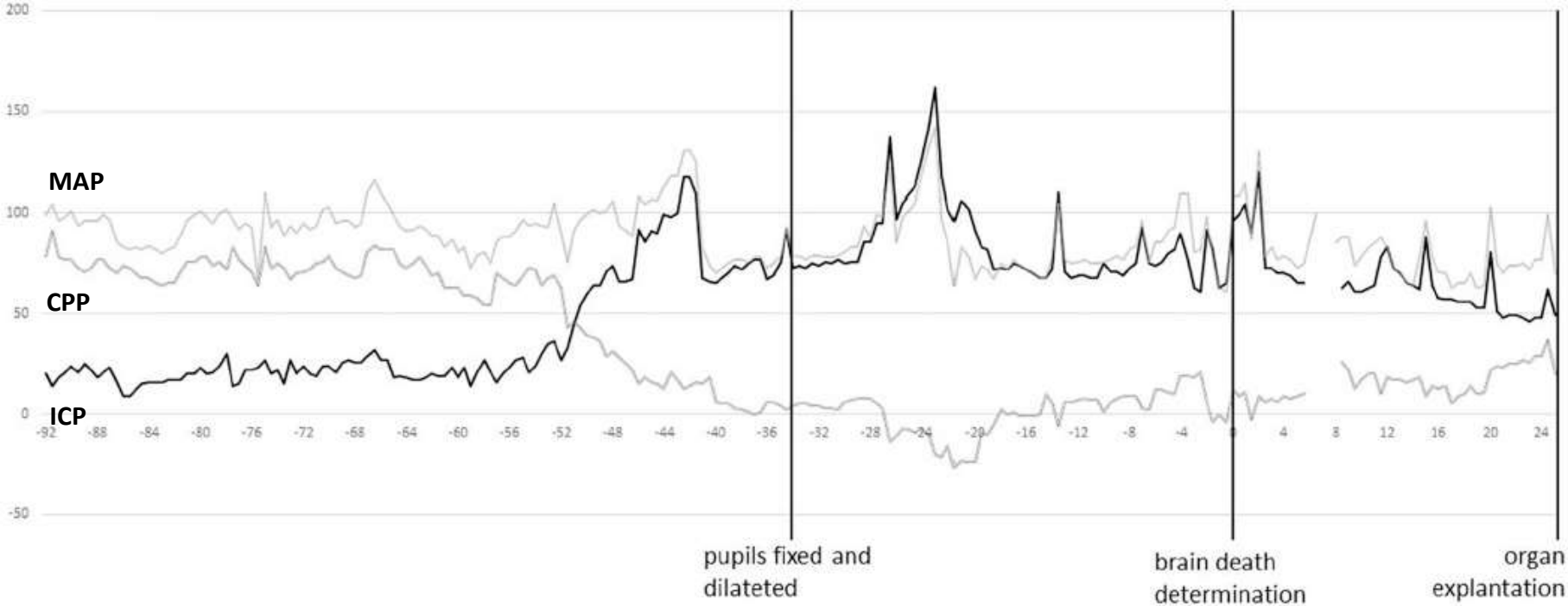


Neurosurgery, 2015

Pressione di Perfusione Cerebrale = Pressione Arteriosa Media – Pressione Intracranica

Progress of intracranial pressure and cerebral perfusion pressure in patients during the development of brain death

Christian Roth[a,b,*], Andreas Ferbert[c], Johannes Matthaei[a], Stefanie Kaestner[d], Holger Engel[e], Markus Gehling[f,g]

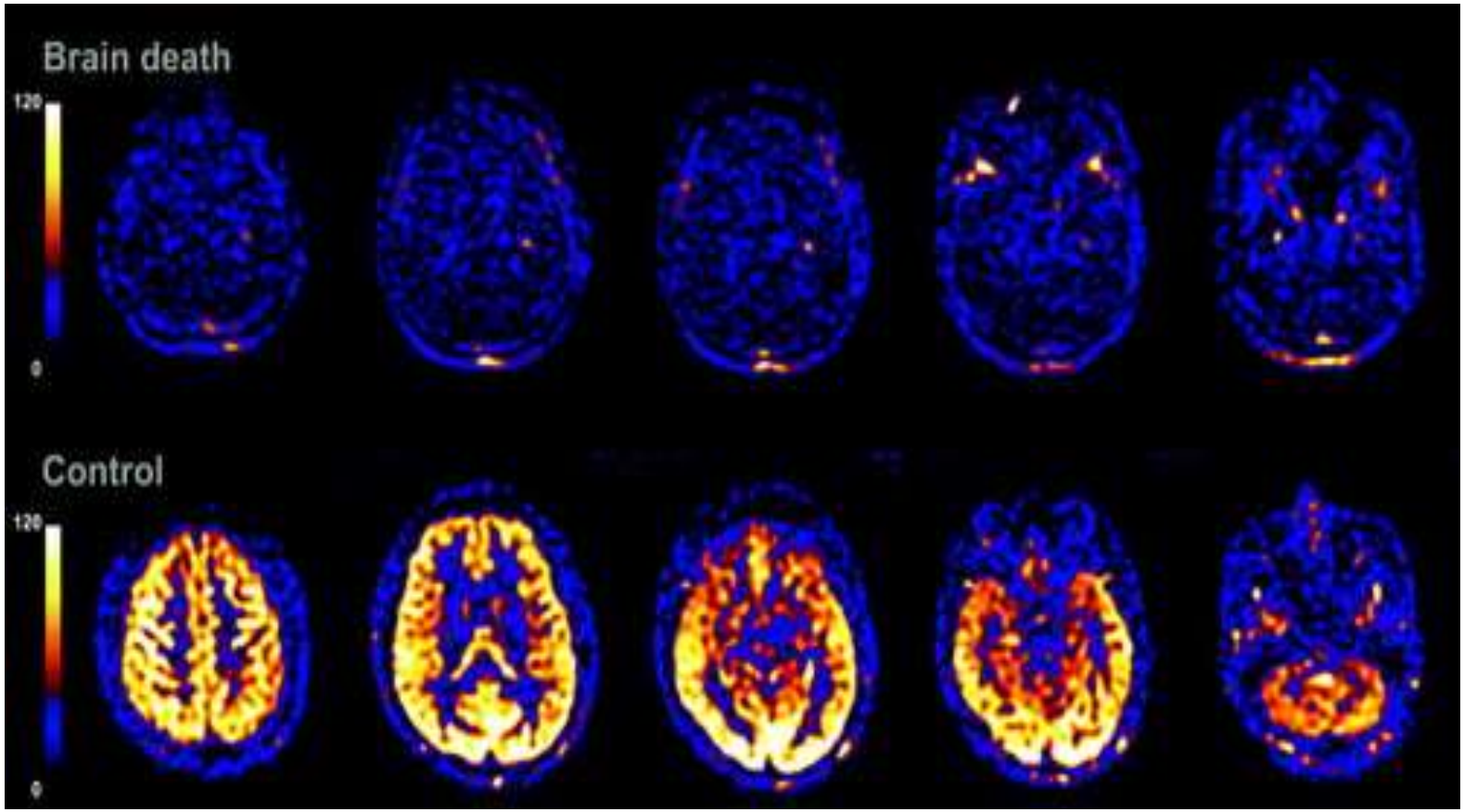


Journal of Neurological Science, 2019

Brain Death

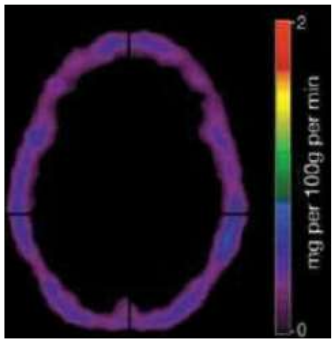
Evaluation of Cerebral Blood Flow by Use of Arterial Spin Labeling

Tae Jin Yun, MD, Chul-Ho Sohn, MD, Byung-Woo Yoon, MD, Beom Seok Jeon, MD, Seung Hong Choi, MD, Ji-hoon Kim, MD, Moon Hee Han, MD, and Kee-Hyun Chang, MD



Circulation, 2011

Encefalo non più perfuso



Polmoni Ventilati

Cuore che batte

Determination of Brain Death/Death by Neurologic Criteria
The World Brain Death Project

David M. Greer, MD, MA; Sam D. Shemie, MD; Ariane Lewis, MD; Sylvia Torrance, BSc; Panayiotis Varelas, MD; Fernando D. Goldenberg, MD; James L. Bernat, MD; Michael Souter, MBChB; Mehmet Akif Topcuoglu, MD; Anne W. Alexandrov, PhD; Marie Baldisseri, MD, MPH; Thomas Bleck, MD; Giuseppe Citerio, MD; Rosanne Dawson, LLB; Arnold Hoppe, MD; Stephen Jacobe, MD, MHL; Alex Manara, MBBCh; Thomas A. Nakagawa, MD; Thaddeus Mason Pope, JD, PhD; William Silvester, MD; David Thomson, MD; Hussain Al Rahma, MD; Rafael Badenes, MD, PhD; Andrew J. Baker, MD; Vladimir Cerny, MD, PhD; Cherylee Chang, MD; Tiffany R. Chang, MD; Elena Gnedovskaya, MD, PhD; Moon-Ku Han, MD; Stephen Honeybul, MD; Edgar Jimenez, MD; Yasuhiro Kuroda, MD, PhD; Gang Liu, MD, PhD; Uzzwal Kumar Mallick, MD; Victoria Marquevich, MD; Jorge Mejia-Mantilla, MD, MSc; Michael Piradov, MD, PhD; Sarah Quayyum, JD, LLM; Gentle Sunder Shrestha, MD; Ying-ying Su, MD, PhD; Shelly D. Timmons, MD; Jeanne Teitelbaum, MD; Walter Videtta, MD; Kapil Zirpe, MD; Gene Sung, MD, MPH

Brain Death is the **irreversible loss** of capacity for **consciousness** combined with the irreversible loss of all **brainstem functions** including the **capacity to breathe**

It is recommended that persistence of hormonal regulatory function does not preclude the diagnosis of BD/DNC.

JAMA, 2020

LA DIAGNOSI DI MORTE
E' COSA DIVERSA
DALL' ACCERTAMENTO/CERTIFICAZIONE DI MORTE

DIAGNOSI	**ACCERTAMENTO**
E' clinica	E' giuridico
Risponde a scienza e coscienza	Risponde alla legge
E' uguale ovunque	Varia a seconda della legislazione vigente

In 1981, there were seven different brain death statutes. So
theoretically (but not really) you could put someone in an ambulance
in California and drive them across the country to Pennsylvania and
they'd be dead, alive, alive, dead, alive, dead, dead, alive, dead,
dead, and arrive in Pennsylvania alive.

That's ridiculous. Our death criteria must be uniform - you can't be
dead in one state and alive in another state.

Annas GJ: The "right to die" in America: sloganeering from Quinlan and Cruzan to Quill and Kevorkian.
Duquesne Law Rev 1996; 34: 875-897

Caren G. Solomon, M.D., M.P.H., *Editor*

Determination of Brain Death

David M. Greer, M.D.

1. Eziopatogenesi Nota

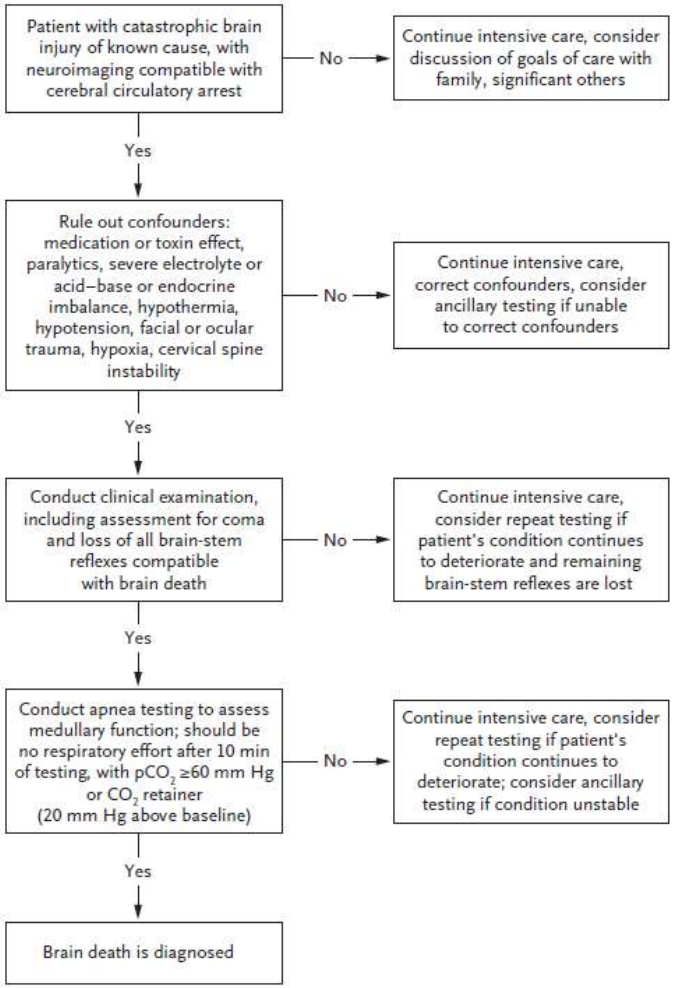


Figure 2. Algorithm for the Determination of Death According to Neurologic Criteria.

NEJM, 2021

Centro Nazionale Trapianti

Rete Nazionale Trapianti

TPM Transplant Procurement Management

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Determination of Brain Death

David M. Greer, M.D.

2. Fattori Confondenti

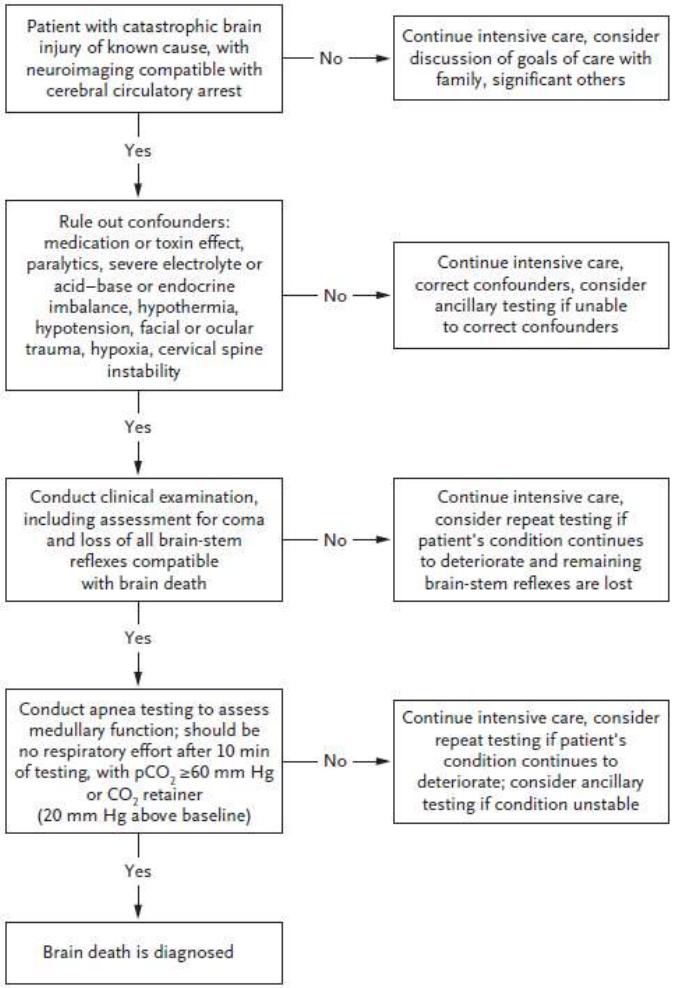


Figure 2. Algorithm for the Determination of Death According to Neurologic Criteria.

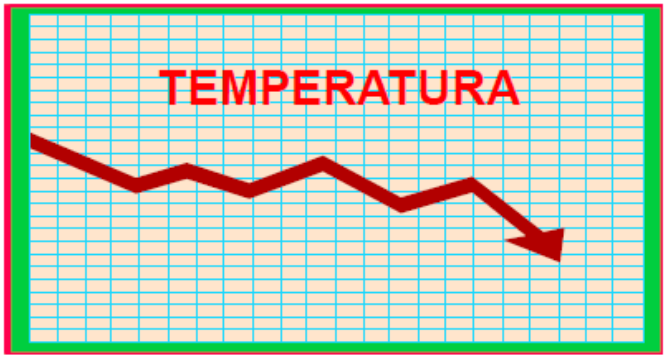
NEJM, 2021

STABILITA EMODINAMICA

OCCORRE IL MANTENIMENTO DI UNA POTENZIALE PRESSIONE DI PERFUSIONE CHE RENDA ATTENDIBILE L' ESAME NEUROLOGICO

P.A. media > 70 mmHg

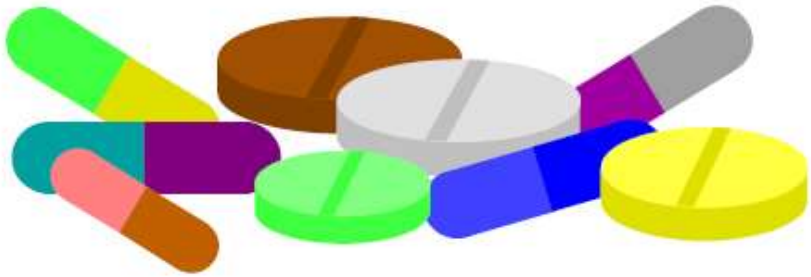
TEMPERATURA



- **ipotermia lieve (35-32ºC)**
  - depressione metabolismo cerebrale
  - amnesia disartria
  - confusione, stupor
  - ipertonia
- **ipotermia moderata (32-28ºC)**
  - diminuzione del livello di coscienza
  - dilatazione pupillare
  - iporeflessia tendinea
  - anormalità EEG
- **ipotermia severa (28-20ºC)**
  - coma
  - assenza del riflesso fotomotore
  - areflessia tendinea
  - riduzione attività EEG fino al S.E.C.

Temperatura non inferiore a 35° C

INTERAZIONI FARMACOLOGICHE



- barbiturici
- benzodiazepine
- morfinici
- propofol
- curari
- altro

INTERFERENZE ENDOCRINO - METABOLICHE

Escludere che il quadro neurologico possa essere alterato da patologie concomitanti

- coma ipoglicemico
- encefalopatia epatica
- coma ipotiroideo

Caren G. Solomon, M.D., M.P.H., *Editor*

Determination of Brain Death

David M. Greer, M.D.

3. Esame Clinico

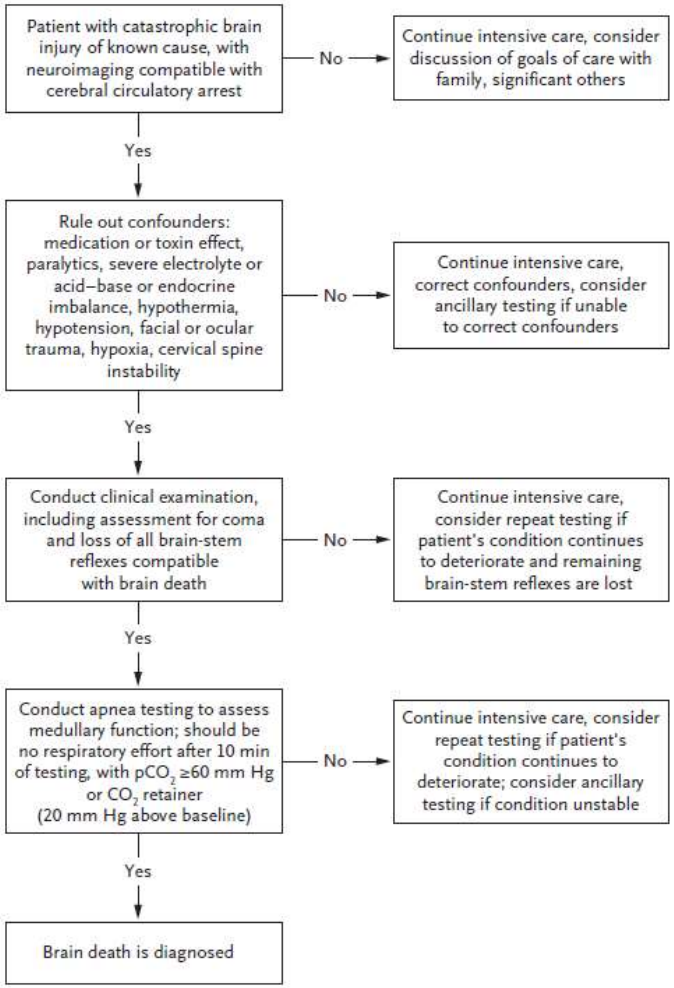


Figure 2. Algorithm for the Determination of Death According to Neurologic Criteria.

NEJM, 2021

ESPLORAZIONE NEUROLOGICA

- sistematica, completa, rigorosa
- eseguita da medici esperti
- la diagnosi di M.E. è eminentemente clinica
- le sue componenti fondamentali sono:
- **coma areattivo**
- **assenza dei riflessi di tronco**
- **apnea**

COMA AREATTIVO

- nessuna risposta motoria allo stimolo portato nel territorio trigeminale
- nessuna risposta motoria facciale allo stimolo doloroso ovunque sia portato
- non attegiamenti di decerebrazione o di decorticazione
- *è possibile una attività motoria spinale spontanea o provocata*

Morte “cerebrale” e riflessi spinali

Encefalo in necrosi

Midollo
senza
controllo superiore

1

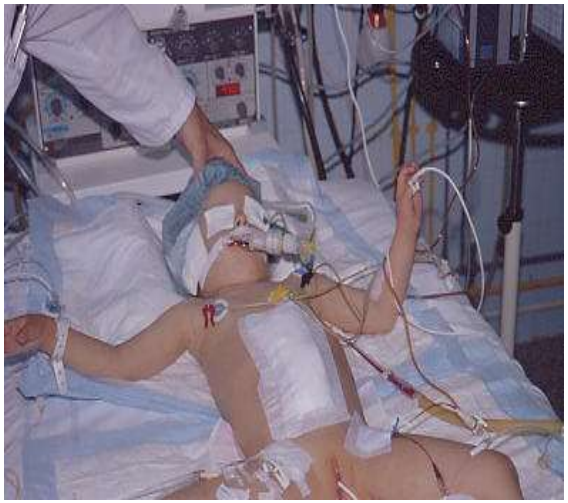
Shock
Midollare

2

Recupero
funzionalità

3

Ipereccitabilità



Described spinal reflexes in BD/DNC

Reflex	Description
Decerebrate-type movements[54]	Spontaneous extension of the extremities
Extensor posturing[54]	Back arching to the left or right
Eyelid opening[54]	Opening of the eyelids after nipple stimulation
Fasciculation[56]	Twitching of contiguous groups of muscle fibers
Head turning[54,67-69]	Intermittent head turning from side to side every 10-30 seconds with or without extension of the upper extremities
Hugging[54]	Flexion of the trunk and movement of the arms in a hugging-like manner
Lazarus sign[54-58,62-64]	Bilateral arm flexion, shoulder adduction and hand raising to chest, face or endotracheal tube with dystonic posturing of the fingers
Limb elevation[54]	Raising of limbs off the bed
Myoclonus[56]	Twitching or contraction of a muscle or group of muscles
Plantar response[56]	Plantar flexion
Pronator-extension[56]	Pronation and extension of the upper extremity
Respiratory-like movements[54]	Adduction of both shoulders followed by a slow cough-like movement
Repetitive leg movements[65]	Slight flexion of the leg and foot
Thumbs Up Sign[70]	Isolated thumb extension
Triple flexion[56]	Flexion of the thigh, leg and foot
Undulating toe[54]	Slow flexion then extension of the toes

ASSENZA DEI RIFLESSI DEL TRONCO ENCEFALO

- FOTOMOTORE
- CORNEALE
- NOCICEZIONE (aff V eff VII)
- *OCULOCEFALICO*
- OCULOVESTIBOLARE
- FARINGEO
- CARENALE
- *TEST ALL'ATROPINA*

Caren G. Solomon, M.D., M.P.H., *Editor*

Determination of Brain Death

David M. Greer, M.D.

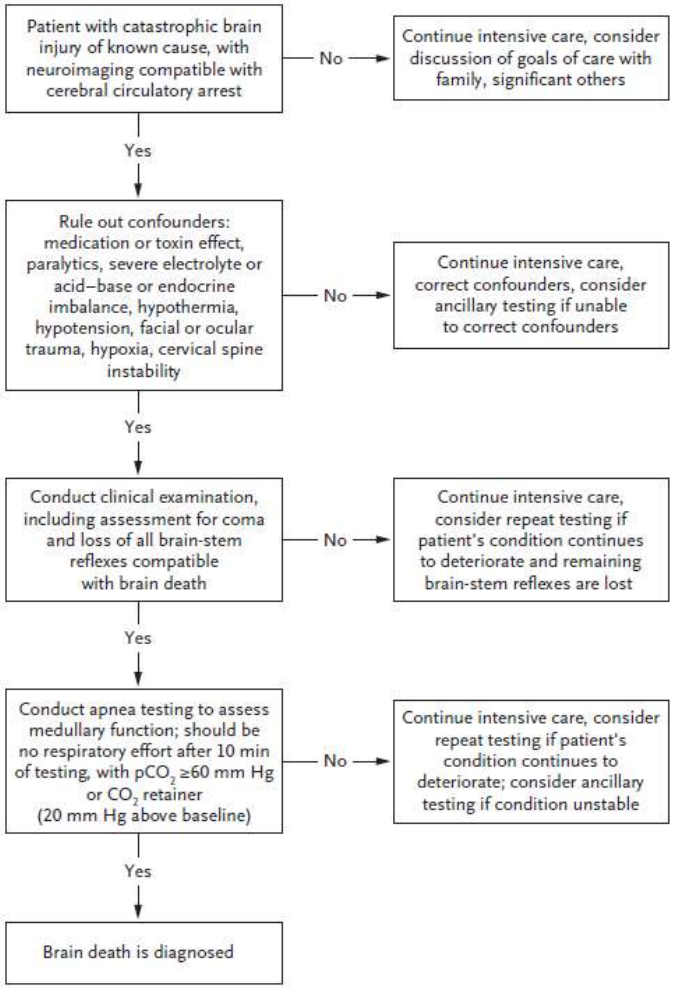


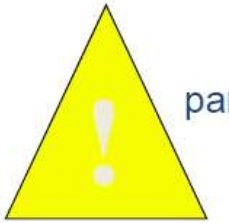
Figure 2. Algorithm for the Determination of Death According to Neurologic Criteria.

4. Test d'Apnea

NEJM, 2021

TEST APNEA

In M.E. la stimolazione del centro respiratorio con CO_2 non suscita alcuna attività respiratoria



paralisi neuromuscolare

$PCO_2 > 60$ mmHg con pH < 7.40

Extracorporeal Membrane Oxygenation to Support Cardiopulmonary Resuscitation in Adults

Ravi R. Thiagarajan, MBBS, MPH, Thomas V. Brogan, MD, Mark A. Scheurer, MD, Peter C. Laussen, MBBS, Peter T. Rycus, MPH, and Susan L. Bratton, MD, MPH

Department of Cardiology, Children's Hospital Boston and Department of Pediatrics, Harvard Medical School, Boston, Massachusetts; Department of Pediatric Critical Care Medicine, Children's Hospital and Regional Medical Center and the University of Washington, Seattle, Washington; Extracorporeal Life Support Organization, University of Michigan, Ann Arbor, Michigan; and Department of Pediatrics, University of Utah, and Primary Children's Medical Center, Salt Lake City, Utah

Table 3. ECMO Complications in Patients Treated With E-CPR

Complication n (%)	Survivors (n = 79)	Nonsurvivors (n = 216)	*p* Value
ECMO circuit complications:			
Mechanical problems	22 (28)	73 (34)	0.33
Clots in the ECMO circuit	13 (17)	43 (20)	0.50
Air embolus	1 (1)	4 (2)	0.60[a]
Cannula site bleeding	15 (19)	46 (21)	0.67
Surgical bleeding	17 (22)	54 (25)	0.54
CNS complications:			
Brain death	0	61 (28)	<0.001[a]
Radiologic evidence of infarction or hemorrhage	6 (8)	27 (13)	0.24
Seizures	2 (3)	10 (5)	0.53
Cardiac complications			
CPR on ECMO	7 (9)	27 (13)	0.39
Arrhythmias on ECMO	21 (27)	46 (21)	0.34
Cardiac tamponade	5 (6)	24 (11)	0.22

Table 3. ECMO Complications in Patients Treated With E-CPR

Complication n (%)	Survivors (n = 79)	Nonsurvivors (n = 216)	*p* Value
Pulmonary complications:			
Pneumothorax	0	9 (4)	0.12[a]
Pulmonary hemorrhage	1 (1)	12 (6)	0.20[a]
Culture proven infection	14 (18)	47 (22)	0.45
Metabolic complications:			
Blood pH < 7.2 on ECMO	13 (17)	67 (30)	0.01
Blood glucose > 240 mg/dL	32 (41)	74 (34)	0.32
Blood glucose < 40 mg/dL	0	6 (3)	0.35[a]
Gastrointestinal complications:			
Gastrointestinal hemorrhage	3 (4)	9 (4)	1.0[a]
Hyperbilirubinemia	0	21 (10)	0.004[a]
Renal complications:			
Serum creatinine 1.5–3.0 mg/dL	24 (30)	68 (32)	0.86
Serum creatinine > 3 mg/dL	23 (27)	51 (24)	0.33
Need for dialysis	19 (24)	93 (43)	0.003

Declaring a Patient Brain Dead on Extracorporeal Membrane Oxygenation (ECMO): Are There Guidelines or Misconceptions?

Kristin J. Kreitler,[1] Nicholas C. Cavarocchi,[1] Hitoshi Hirose,[1]
Sharon West,[2] Richard Hasz,[2] Michelle Ghobrial,[3] Rodney D. Bell,[3]
[1] Department of Surgery, [3] Department of Neurology, Thomas Jefferson University Hospital, Philadelphia, PA.
[2] Gift of Life Donor Program, Philadelphia, PA.

Introduction

- ECMO is becoming a widely used therapy for the supportive care of patients with respiratory and/or cardiac failure, acute MI, and cardiac arrest.
- One of the complications of ECMO is neurological injury resulting in brain death.
- Patients who have been pronounced brain dead on ECMO have gone on to become viable organ donors, which is important in the setting of a rapidly growing transplant list.
- A key aspect in the pronunciation of brain death, the apnea test, can be technically challenging and confusing to interpret in the setting of ECMO.
- A lack of consensus exists among clinicians regarding the correct way to declare a patient brain dead on ECMO.

Objectives

- To review the clinical practice variations and trends with declaring patients brain dead on ECMO
- To highlight the need for the development of consensus guidelines to assist clinicians in the accurate diagnosis of brain death in this specific patient population

Contact Information

Dr. Nicholas Cavarocchi
Nicholas.Cavarocchi@Jefferson.edu

Methods

Study Type: IRB approved retrospective chart review

Patients: Organ donors from our local organ procurement organization who were declared brain dead on ECMO

Study Period: October 1995- July 2014

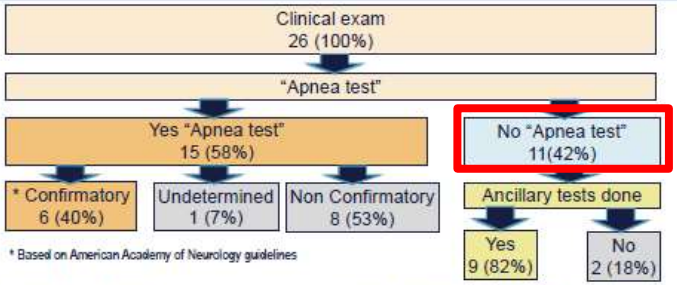
Exclusion Criteria:
- Pronounced brain dead on another form of mechanical circulatory support, such as biventricular assist device or left ventricular assist device
- Not on ECMO at the time of brain death

Number of Patients Identified: 26
- Mean Age (years): 26.9 ± 21.7
- Male : Female = 13 : 13
- Mean Length of ECMO (days) : 5.4 ± 6.6

Modalities for Determining Brain Death on ECMO

#	Year	Clinical	Apnea	EEG	CBF	TCD	Angio	CT
1	1995	xx	x	x				
2	1997	x		x				
3	2001	xx	x					
4	2006	xx	x					
5	2007	xx	x					
6	2007	x	x		x			
7	2008	xx	x	x				
8	2008	xx						
9	2009	xx		x		x		
10	2009	xx	x	x				
11	2010	xx	x					
12	2011	xx	x		x			
13	2012	xx	x					
14	2012	xx					x	
15	2012	xx	x					
16	2013	xx	x					
17	2013	xx						
18	2013	xx		x				
19	2013	xx			x			
20	2013	x			x			
21	2013	xx	x		x			
22	2014	xx	x	x		x		
23	2014	x			x			
24	2014	xx			x	x		
25	2014	xx	x					
26	2014	xx						x

Results

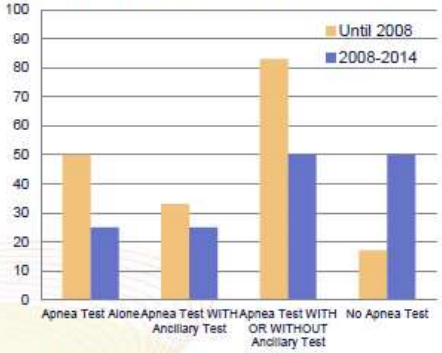


* Based on American Academy of Neurology guidelines

Apnea testing in ECMO patients:
- Even when an apnea test was performed, at least one ancillary test was also performed in 47% of cases.
- There were five documented examples of how the apnea test was performed while the patient was on ECMO and all five were performed differently.
- In several of the cases, even when an apnea test was documented as confirmatory, it was not considered confirmatory based on American Academy of Neurology guidelines.

Lack of apnea testing in ECMO patients:
- When an apnea test was not performed, 55% of clinicians documented ECMO or patient instability as the reason for not performing an apnea test.
- In the other 45% of patients in whom an apnea tests was not performed, there was no documentation available in regards to why an apnea test was not performed.

Trends in Modalities for Determining Brain Death on ECMO



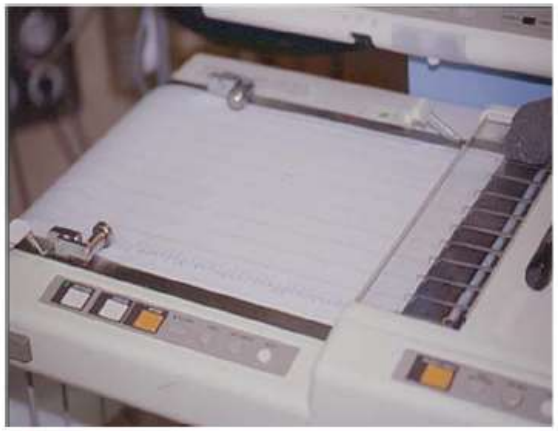
Most common ancillary test:
- From 1995 to 2010: EEG
- From 2010 through 2014: CBF study

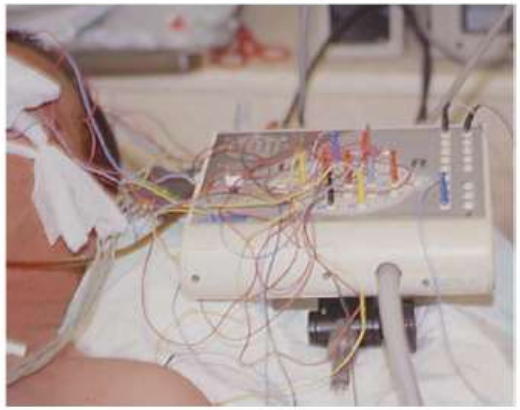
Conclusions

- This study shows that the diagnosis of brain death on ECMO lacks consensus guidelines regarding clinical exam, performance of apnea testing and use of definitive ancillary testing.
- There appears to be a trend towards utilizing ancillary tests as opposed to the apnea test in the diagnosis of brain death for patients on ECMO.
- The difficulty and controversy with performing a standard apnea test while on ECMO has led to inconsistent performance of and interpretation of the test, which has prompted unguided use of ancillary studies.
- Due to the substantial increase in the use of ECMO, it is vital that guidelines are developed to assist clinicians in the accurate diagnosis of brain death in patients on ECMO.

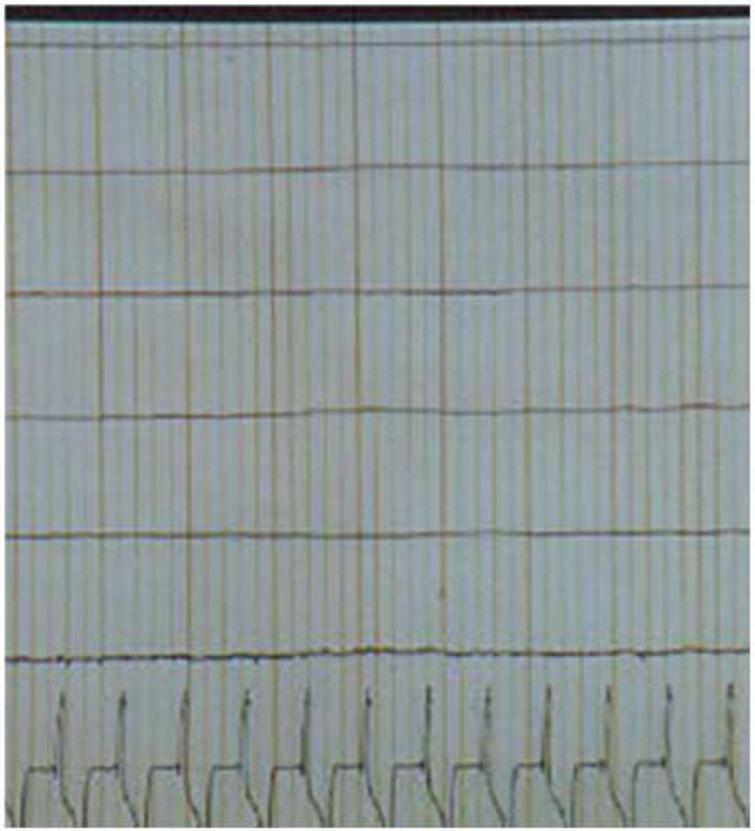
ELETTROENCEFALOGRAMMA

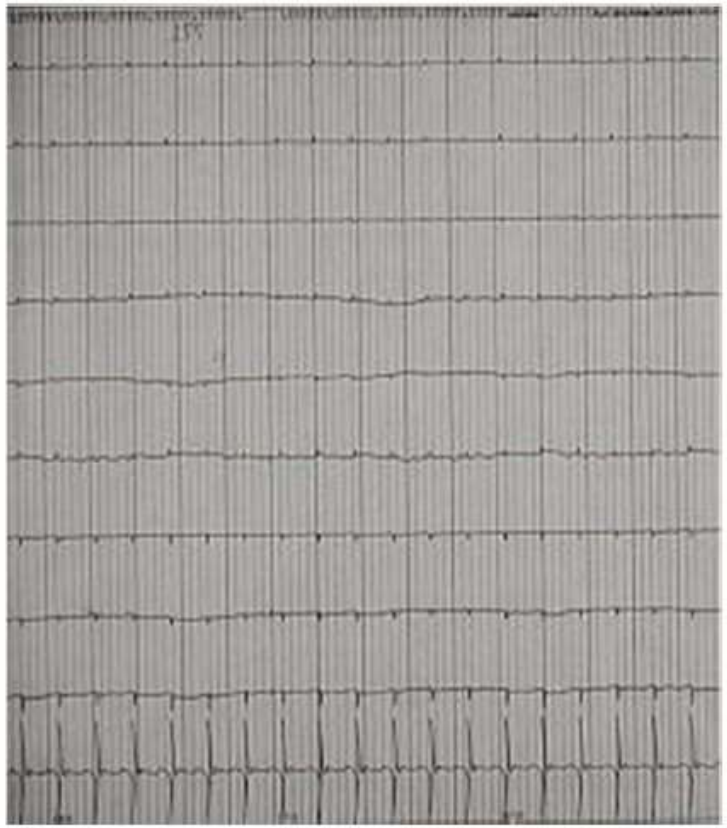
- Molto utilizzata
- Rapida
- Non invasiva
- Portatile
- Basso costo





ELETTROENCEFALOGRAMMA





SILENZIO ELETTRICO CEREBRALE

LA DIAGNOSI DI MORTE

CON STANDARD NEUROLOGICO E' DETERMINATA QUANDO:

1) Sono stati soddisfatti i presupposti

2) E' stata valutata e confermata l'assenza
   - dello stato di vigilanza e di coscienza
   - dei riflessi del tronco encefalico
   - del respiro spontaneo

3) E' stata valutata e confermata l'assenza di attività elettrica cerebrale

4) E' stata condotta un'indagine per la valutazione del flusso ematico cerebrale (*solo nei casi previsti dai decreti legge*) che è risultata diagnostica per assenza di flusso

A questo punto è terminata la fase diagnostica!!!

Il medico, in forza dell'art. 3 della legge 29 dicembre 1993, n° 578, è tenuto a darne immediata comunicazione alla direzione sanitaria.

SITUAZIONI CHE RICHIEDONO INDAGINE DI FLUSSO

Bambini di età inferiore a 1 anno	• Farmaci depressori del S.N.C • Alterazioni dell'omeostasi cardio-circolatoria e respiratoria • Alterazioni endocrino-metaboliche • Ipotermia
Presenza di fattori di grado tale da interferire sul quadro clinico e su quello EEG	
Assenza di diagnosi eziopatogenetica certa	
Situazioni cliniche che impediscono l'esecuzione dei riflessi del tronco e del test di apnea	• Traumatismi cranio facciali • Alterazioni anatomiche
Situazioni cliniche che alterano l'esecuzione dell'EEG	• Traumatismi cranio facciali • Alterazioni anatomiche • Artefatti EEG

EZIOLOGIA POST ANOSSICA

In caso di insulto anossico, in assenza di test strumentale che accerti l'assenza di flusso ematico cerebrale, occorre attendere almeno 24 ore prima di effettuare diagnosi clinica di morte encefalica.

Conclusioni

La morte è una ed una sola e si identifica con la cessazione irreversibile di tutte le funzioni dell'encefalo

Esistono due modalità per determinare la morte, utilizzando criteri neurologici o criteri cardiologici

I criteri neurologici sono comprensibili, riproducibili in clinica, univoci, condivisi ed infallibili

Coma, stato vegetativo, morte encefalica e locked in syndrome devono essere ben distinte

La diagnosi di ME è compito ed obiettivo degli Intensivisti nelle TI

Per i pazienti con lesioni cerebrali devastanti in cui il prosieguo delle cure appare futile l'opzione donazione a cuore fermo deve essere sempre considerata

Centro Nazionale Trapianti
ISTITUTO SUPERIORE DI SANITÀ

Rete Nazionale Trapianti

TPM Transplant Procurement Management

Transplant Procurement Management

Diagnosi di Morte

Test diagnostici e strumentali per la diagnosi di morte con criteri neurologici

Carlo Alberto Castioni

Anestesia e rianimazione, IRCCS - Bologna

Obiettivi

TEST CLINICI DI DIAGNOSI DI MORTE CON CRITERI NEUROLOGICI

- **SAPER FARE DIAGNOSI DI MORTE CON CRITERI NEUROLOGICI (Morte Encefalica)**
  - Conoscere i presupposti per poter porre la diagnosi
  - Conoscere gli elementi costitutivi della diagnosi
  - Saper eseguire un'esplorazione neurologica sistematica, completa e rigorosa
  - Sapere quali prove strumentali sono necessarie a seconda dei casi

ELEMENTI COSTITUTIVI

- PRESUPPOSTI DELLA DIAGNOSI
- ESPLORAZIONE NEUROLOGICA
- ESAMI STRUMENTALI

PRESUPPOSTI

- EZIOPATOGENESI CERTA
- STABILITA' EMODINAMICA
- NORMOTERMIA
- ASSENZA DI INTERFERENZE FARMACOLOGICHE
- ASSENZA DI INTERFERENZE ENDOCRINO METABOLICHE

ESPLORAZIONE NEUROLOGICA

- sistematica, completa, rigorosa
- eseguita da medici esperti
- la diagnosi di M.E. è eminentemente clinica
- le sue componenti fondamentali sono:
- **coma areattivo**
- **assenza dei riflessi di tronco**
- **apnea**

ESPLORAZIONE NEUROLOGICA

COMA AREATTIVO

- nessuna risposta motoria allo stimolo portato nel territorio trigeminale
- nessuna risposta motoria facciale allo stimolo doloroso ovunque sia portato
- non atteggiamenti di decerebrazione o di decorticazione
- è possibile una attività motoria spinale spontanea o provocata

ESPLORAZIONE NEUROLOGICA

ASSENZA DEI RIFLESSI DEL TRONCO ENCEFALICO

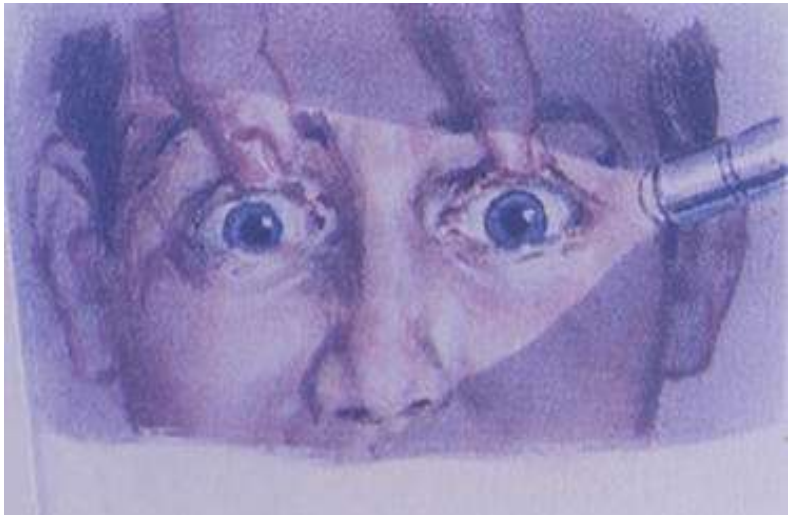
- FOTOMOTORE
- CORNEALE
- NOCICEZIONE
- *OCULOCEFALICO*
- OCULOVESTIBOLARE
- FARINGEO
- CARENALE
- *TEST ALL'ATROPINA*

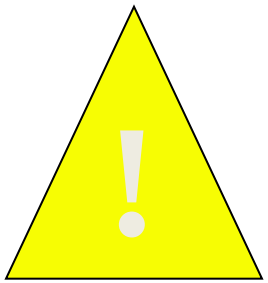
RIFLESSI DEL TRONCO

RIFLESSO	AFFERENZA	EFFERENZA
FOTOMOTORE	II	III

RIFLESSI DEL TRONCO «fotomotore»

- Stimolazione luminosa
- Contrazione pupillare
- In ME pupille areattive





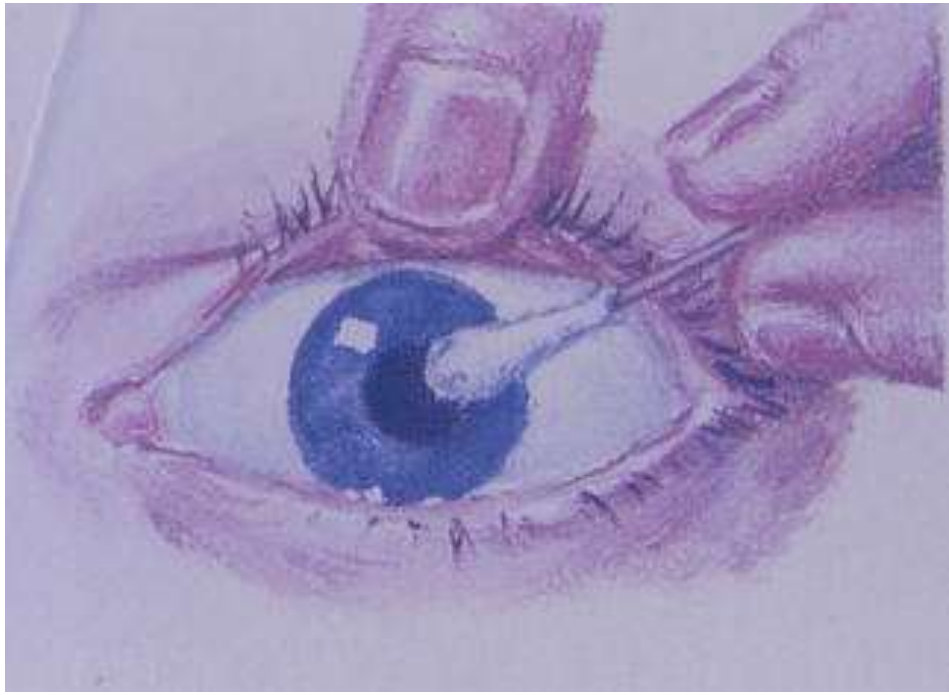
•Trauma oculare diretto (lesione del n. ottico)
•Compressioni in cavità orbitaria (3)
•Somministrazione di atropina
•Colliri anticolinergici
•Pregressa chirurgia

RIFLESSI DEL TRONCO

RIFLESSO	AFFERENZA	EFFERENZA
FOTOMOTORE	II	III
CORNEALE	V	VII

RIFLESSI DEL TRONCO «corneale»

- Stimolazione congiuntivale con garza o cotone umidi
- Contrazione palpebrale e/o lacrimazione
- In M.E. nessuna risposta



- intenso edema palpebrale
- paralisi neuromuscolare

RIFLESSI DEL TRONCO

RIFLESSO	AFFERENZA	EFFERENZA
FOTOMOTORE	II	III
CORNEALE	V	VII
NOCICEZIONE	V	VII e qualsiasi
NOCICEZIONE	qualsiasi	VII

COMA AREATTIVO

- nessuna risposta motoria allo stimolo portato nel territorio trigeminale
- nessuna risposta motoria facciale allo stimolo doloroso ovunque sia portato

RIFLESSI DEL TRONCO

RIFLESSO	AFFERENZA	EFFERENZA
FOTOMOTORE	II	III
CORNEALE	V	VII
NOCICEZIONE	V	VII e qualsiasi
NOCICEZIONE	qualsiasi	VII
OCULOCEFALICO	VIII	III, IV, VI

RIFLESSI DEL TRONCO «oculocefalico»

- Occhi aperti e rapida rotazione del capo
- Deviazione oculare coniugata controlaterale
- In M.E. lo sguardo resta fisso e centrale

attenzione alle lesioni del rachide cervicale

RIFLESSI DEL TRONCO

RIFLESSO	AFFERENZA	EFFERENZA
FOTOMOTORE	II	III
CORNEALE	V	VII
NOCICEZIONE	V	VII e qualsiasi
NOCICEZIONE	qualsiasi	VII
OCULOCEFALICO	VIII	III, IV, VI
OCULOVESTIBOLARE	VIII	III, IV, VI

RIFLESSI DEL TRONCO «oculovestibolare»

- Otoscopia preliminare
- Capo a 30° occhi aperti
- Iniezione lenta di 50 ml di soluzione fredda a 4° C
- Nistagmo
- In M.E. lo sguardo resta fisso e centrale

lesioni timpaniche, frattura della base cranica

RIFLESSI DEL TRONCO

RIFLESSO	AFFERENZA	EFFERENZA
FOTOMOTORE	II	III
CORNEALE	V	VII
NOCICEZIONE	V	VII e qualsiasi
NOCICEZIONE	qualsiasi	VII
OCULOCEFALICO	VIII	III, IV, VI
OCULOVESTIBOLARE	VIII	III, IV, VI
FARINGEO	IX	X

RIFLESSI DEL TRONCO «faringeo»

Sondino o abbassalingua

Stimolazione orofaringe, palato molle, ugola

Comparsa di conato di vomito

In M.E. nessuna risposta

paralisi neuromuscolare

RIFLESSI DEL TRONCO

RIFLESSO	AFFERENZA	EFFERENZA
FOTOMOTORE	II	III
CORNEALE	V	VII
NOCICEZIONE	V	VII e qualsiasi
NOCICEZIONE	qualsiasi	VII
OCULOCEFALICO	VIII	III, IV, VI
OCULOVESTIBOLARE	VIII	III, IV, VI
FARINGEO	IX	X
CARENALE	X	X

RIFLESSI DEL TRONCO «laringeo»

Sondino

Stimolazione tracheale

Comparsa di tosse

In M.E. nessuna risposta

•paralisi neuromuscolare

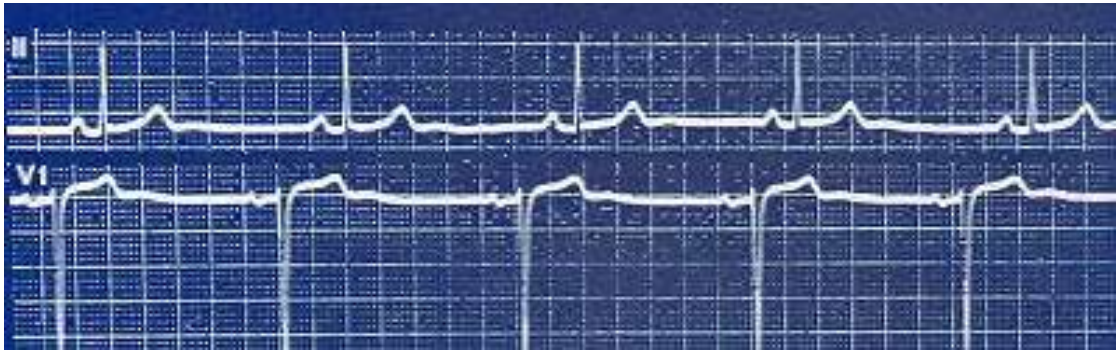
RIFLESSI DEL TRONCO

RIFLESSO	AFFERENZA	EFFERENZA
FOTOMOTORE	II	III
CORNEALE	V	VII
NOCICEZIONE	V	VII e qualsiasi
NOCICEZIONE	qualsiasi	VII
OCULOCEFALICO	VIII	III, IV, VI
OCULOVESTIBOLARE	VIII	III, IV, VI
FARINGEO	IX	X
CARENALE	X	X
ATROPINA	nucleo motore dorsale del vago	

TEST ALL'ATROPINA

Iniezione di 0.04 mg/kg

Tachicardia per parasimpaticolisi



In M.E. la F.C. non aumenta oltre il 10% del basale

Linea venosa libera da catecolamine

APNEA

In M.E. la stimolazione del centro respiratorio con CO_2 non suscita alcuna attività respiratoria

paralisi neuromuscolare

$PCO_2 > 60$ mmHg con pH < 7.40

TEST DI APNEA «old fashion»

- FiO2 = 1 per 15 minuti
- Riduzione volume minuto
- E.G.A. basale
- Deconnessione
- O2 6l/min nel TET
- SpO2, P.A., F.C.
- paCO2: + 2-3 mmHg/min
- E.G.A. controllo
- Riconnessione

PCO2 > 60 mmHg
con pH < 7.40

TEST DI APNEA «con ventilatore elettronico»

- FiO2 = 0,8 per 15 minuti
- Riduzione volume minuto
- E.G.A. basale
- Passaggio a CPAP+5 cmH2O
- SpO2, P.A., F.C.
- paCO2: + 2-3 mmHg/min
- E.G.A. controllo
- Ripresa della ventilazione

evita le atelettasie da ossigeno puro
e il dereclutamento da deconnessione

PCO2 > 60 mmHg
con pH < 7.40

DIAGNOSI STRUMENTALE DI MORTE ENCEFALICA

ESAMI STRUMENTALI

VALUTAZIONE DELLA FUNZIONE NEURONALE

VALUTAZIONE DEL FLUSSO EMATICO

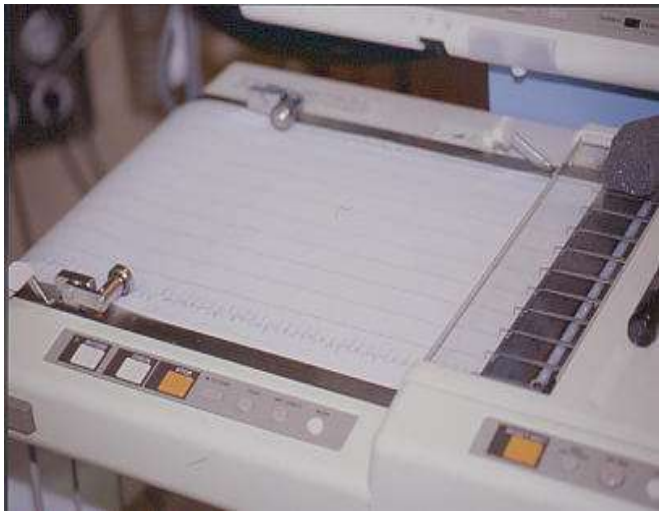
ESAMI STRUMENTALI

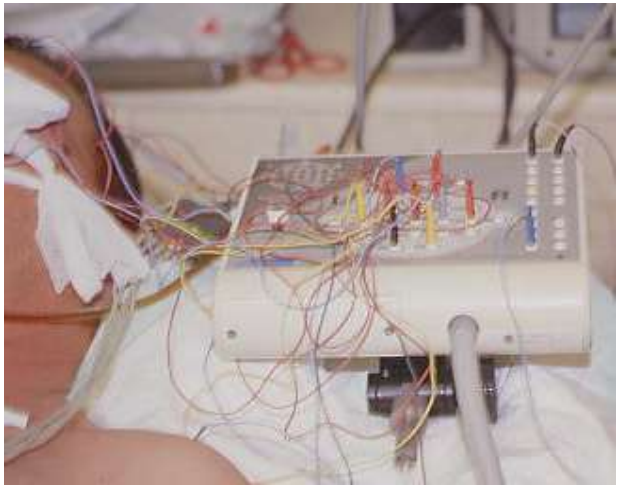
VALUTAZIONE DELLA FUNZIONE NEURONALE

elettroencefalogramma

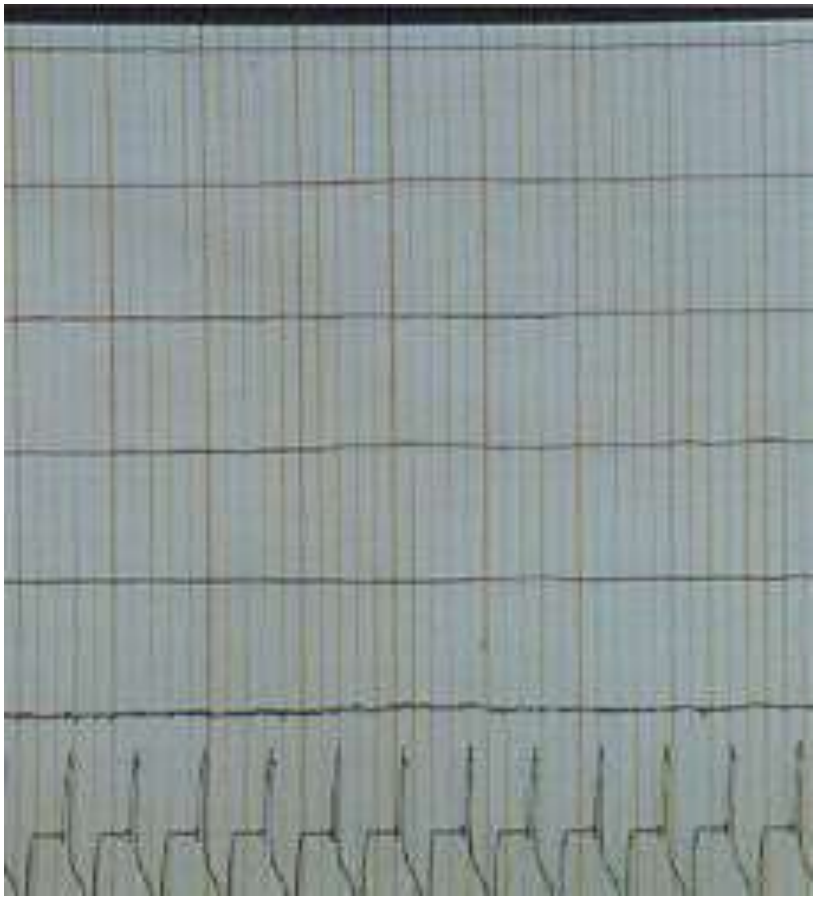
ELETTROENCEFALOGRAFIA

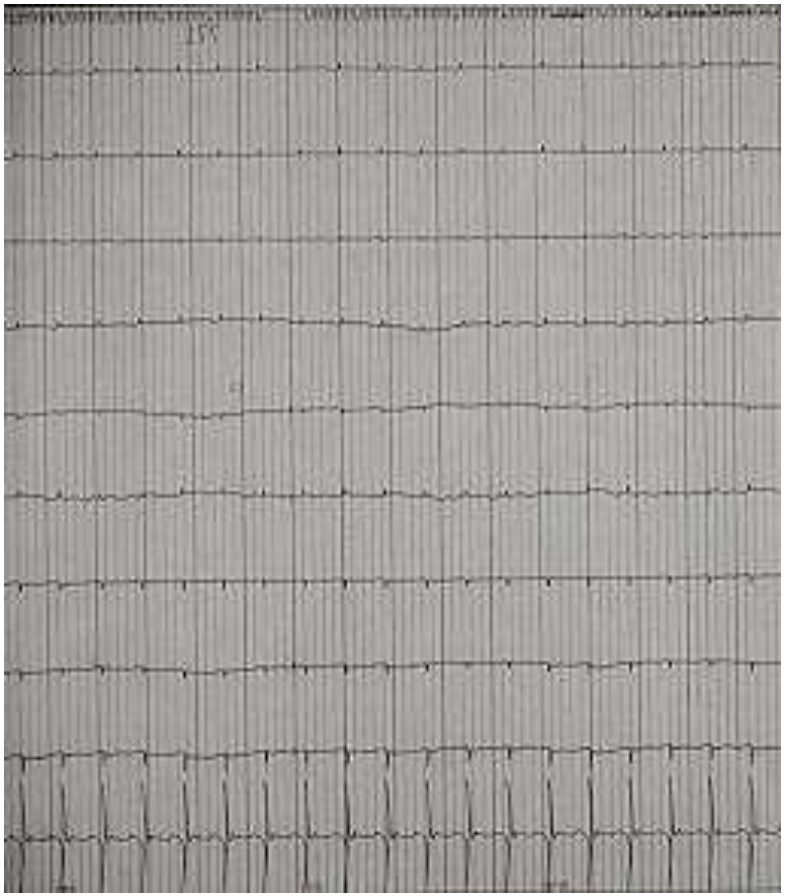
- Molto utilizzata
- Rapida
- Non invasiva
- Portatile
- Basso costo





ELETTROENCEFALOGRAFIA





SILENZIO ELETTRICO CEREBRALE

ELETTROENCEFALOGRAFIA

E.E.G. Limiti tecnici

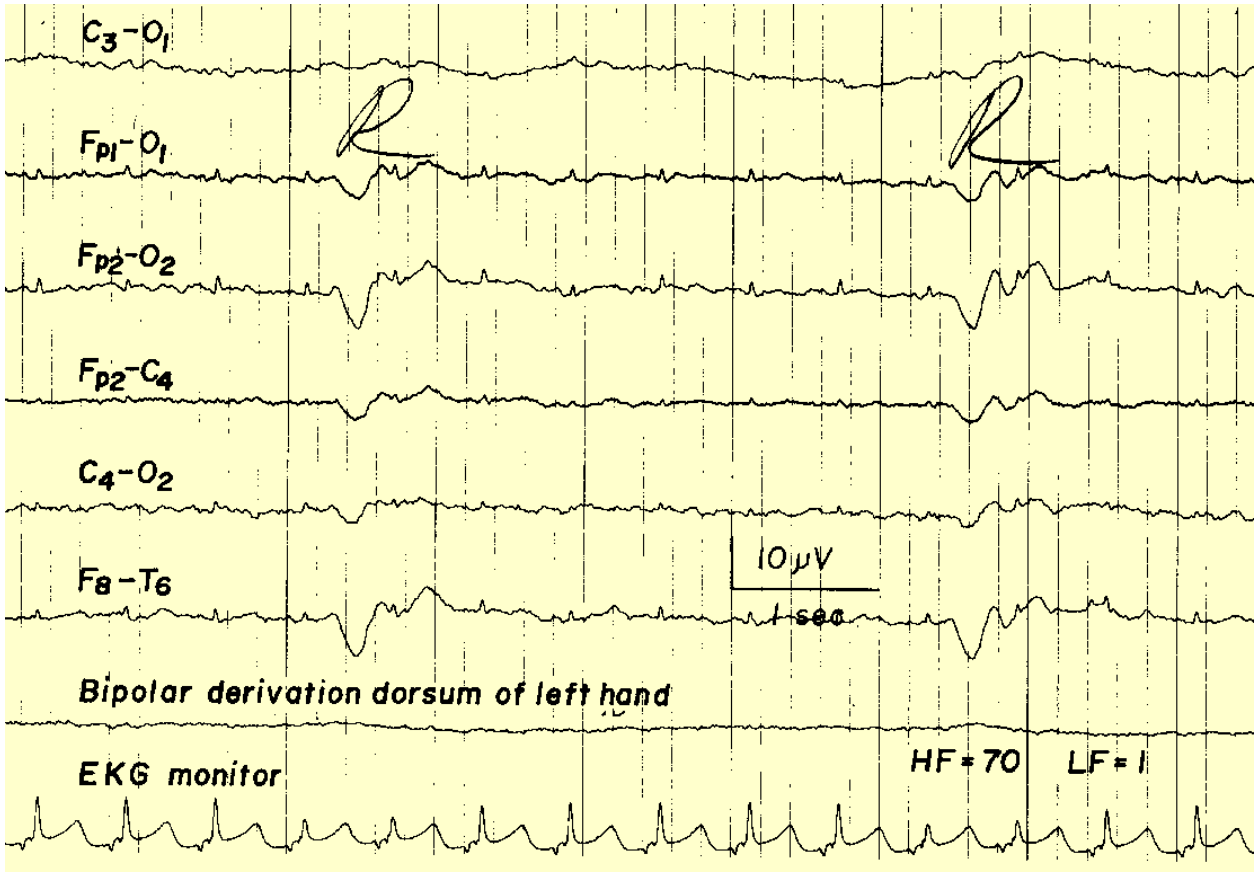
- Potenziali idiomuscolari
- Polso
- ECG
- Movimenti
- Tremore

- Apparecchi
- Ventilatore
- Personale
- Pacemaker
- App. dialisi
- Pompe

ARTEFATTI

ELETTROENCEFALOGRAFIA
ARTEFATTI

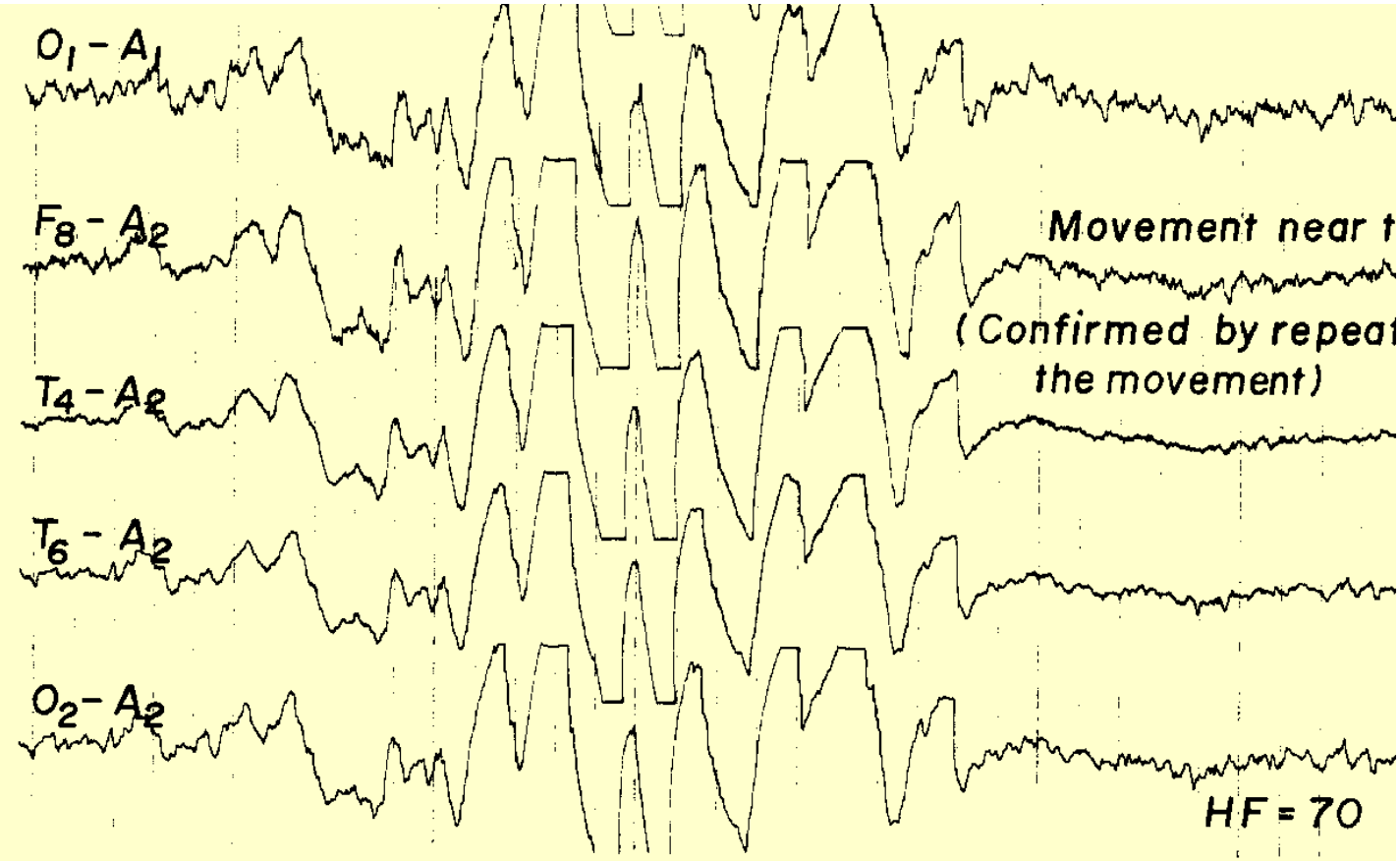
Cicli del ventilatore



ELETTROENCEFALOGRAFIA

ARTEFATTI

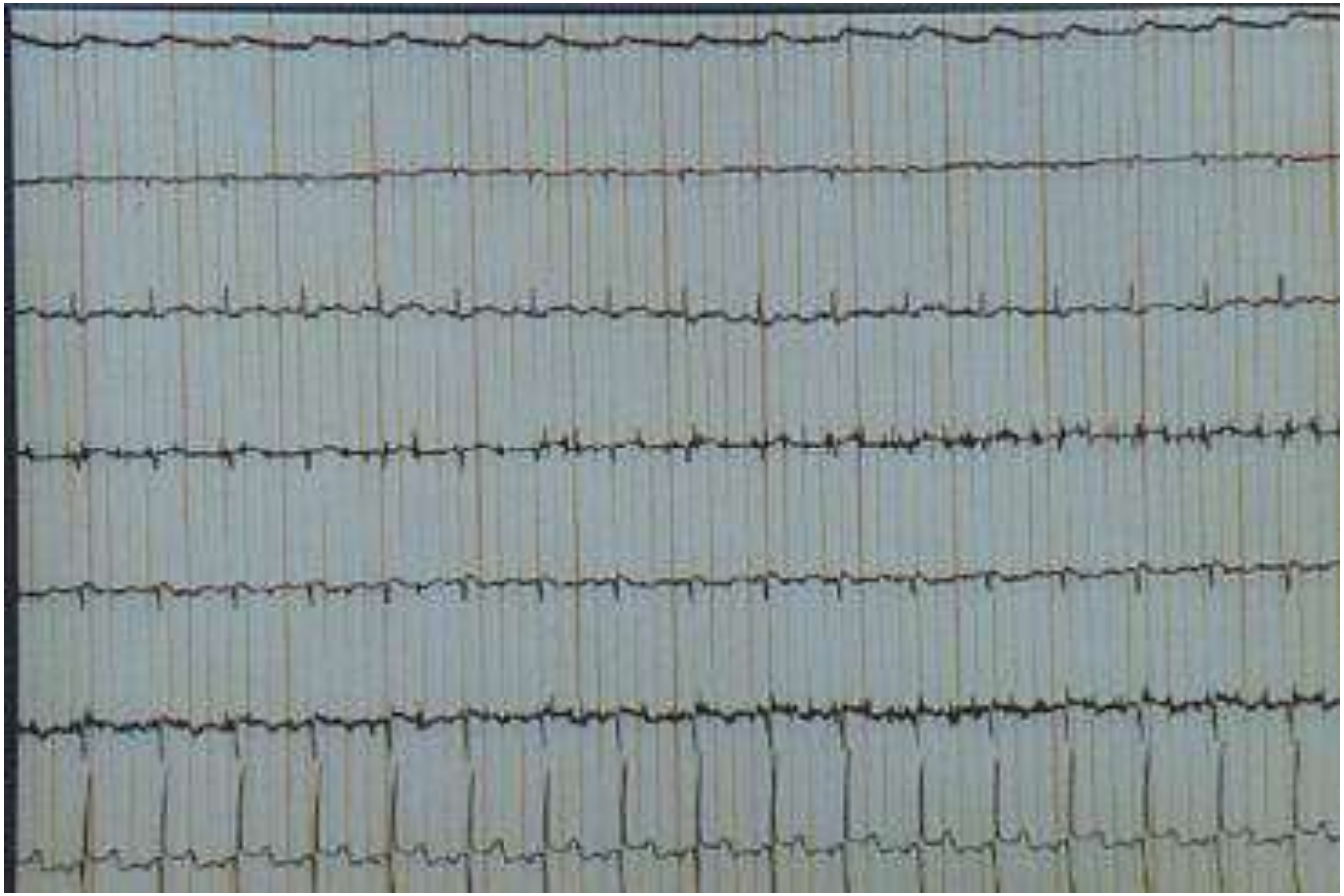
Movimenti di persone



ELETTROENCEFALOGRAFIA

ARTEFATTI

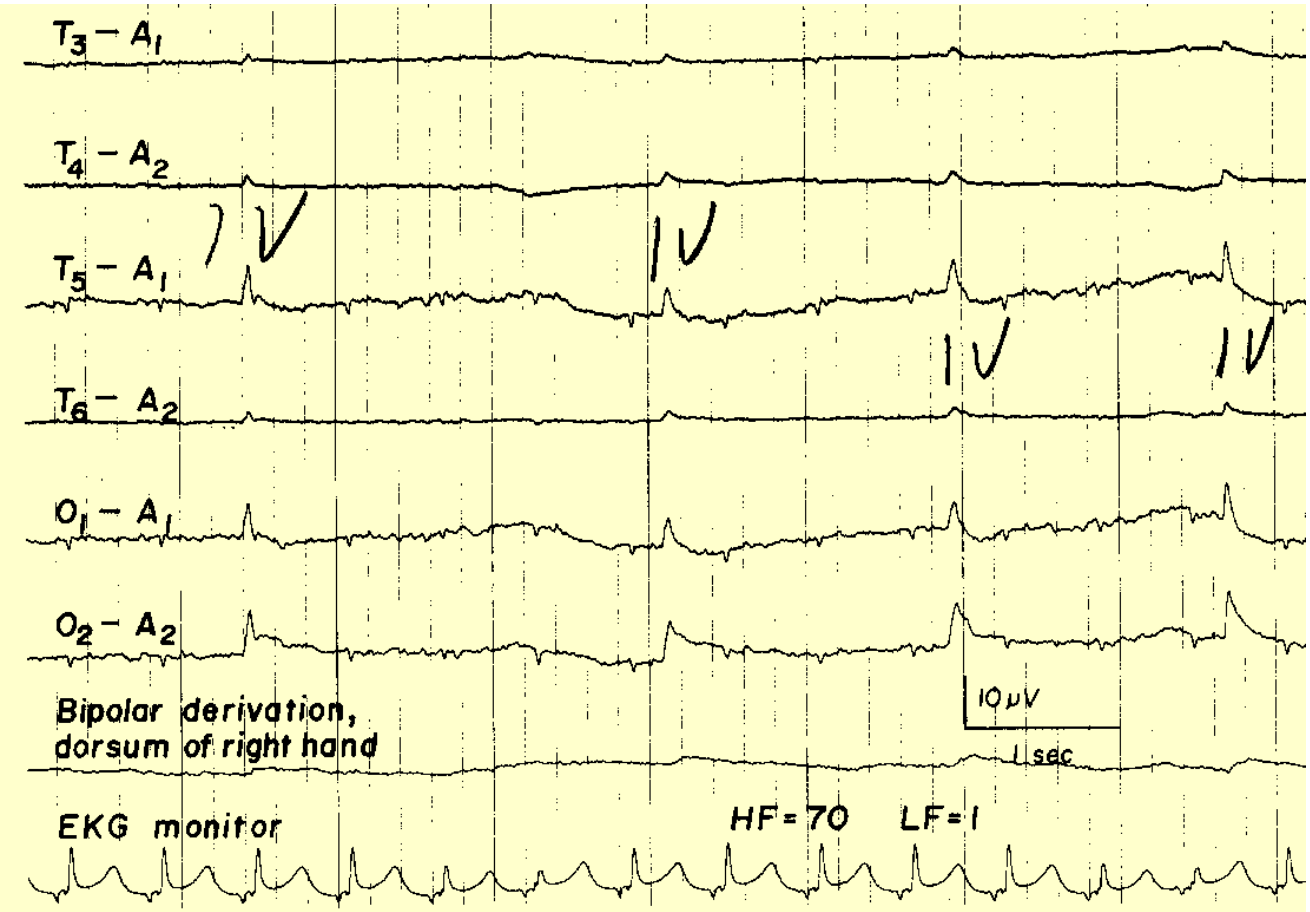
Potenziali idiomuscolari



ELETTROENCEFALOGRAFIA

ARTEFATTI

Pompa infusionale



ELETTROENCEFALOGRAFIA
LIMITI CLINICI

- SILENZIO ELETTRICO REVERSIBILE
  - farmaci depressori
  - ipotermia
  - turbe metaboliche
  - ipotensione

ESAMI STRUMENTALI

Centro Nazionale Trapianti

LINEE GUIDA

APPLICAZIONE DELLE INDAGINI STRUMENTALI
DI FLUSSO EMATICO CEREBRALE

Emendamento alle Lineeguida nazionali della Consulta
"Applicazione delle indagini strumentali di flusso ematico cerebrale" emanate il 20 febbraio 2009.

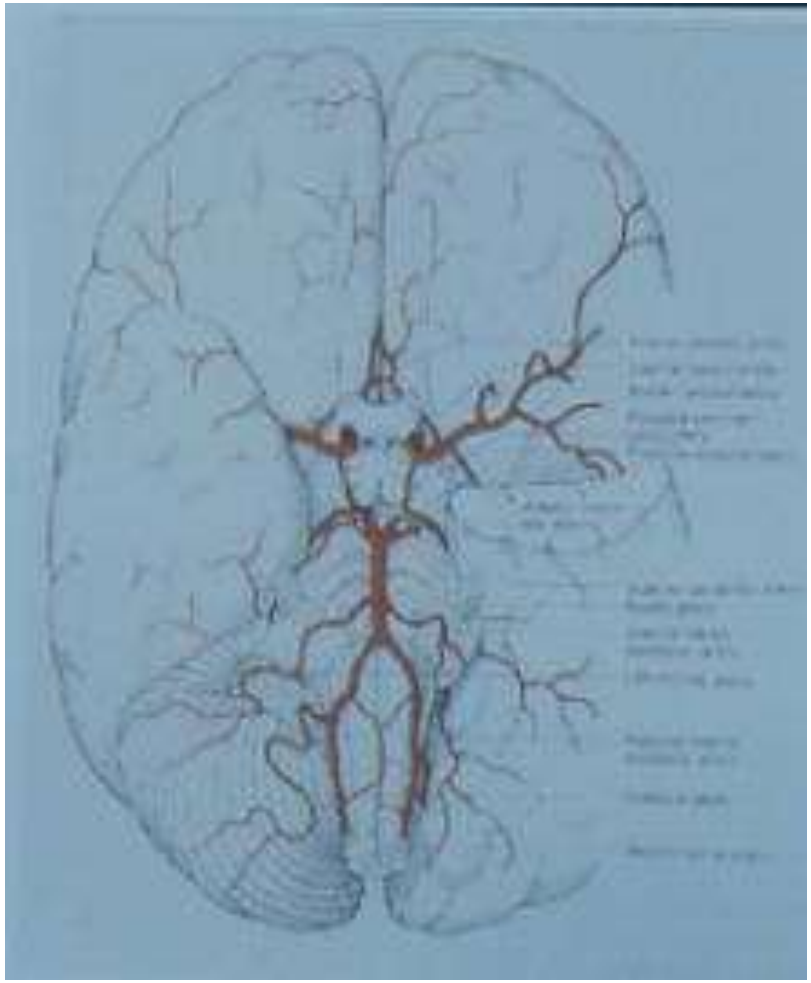
Il testo e le tabelle sostituiscono in toto il paragrafo Angio-TAC delle Lineeguida.
L'emendamento è stato approvato dalla Consulta (16 luglio 2014), dal CNT (5 novembre 2014) e dall'Associazione Italiana di Neuroradiologia (AINR) (28 novembre 2014).

VALUTAZIONE DEL FLUSSO EMATICO

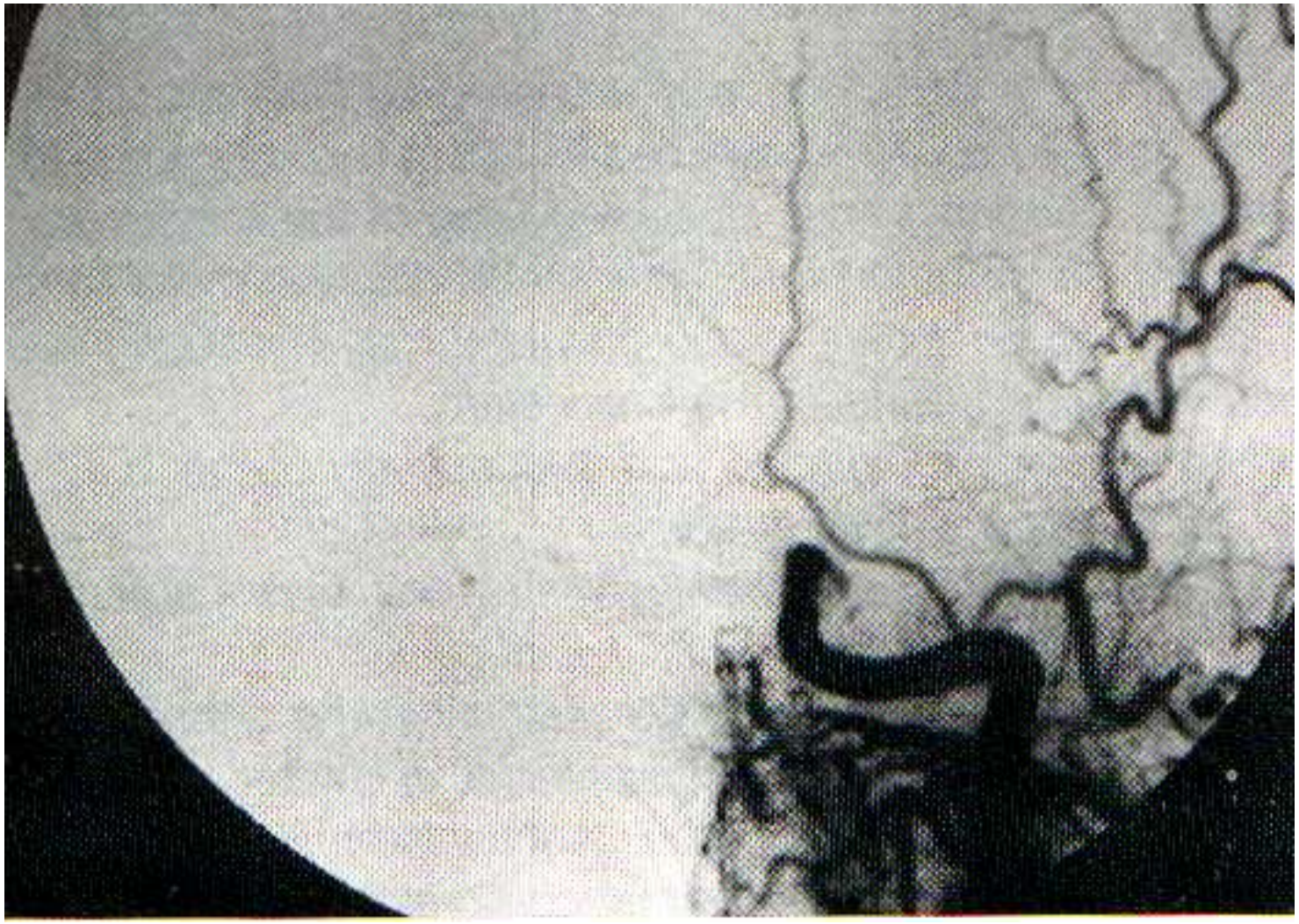
- arteriografia cerebrale
- angiogammografia con HMPAO
- spect
- angio TC
- doppler transcranico

ANGIOGRAFIA CEREBRALE

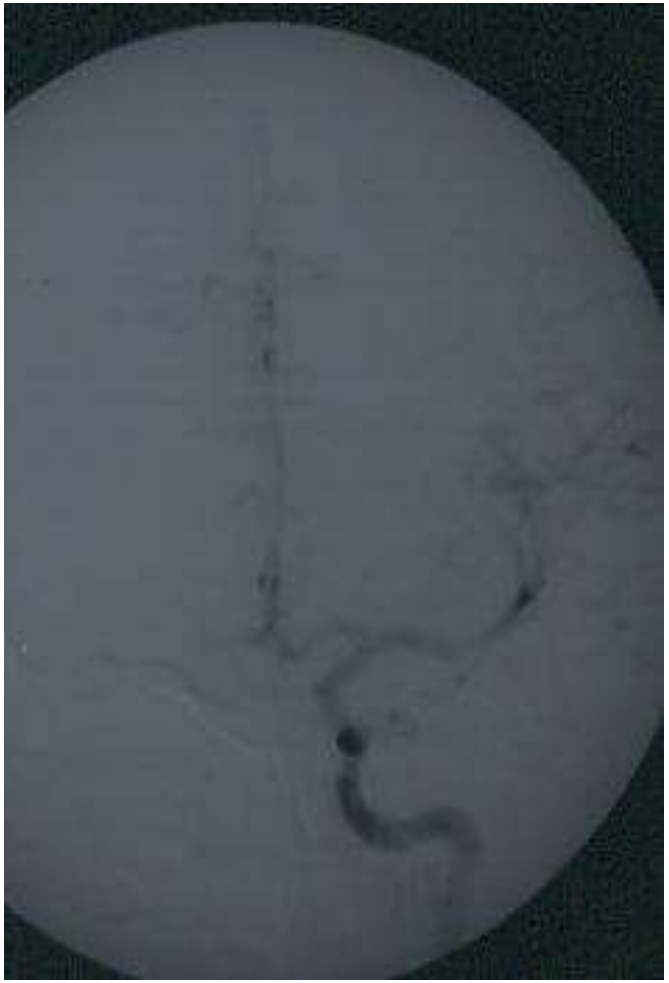
Invasiva
Richiede lo spostamento del paziente
Complessa
Accessibilità limitata
Non alterata dall'ipotemia
Non alterata dai farmaci depressori del SNC



ANGIOGRAFIA CEREBRALE



ANGIOGRAFIA CEREBRALE

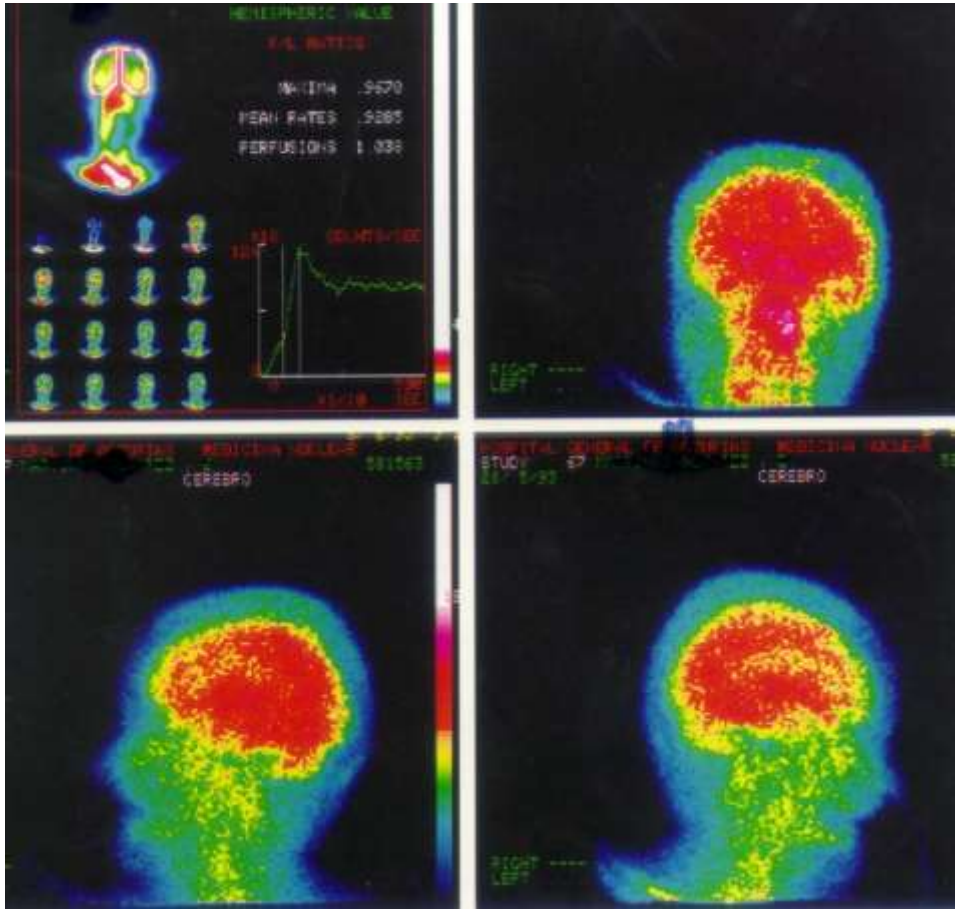


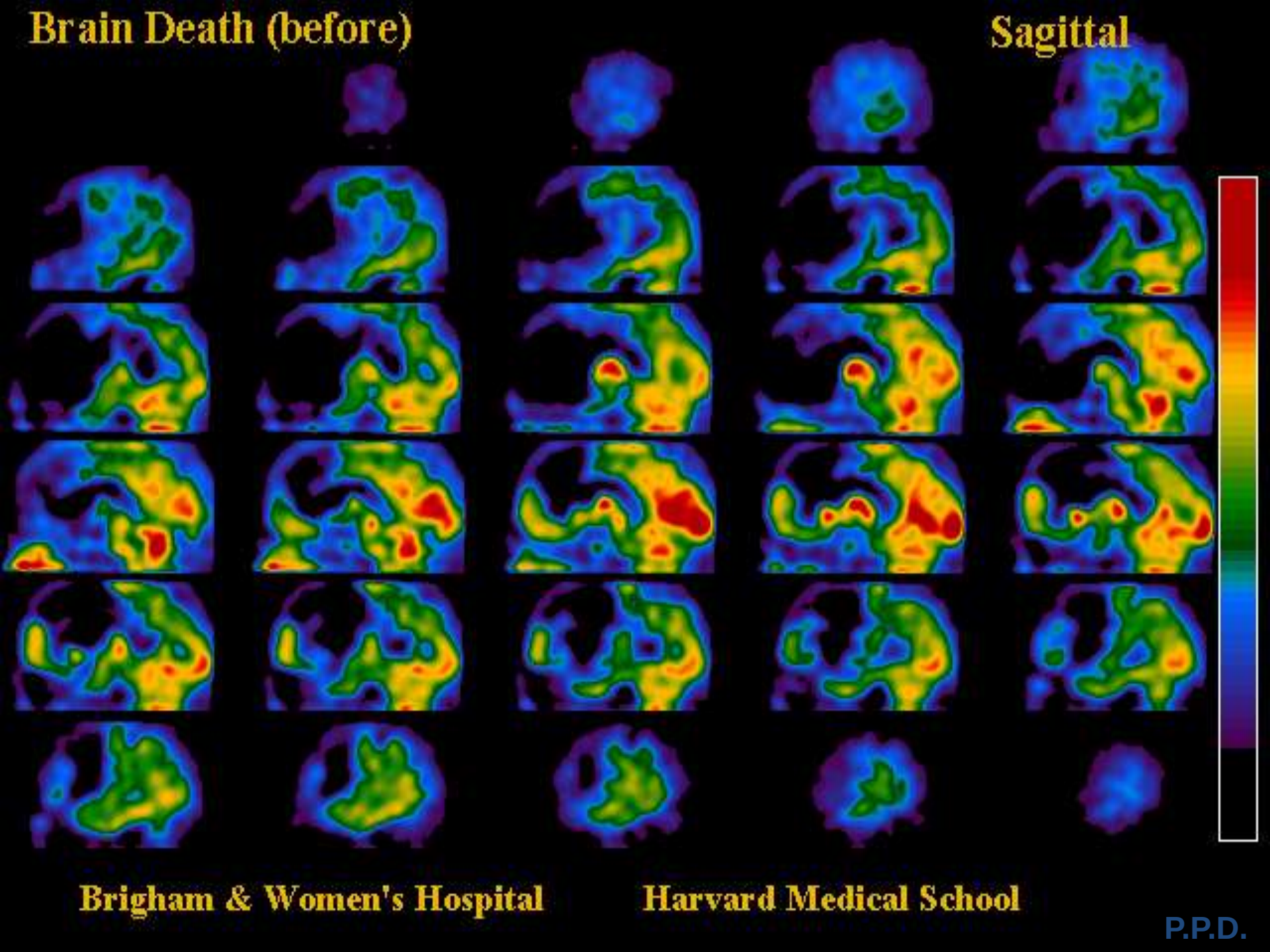
normale

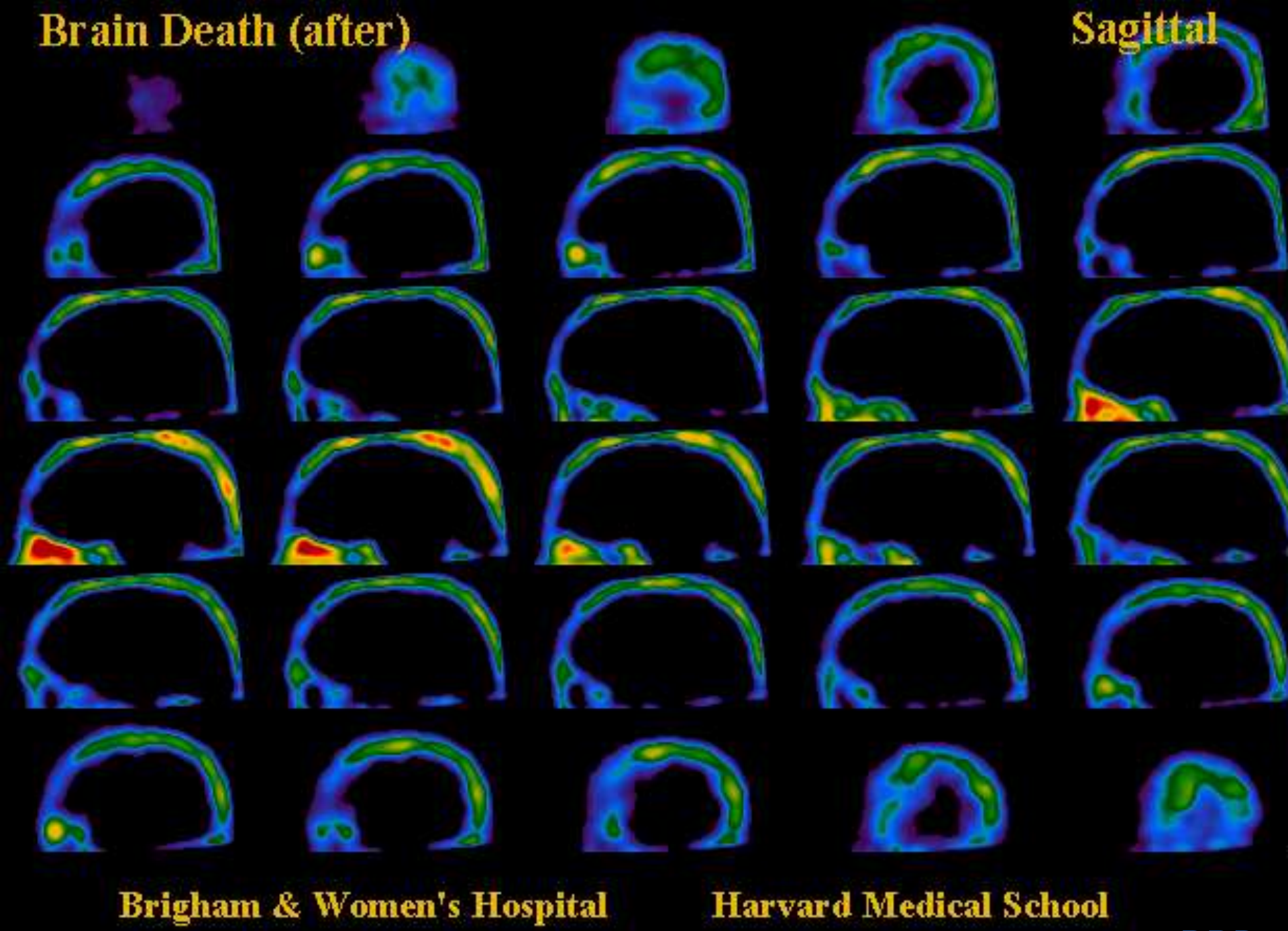
morte encefalica

ANGIOGAMMOGRAFIA CON HMPAO

Rapida
Facile da realizzare
Non invasiva
Richiede lo spostamento del paziente
Accessibilità limitata
Non alterata dall'ipotermia
Non alterata dai farmaci depressori del SNC

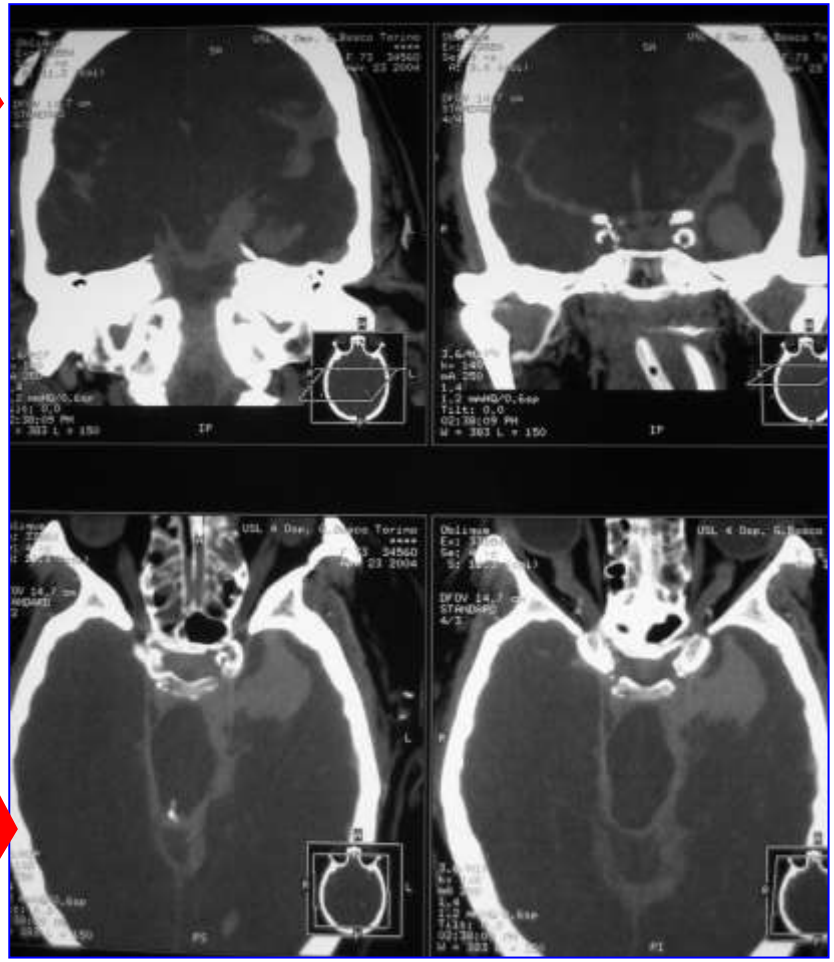



Brain Death (before)
Sagittal
Brigham & Women's Hospital
Harvard Medical School
P.P.D.

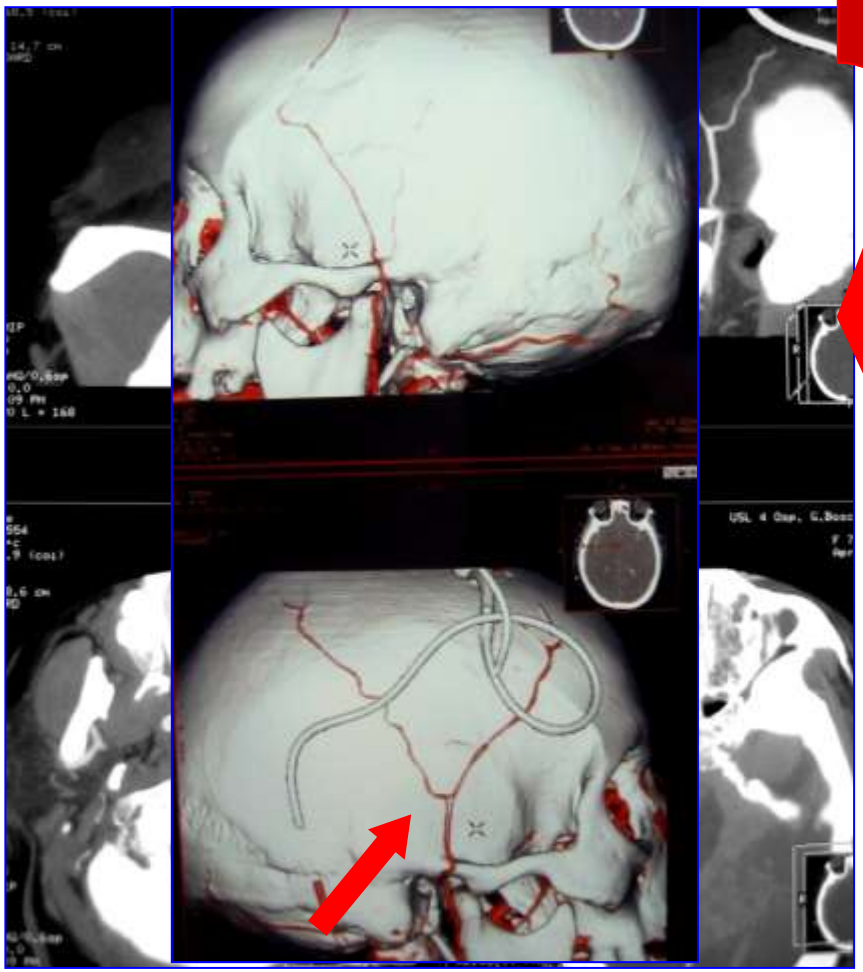

Brain Death (after)
Sagittal
Brigham & Women's Hospital
Harvard Medical School

P.P.D.

Angio-TC a 48 h dall’ esordio:
Fase arteriosa a 30”
Assenza del circolo carotido-vertebrale



Fase arteriosa a 30”
Pervietà delle a. temporali in assenza del
Circolo arterioso intracranico

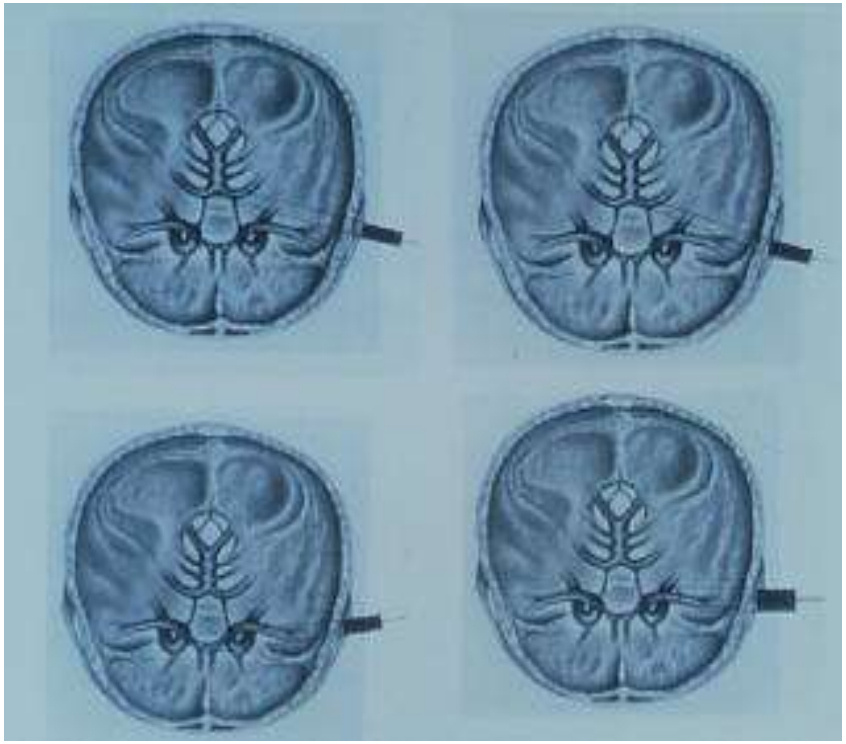


Angio-TC:
Fase venosa a 60”
Assenza dei grossi seni venosi

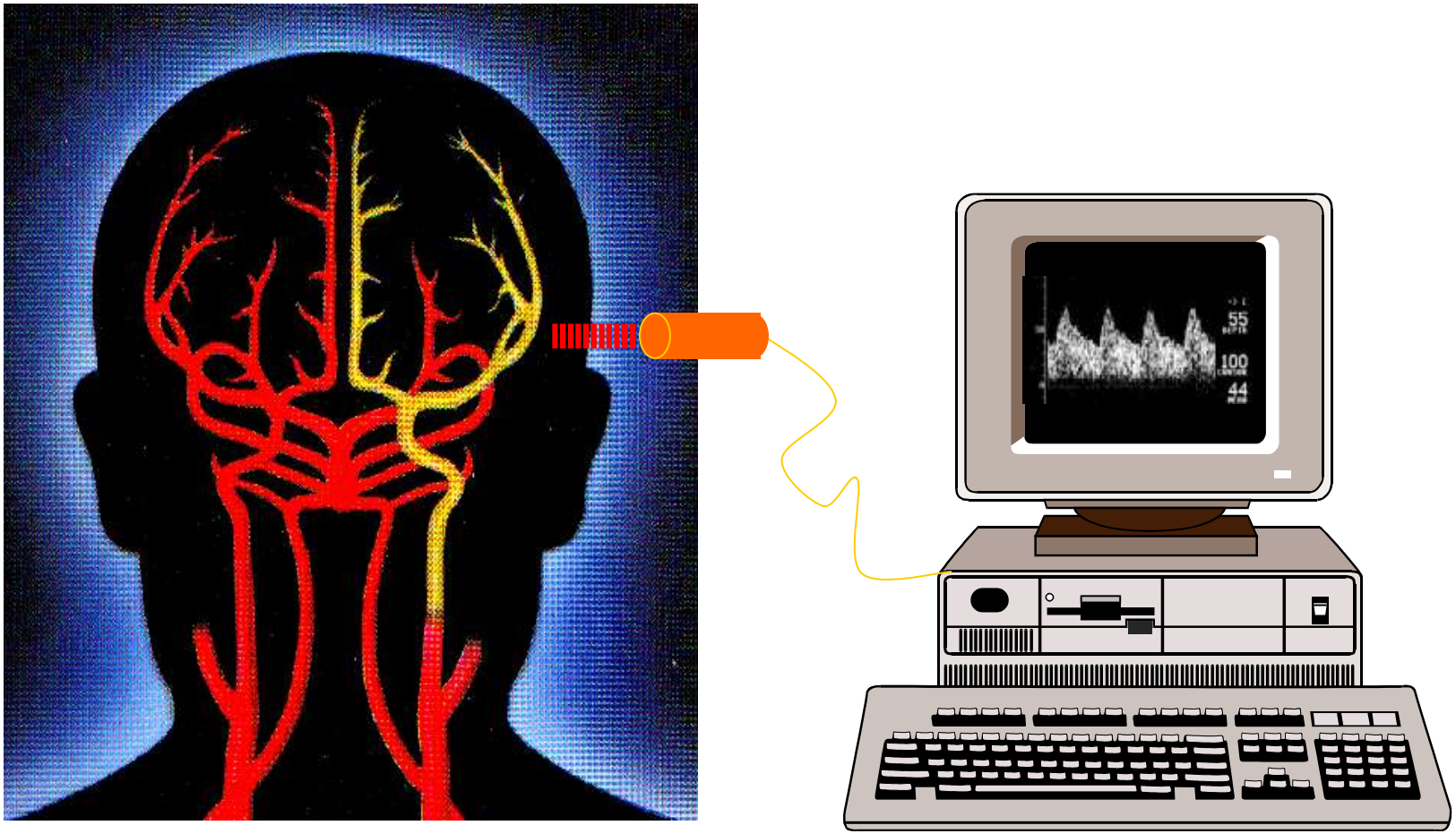
Angio-3D con a. temporali pervie

ULTRASONOGRAFIA DOPPLER (doppler transcranico – T.C.D.)

Rapida
Non invasiva
Portatile
Permette il monitoraggio
Poco costosa
Non alterata dall'ipotemia
Non alterata dai farmaci depressori del SNC
Richiede un esaminatore esperto



ULTRASONOGRAFIA DOPPLER (doppler transcranico – T.C.D.)

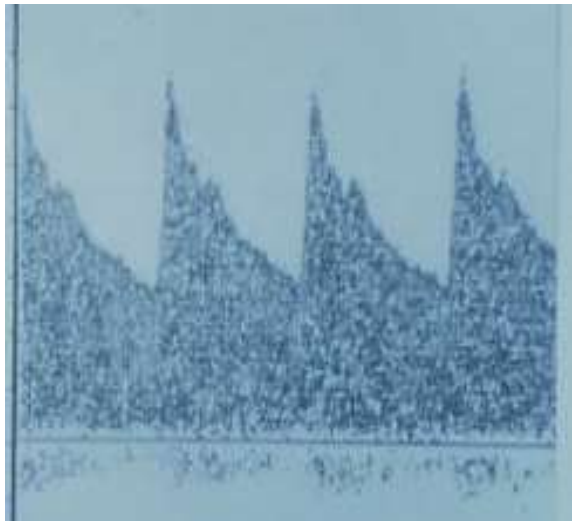


T.C.D. - finestre ultrasoniche

- Temporale →
- Occipitale
- Retromandibolare o sottomascellare
- Orbitaria →

EVOLUZIONE del T.C.D. nella M.E.

1



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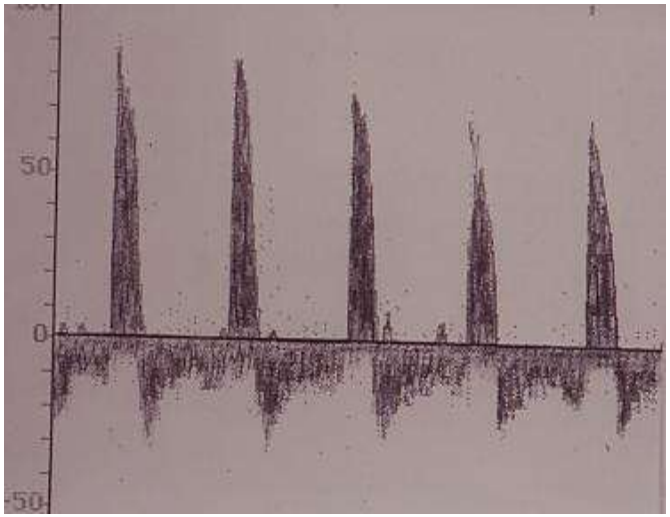

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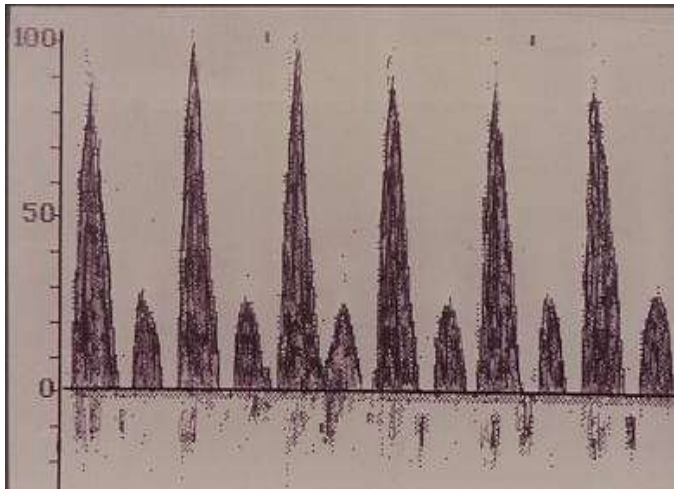

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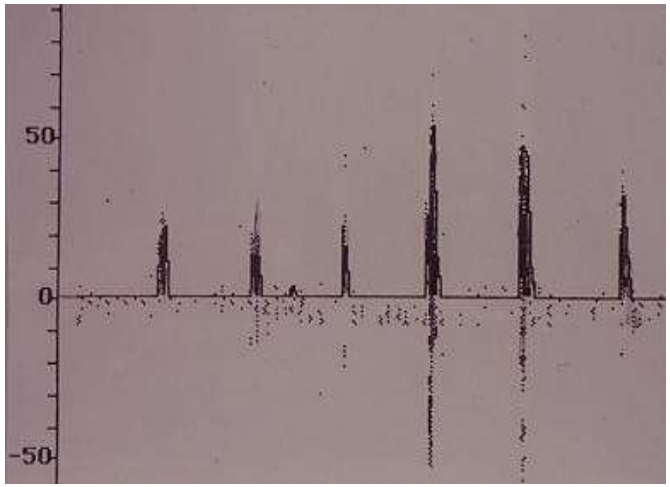

Conclusioni

TEST CLINICI DI DIAGNOSI DI MORTE CON CRITERI NEUROLOGICI

- Diagnosi facile
- Ben protocollata
- Deve essere nota a tutti i medici (e non solo medici) che lavorano in T.I.
- E' opportuno conoscere tutte le prove strumentali disponibili con i loro vantaggi e svantaggi

Take Home Messages

TEST CLINICI DI DIAGNOSI DI MORTE CON CRITERI NEUROLOGICI

- Fare un esame sistematico, completo, rigoroso
- Escludere interferenze
- Esplorare tutti i riflessi dei nn.cranici
- Verificare l'apnea
- Eseguire l'E.E.G. (sempre)
- Se ci sono interferenze o non sono esplorabili tutti i riflessi eseguire prova di flusso