Complete Heart Block Following a Blow on the Chest by a Soccer Ball: A Rare Manifestation of Commotio Cordis

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Commotio cordis is a rare type of blunt cardiac injury in which low impact chest trauma causes sudden cardiac arrest, usually occurs from being struck by a projectile during sports. The most common arrhythmia during commotio cordis is ventricular fibrillation, although complete heart block and an idioventricular rhythm have also been reported. We describe a case of a young patient who presented with a persistent third-degree atrioventricular block and a left bundle branch block, following blunt chest trauma, as a result of blow by soccer ball and subsequently needed a permanent pacemaker.

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Commotio cordis is a rare type of blunt cardiac injury in which low impact chest trauma causes sudden cardiac arrest, usually occurs from being struck by a projectile during sports. The most common arrhythmia during commotio cordis is ventricular fibrillation (VF), although complete heart block (CHB) and an idioventricular rhythm have also been reported.¹ We describe a case of a young patient who presented with a persistent CHB (third-degree atrioventricular block) and a left bundle branch block (LBBB), following blunt chest trauma as a result of blow by a soccer ball.

CASE REPORT

A 23-year-old man was hit on the chest with a soccer ball from a distance of two feet during a game of soccer in which he was the goalie. Following the impact, he fell to the ground, felt extremely weak and had a few episodes of vomiting. Paramedics arrived promptly and found him hypotensive with a BP of 90/50 mmHg. An electrocardiogram performed in the field revealed a third-

degree atrioventricular (AV) block with a heart rate of 38 beats per minute. He was promptly brought to the emergency room where another electrocardiogram was performed which confirmed third-degree AV block at 40 beats per minute with LBBB morphology. (Fig. 1)

His physical examination revealed a circular bruise over the precordial region (at the site of impact by the soccer ball), jugular cannon A waves on neck exam, and variable S1 on cardiac auscultation consistent with third-degree AV block. Remainder of his physical examination was normal. Electrolytes and urine toxicity screen were normal. Cardiac enzymes were elevated with an initial troponin value of 0.10 mcg/L which trended up to 2.43 mcg/L and then trended down to 1.88 mcg/L, diagnostic of myocardial damage. An echocardiogram was performed which did not reveal pericardial effusion or segmental wall motion abnormalities, but abnormal ventricular septal motion consistent with conduction abnormality. Chest radiograph was normal. Patient was observed in the cardiac intensive care unit. His heart rate

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Figure 1. Patient's electrocardiogram showing third-degree atrioventricular block with left bundle branch block morphology.

subsequently increased to reach a maximum of 50 beats per minute, but continued to have third-degree AV block on cardiac monitor and serial electrocardiograms. Though he remained asymptomatic and hemodynamically stable, a permanent pacemaker was inserted on day 3 of hospital admission due to persistent third-degree AV block. He was discharged home in stable condition. This is a rare case of complete heart block following commotio cordis due to blunt trauma from a soccer ball. The fact that he had elevated cardiac enzymes on labs, became symptomatic immediately after the impact, and had electrocardiographic evidence of third-degree AV Block establishes the causal relationship between the blunt trauma by the soccer ball and the development of complete heart block.

DISCUSSION

The patient described above was regularly involved in sports like soccer as an adolescent, with no history of symptoms suggestive of physiologic consequences of bradycardia, until his presentation this time after the blunt chest trauma. Since most cases of congenital CHB present with symptoms by late childhood, a preexisting congenital CHB was ruled out. The prolonged QRS interval with LBBB

in this setting suggests that the block in the cardiac conduction system was at the level of the fascicles and/or left bundle branch, which was consistent with the abnormal ventricular septal motion on the echocardiogram.

Commotio cordis has been reported in baseball, ice hockey, lacrosse, softball, and as a consequence of fistfights.^{2,3} Most patients with blunt cardiac injury admitted for cardiac monitoring suffer from a minor dysrhythmia. Zero to 5 percent of patients with blunt cardiac injury develop a dysrhythmia that requires treatment.⁴⁻⁶ Criteria for treatment may include elevated cardiac biomarkers, an abnormal ECG or echocardiogram and hemodynamic instability, or a combination of these. Cardiac arrest during blunt cardiac injury appears to stem from the timing of the blow during a period of electrical susceptibility. An animal model was developed in which low-energy blows to the chest wall delivered and found that the electrophysiologic consequences of chest-wall impacts were critically dependent on the precise timing of the impact during the cardiac cycle. VF was common when the impact occurred during cardiac repolarization (just before the peak of T wave). Chest-wall impact during ventricular depolarization (the QRS complex) did not produce VF, but rather transient complete heart block followed by ST segment elevation and

sometimes LBBB. Impacts during the ST segment caused LBBB, associated with ST-segment elevation. This could be a result of blunt chest-wall impact causing trauma to critical areas of the conduction system directly.⁷ Studies have demonstrated that about 40% of sudden death in young athletes due to blunt cardiac injuries occurs despite the use of commercially available chest barriers perceived as protective of VF and commotio cordis. These chest protectors however were not specifically designed to protect from commotio cordis related chest blows, but to avoid traumatic structural injury to the chest wall. This raises the concern that perhaps improved design of chest barriers after better understanding of optimal chest-wall protection will be needed to protect young athletes against commotio cordis.⁸ It is reasonable to suspect that equipment that maintains coverage of entire heart during athletic activity would be more protective. Increased availability of automated external defibrillators at youth sporting events has also shown to be effective in preventing commotio cordis.⁹

REFERENCES

1. Maron BJ, Gohman TE, Kyle SB, et al. Clinical profile and spectrum of commotio cordis. *JAMA* 2002;287:1142-1146.
2. Maron BJ, Poliac LC, Kaplan JA, et al. Blunt impact to the chest leading to sudden death from cardiac arrest during sports activities. *N Engl J Med* 1995;333:337-342.
3. Maron BJ, Strasburger JF, Kugler JD, et al. Survival following blunt chest impact-induced cardiac arrest during sports activities in young athletes. *Am J Cardiol* 1997;79:840-841.
4. Godbe D, Waxman K, Wang FW, et al. Diagnosis of myocardial contusion. Quantitative analysis of single photon emission computed tomographic scans. *Arch Surg* 1992;127:888-892.
5. Helling TS, Duke P, Beggs CW, et al. A prospective evaluation of 68 patients suffering blunt chest trauma for evidence of cardiac injury. *J Trauma* 1989;29:961-965.
6. Bodin L, Rouby JJ, Viars P. Myocardial contusion in patients with blunt chest trauma as evaluated by thallium 201 myocardial scintigraphy. *Chest* 1988;94:72-76.
7. Link MS, Wang PJ, Pandian NG, et al. An experimental model of sudden death due to low-energy chest-wall impact (commotio cordis). *N Engl J Med* 1998;338:1805-1811.
8. Doerer JJ, Haas TS, Estes NA, 3rd, et al. Evaluation of chest barriers for protection against sudden death due to commotio cordis. *Am J Cardiol* 2007;99:857-859.
9. Salib EA, Cyran SE, Cilley RE, et al. Efficacy of bystander cardiopulmonary resuscitation and out-of-hospital automated external defibrillation as life-saving therapy in commotio cordis. *J Pediatr* 2005;147:863.