



Brain Death

Clinical and Legal Background

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Brain Death

Medico-ethical reasons

Brain Death is stated in patients where continuing treatment of the patient is without any hope of regaining any level of brain function. A continuation of therapeutic measures in brain death is neither in the interest of patient nor ethically permissible. To treat a living corpse is unethical, it reduces a human being „to a mere collection of organs“.

Shewmon (1998).

Brain Death

different terms in historical view

| | |
|--|---------------------|
| Mollaret und Goujon (1959) | „Le Coma Dépassé“ |
| Committee of Harvard Medical School (1968) | “Brain Death” |
| Ingvar (1971) | “Brain Death” |
| The Conference of Royal Medical Colleges and Faculties UK (1979) | “Brain Stem Death” |
| The Subcommittee of A.A. N. for quality standards (1995) | “Whole Brain Death” |

Brain Death

basic requirements

The diagnosis of brain death is established by the medical community according to current standards of scientific and medical practice (Haupt & Rudolf, 1999)

Diagnosis for Brain Death Syndrome is based on strict verification of clinical symptoms, clarification of pathology, exclusion criteria, symptoms confirmed by experienced neurologist and additional examinations, EEG, TCD or substitute for brain circulation obligatory, accepted by national laws.

Brain Death Definition

- Irreversible loss of brain and brain stem functions.
- Death of the brain is the death of a particular human organ, a critical organ, the central integrator.
- Function of brain cannot be sustained even for a while and with extraordinary care (Wijdiks, 2001).
- Total discontinuation of brain and brain stem functions is based on an irreversible substantial damage of brain and brain stem.
- Clinically declaration as Brain Death Syndrome

Prerequisites for diagnosis of Brain Death Syndrome

- Clarification of the pathological process
- Exclusion of confounding factors
- History and clinical course
(initial stage/ full stage)
- Clearly defined symptoms
- Exact and careful neurological examination
- Additional examinations
EEG obligatory, TCD or substitution obligatory
- Documentation and monitoring of clinical course
- Fixed timing for observation period
- Independent medical team

Brain Death Syndrome Symptoms

- Coma, irreversible loss of consciousness
- No response to sensory-sensitive stimuli
- No spontaneous motor actions, including primitive motor reflexes (areflexia, atonia)
- Brainstem reflexes absent
 - Pupils maximal wide, without any reaction,
 - Oculo-cephalic, vestibulo-ocular reflexes absent
 - Tracheal reflex absent
- Apnea, demonstrable
- Vegetative dysregulation, poikilothermia
- Autonome spinal reflexes possible (60%)

Brain Death Syndrome Etiology clarification absolutely necessary

- Traumatic brain injury
- Encephalitis, different etiology
- Hypoxia
- Hypoxaemia
- Brain tumour
- Subarachnoidal hemorrhage
- Hematoma, (cerebral, extracerebral)
- Brain or brain stem infarction
- Intoxication (exogenous, endogenous)
- Poisoning (venoms, plant toxins)
- Relaxation treatment (Baclofen, Diazepam)
- Anesthesia accident
- Hypothermia, exogenous

Confounding factors Brain Death Syndrome

Mimics of Brain Death

- Hypothermia below 28°
- Drug intoxication
 - Diazepam, Barbiturates, Baclofen
- Metabolic derangements (hyperglycemia, hypoglycemia etc.)
- Exogene intoxication (plant toxins, venoms)
- Guillain-Barre-Syndrom including cranial nerves
- Myasthenia gravis
- Cervical spinal cord lesion

Brain Death Team European Proposal

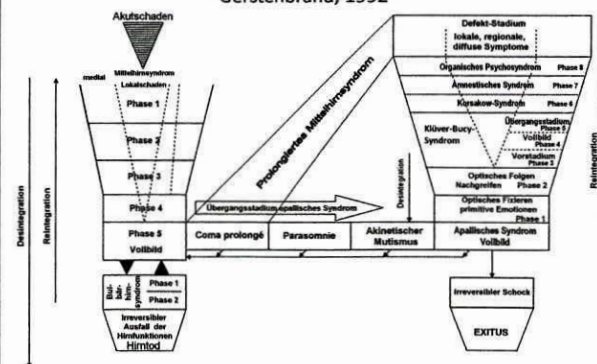
- Neurologist - clinical monitoring
- EEG- Specialist
- TCD- Specialist
- Anesthesiologist – ICU Physician in charge
- Excluding members of the transplantation team

Clinical course of Brain Death Syndrome

- Initial stage (Brain stem symptoms)
 - Acute Midbrain Syndrome,
 - Midbrain-upperpons stage (Plum, Posner)
 - Acute Bulbarbrain Syndrome
 - Lower pons-upper Medulla stage (Plum, Posner)
- Full stage of Brain Death Syndrome (irreversible breakdown of brain and brainstem functions)
- EEG, isoelectric line
- TCD, zero flow (total absence of cerebral blood flow)
- Autonomic cardiac functions
- Autonomic spinal reflexes possible (60%)

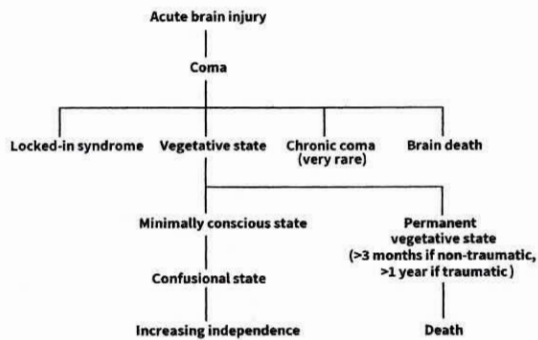
Severe Brain Damage initial stage to Brain Death

Gerstenbrand, 1992



Severe acute Brain Damage

Laureys et al, 2004



Identification of Brain Death

L.P. Ivan, 1981

Differentiation of 4 clinical phases:

1. Onset of coma and apnea (Bulbar Brain Syndrome)
2. Discontinuation of brain and brain stem functions (irreversible Bulbar Brain Syndrome)
3. Irreversible discontinuation of brain functions (Apparent Brain Death Syndrome)
4. Cessation of brain functions can be proved as irreversible (Brain Death)

Observation period

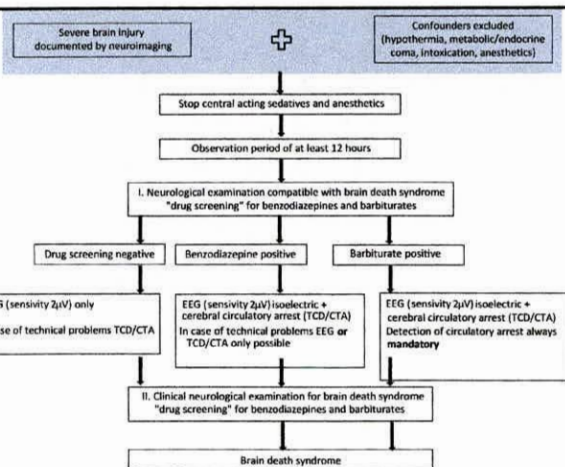
- Diagnosis of Brain Death Syndrome:
No observation period
- Diagnosis of Brain Death:
immediate cessation of medication
(ICU-treatment, sedoanalgesia)

Observation period: 12 hrs.

Observation Period

Extended Observation Period:

- Children: 24 hrs.
- Hypothermia, exogenous
below 28°: 12 hrs.
- Acute intoxications, exogenous,
endogenous: 12 hrs.
- Anesthetic accidents: 12 hrs.
- Surgical incidence: 12 hrs.
- No certain etiology: 12 hrs.



Minimal standards for Brain Death

Developing countries

Baumgartner, Gerstenbrand, 1996

- No neurologist available
- ICU, emergency rooms and intermediate care units organized.
- Neurosurgical departments fully equipped.
- Internistic ICU's without neurologist
- Neurological patients cared by general practitioner
- EEG, TCD equipment missing or not well maintained

Minimal standards of Brain Death prerequisites

Baumgartner, Gerstenbrand, 1996

1. History and clinical course of patient, carefully analyzed
2. Clarification of basic pathology, fully cleared
3. Confounding factors excluded
4. History and clinical course detailed analyzed (Initial phase, full stage) documented
5. Symptoms of Brain Death Syndrome, full stage
6. Use of existing diagnostic abilities and equipment
7. Observation period 12 hours as minimum

Omissions in international Brain Death Diagnosis

(Powner, 2009)

- Apnea test missing or superficially executed
- History and neurological course missing or not carefully performed
- Neurological examination reduced or casually
- Exact analysis of clinical course missed
- Endogenic intoxication missed or not cleared
- Drug and drug-metabolics intoxication missed or not cleared
- Unknown cause of „coma“

Autonomic Spinal Reflexes „Unexpected movements, spontaneously or during examination“

- 21 different types of autonomic spinal reflexes
F. Gerstenbrand, C.H. Lücking, 1968

- Type I: Increase of deep tendon reflexes (PSR, ASR)
- Type II: Exaggeration of spinal primitive motor patterns (asymmetric tonic neck reflex, flexion withdrawal reflex, Lazarus Sign)
- Type III: Long lasting fasciculation in muscles of the extremities, chest and abdomen, "sheet lightning" of the face

Idiomuscular contraction following local mechanical muscle stimulation.

Determination of Brain Death Proposal for International Standard

XXI World Congress of Neurology 2013

- Clarification of the basic pathological process, exclusion of confounding factors, mimicking Brain Death
- Exact analysis of history and clinical course
- Exact neurological examination (carefully performed)
- Additional examination, EEG, TCD obligatory, carefully and competent
- Documentation of neurological findings and additional technical results, exact protocol
- Experienced Brain Death team, 4 members with different obligations (clinic, ICU care, EEG, TCD)
- Protocol with signature of all 4 members of Brain Death team



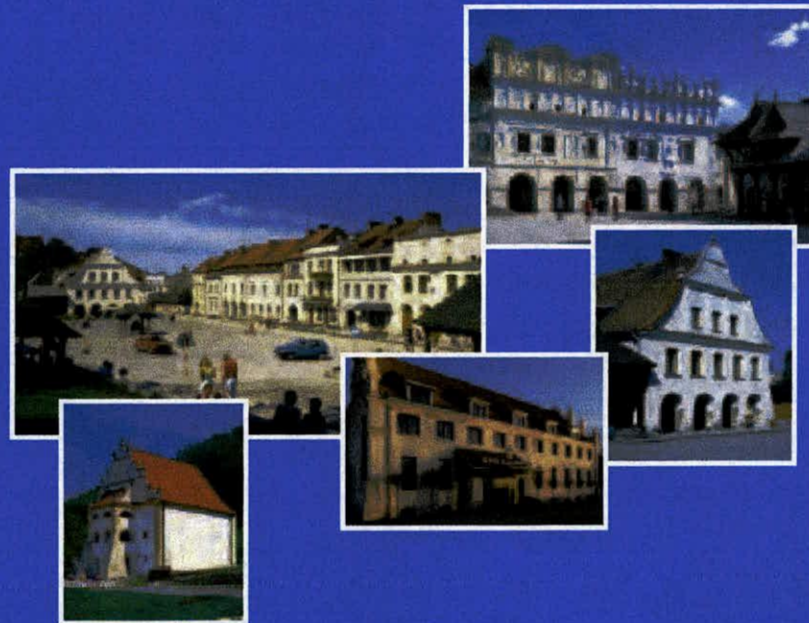
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Lublin Branch of Polish Neurological Society

Department of Neurology
Medical University of Lublin

X Międzynarodowe Warsztaty Szkoleniowo-Naukowe

**PROGRAM
FINAL PROGRAMME**



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