LETTER FROM JERUSALEM

Defining death anew

The brain's oxygen use, rather than brain waves, seems a good indicator

by Dr. Hadassah Gillon

The burgeoning of cadavar organ transplant operations has focused intense interest on the question of just when a person becomes a cadaver, and therefore eligible to be an organ donor. Realizing that early criteria for death, such as cessation of breathing and heartbeat, are inadequate, the medical community recently has developed new guidelines (SN: 8/21/68, p. 172).

The kingpin of these new guidelines is that the victim records a flat electroencephalogram, indicating that no brain waves are being produced. Now it appears that, even before the guidelines have been fully circulated, a flat EEG is being found to be an inadequate index. Instead the consumption of oxygen by the brain appears to be a significant indicator.

A fifteen-year-old Israeli boy out on a hike with friends fell into a deep cave and sustained severe brain injury. With great difficulty he was brought out of the cave and rushed to the Hadassah Hospital.

At Hadassah, the doctors found that he was dead according to the five criteria of death laid down in June, 1968, by the Council for International Organization of Medical Science, established under the World Health Organization. These criteria are the loss of all response to the environment; complete abolition of reflexes and loss of muscle tone; cessation of spontaneous respiration; abrupt fall in the arterial blood pressure and a flat EEG.

Nevertheless, the doctors were not prepared to issue the death certificate. Some intuition made them think there was still hope. For two weeks the Hadassah neurosurgeons kept the boy on drugs and artificial respiration despite the flat EEG.

One day there was a change. His EEG reading began to indicate new activity in the brain. Then spontaneous respiration was regained. Within two months of the accident, he was mentally and physically in excellent condition, with a normal EEG.

From this case it might seem that the solution to the problem of determining the point of death is to wait some weeks, with the heart kept artificially beating and the blood pressure up, in case the injured brain should recover. The trouble with this approach is that the transplant surgeons have to receive organs from a donor within some hours of death, while they are still perfused with blood. Waiting too long after death will deny life to somebody else in need of a transplant.

"We have to find the point when the patient enters the narrow space where the brain has completely and irrevocably ceased to function, yet the other organs are still suitable for transplantation," say Dr. Mordechai Shalit of Hadassah Hospital.

Dr. Shalit's surgical team thinks that the five criteria for death laid down by the council in Geneva this year are adequate for the great majority of cases, but they are worried about the extraordinary event.

A second unusual case in Hadassah was a 14-year-old girl, her head wounded by a shell fragment during the Arab-Israeli war in 1967. She was deeply comatose on admission, and required an operation for a fracture of the skull and bleeding in the brain. Although there was spontaneous respiration and normal blood pressure, she remained deeply comatose, with wide pupils and no response to stimuli, and the EEG recording on the second day was flat. Yet within a week her EEG reading was normal. Today the patient is in good condition.

The Hadassah surgeons have sought an additional test for life to cover such cases. They theorize that if the brain is still alive, flat EEG or no, it will consume oxygen. (The brain is the organ in the body most sensitive to lack of oxygen.) The team uses a well-established test for oxygen consumption.

The patient is administered nitrous oxide gas. The degree of clearance of this gas through the brain gives an index of blood flow and thus of the amount of brain tissue being perfused. Catheters then are placed high in the internal carotid artery and the jugular vein. Oxygen level in arterial and venous blood is measured. If there is a difference between the two levels, at least some part of the brain in metabolizing and the patient has some chance.

"Our test has one great advantage," Dr. Shalit says. "It enables us to look into the brain of the comatose patient and see what is going on. We intend to use it on more cases.

"For the vast majority of people dying in a hospital, the question of death poses no problem. But in almost all these cases, the deceased cannot be used for transplants because his organs have suffered. In the case of brain injuries, where transplants are possible, we need some parameter to measure the irreversible downward curve of the nervous system to death. We think that measuring the oxygen consumption of the brain may provide the answer."