Commotio Cordis: The Importance of a Treatment Window

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Introduction:
Commotio cordis is defined as sudden cardiac death following modest blunt force chest trauma, and is commonly seen in youth associated with sports events. It develops when individuals are struck in the chest during early ventricular repolarization, stimulating ventricular fibrillation upon impact. Affected patients have a mean age of 15, and are predominately male. Behind cardiac hypertrophy, commotio cordis is the second leading cause of cardiac death in young athletes, seen most often in contact sports. Evidence of commotio cordis has been seen as early as 1763 with low incidence. However, reporting has increased due to increased awareness and recognition, which has also caused an increase in survival rates. Survival times increase with early recognition, access to Automated External Defibrillator (AED) within 2 minutes, and quick bystander response (1). Survival rates will continue to increase with additional resuscitative treatment measures.

Importance in diagnosis is excluding major chest trauma inducing structural cardiac impairment. Increased awareness of disease states causing sudden cardiac arrest is increasing survival rates in all instances of sudden cardiac arrest, including commotio cordis.

Case Description:
This case describes a previously healthy 22-year-old Latin American male minor league baseball player struck in the chest by a pitch during a spring training game. He suddenly developed shortness of breath and quickly lost consciousness. He was found in ventricular fibrillation. Cardiac resuscitation was initiated with immediate bystander chest compressions and defibrillation prior to EMS arrival. Paramedics continued resuscitation, and he was transported to the emergency department.

Upon arrival, patient was sedated, intubated, tachycardic, and tachypneic. No acute signs of trauma were noted upon physical examination. Patient had spontaneous movement in all extremities. He was admitted to the ICU, had a full cardiac workup performed which was unremarkable, and discharged home after a three-week hospitalization with close follow-up with his cardiologist.

Vital Signs:
Temp: 100.4°F  Heart rate: 146 Resp: 44 BP: 115/50 mmHg SpO2: 95% on 100% oxygen

EKG (s/p electrical conversion):
Normal Sinus Rhythm, rate of 140, with T-wave inversion noted anteriorly.

Conclusions:
This case is rare due to the patient’s age, seeing as commotio cordis normally presents in children. Children are at risk to commotio cordis due to an immature thorax, making the chest unable to withstand modest blunt force trauma, even when wearing chest protection. One-third of commotio cordis deaths were in children wearing chest protectors. In 2017, National Operating Committee on Standards for Athletic Equipment (NOCSAE) released the latest statement regarding chest protection and commotio cordis. Their findings state the most effective chest protectors were made up of four material layers (coated aramid, semirigid polypropylene, high and low density elastomers) paired with increasing thickness. With the aforementioned materials, the animal experimental model shows promising outcomes: this protector showed a reduction in the incidence of commotio cordis. (6) If chest protectors can be more tightly regulated, this could be a successful way to increase survival rates following chest wall trauma in young athletes.

Another way to decrease incidence of commotio cordis is training children how to properly avoid chest impact in their respective sports. An additional approach would be to increase efficacy of onsite treatment. Better access to automatic external defibrillators and immediate bystander cardiopulmonary resuscitation increase survival rates.

Therapist changes and onsite treatment will both require additional education. If coaches or teachers, league or facility managers, referees, or parents were educated on disease symptoms, early recognition, and how to respond quickly and appropriately, survival rates will continue to increase. Though chest protection may be a helpful addition for increased survival rates, the single most important factor in surviving commotio cordis is the time from the cardiac arrest to defibrillation. (8)

Acknowledgement: I would like to thank Northern Health Southside Osteopathic Medical Center for providing medical records and radiologic images needed to present this case. I would like to thank Dr. Michael Weinstock, Dr. W. Patrick Stump, Dr. R. Taylor Fincher, Dr. Christopher C. Wright, Dr. W. Mark Houck, Dr. Rich Kang, Dr. John I. Myung, Dr. Charles Bishop, and Dr. Michael J. Lamas for their assistance in analyzing and writing this case. I would also like to thank Dr. Brannon Traxler, MD, for his assistance in analyzing and writing this case. Finally, I would like to thank Dr. William E. Pappas, DC, for his assistance in the analysis of this case.

References:

Serial lab tests are vital in trauma patients to monitor current condition and recovery proceedings.

Due to chest trauma, lung function and electrolytes have to be consistently monitored since the lungs and kidneys work jointly in acid/base balance.

These findings are consistent with moderate blunt force trauma (commotio cordis).

External variables
- Impact object
- Circular shape
- Greater height
- Smaller diameter
- Velocity
- Impact speed: 40 mph
- Orientation: Direct

Activation of T wave inversion (VF)
- Increase a current in myocardial membranes
- Increasing involvement of other ion channels

Fig 1 (3): Increasing survival rates are due to disease recognition, increased awareness, and most importantly quickening bystander response time and AED access (3).

Fig 2 (4): Implementing this chain of survival published by the American Heart Association increases survival rates in all instances of sudden cardiac arrest, including commotio cordis. Increased awareness of disease states causing sudden cardiac death is important; however, note immediate bystander CPR and defibrillation, as these are the key for improved survival rates.

Fig 3: Head CT, Cervical Spine CT, and Chest x-ray were all unremarkable. However, his Chest CTA showed small bilateral pneumothoraces.

Fig 4: Blunt force impact effect on cardiac conduction.