

# **A critique of the concept of «Brain death» (Professor Konstantinos Karakatsanis, Department of Nuclear Medicine, Medical School, Aristotle University of Thessaloniki, Greece)**

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## Introduction

The notion of «brain death» was introduced in medical terminology by the ad hoc Committee of the University of Harvard in 1968. This idea was basically invented in order to bring relief to the families of the sick, free up beds in the Intensive Care Units and remove the grounds for objecting to the obtaining of organs for transplantation.

Two criteria were considered for determining «brain death»: either the irreversible loss of all of the functions of the entire brain, including the brain stem, (The American School and many European countries), or the irreversible loss of the functions of the brain stem alone (The English School). It would appear that, as of late, the latter criterion has gained acceptance in the United States, as well.

«Brain death», either when referring to the entire brain or to the brain stem alone, is a concept without precise clinical or pathological basis and, for this reason, the criteria employed in the diagnosis of existence are arbitrary. The concept of «brain death» has come to be considered as a state of relative neurological inactivity and as an approximate diagnosis.

Are there vegetative functions in “brain dead” patients?

During the last thirty three years, since the notion of «brain death» was asserted, there has been enough evidence found in «brain dead» patients to determine the following:

1. The existence of hypothalamic-endocrine functions
2. The maintenance of a stable haemodynamic state in a high percentage of cases (30-78%), depending on the time of examination from the outset of diagnosis.

3. The maintenance of actual electro-cerebral activity, even in the absence of cerebral blood flow.

4. The existence of the radiopharmaceutical Tc99m-HMPAO, which is taken up by viable cerebral cells, in the cerebrum, in the cerebellum and/or the cerebellum or in the basal ganglia and in the brain stem.

It is worth noting that, in «brain dead» patients without cerebral blood flow, hypothalamic-hypophyseal functions have been observed, as well as cerebral electrical activity. Thus, **it follows that the absence of cerebral blood flow is not adequate evidence that all of the functions of the entire brain have irretrievably ceased.**

5. Many «brain dead» patients, up to 75%, retain «complex spinal reflexes», which were not identified as known reflexes by the investigators of the NINCDS study. Furthermore some of these complex movements, known as «Lazarus sign», have been defined by Professor Fred Plum as «semipurposful» and «semidirected». It is worth noting that such movements have also been noticed in the absence of hypoxia and hypotension.

6. It has been shown that some «brain dead» patients retain the jaw jerk and snout reflex while other patients manifest facial myokymia or decerebrate like posturing of the upper limbs. All these reflexes implies some living neurones in the brainstem and is thus not compatible with brain death diagnosis».

7. **Data from the apnoea test are inadequate.** As is well known, most investigators consider that if spontaneous respiration is not resumed, when the partial pressure of the arterial carbon dioxide reaches the arbitrary value of 60 mm Hg, the apnoea test is characterized as abnormal. Nevertheless, there are recent suggestions to continue the apnoea test until the critical value of the pCO<sub>2</sub> exceeds 90 or even 100 mm Hg. The reason for the above suggestions is that spontaneous respiration has been resumed with values of pCO<sub>2</sub> well above 60mmHg -in one instance at 91 mmHg!

On the other hand the duration of the apnoea test was 3 min according to the ad hoc Committee of the Harvard University, 4 min according to the suggestion of Mohandas and Chou, 10 min for the investigators nowadays and even up to 20 min.

8. Some «brain dead» patients retain auditory and somatosensory evoked potentials. The clinical signs of «brain death», especially when it is the result of a hypoxic injury are not considered adequate for the investigation of all the pathways which run through the brain stem. These pathways can be checked only with the evoked potentials.

**The above findings demonstrate that in many «brain dead» patients there are residual functions of the brain and the brain stem.**

Is there permanent loss of consciousness in “brain dead” patients?

It is thought that «brain dead» patients suffer an irreversible loss of consciousness. What is actually lost in «brain dead» patients is only the «crude consciousness» whose anatomic seat is in the upper brain stem and the diencephalic regions through which a general activation of the cerebrum is achieved. On the other hand primary alterations of the mood, emotion and thought in humans have been associated with abnormalities primarily focused on the «limbic system», the temporal and frontal lobes.

For the time being **there does not exist medical or other criteria for the diagnosis of the loss of consciousness, since consciousness is by nature a subjective experience.** Furthermore it is impossible to check for the **preformed content of consciousness** (the content of consciousness which was present before the injury, which caused the cerebral lesion). As Plum and Posner and Ropper and Martin allege, **the check of the mental content or of the content of consciousness is impossible when the wakefulness is reduced.** In addition, the permanent irreversibility of the loss of consciousness is very difficult to be diagnosed, as it is evident from PVS patients who regained consciousness after long intervals.

Furthermore it is known that there are limitations in the clinical assessment of the internal awareness and the inner speech, which is interrelated to the self-consciousness of the man.

**It is concluded from the above mentioned data that the permanent loss of the content of consciousness, which cannot be checked by any medical test is based on an unproved hypothesis! Thus, it follows that the diagnosis of human death is also based on the same unproved hypothesis** in both situations, that is, either when, as a criterion of death, the loss of the functioning of the whole brain is applied, or only the loss of the functioning of the brain stem.

The role of confirmatory tests in the diagnosis of “brain death”

It should be mentioned that, according to recent publications, it is necessary to use confirmatory tests for the diagnosis of «brain death» in a high percentage (42-65%) of these patients.

What follows is a critical evaluation of the role and the limitations of the various medical tests in the diagnosis of «brain death»:

**a. EEG.** When there is real electrical activity of the brain, as it happens in a significant number of «brain dead» patients, it is concluded that there is viability at least in a part of the brain. When, on the other hand, the EEG is repeatedly isoelectric, this finding is compatible with a non functioning brain under the presupposition that there is not drug intoxication (sedative drugs or barbituates), hypothermia or shock and that the patient does not suffer from metabolic encephalopathy or encephalitis or from severe, congenital malformations of the brain.

**b. Cerebral blood flow.** The existence of cerebral blood flow as it is determined by either radionuclide studies or angiography is compatible with the viability -not without exceptions- of the brain. The uptake of the lipophilic radiopharmaceutical Tc99m-HMPAO (Tc99m-hexamethylpropylene amine oxime) only by viable cerebral cells and, especially, the uptake of the radiopharmaceutical F-FDG which is a marker of glucose metabolism in the brain are indicative of viability of the perfused part of the brain.

On the other hand the sustained absence of cerebral blood flow is, in principle, indicative of a non viable brain. This absence, however, cannot be considered as a necessary criterion for the diagnosis of «brain death». Thus, it has been shown that the presence of blood flow is not incompatible with the diagnosis of «brain death» in various conditions and especially in infants. It is also known that, when the «brain death» is a consequence of cerebral ischaemia because of persistent increase of

intracranial pressure, what usually happens, if the support in the Intensive Care Unit is continued, the cerebral blood flow is resumed.

The sensitivity and the specificity of the digital subtraction arteriography for diagnosing «brain death» is, according to Professor Fred Plum, 96-98% and 100% respectively. Nevertheless the cases of «BD» patients without cerebral blood flow but with the existence of actual electro-cerebral activity and/or evidence of maintenance of hypophyseal-hypothalamic endocrine function **show that the result of cerebral angiography was false positive.**

**The conclusion is that the absence of cerebral blood flow is not incompatible with the existence of viability at least in some parts of the brain.**

Furthermore the classical angiography has various side effects and may cause further damage to an already heavily damaged brain, so its use in these patients may be problematic.

What remains to be demonstrated is whether the scan with the radiopharmaceuticals Tc99m-HMPAO or with the F-FDG, **which are direct markers of viability of brain cells**, are more sensitive and more specific tests in the diagnosis of the non functioning brain than any other diagnostic techniques.

**c. Evoked potentials.** The auditory and somatosensory evoked potentials are very useful tests for the diagnosis of the non functioning brain stem especially when the patients are in coma due to overdose of CNS depressant drugs. The sensitivity of the evoked potentials in the diagnosis of the non functioning brain stem is almost 100% while the specificity is on the order of 94-95%. Nevertheless the specificity of the

evoked potentials for the diagnosis of «BD» (with a false positive rate of 5-6%) is unacceptable in the clinical practice.

With the evoked potentials one can search for the integrity of pathways through the brain stem, which cannot be checked clinically.

**d. Transcranial Doppler.** The transcranial Doppler has several technical limitations. The sensitivity of this test in the diagnosis of «brain death» is on the order of 91-96%, while the specificity on the order of 99-100%. However the false positive percentage of 1 % in the diagnosis of «BD» with this technique is also unacceptable.

According to Professor Molinary, one of the investigators of the NINCDS study, «the criteria for the diagnosis of irreversible coma may not require confirmatory tests of EEG or cerebral circulation, but prompt pronouncement of death by criteria for total brain destruction may require both».

In the above mentioned NINCDS study, where 503 patients were studied «it was not possible to verify that a diagnosis made prior to cardiac arrest by any set or subset of criteria would invariably correlate with a diffusely destroyed brain». What was actually found was that it was possible to foresee, with an accuracy of 99%, that death would follow within one week, when the patient suffered from an unresponsive coma, apnoea and exhibited electro-cerebral silence.

During the 33 years since the Harvard Committee formulated the concept of brain death, it has been shown that «the conceptual and operational definitions are inconsistent and that current operational criteria are inherently inadequate» as Professor Robert Truog states. The same opinion is expressed by Professor Shewmon

who writes that «the whole brain concept is plagued by internal inconsistencies in both the tests-criterion and the criterion-definition relationships». **Furthermore Professor Truog thinks «that the diagnosis of death is not something that we can discover by any scientific method, but rather something we must choose, based upon our religious and philosophical values».**

### Conclusion

The author believes that for the time being the diagnosis of the unquestionable loss of all the functions of the entire brain is feasible -indirectly but with surety- only after the definite, irreversible cessation of cardiac functioning. Furthermore he believes that human death is not a process but an instantaneous event during which the «logical soul» leaves the human body.

The conclusion which follows the presentations of the above data is that the concept of «brain death» is a construct which was basically invented for social reasons. This concept should be abandoned for the problems, which have been created, increase with the passing of time, especially those which are related to the notion of brain death, when it is defined as the irretrievable loss of higher mental functions.

**The goal of obtaining organs for transplantation is possible to be obtained only after informed, free consent from healthy, living donors as an expression of Christian love as it is lived in the Eastern Orthodox, Christian Church.**

**Those practices which hasten death or bring about the direct termination of life (for the harvesting of organs for transplantation) trivialize the human**

**person and lead the human community into nightmarish scenarios.**

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NOTE: This text includes a number of references and is accompanied by an extensive bibliography, which can be found in the book "Brain Death", pages 108-115, 127-136.

(From the book "Brain Death", University Studio Press, 2nd edition, 2001")

*("Source: Holy Metropolis of Glyfada)*