DETERMINING THE PRESENCE OF DEATH - A MEDICAL, LEGAL AND ETHICAL PROBLEM

Until recent times, death as a biological process has received little scientific attention. The philosophers have concerned themselves with debate on life and existence, the religions with existence of life after death, the military with the methods of causing death and the physicians with postponement of death. Presumably, at that time in history when inheritance of worldly possessions first became an identifiable process, the legal profession then involved itself with need for evidence of death.

It is not known when the criteria for the presence of death were first formulated. At least three things must have been known from earliest times — if breathing stopped, after several hours the body became completely rigid — *rigor mortis* set in. Thereafter the *rigor mortis* disapeared and the body started to decompose. Even the most naive pre-human must have realized that such a body was no longer alive. Probably later in prehistory absence of heart beat was also observed to precede the decomposing process of death. However, it must be remembered that the functions of the heart were not scientifically understood in the western world until 1628 when William Harvey published his classical work entitled *"De Motu Cordis"*. We do not know how the presence of death was established in satisfactory medical and legal terms until relatively recent times and can only assume that absence of breathing and pulsations of the heart and blood vessels were used as criteria. Possibly even a feeling of coldness was added or substituted since a dead body takes on the temperature of the surroundings.

The first scientific studies of life and death processes appear to have been those of Bichat who published a now little know text entitled *Recherches physiologiques sur la vie et la mort* in Paris in 1800. Some of his studies were on bodies of the guillotined and others on animals killed by various methods. Two significant findings were recorded — thirty to forty minutes after severance of the head in some bodies ". . . one could revive this property (i.e. of movement) more of less easily in all the muscles, by usual agents." Also, Bichat noted that death ". . . takes place by the heart or by the lungs or by the brain."[1]

The first observations indicated that in a headless body reactivity of muscles ("la vie animale") remained long after decapitation. Death occurs in the conventional sense at decapitation but body tissues remain alive after this. The second observation is also of significance since it demonstrated that stoppage of function - or death - of the heart, or of respiratory mechanisms or of the brain causes death of the person in the conventional sense.

Since the time of Bichat many investigators have shown that it is possible to remove the heart from the body and keep it beating spontaneous for hours or days after the body from which it is removed is acceptably dead.[2] One can argue that the heart is still alive but the body from which it was taken is dead. It has also been known since the last century that by replacing spontaneous respiratory action - which is under control of the brain - with a mechanical pump it is possible to keep adequate oxygen in all the tissues. By such mechanical means animals can

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1. Bichat, M.F.X., **Recherches Physiologiques Sur La Vie et La Mort** Gabon et cie. Paris 1800.
2. Howell, W. H., Textbook of Physiology, W. B. Saunders Co. Philadelphia, (2nd edition) 1907, p. 939.

be kept alive for long periods. Stopping this mechanical assistance rapidly causes unconsciousness, loss of function of the brain and ultimately cessation of the spontaneous heart beat. The brain dies first, then other tissues one after another. The situation can and does exist where the brain has died and undergone complete, permanent, decomposition and liquefaction while the remainder of the body is artifically and by mechancial means kept 'alive'. Such a case was presented in *Regina* vs. *Page,* Province of Manitoba, Fall Assizes 1970.[3]

The process of death is not a simple one and attitudes to the existence of death or the time of dying have been simplistic and naive. This is reflected in the uncritical and assumed legal criteria for determining death to be the absence of heart action and respiration. No statutes of Common Law or of Civil Law - with three recent exceptions - are known to define death by absence of heart beat and respiration. However, both Black's Law Dictionary[4] and the *Corpus Juris Secundum*[5] explicitly define death as absence of cardiac and respiration function. Interestingly, never is there notation or request for observation that the body must also be unrousable, unconscious or unresponsive. Presumably it is assumed that when the heart and respiration cease this state must exist. If by some method it were possible to mechanically perfuse and keep alive a body including the brain with some complex oxygenated fluid - which is already known to exist - and respiration and heart beat stopped, the individual by legalistic and conventional definition would be dead. Common sense indicates that such an individual would be alive.

The macabre observations by some unknown observer during the French Revolution that for up to fifteen seconds after severance of the head the eyes will deviate when the name is called raises the question as to whether death occurs exactly at the severance or fifteen or more second later. Or as Bichat recorded are the muscles still separately alive forty minutes later? A similar anomaly arises in judicial hanging since the heart continues to beat for many minutes after the drop[6] and pronouncement of death cannot be made by the attending physician until the heart sounds can no longer be heard with a stethoscope. To produce death judicially most forms of execution are ones that cause death of the brain. This brain death then causes failure of respiration and then cessation of the heart beat. Even with a firing squad the final *coup de grace* is given with a pistol shot into the brain.

The observations and arguments given above show that it is death of the brain which is the process drawing attention to the presence of death. In reality this process of brain death is that which indicates absence of the states of reactivity, spontaneity, higher reflex response and all those processes thought of as life even in the most severe mental defective. The observations show that there can be no such thing as a "moment of death", despite the use of this phrase by learned members of legal profession[7], since death is a continuum going from life or being into a progressing sequential state of death and disintegration of the different body tissues.

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3 Kapoor, S., Kirk, B. W., Saunders, M. G., Schachter, P. and Taylor, J. R., Trauma, 1972, 14:1-41.

4 Black, H. C., Black's Law Dictionary West Pub. Co., St. Paul (1951), p. 1073.

5 Ludes, F. J. and Gilbert, H. J. eds. **Corpus Juris Secundum.** American Law Book Co., New York, 1966, p. 1188.

6 Glaister, J. Medical Jurisprudence and Toxicology E. & S. Livingstone Ltd., Edinburgh, 1962 11th ed., p. 720.

7 Haines, E. L. The Moment of Death. Chitty's Law Journal, 1972, 20:41-48. Rozovsky, L. E. The Moment of Death. Canadian Hospital Journal, 1972, Sept. 24-25.

The continuum may last for several minutes or for days in cases of certain disease processes.

In the past the misconceptions and simplistic approaches have been of little medical or legal import. The time the heart stopped producing visible or audible beats was adequately the misnamed moment of death. In the vast majority of deaths this criterion is still perfectly adequate - but no longer in all cases. It has become necessary to review the fundamental issues that has been discussed above.

The need for re-appraisal came when new methods of mechanical respiration for humans were introduced[8]. With these devices, if for any reason a person ceases to breathe, insertion of a tube into the trachea connected to the pump permits oxygen to be perfused throught the lungs. Such artificial respiration can be, and is, maintained for years. Within minutes of the pump stopping, the blood becomes insufficiently oxygenated, the brain dies, then other tissues and later the heart stops. The fact that the heart can continue to beat spontaneously, as has been noted earlier, must be re-emphasized here to develop further arguments.

Should breathing cease for more than three to five minutes, the lack of oxygen to the brain causes the brain to die. Since the brain controls and causes breathing, a dead brain causes permanent cessation of breathing. The heart stops beating several minutes later. If, before three minutes, adequate artificial respiration is used the brain can be prevented from being damaged. Partial or complete recovery follows. If, alternatively, artificial respiration is used after three to five minutes, the brain will be dead and unable to return to function. However, the heart will continue to beat. The body with a dead brain, artificially supported by mechanical respiration, and a beating heart can remain in this state for days or weeks[9]. Other procedures such as maintaining blood pressure by drugs and keeping body temperature normal by heating blankets are also necessary. All such procedures are performed in the modern Intensive Care Unit. The obvious question arises as to whether such a body is factually alive or dead.

Arguments presented previously suggest that there is death when the brain is dead. The presence of the beating heart is fortuitous and irrelevant. Not all physicians agree with this[10] possibly due to ingrained and mis-emphasised teaching of the physician that death is determined by absence of heart beat.

In 1968 a Committee of the Harvard Medical School[11] analysed the neurological status of patients with irreversible coma (i.e. brain death) and laid down medical criteria to establish how to demonstrate such a state. These criteria have been accepted by the World Medical Association, the Canadian Medical association and other authoritative bodies. However, none of these bodies have stated that brain death is equivalent to death in the conventional sense.

The problem would be of academic interest if it were not for two highly significant factors. The first is socio-economic. Care of the intensely ill is the most demanding and expensive procedure in medicine. The physicians must be of the highest competence, many skilled nurses and technologists

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8 Mushin, W. M., Rendell-Baker, L., Thompson, P. W. and Mapleson, W. W. Automatic Ventilation of Lungs Blackwell Scientific Publications, Oxford (2nd Ed.) 1969, p. 841.

9 Jenne, H. B. and Plum, F. Persistent Vegetative State of The Brain. Lancet, 1972, 1:734-737.

10 Crosby, D. L. Determination of Death. Lancet, 1970, 1:1287-1288

11 Beecher, H. K. **et al.** A Definition of Irreversible Coma. J. A. M. A., 1968, 205.86-88

are needed and inordinate sums of money spent on monitoring and mechanical devices. The cost in the U.S. may reach $1000 per patient per day. Partly due to the enormous cost and special skills, the number of beds available tend to be restricted. There is no advantage but great disadvantage to keep a being with a dead brain but with spontaneously beating heart in an intensive care unit for days or week until ultimately the heart beat does stop. By doing this monies to care for the less ill and recoverable are diverted and bed space may be filled to prevent admission of others, potentially capable of recovery. A second factor has been brought by the use of the healthy organs of one person being transplanted into another who has diseased non-functional organs. This process of transplantation has been used for many years particularly for corneal transplants. The cornea remains viable and transplantable for many hours after the heart has stopped beating - it dies later than most other tissues. Unfortunately, the kidneys die very rapidly after the heart stops beating and so stops circulating oxygenated blood through their tissues. Unlike the cornea, to obtain a good result for a kidney transplant the kidney must come from the donor while there is still heart beat present. It is obviously unjustifiable and indeed unethical to perform an involved risky operation on a patient with non-functional kidneys if the probability of the donor kidney not taking on transplant is present.

If brain death is death, then it is not medically, morally or ethically justifiable to keep a corpse intensely cared for during days or weeks until the heart ceases to beat. It is justifiable to remove kidneys from such a corpse in order to prolong the life for years of another patient who would otherwise soon be dead.

The decisions as to whether a body with a spontaneously beating heart, full mechanically assisted breathing and a completely dead brain is alive or dead is a matter of decision for the individual physician caring for this body. Unfortunately, the law introduces problems. The first is that, with the exceptions to be discussed, no statutory definition of death exists in Common or Civil Law. The definitions, the recording of occurrence and the time of death are left to the discretion of the physician acting in common practice. The second is the statutory need to issue a Death Certificate before certain procedures can ensue. The Death Certificate originated in England in 1836 under the Births and Death Registration Act as a public health measure to collect information on cause of death. Later through various Acts legal connotations to the Certificate were added such as inability to bury the body before filing the Certificate. When time of death was included in the Certificate this came by common practice, the time at which that person ceased to be a legal entity. As from the time recorded the heirs, trustees and governments take possession of the worldly goods of the deceased. The time recorded is contestable in court.

It is probable that the need to put time on the certificate has caused the misconception that there is a "moment of death". Commonly, the time given is when the physician detects absence of heart beat or when from indirect evidence he thinks the beat must have stopped. There is no indication how the time of death should be arrived at and again this is left to the common practice. Until modern technology changed the concepts of such practice the system has worked adequately well. Now the anomalies previously discussed carry legal implications. If it is necessary for the heart to stop before issuing a Death Certificate, needless care of a functional corpse

must be performed or transplantation of less than adequately viable kidneys made.

Four courses are open. The existing procedures may be continued - requiring cessation of heart beat as the criterion. In this case, socio-economic and medical disservice is done to the community as a whole and to other ill individuals specifically. From the point of view of others who are ill, particularly those with serious kidney disease it appears unethical to continue present procedures.

The second course is to accept the concept of death of the brain exclusive of heart status as the criterion of death. This acceptance must be as common practice. The legal support, when needed, can be argued from the fundamental principles of Common Law.

The third alternative is to follow the above then evolve a test case to evoke Appeal Court pronouncment, thus creating a written and defined precedent.

The fourth method is to make a statutory definition of death. This last course has been followed first in the State of Kansas, then Maryland, and recently Virginia. Each of these states ammended their Anatomical Gift acts and gave two definitions of death:

a) "A person will be considered medically and legally dead if . . . there is absence of cardiac and respiratory function . . ."
or if

b) ". . . there is absence of spontaneous brain function . . ."

Other statements of controversy occur in these Acts not of relevance here. The point of significance is that they imply two forms of death. There are not two forms of death. Either one must accept absence of "cardiac and respiratory funtion" or the "absence of spontaneous brain function" (i.e. brain death), not both. Since brain death must always follow, within a few minutes, cessation of cardiac and respiratory function, there is need only to define death in terms of brain death. That is, one is not dead until the brain is dead and conversely one is not alive if the brain is dead.

Whether it is necessary to define by statute is debated. In three known jury trials, one in England, one in Manitoba and one in Virginia, equating brain death with death was part of the evidence. Since each jury brought in a verdict that has indicated that all jury members must have accepted this state as death, it may be presumed that the concept is acceptable to the common public. It is to assist the physicians, particularly those involved in Intensive Care and transplantation, that statutory definition would be of value. Whilst defining death in terms of brain death by statute is acceptable and advantageous, it must be appreciated that such a statutory definition ought not to specify the means by which brain death must be determined. The advances in technology and research are changing too rapidly to permit definitions that would not soon become outdated. Existing studies (Silverman et al 1970, Walker 1972) have set criteria that are medically sound and the medical and technical procedures for demonstrating brain death are established (Beecher et al 1968), accepted and of common practice.

If statutory definition of death as brain death is made four points must be understood. The first point is that the wording must exclude those with partial brain death. This is to explicitly protect persons such as mental defectives in whom parts of the brain may have died for a variety of reasons.

The second point is that the time of death recorded on the Death Certificate is not the "moment of death" for such does not exist. The time recorded is that time at which the physician is certain from his judgement and observations that death has occurred.

The third point is that existing methods of deciding on the existence of death - absence of heart beat - are not affected.

The fourth point is that the anomalies of the types discussed above are fully resolved.

Despite the length of this dissertation to attempt to prove the point, the fact is, in an unemotional context, that when all the brain dies the individual dies.

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The Manitoba Law Journal regrets having to inform its readers that Dr. Saunders died prior to publication of this article.