5.4 Diagnosing Death

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Learning Objectives

1. To understand the concept of brain death as it is used to diagnose death
2. To understand the medical standards for the neurological determination of death

Questions

1. How can death be determined if someone is on maximal cardiorespiratory support?
2. Can treatment be stopped if the patient is diagnosed as being brain-dead?

Case

Sam is a 57-year-old man who was admitted to the intensive care unit after suffering a massive stroke from a hypertensive bleed. At the time of presentation, his Glasgow Coma Score was 5, and he was intubated and ventilated for airway protection and management of raised intracranial pressure. He was taken to the operating room for an emergency craniotomy to evacuate the intracerebral hematoma. Since the procedure, his Glasgow Coma Score has been 3. It is now 72 hours since his initial presentation, and the medical team caring for him is beginning to question whether he has died and whether life-sustaining treatments, such as the ventilator, are not allowing his heart to stop beating so that he will be recognized as dead. They are concerned that continued medical treatment in this case is futile and should be withdrawn because he is brain-dead. The family, however, continues to have hope that he will recover, arguing that if his heart continues to beat and his body continues to function that he must still be alive. They insist on a demonstration that their loved one has actually died before discontinuing treatment.

Discussion

The question of the diagnosis of death is largely a phenomenon of modern medicine. Prior to the advent of medical technology and the ability to artificially support the cardiac and respiratory functions of the body, death was recognized to have occurred when the heart stopped beating and was followed shortly thereafter with the cessation of spontaneous respiration or when the person stopped breathing and this led to the cessation of heart function. Such clear markers are no longer always present in the death of patients as they are maintained with life-sustaining technology. This situation has led to the question of whether or not the deeply comatose patient is truly alive or has died, leaving only a body in which the cardiac and respiratory systems are artificially maintained. This question has also been driven by the practice of organ transplantation because a common source of organs for transplantation is from a person who has been shown to be brain-dead. Thus, there are two scenarios where death may be determined by the demonstration that brain death has occurred: the first is to aid in the decision to discontinue life-sustaining treatments, such as mechanical ventilation, and the second is for the purpose of organ donation and procurement in accordance with the Dead Donor Rule. The first case seeks to avoid continued treatment for someone beyond the time of death, whereas the second ensures that the patient is no longer living before organs necessary for continued life are removed. In either case, the declaration of death by this means serves as proof that the act of removing organs for transplant and the removal of the patient from the ventilator is not the cause of death of that patient.

Discussions of the concept of brain death have given rise to three paradigms: whole-brain death, higher-brain death and brain-stem death. Whole-brain death implies that the entire brain, cortex and brain stem are involved with the complete and irreversible cessation of function of the brain at all levels. Higher-brain death, or cortical brain death, indicates that there is complete and irreversible loss of hemispheric function with preservation of brain-stem function. Brain-stem death implies the complete and irreversible loss of brain-stem function with preservation of cortical function.

For the purposes of declaration of death in Canada, whole-brain death criteria are used. Whole-brain death is
compelling because there is no place for any neurological activity from the brain stem or above, thus eliminating the possibility of consciousness at any level. Including the brain stem as part of the determination ensures that all levels of the brain have died. Brain-stem death, however, by virtue of the fact that it allows for functioning of the higher levels of the brain, such as the cortex and the neuroendocrine system, does not allow for the fact that one can be conscious and have full awareness in the absence of brain-stem function. Cortical death with preservation of the brain stem assumes that the entirety of one’s being resides above the brain stem, a concept that cannot be proven.

Historically, the first set of criteria for the determination of brain death was developed in 1968. There were, however, some inconsistencies and variability in the use of these criteria, although the ethical principles remained the same. This situation prompted a Canadian forum to develop a set of recommendations for consistent and reliable neurological determination of death. These recommendations stipulate the minimum clinical criteria, in the absence of confounding factors, for the neurological determination of death. These criteria begin with a known process capable of causing neurological death with unresponsive coma, with motor responses absent bilaterally. Spinal reflexes may be present, however. Brain-stem reflexes, gag and cough responses, corneal responses, pupillary responses with pupils midsize or larger, and vestibule-ocular responses must be absent, bilaterally where applicable. Finally, there must be no respiratory effort as demonstrated by the apnea test.

The apnea test involves pre-oxygenation of the patient on 100% oxygen for a defined period prior to the test and the administration of 100% oxygen delivered into the trachea during the test. Arterial blood gas measurements are taken at the beginning of the test and at defined intervals throughout the test. The patient is observed closely throughout the test for any signs of respiratory effort. The test is considered confirmatory if there is no respiratory effort, the PaCO2 is greater than 60 mm Hg (and >20 mm Hg above the pre-apnea test level) and the pH is less than 7.28 as confirmed by arterial blood gas measurement.

The neurological determination of death on the basis of these minimal clinical criteria, as recommended by the Canadian forum, must be performed in the absence of confounding factors, such as shock, hypothermia (core temperature >34°C), metabolic disorders or abnormalities, peripheral nerve or muscle dysfunction, or drug effects. It is also recommended that a second determination be performed for confirmation. If any confounding factors are present, an ancillary test, such as cerebral angiography or perfusion scintography, should be performed to demonstrate the global absence of intracerebral blood flow.

The use of neurological criteria for the determination of death has not gained universal acceptance, however. Some people reject the concept for cultural or religious reasons. There is controversy among ethicists as well. Those in favour of brain death suggest that the permanent loss of critical functions of the organism as a whole, such as spontaneous breathing, circulatory control, homeostasis and consciousness, support this stance. Opponents argue that many more functions are somatically mediated rather than brain-mediated, leading to the rejection of brain death as a legitimate means of determining death. They argue that, despite the fulfillment of neurological criteria, the body maintains the ability to fight infection, heal wounds, and maintain homeostasis and energy balance. Children maintain the ability to grow and mature sexually, and pregnant women are able to carry a fetus to term. They also argue that these patients continue to be resuscitatable and can survive with little medical intervention.

Nevertheless, medical and legal circles have accepted the neurological determination of death as a means of diagnosing that death has occurred before discontinuing treatment or procuring organs for transplantation. However, those involved in the care and treatment of these patients should be aware of the controversies surrounding the practice and the effect they may have on the acceptance of death by families in this setting. One must be patient with and supportive of families as they struggle with the loss of a loved one.

The above case illustrates how the concept of brain death often plays out in clinical practice. Sam has a significant neurological injury that appears to have progressed, despite aggressive surgical and medical management, to brain death. The clinical impression is that he would meet the criteria for brain death. The physicians caring for him at this point can assess whether or not he meets the criteria for brain death either via the aforementioned clinical criteria or, in the presence of confounding factors, by the use of ancillary tests such as a cerebral perfusion scan. Establishing that brain death has occurred would then allow for the discontinuation of treatment, including mechanical ventilation, or the procurement of organs for transplantation before the discontinuation of life-sustaining therapy.

References


