G31 Commotio Cordis: Sudden Death Among Young People During Sporting and Recreational Activities

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After attending this presentation, attendees will have an improved understanding of sudden deaths due to commotio cordis including its definition, demographics, mechanisms, treatment, prevention, and potential medicolegal consequences.

This presentation will impact the forensic community and/or humanity by improving awareness among the forensic community of sudden deaths due to commotio cordis. Increased understanding of commotio cordis may lead to more accurate determination of cause of death by forensic professionals, improve preventive and safety measures in the community, and help avoid inappropriate charges and convictions in the criminal justice system.

A 21-year-old white man with no significant medical history was hiking and rock climbing with friends and sustained a 15-foot fall which led to immediate loss of consciousness. A policeman was the first rescuer to the scene. He found the young man to be apneic and pulseless. The policeman administered defibrillation and cardiopulmonary resuscitation. The man was airlifted to a local hospital where he was pronounced dead shortly after admission. The case was referred to the medical examiner's office. At autopsy, multiple horizontal abrasions were observed on the face, thorax, and legs. There was no intracranial or spinal pathology. There was no evidence of cardiomyopathy and the coronary arteries had normal anatomy. There was focal petechial hemorrhage on the posterior epicardium. Blood toxicology was positive for cannibinoids and ethanol
(0.010 gram %). The cause and manner of death were determined to be commotio cordis and accident, respectively.

Commotio cordis is defined as cardiovascular collapse secondary to cardiac arrhythmia caused by low energy impact blunt trauma to the chest without structural injury to the sternum, ribs, or heart.

Maron *et al*. (JAMA, 2002) reviewed 128 cases entered into the U.S.Commotio Cordis Registry. The ages ranged from 3 months to 45 years with a median age of 14 years. Seventy-eight percent were under 18 years old and 95% were male. Eighty-one percent involved precordial blunt impact from a projectile, most commonly a baseball, softball, or hockey puck. Twelve percent involved a fight, play fighting, or parental discipline. One case involved a fall on playground monkey bars. It is thought that the narrow, compressible chest of youth increases the risk for commotio cordis.

Link *et al*. (Prog Biophys Mol Biol, 2003) conducted a series of experiments on a swine model to improve understanding of the mechanisms of commotio cordis. Using projectiles fired at anesthetized juvenile swine, the researchers found that ventricular fibrillation could be consistently produced when impact occurred 10-30 milliseconds prior to the T-wave peak. Impacts led to premature ventricular depolarization. Ventricular fibrillation was most consistently produced by impacts at the center of the left ventricle. The authors found that early defibrillation was a critical factor in survival.

It has been suggested that soft core baseballs, improved chest protection, and the presence of defibrillators at organized sporting events may decrease commotio cordis events and deaths.

Of particular importance to the medicolegal community, Maron *et al*. (American Journal of Cardiology, 2002) described six cases of commotio cordis which entered the criminal justice system. The cases involved parental discipline, domestic dispute, and gang initiation. In all cases, there was no intent to cause death and none of the victims showed sufficient trauma to cause death. Convictions ranged from reckless homicide to first degree murder, with sentences from 8-20 years. The authors purport that criminally negligent homicide is not the appropriate charge in many cases of commotio cordis and that it is the responsibility of the physician community to educate the justice system regarding the nature of commotio cordis deaths.

Commotio cordis is an important cause of sudden death in young people during sporting and recreational events. It is caused by low energy impact blunt trauma to the chest which causes fatal cardiac arrhythmia. Rapid defibrillation is critical to survival. Protective measures may decrease commotio cordis events and deaths. It is of great importance to increase awareness of commotio cordis within the medicolegal community to prevent inappropriate criminal charges and convictions.

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