

Acute Severe Mitral Regurgitation due to Papillary Muscle Rupture after Blunt Chest Trauma: Case Report

Yasser Mubarak ^{1*}

¹Thoracic Surgeon, Cardiothoracic Surgery Department, Faculty of Medicine, Minia University, Egypt. Madinah Cardiac Center, King Fahad Hospital, Madinah, KSA.

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ABSTRACT

Cardiac injury is a common unexpected injury with high rate of mortality in multi-trauma patients. Blunt thoracic trauma leading to heart injury presented with variable presentations from myocardial contusion to rupture. Cardiac injury is about 15% - 25% of blunt chest trauma. Cardiac contusion is the most common type of injury with variable manifestations associated with electrocardiogram (ECG) changes or cardiac enzyme abnormality. Traumatic rupture of intra-cardiac structures after blunt Thoracic trauma is an uncommon. Cardiac valves rupture is uncommon, and the most frequent being aortic valve, and then followed by mitral and tricuspid. Nowadays, the incidence of these types of injury is increasing due to high increase of road traffic accidents (RTA). Following blunt thoracic trauma, rupture of papillary muscle or its chordae tendineae is a very rare causing acute mitral regurgitation (MR) with sequence of congestive heart failure (HF) and pulmonary edema.

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Introduction:

Blunt thoracic trauma results in cardiac injury are very rare, which varies in severity from asymptomatic myocardial contusion to catastrophic cardiac rupture (1). However, the incidence of intra-cardiac injury is

extremely rare (2). Blunt chest trauma is a rare cause of acute MR. Papillary muscle rupture caused by blunt thoracic trauma is a relatively rare cause of MR (1, 3).

The mechanism of injury is caused by sudden increase of intra-ventricular pressure

*Corresponding author: Yasser Mubarak, Minia University, Egypt. Associate Consultant of Cardiac Surgery, Madinah Cardiac Center, KSA. Tel: +201002554078 +966560708223, E-mail: yassermubarak73@gmail.com.

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due to compression of the heart between sternum and vertebral column, or sudden deceleration injury with the heart being pushed against the sternum (1). Sudden deceleration or compression of the heart due to RTA is the leading cause of intra-cardiac valves damage or subvalvular apparatus (3).

Traumatic mitral valve (MV) damage occurs during late diastole and early systole. The most common mitral apparatus injuries is firstly papillary muscles rupture, then ruptures of chordae tendineae, and lastly leaflet injury. Presenting manifestations of traumatic mitral insufficiency include a wide range of symptoms and signs varying from asymptomatic to acute cardiogenic shock (2).

Case report

We report a case of 27-year-old male patient with no past history of medical diseases. He was complaining of shortness of breath (SOB) and stitching chest pain after RTA one week ago. His vital signs were; Heart Rate 100 beats/minutes (tachycardic), Blood Pressure 100/70 mmHg, Respiratory Rate 35 breath/minute (tachypneic), Temperature 36.5°C, Glasgow Coma Score (GCS) 14/15, and O₂ saturation 94% on 3Liters face mask. On auscultation a significant pansystolic murmur was heard at apex propagated to axilla. Electrocardiography (ECG) revealed diffuse ST concave elevation. Laboratory data was Troponin I (0.011 ng/ml), lactate dehydrogenase (LDH) (1, 54 mU/mL) and creatine phosphokinase (CK) (456 mU/mL). Arterial blood gas (ABG) analysis in a 3Liters face mask were as follows: pH 7.35, carbon dioxide tension 42.5 mmHg, oxygen tension 84 mmHg, base excess of -2.0 mmol/L and oxygen saturation 94%. Chest X-ray showed diffuse patch opacities bilaterally without ribs or sternal fractures or pneumothorax or hemothorax. Chest computed tomography (CT) revealed bilateral infiltration opacities. Covid-19 swab was done and result was negative. Transthoracic echography (TTE) revealed severe mitral regurgitation (MR) with fail anterior mitral leaflet and rupture of anterolateral papillary muscle (Figure 1, 2). Ejection fraction (EF) was 77%. Within 12-hours after admission to emergency department, he developed progressive worsening SOB and was transferred to intensive care unit (ICU), where he received

intravenous Furosemide and Nitroglycerin (NTG). Final diagnosis was traumatic rupture of anterolateral papillary muscle of MV, after blunt chest trauma, causing acute severe MR and pulmonary edema. Surgery was decided by emergency consultant's heart team and transferred to our cardiac surgery center. Then, emergency mitral valve replacement (MVR) performed.

Planning repair of mitral valve was decided, if possible. After general anesthesia induction, trans-esophageal echo (TEE) was performed, confirming severe MR, together with an echogenic mass prolapsing into the left atrium (LA). This mass was presumed to be the papillary muscle (PM) rupture. On cardiopulmonary bypass (CPB) with cold blood cardioplegic arrest, LA was opened. The anterolateral PM had torn out of the left ventricular wall and twisted itself several times around the chordae. Because of the possibility of failure with simple re-attachment of the anterolateral PM to the friable ventricular wall, the MV was replaced with (St. Jude Medical 29-mm) mechanical valve (Figure 3). LA was closed, and the patient weaned smoothly off bypass without need of mechanical support or high doses of inotropics. His postoperative course was uneventful, and an echocardiogram on the 5th postoperative day (POD) showed well function prosthetic MV with good EF. He was discharged to his home on 10th POD after INR adjusted, and was seen in out-patient clinic 2-weeks later, at which time he was asymptomatic. After 3-month follow-up period, TTE revealed well function MV without gradient, and INR was 2.5 on warfarin 5mg.



Figure 1: TTE revealed severe mitral insufficiency with rupture papillary muscle

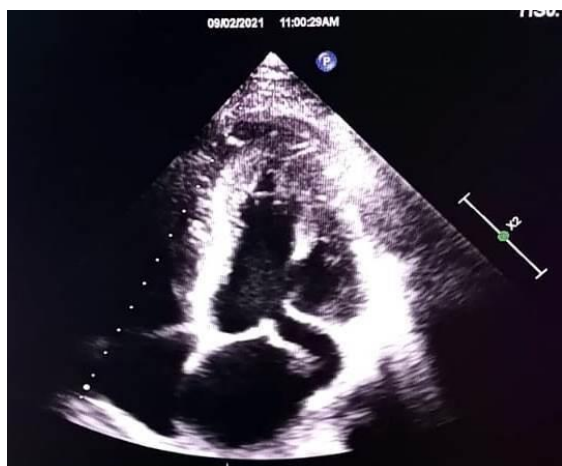


Figure 2: TTE revealed flail anterior mitral valve leaflet

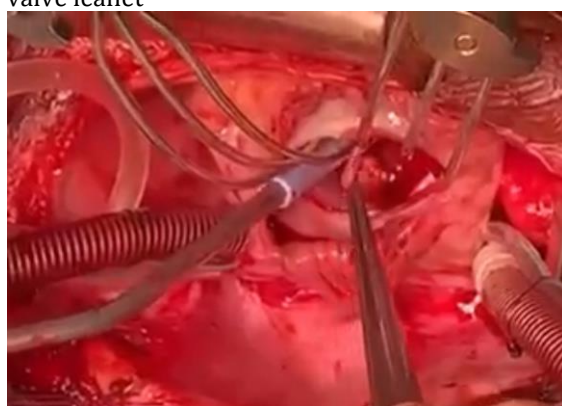


Figure 3: Intra-operative photo of rupture papillary muscle

Discussion

Thoracic trauma is a common cause of referral to Emergency Departments, especially following RTA. Myocardial contusion is frequent sequelae. However, acute valvular dysfunction following blunt thoracic trauma is very rare presentation (4). In 1936, traumatic mitral regurgitation was firstly reported, and in 1964, the first successful repair (5). Recently, blunt chest trauma incidence has been increasing because of traffic accidents, and a few cases unfortunately lead to mortality without definite diagnosis and treatment in spite of improved diagnostic procedures and surgical techniques due to lack of high index of suspicion. In spite of, myocardial injuries are not uncommon, MV injury is seldom rare. In every case of blunt chest trauma, it is very essentially to detect new systolic murmurs and any symptoms of heart failure (HF). Ordinarily, TTE or TEE is used as diagnostic procedure for intra-cardiac valves injury. Surgeons should determine whether to perform MV repair or replacement according

to intraoperative findings. Mitral valve replacement (MVR) is a rapid, reliable and simple procedure. The choice for a particular approach must be based on the extent of damage, analysis of the mitral apparatus and surgeon's experience (2).

Traumatic acute severe MR is occurred as a result of loss of valve integrity from a sudden increase in intra-cardiac pressure while the heart is completing diastole and entering systole, with the ventricles dilated and the atrioventricular valves closed. Most frequently damaged is the papillary muscle, and then chordae tendineae. Symptoms of acute MR are due increased LA pressure and decreased left ventricular EF. Acutely, the patient usually presents with manifestations of pulmonary edema such as; dyspnea, cough and orthopnea (6).

Cardiac valves injury after blunt chest trauma leads to progressive HF often requiring urgent surgery. Valve replacement is the most rapid, safe, and frequently option of choice. MR following non-penetrating cardiac injury is usually the result of PM rupture, or chordal rupture, or leaflet disruption. Papillary muscle rupture has two types; partial through one of the heads, or complete through the muscle body. In complete type, severe left ventricular failure ensues and surgical management is usually essential urgent. The manifestations can be appeared later, because of rupture of a necrotic papillary muscle was delayed (4).

After blunt chest trauma, intra-cardiac valve injury is a rare clinical entity, and its diagnosis is very difficult at the time of initial evaluation. In case of traumatic valve injury, patients often have hemodynamic instability. Some authors have recommended that valve replacement should be done for all cases of acute traumatic valvular disruption. A high index of suspicion is very important for the early diagnosis of traumatic valve injury. Once, intra-cardiac valve injury is suspected to injury, TEE should be performed (9).

Early undiagnosed traumatic MR and properly treated can get complicated and progress to CHF and cardiogenic shock. Traumatic damage resulted in the development of coagulation necrosis, with subsequent PM rupture. Patient's clinical condition will detect the timing and type of surgery (10-12).

Conclusion

In cases of blunt chest trauma, it is clinically important to detect newly developed systolic murmurs and any symptoms of congestive heart failure. Echocardiography is essential in diagnosis. It is important to perform surgery in a timely fashion. Replacement of injured mitral valve is safe, rapid, and the suitable option in most cases.

Abbreviations

ABG: arterial blood gas, **CK:** creatinine kinase, **CPB:** cardiopulmonary bypass, **CT:** computed tomography, **ECG:** electrocardiography, **EF:** ejection fraction, **GCS:** Glasgow coma score, **HF:** heart failure, **INR:** international normalized ratio, **LA:** left atrium, **LDH:** lactate dehydrogenase, **MR:** mitral regurgitation, **MV:** mitral valve, **MVR:** mitral valve replacement, **SOB:** shortness of breath, **PM:** papillary muscle, **POD:** post-operative day, **RTA:** road traffic accident, **TEE:** trans-esophageal echo, **TTE:** trans-thoracic echo, **CHF:** congestive heart failure.

Conflicts of interest

The authors have declared no conflict of interest.

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