

DEFINITION OF LEGAL DEATH AS BRAIN DEATH

 omarkasule-tib.blogspot.com/2011/06/definition-of-legal-death-as-brain.html



Background material by Professor Omar Hasan Kasule Sr. for Year 3 Semester 1 Medical PPSD session on 14th August 2008

1.0 TRADITIONAL CRITERIA OF DEATH

1.1 NEED FOR CRITERIA

In general death is defined as irreversible loss of the integrated functioning of the organism as a whole. For most of human history, death has been defined in a more subjective way with little attention being given to objective criteria. There were not legal or practical necessities for early diagnosis or certification of death. They had the luxury of waiting until all signs of life disappeared before pronouncing death. The earliest criteria of death that humans used were respiratory arrest. The Qur'an and sunnat describe death mostly in terms of respiratory failure. Later circulatory/cardiac arrest as absence of a heart beat or a pulse was also used. Unconsciousness was another criterion used and it related to the brain. Technological developments in intensive care units have blurred the demarcation between life and death that was taken for granted before. Many unconscious people with no cardiac or respiratory functions can be kept apparently alive on artificial life support. The increase in transplantation has given momentum to the need to develop new criteria for death. This is because organs have to be harvested quite early in the death process to prevent them from further degeneration.

1.2 RESPIRATORY FAILURE

The main purpose of the respiratory system is to deliver oxygen to the tissues. Oxygen is necessary for tissue metabolism. Tissues cannot survive prolonged hypoxia. Thus respiratory failure is followed by death of tissues due to oxygen deprivation. Respiratory failure is defined as type I failure which is hypoxemia (partial pressure of oxygen <8 kpa) due to decreased pulmonary perfusion or type II failure which is hypoxemia with hypercapnia (partial pressure of carbon dioxide >6.5 kpa) due to failure of breathing.

1.3 CARDIO-VASCULAR FAILURE

In cardio-vascular failure, tissues are not perfused sufficiently with blood that carries food and oxygen as well as takes away tissue metabolic waste. The brain is more sensitive to circulatory failure than other tissues of the body. Cardiovascular failure has 2 components: cardiac failure and circulatory failure. Cardiac failure is cardiac output inadequate for tissue perfusion due to failure of pumping blood by the heart. Cardiac

failure also manifests as blood congestion in the pulmonary and the systemic circulations. Cardiac failure is caused by a variety of diseases some localized and others systemic. Circulatory failure, failure of adequate tissue perfusion and oxygen delivery, is caused by hypovolemia, cardiac failure, obstruction to blood flow, and neurogenic due to brain stem and spinal injury, anaphylactic, and sepsis. Its common manifestation is hypotension.

1.4 NEUROLOGICAL FAILURE: IMPAIRED CONSCIOUSNESS (COMA)

When blood circulation to the brain stops or is decreased, brain function is impaired and a common manifestation of this is persistent impairment of consciousness called coma. Coma indicates severe disease of the brain stem that impairs arousal mechanisms that keep us awake and conscious. The systemic causes of coma are cerebral hypoxia due to respiratory failure, cerebral ischemia due to cardiac failure or circulatory failure, and various metabolic derangements. Coma can be caused by conditions of the brain which could be traumatic injury, hemorrhage, ischemia, and infections. The extent of impairment of consciousness is measured using the Glasgow scale. Scores are given for various abilities in opening the eyes, motor response, and verbal response. Adding up these scores gives the coma score.

2.0 BRAIN DEATH

2.1 SIGNIFICANCE OF BRAIN DEATH AS A CRITERION OF DEATH

Brain death is a form of biological death but we will discuss it here separate from other forms of biological death because of its importance. We need to establish a point of no return as irreversible loss of function because death is a process. The heart for example could stop for a short time and be revived later. Brain death seems to be the point of no return and it occurs before any of the other classical signs of death. Once the point of no return is reached, all the other signs will occur in due course. This point of no return is when the organism can no longer function as a whole because some parts have died.

In 1968 the Harvard criteria for a permanently non-functioning brain were published. These criteria were based on irreversible loss of function of the whole brain. The brain is very sensitive to injury and it has no potential for recovery or replacement after severe injury. Irreversible death of the brain will in time result in the death of all other organs because the brain is the command, coordination, and communication (C-C-C) center of the bodily functions. Without a functioning brain all bodily functions will in time disintegrate. Death of the brain manifests as loss of consciousness and all intellectual functions (cognition, memory, thought, and sensory perception) as well as loss of vital physiological functions like breathing and blood circulation. The dilemma of modern medical technology is that it can 'take over' the C-C-C functions of the brain by continuing bodily functions after death of the brain. This gives rise to many ethico-legal issues the central one being the contrast between 'supporting life' versus 'a dead corpse with a beating heart'.

2.2 CONCERNS ABOUT ACCEPTING BRAIN DEATH

2.2.1 THE CHICKEN-AND-EGG DILEMMA: When the brain dies, the rest of body functions will disintegrate and cardio-respiratory failure will inevitably occur unless there is technological intervention. On the other hand cardio-respiratory failure causes brain death because of nutrient and oxygen deprivation. Cardio-respiratory failure need not be complete before leading to brain death. The brain is more sensitive to oxygen and nutrient deprivation than any other organ of the body. It will therefore die if the cardio-respiratory system is working sub-optimally. There is therefore a vicious cycle involving brain death and cardio-respiratory failure that may cast doubt about brain death as the first criterion of death but does not cast doubt on it as a definitive criterion of death. Brain death is therefore closely associated with traditional definition of clinical death by cardio-respiratory criteria that are the underlying cause of clinical death that had been used traditionally as criteria of death. In this sense it is not something new but is a refining of what has been used for a long time a definitive indicator of death.

2.2.2 PRESSURE TO HARVEST ORGANS: It seems that the motivation to use brain death as criterion of death was motivated by the need to have a very early declaration of death so that organs can be harvested before they deteriorate further.

2.2.3 OTHER FUNCTIONS OF THE BRAIN: We may speculate that it is possible that death of the brain as measured using available technology today misses out on other unknown functions of the brain that may continue after its 'perceived' physical death.

3.0 BRAIN STEM DEATH AS DEFINITION OF DEATH

3.1 BRAIN STEM DEATH IS IN ESSENCE WHOLE BRAIN DEATH: Whole brain death is cessation of function in all parts of the brain: the cerebral cortex, the brain stem, and the cerebellum. Death of the cerebral cortex means cessation of intellectual functions and the coordination of bodily activities. Death of the brain stem means cessation of the vital cardio-respiratory functions. Thus whole brain death is irreversible loss of bodily function. Whole brain death in effect means death of the brainstem because when the brain stem is dead the cerebral cortex cannot function since it depends on the brain stem. Brain death also causes irreversible loss of consciousness. Brain stem death causes respiratory failure first followed by cardiac failure.

3.2 THE BRAIN STEM: STRUCTURE AND FUNCTION: The brain stem consists of the midbrain (mesencephalon), the pons, and the medulla. It also contains the vasomotor centers that control cardio-respiratory functions, the ascending reticular activating system that maintains alertness (consciousness). Neurons to and from the cerebral cortex pass through the brain stem. Thus any damage to the brain stem has far-reaching impact on overall physiological integrity of the organism.

3.3 CAUSES BRAIN STEM DEATH: Brain stem death caused by direct cranial trauma and cardiopulmonary arrest. The brain dies because it can no longer receive nutrients and oxygen conveyed by the blood.

3.4 BRAIN DEATH IS LIKE DECAPITATION: Dr Ali al Bar has a very graphic definition of brain stem death when he says it is the equivalent of decapitation. There may be some movements of limbs and the trunk after decapitation but these will cease soon.

4.0 HIGHER BRAIN DEATH AS DEFINITION OF DEATH

The cerebral cortex is the seat of intellect, memory, thought, feelings, and all what distinguishes a human. Irreversible loss of function in the cerebral cortex leads to loss of some these higher functions in the human in addition to functions such as voluntary movement. However a lot of autonomic functions that do not require voluntary control by the cerebral cortex remain intact because they are controlled by the brain stem. Thus a person who is in an irreversible state of unconsciousness, referred to as persistent vegetative state, can have a functioning cardiac and respiratory systems for a time. These functions however cannot last forever and they will cease unless some form of artificial life support is instituted. With life support such a person can be kept 'alive' for years and decades. Death usually occurs because of another cause like infection.

5.0 DIAGNOSIS OF BRAIN DEATH

5.1 OVERVIEW

Brain death is quite an early event in the death process. It was first proposed as a criterion for death by an adhoc committee of the Harvard Faculty that redefined death as brain death in 1968. Brain death was defined in 1968 by a publication 'A Definition of Irreversible Coma' in the Journal of the American Medical Association by the Ad Hoc Committee of the Harvard Medical School. The criteria for brain-death syndrome were given as: apnoeic coma with no evidence of brain stem or spinal reflexes and a flat electroencephalogram over a period of 24 hours. The report implied that death was brain death and recommended withdrawal of life support. In 1973 brain stem death was identified as the point of no return.

5.2 CLINICAL DIAGNOSIS OF BRAIN STEM DEATH

5.2.1 CONDITIONS TO BE EXCLUDED BEFORE TESTING FOR BRAIN STEM DEATH: Coma or loss of consciousness is first ascertained. Then causes of coma due to reversible brain stem injury are excluded. These include hypothermia (rectal temperature below 35 degrees centigrade), depressant drugs (narcotics, hypnotics, and tranquillizers), metabolic derangements (serum electrolytes, acid-base balance, disorders of glucose metabolism, and endocrine disorders), and drugs that block respiratory muscles. Diagnosis of brain stem death will also require identification of a probable cause of the brain death.

5.2.2 CLINICAL TESTS FOR BRAIN DEATH: Clinically brain death is indicated by: absence of pupillary reflexes (constriction of pupils when light is shorn in them), fixedly-dilated pupils, absence of the corneal reflex (blinking when cornea is

stimulated), absence of eye movements, absence of the orbicularis oculi reflex, absence of the vestibule-ocular reflex which is no eye movement when the external auditory meatus is flushed with 20 ml of ice cold water, no motor response to stimulation in the area of cranial nerve distribution such as absence of grimacing on applying firm pressure above the eye socket, absence of spontaneous respirations (Apnea is also confirmed by first making the patient breathe oxygen and then disconnecting the respirator long enough for carbon dioxide to accumulate in the lungs to trigger spontaneous breathing), absence of cephalic reflexes, absence of motor response to pain, absence of the cough reflex and absence of the gag reflex (coughing or gagging when a catheter is passed down the airway).

5.2.3 LABORATORY TESTS FOR BRAIN STEM DEATH: These clinical criteria are considered less accurate and have to be confirmed by laboratory measurements. They also are sometimes too late for purposes of declaring death to enable harvesting organs for transplantation. The above tests for brain death may have to be repeated several times at certain time intervals to make sure. Laboratory assessments are considered confirmatory and include: electrocorticogram measurements, electro-retinography, cerebral blood gas analysis, cerebral angiography to show cerebral circulatory arrest, retinal fluoroscopy, assessment of brain stem auditory responses

5.2.4 DIAGNOSIS OF THE PERSISTENT VEGETATIVE STATE (PVS): PVS is a state of higher brain death with lack of intellectual, emotional, memory, and other functions associated with a functioning cerebral cortex. Patients in PVS have a flat EEG of the cerebrum. They are not aware of who they are and where they are. They carry out movements but these are purposeless and are not coordinated. They have no sensory or language functions. They retain automatic cranial and spinal reflex response on stimulation. They can also produce meaningless sounds. Because of intact brain stem and hypothalamic function, they retain autonomic functions of swallowing, coughing, gagging, sucking, and gastro-intestinal movements. They can swallow food and drink on their own or assisted by means of nasogastric tubes. Patients can survive in the vegetative state for up to 30 years.

5.2.5 DIAGNOSIS OF 'COMA VIGILANTE' OR 'LOCKED IN SYNDROME': Care must be taken to distinguish PVS from the locked in syndrome. In the locked in syndrome the cerebral cortex is intact as indicated by EEG measurements. The patient is aware of himself and his surroundings. He however has lost the ability to make any voluntary movements. The only movement that is usually preserved is movement of the eyes up and down. They can develop some communication using eye movements.

6.0 CONCLUSION: WHAT IS ABOUT LEGAL DEATH?

6.1 After reviewing the various definitions of death, we need to address the legal definition of death. This is necessary because when a person dies, there are legal consequences involving burial, marriage, inheritance, and legal responsibilities. Legally

several conventions are adopted by various countries and communities. These conventions change from time to time depending on the level of technological development and the underlying societal values.

6.2 The *shari'at* definition of death is guided by the *fiqh* concept of custom or precedent, '*aadat*. Thus the shariat definition can change from time to time and also from place to place depending on the level of technological development. Definition of death for the lost person, *hukm al mafquud*, can rely on the average expected life expectancy that varies by place, ethnicity, and socio-economic status. Cardio-respiratory failure used to be the traditionally accepted definition of death. Since the invention of life support technology, a consensus is developing to use whole brain death (in essence brain stem death) as a necessary and sufficient criterion of death. Brain stem death has the same effect as complete decapitation. Just as life support measures are useless for a decapitated person, they are useless for a person with brain stem death. There is no consensus that cerebral death (higher brain death) with a functioning brain stem is an acceptable definition of legal death. In the absence of time and financial pressures, the traditional cardio-respiratory criteria of death remain operational.