



A Rare Case of Commotio Cordis After the Fatal Blow, Who was Miraculously Saved From Death: In A Teenage Girl

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Abstract

A 12-years old girl during martial arts training suffered a cardiorespiratory arrest after being kicked, In EMS chest compression was done and in emergency unit CPR was continued the patient was intubated. Cardiac rhythm was VF and electroshock 2 J/Kg was given and rhythm changed to Ventricular tachycardia (VT) then Normal sinus rhythm with PVC, the patient again developed VT and Amiodaron was prescribed, After starting amiodarone, the patient's rhythm became sinus, Amiodarone changed to Metoral after 72 hours and discharged with good condition.

Introduction

Commotio cordis, It is a word that comes from Latin and means anxiety in the heart, is defined as sudden cardiac death secondary to a non-penetrating trauma on anterior precordial of chest. The cause of Sudden death in commotio cordis is a primary arrhythmic event and usually the chest blow does not inflict direct structural damage to the heart itself. commotio cordis along with structural causes of the heart and cardiac channelopathies, are the most important causes of sudden death in athletes (1,2,3).

In this article, we Introduced a 12-year-old patient who was miraculously saved from commotio cordis and revived despite the lack of cardioversion at the accident scene.

Case Report

A 12-years old girl during martial arts training suffered a cardiorespiratory arrest after being kicked after BLS referred to Emergency Department of Hospital of Neyshabour University of Medical Sciences with EMS. In EMS chest compression was done and in emergency unit CPR was continued the patient was intubated. Cardiac rhythm was VF and electroshock 2 J/Kg was given and rhythm changed to Ventricular tachycardia (VT) (figure 1) then Normal sinus rhythm with PVC (figure 2) for mor evaluation patient refer to Pediatric akbar hospital in Mashhad.

The patient again developed VT in Akbar Hospital and Amiodaron (5mg/kg/dose/stat then infusion 5ug/kg/min) was prescribed.

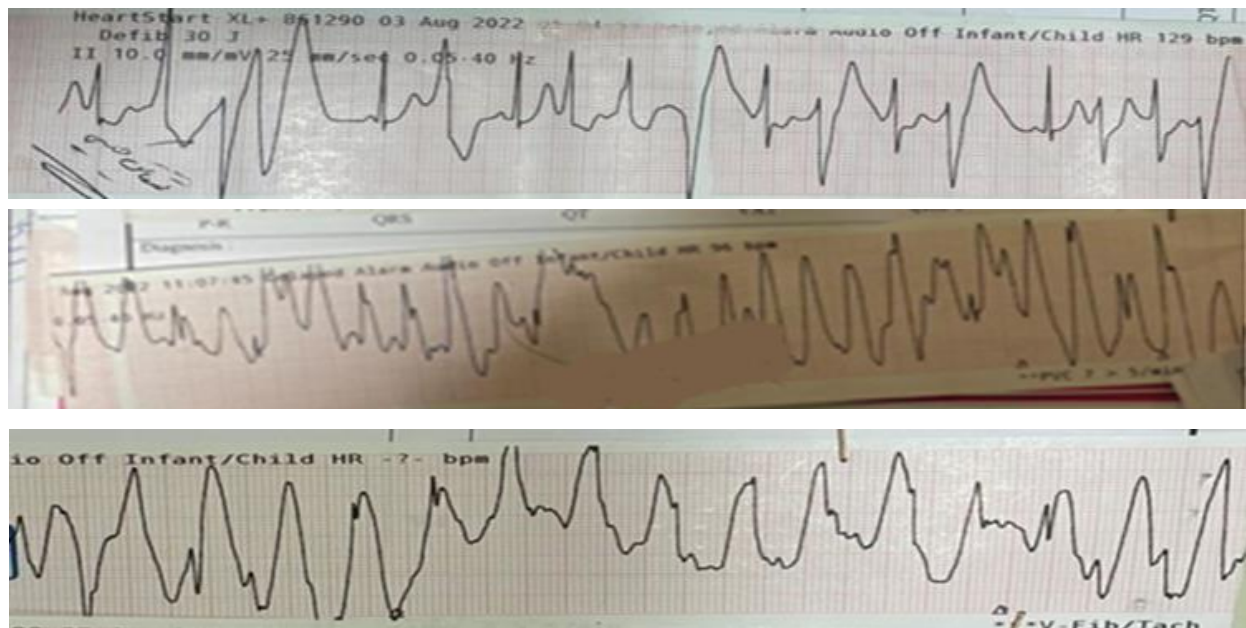


Figure 1: ECG Lead II showed poly morphic Ventricular tachycardia

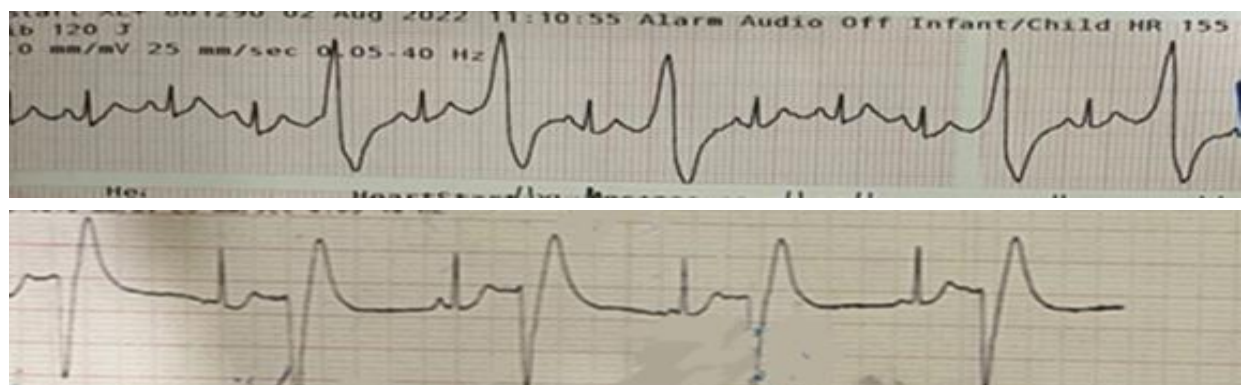


Figure 2: ECG Lead II showed Normal sinus rhythm with PVC

For more investigations and specific cardiac treatments, go to the children's heart department of Imam Reza Hospital, which is the third referral center. The patient was transferred to CCU and complete cardiac monitoring was performed, After starting amiodarone, the patient's rhythm became sinus (figure3)

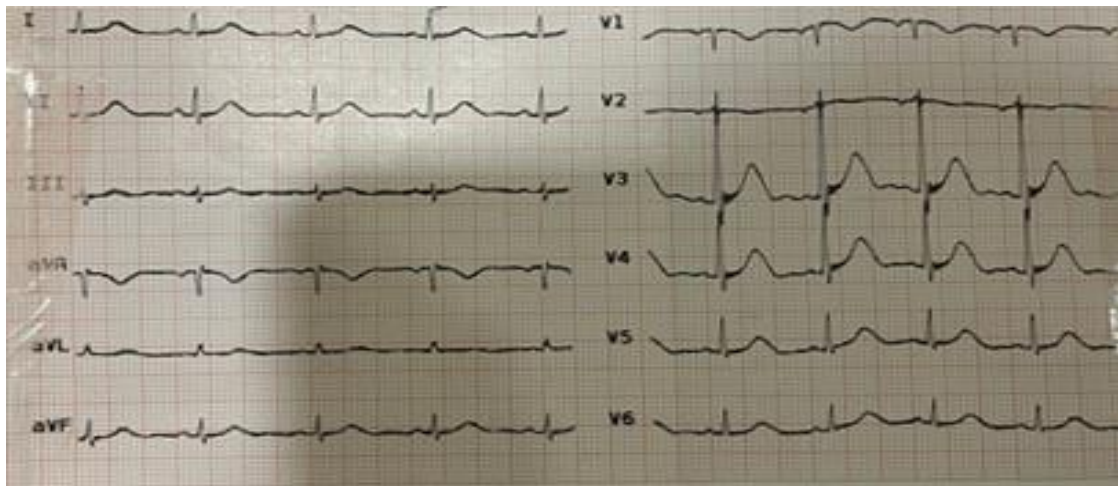


Figure 3: Standard ECG 12 Lead showed Normal sinus rhythm

In lung auscultation the sound in left side was reduced. With probability of hemorrhage in abdomen and tension pneumothorax cardiac and surgery consultation was requested. emergency abdomen and pelvic sonography and chest X-Ray was done and there was no fluid in the abdomen and no fracture in ribs, but lung contusion was seen (figure 4).

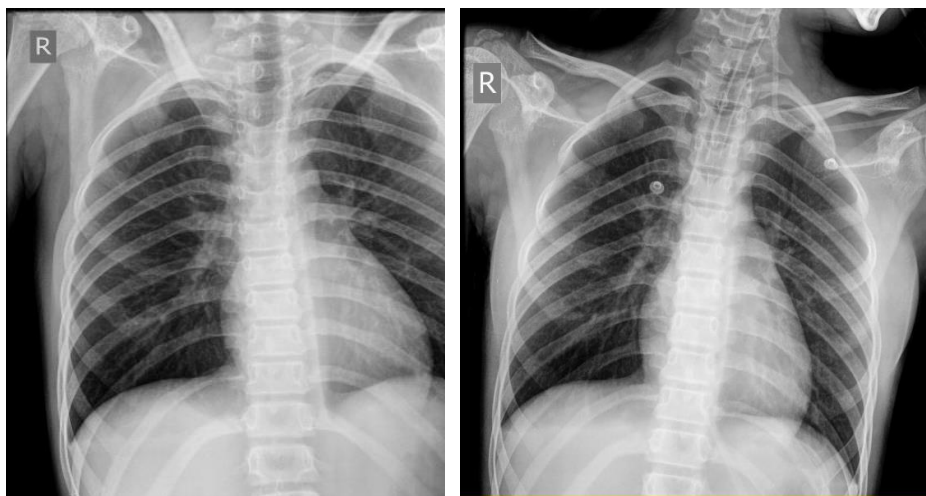


Figure 4: CXR in PA View normal heart size before and after intubation

Echocardiography showed normal structure heart without any functional abnormality and Pericardial effusion. Amiodarone changed to Metoral (1mg/kg/day) after 72 hours and discharged with good condition. Electrocardiographic Holter monitoring before discharge showed no Significant PVC or other arrhythmia. At the time of discharge, the necessary training on activity and danger signs and follow-up to check for chanelopathies were done.

Discussion

Although commotio cordis begins with trauma, the main pathology is fatal arrhythmia in the heart, this dangerous arrhythmia is usually VT, VF (4,5).

Intensive energy that directly over the precordium are more likely to cause VF due to an increase in potassium current across the cell membrane via potassium ATP channel (6).

These Intensive energy occur in 10–30 ms prior to the T wave peak, resulting in VF(7).

Most individuals affected by commotio cordis will not survive after the cardiac arrest and resuscitation attempts being successful in only 35% of patients (1).

Factors involved in the onset of commotio cordis include:

- 1) the timing of impact during the cardiac cycle,
- 2) location of impact,
- 3) and perhaps the velocity of impact.

The most important factor for inducing of VF in commotio cordis appears to be the timing of chest wall impact in the cardiac cycle, Only when impacts occurring during a 20 to 40 millisecond on the upslope of the T-wave (early ventricular repolarization) will cause VF (8).

The diagnosis of commotio cordis is based on clinical presentation for example a blunt chest impact followed by cardiac collapse, if electrocardiogram was available ECG data demonstrating ventricular fibrillation, In the studied patient, we could not record an EKG at the accident scene, but the history of the patient was typical of commotio cordis and in the echocardiography, there was no evidence of structural heart disorder, coronary artery anomaly, etc.

Survival in commotio cordis have historically poor outcome, with no reported survival in the initial 25 patients in the National Commotio Cordis Registry (3).

The survival in commotio cordis relate to earlier recognition and activation of emergency medical services, increased cardiopulmonary resuscitation, and earlier defibrillation, often by using automated external defibrillators, basic and advanced life support algorithms include chest compressions. (9)

In this patient, due to the lack of cardioversion at the scene, only basic resuscitation support and chest compressions were performed, and after being transferred to the hospital, cardioversion was performed, and in hospital the patient's rhythm became sinus, However, the patient's consciousness returned to normal after 48 hours, despite that there were no brain damage findings and the patient needed pulmonary support due to pulmonary contusion,

Finally, the patient was successfully extubated with proper heart and lung support, and the patient's level of consciousness returned to normal, and the patient was discharged in good condition.

Conclusion

Blows on the precordium, even non-penetrating types, can be dangerous and life-threatening in children and adolescents. Familiarity and general training of basic resuscitation, especially trainers, and timely implementation of resuscitation measures on site, as well as access to electroshock and quick transfer to medical centers can be life-giving.

References

1. Maron BJ, Gohman TE, Kyle SB, et al. Clinical profile and spectrum of commotio cordis. *JAMA* 2002; 287:1142.
2. Madias C, Maron BJ, Weinstock J, et al. Commotio cordis--sudden cardiac death with chest wall impact. *J Cardiovasc Electrophysiol* 2007; 18:115.
3. Maron BJ, Estes NA 3rd. Commotio cordis. *N Engl J Med* 2010; 362:917.
4. Maron BJ, Doerer JJ, Haas TS, et al. Historical observation on commotio cordis. *Heart Rhythm* 2006; 3:605.
5. Link MS. Commotio cordis ventricular fibrillation triggered by chest impact induced abnormalities in repolarization. *Circ Arrhythm Electro-physiol.* 2012;5(2):425–32. [https:// doi. org/ 10. 1161/ circep. 111. 962712](https://doi.org/10.1161/circep.111.962712).

6. Link MS, Maron BJ, Wang PJ, Van der Brink BA, Zhu W, Estes NA III. Upper and lower limits of vulnerability to sudden arrhythmic death with chest-wall impact (commotio cordis). *J Am Coll Cardiol*. 2003;41:99–104
7. Link MS, Wang PJ, Van der Brink BA, Avelar E, Pandian NG, Maron BJ, Estes NAM. Selective activation of the K ATP channel is a mechanism by which sudden death is produced in low energy chest wall impact (commotio cordis). *Circulation*. 1999;100:413–8. <https://doi.org/10.1161/01.CIR.100.4.413>.
8. Cooper S, Woodford NW, Maron BJ, et al. A Lethal Blow to the Chest as an Underdiagnosed Cause of Sudden Death in United Kingdom Sports (Football, Cricket, Rugby). *Am J Cardiol* 2019; 124:808.
9. Maron BJ, Haas TS, Ahluwalia A, et al. Increasing survival rate from commotio cordis. *Heart Rhythm* 2013; 10:219.

