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of the contributions of trauma and disease to individual deaths, we have organized the mechanisms by physical rather than physiological terms, and we have emphasized the mechanisms of violent deaths.

Electrical Disturbances of the Heart and Central Nervous System

The physiological derangements leading to death can be simple and few, or numerous, complex and sequential. The final, or occasionally the only, mechanism almost always involves malfunction of the electrochemical intercellular communications of the heart, central nervous system or both. Electrical irritability of the heart generates ventricular arrhythmias, and electrical irritability of the brain finds expression as seizures. Electrical depression of the heart, for example, by global hypoxia or the effects of drugs or vagotonicity, finds lethal expression as bradyrhythmias degenerating to idioventricular complexes without effective pump activity (electromechanical dissociation). Cerebral electrical depression, caused for example by cerebral hypoxia or depressant drugs, leads to respiratory arrest. Virtually all the mechanisms that are discussed below find their final expression in electrical excitation or depression of the heart or central nervous system.

Exogenous Electrical Disturbances of the Heart and Nervous System

The physiological derangements caused by electrocution vary depending on the magnitude of electron flow, that is, the amperage, and on whether the system for distributing electricity uses alternating or direct current.[6] The heart is susceptible to the development of ventricular fibrillation when alternating current passes through it during the vulnerable phase of depolarization. Direct current and alternating current of high amperage produce tetany of skeletal muscles and the heart. Spontaneous resumption of sinus rhythm is possible after cessation of direct current electrocution.[7] Although the neural effects of electroconvulsive therapy are well known, the possible lethal effects of electrical current on the brain are poorly described in comparison to the cardiac effects.

Conversion of Impulsive Mechanical Energy (Impact) to Electrical Energy

With blunt impact to any part of the body, the transferred energy is conserved as mechanical energy to some degree, with the production of motion of the stricken member, and part of the transferred energy is absorbed as harmonic oscillations which are dampened out and converted to heat. A small part of the imparted kinetic energy may be converted to electrical impulses. The medical term for the functional consequence of this phenomenon is *concussion*. Concussion can involve the brain, spinal cord or heart, and it can be directly lethal. Cardiac concussion can induce immediately lethal ventricular fibrillation or asystole. Concussion of the brain or spinal cord can paralyze respiration or produce surges or autonomic current flow to the heart, with the same result. By definition, a concussion does not require the demonstration of cerebral, spinal cord or cardiac contusion. Evidence of blunt impacts to the head, of internal derangements of the neck, or of impacts to the chest are, however, helpful in deducing the occurrence of concussion.

Non-Impact Pressure Gradients in Vital Sensitive Areas

Subarachnoid hemorrhages so voluminous as to constitute hematomas can be produced by ruptured aneurysms of cerebral arteries or by blunt impact trauma. Ventricular cardiac arrhythmias have been clinically documented in surviving patients with ruptured cerebral aneurysms. Instantaneous death from subarachnoid hematomas most likely involves fatal autonomic discharge to the heart, induced by the bloody tamponade of the brain stem and hypothalamus. A plausible alternative mechanism which is not mutually exclusive involves spasm of the cerebral arteries serving the brain stem and hypothalamus. Those persons who do not experience instantaneous death can develop respiratory arrest from brainstem pressure.

Cardiac tamponade can be produced by car-