



Cardiac Stab Wound in Remote Area: A Case Report

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Abstract: Penetrating cardiac injuries are life-threatening emergencies requiring immediate surgical intervention. We presented a case of cardiac stab wound leading to cardiac tamponade and rupture of the pulmonary artery and right ventricle who survived long enough to undergo emergency procedure. A 25-year-old male was stabbed in the left chest approximately nine hours before admission. He experienced chest pain and dyspnea but remained conscious. After initially treated at a local hospital, he was later referred to a tertiary facility. On assessment, he was tachycardic, tachypneic, and had distant heart sounds. Laboratory findings revealed leukocytosis, thrombocytosis, hyperglycemia, metabolic acidosis, lactic acidosis, and anemia. Chest radiograph showed a bottle-shaped heart, passive atelectasis, and a rightward shift of the thoracic vertebrae. The initial suspicion was cardiac tamponade due to myocardial rupture. Sternotomy revealed a pericardial hematoma (150 mL), a right ventricular tear extending to the pulmonary artery, and pneumothorax. Surgical repair was performed with drainage placement. After intervention, echocardiograph examination showed no myocardial damage or infarction, a dysfunction in diastolic which showed an impaired in relaxation of the left ventricle which is a temporary consequence of trauma, pericardial effusion or surgical intervention. In conclusion, this case underscores necessity of early surgical intervention even if this patient succeeded surviving for long hours before surgery. While this patient showed promising recovery, close postoperative monitoring remains crucial to detect functional changes and prevent complications.

Keywords: emergency sternotomy; *vulnus ictum*; chest trauma; sharp cardiac injury; repair of artery pulmonary; rupture of right ventricle

INTRODUCTION

Victims of penetrating cardiac injuries are predominantly male with only 6% of patients reached the hospital alive. Cardiac tamponade is the result of an accumulation of fluid, pus, blood, gas, benign or malignant neoplastic tissue within the pericardial sac. The stab wound penetrates the chest, lacerating the myocardium or coronary vessel which causes blood to leak into the pericardial cavity.¹ Asensiio et al² reported a 74% mortality rate of patients with intubated, penetrating cardiac injuries, 82% of patients with no blood pressure detected, and 88% with no pulse detected which show a severely hemodynamically unstable.

The rarity of patients surviving long enough to receive surgical intervention underscores the importance of understanding the pathophysiological mechanisms that can allow for this possibility. The anatomy of the heart plays an important role in such case. However, these compensatory mechanisms are not indefinite solutions, and timely surgical intervention remains essential to prevent rapid deterioration.²

This case report presents the successful management of a 25-year-old male with a penetrating cardiac injury leading to right ventricular rupture and pericardial tamponade. The discussion highlights the significance of early recognition, intervention, and surgical repair techniques in ensuring survival.

CASE PRESENTATION

A 25-year-old male arrived to the emergency department complaining of being stabbed on the left chest. The injury sustained approximately nine hours before admission. The injury occurred while the patient was seated and the assailant, who was standing in front of him, stabbed him once before fleeing with a sharp object. The patient experienced immediate chest pain and shortness of breath but remained conscious. He directly went to the nearest local hospital; immediate chest x-ray showed a normal x-ray (Figure 1). He was referred to a larger local hospital where another chest X-ray was performed (Figure 2). The chest X-ray showed a widened mediastinum, a bottle-shaped heart and passive atelectasis in pneumothorax. He was then referred to Prof. Dr. R. S. Kandou Hospital for further intervention. The ambulance was instructed to drive safely with a maximum speed of 40 Km/hour.⁴⁻⁶

On initial assessment, patient had normal blood pressure, tachycardia, high respiratory rate while given O₂ of 10-15 L/min, no delirium, and distant heart sound was found. Local examination showed a stitched wound of around 1cm x1cm, and the wound had been cleaned (Figure 3). Laboratory findings before referred to a larger hospital showed leukocytosis, thrombocytosis, hyperglycemia, mild elevation of urea and creatinine and normal blood clot function.



Figure 1. First X-ray examination at nearest local hospital (09/02/2025)

Figure 2. Second X-ray examination when the patient was referred to larger local hospital (10/02/2025)



Figure 3. Clinical pictures of the case at Prof. Dr. R. D. Kandou Hospital

Another laboratory examination was done before the intervention. Arterial blood gas (ABG) showed metabolic acidosis with compensatory respiratory alkalosis, severe lactic acidosis, and hyperoxia due to oxygen therapy before surgery. Complete blood count showed a decrease in hemoglobin and mild hypoalbuminemia. Elevated C-reactive protein (CRP) and leukocytosis showed a still ongoing inflammation, meanwhile mildly elevated total bilirubin and direct bilirubin indicated a possible hemolysis from trauma-induced red blood cell (RBC) destruction; no significant liver damage was found. Echocardiogram showed pericardial effusion on the free wall of left ventricle, right ventricle, and right atrium.

The initial diagnosis was suspected cardiac tamponade due to rupture of the heart caused by *vulnus ictum* on the left hemithorax. A combination of colloid and crystalloid solution was given (300 mL colloid, 430 mL of blood, and 1200 mL of crystalloid), and urine output of 1100mL and blood output of 1100mL was noted.

Intervention was done four hours after admission. Several factors contribute to the late intervention such as lack of equipment and perfusionist. The patient had an exploration sternotomy in which when the pericardium was incised, around 50 mL of blood was found, no cardiomegaly, with enough contraction of the heart. After exploration, pericardium hematoma of around 150 mL of blood and tear of the right ventricle to pulmonary artery or the right ventricular outflow tract (RVOT) were found. Repair of the right ventricle and pulmonary artery was done with autotransfusion machine. Another exploration along the wound performed thoroughly revealed that the wound punctured through the pleura showing a pneumothorax. The lung's superior and inferior lobes were intact. The patient was given a substernal drain and intrapericardium minidrain. The drain was filled with 80 mL of serohemorrhagic fluid.

After intervention, echocardiograph examination showed normal size heart chambers with no left ventricular hypertrophy (LVH), normal left ventricular systolic function (LVEF), normal wall motion of the entire left ventricle (LV) suggesting no myocardial damage or infarction, dysfunction in diastolic which showed an impaired in relaxation of the left ventricle as a temporary consequence of trauma, pericardial effusion, or surgical intervention. Normal aortic valve, no significant valve dysfunction or calcification, reduced contraction of right ventricle due to the previous cardiac compression from tamponade, fluid shifts or post-surgical changes with an abnormal tricuspid annular plane systolic excursion (TAPSE), and tissue doppler velocity for right ventricle was slightly lower than normal. The pericardium sac showed no effusion. Another echocardiograph was planned to be assessed after the patient was more stable.

DISCUSSION

Health care delivery systems in rural areas face significant challenges in meeting the communities' needs. A health care delivery system is defined as the organization of people, institutions, and resources to deliver health care services to meet health needs of a target population, whether a single-provider practice or a large health care system.³ Since 2001, the Institute of Medicine has shifted from provider and payment centered to patient centered. This

emphasis seven primary dimensions defined by Picker Commonwealth program: respect for patients' values; preferences and expressed needs; coordination and integration of care; information communication and education' physical comfort' emotional support and alleviation of fear and anxiety; involvement of family and friends; transition; and continuity.⁴

This study identified several critical issues including delayed intervention, limited healthcare infrastructure, and shortages of specialized staffs. Patients often experience multiple referrals before receiving appropriate care, as illustrated by this case where the patient was referred thrice before receiving adequate intervention. The distance from one hospital to another posed a major barrier to timely care meanwhile the ambulance must be driven carefully and slowly in an unstable case such as cardiac tamponade. While direct evidence is limited on how fast an ambulance should go for each case, smooth and efficient transport for patients has to be ensured to avoid potential complications.⁵⁻⁶ Preparedness includes actions that is taken prior to a disruptive event that will reduce the negative effects on health and safety if the event occur. Physical preparedness measures include inventory stockpiling and buffering capacity, in which stock or productive capacity are held to fill a supply shortfall.⁷ Some equipments and technology could be an essential addition inside the ambulance such as a portable X-ray system.⁸ In the healthcare facilities, particularly in the surgery settings, every single equipment must be sterile to maintain a clean and safe environment for patients and staffs. The time needed to sterilize will depend on the manufacturer's recommendations which generally took around 30 minutes in a 121°C steam or less in an even higher temperature.^{9,10} Intervention was halted since the sternal area was still on sterilization after a previous cardiac surgery. Another critical challenge is the shortage of specialized healthcare professionals. A perfusionist is needed in this type of surgery since in the Eastern part of Indonesia, extracorporeal circulation machine, the cardiac pulmonary bypass (CPB), and autotransfusion machine can only be operated by a perfusionist. Meanwhile, there were only two perfusionist in the area. Both perfusionist were stationed in another vascular operating room.^{11,12}

Some innovative approaches can be addressed in health care delivery challenges in rural areas. One of them is the Jeevan Rekha Express, known as the 'Magic Train of India'. It travels to remote regions of India, providing on-the-spot diagnostic, medical and surgical treatment to underserved populations.¹³ Similar to India's Jeevan Rekha Express, in Indonesia there is a surgeon who addresses health care needs in remote Indonesian islands through floating hospital. These two modes of mobile healthcare facilities provide on-the-spot medical diagnosis and treatment to prevent delay of treatment.¹⁴ Dr. Phil Tideman who developed an alternative cardiac rehabilitation system designed to improve access and outcomes for patients in rural areas by eliminating the need for extensive travel. Utilizing telehealth technologies, patients are able to participate in rehabilitation programs from their homes and receive real-time monitoring and support from health care professionals. Board-certified emergency physicians and experienced emergency department (ED) nurses are available 24 hours daily for immediate consultation at the request of a provider or nurse in a rural spoke hospital. In the telemedicine network, telemedicine staffs could provide real-time nursing documentation for rural critically ill patients, enter orders in the rural hospital medical record, and arrange transfer by contacting receiving hospitals and emergency medical services agencies. Especially in resource-constrained settings where local medical staffs are performing hands-on patient care, this service is valued and may contribute to the need for telemedicine consultation. Providing regular training and updates for doctors and nurses in the guidelines that he had laid down for cardiac emergencies management, as well as ensuring the equipment provided for each rural hospital in South Australia for standard cardiac emergencies management. Not only doctors and nurses, the community can be taught preventive and primary care services.¹⁵

Penetrating cardiac injuries predominantly affect males, with approximately 70% of patients succumbing before reaching medical facilities. Cardiac tamponade, a critical complication of such injuries, arises from the rapid accumulation of fluid—such as blood—in the pericardial sac, leading to increased pressure that impairs cardiac filling and output. These findings highlight the

pressing need for improved healthcare infrastructure, better source allocation, and enhanced training programs to address the disparities in rural healthcare delivery. The challenges faced by rural healthcare delivery systems, as highlighted in this case, underscore the urgent need for systemic improvements. We have learned so much from this case, from the access to health system, prompt diagnosis, knowledge of ambulance driver, to lack of equipment and human resources. Addressing these issues requires strategic investment in healthcare infrastructure, workforce development and logistical enhancements to ensure equitable access to quality medical care in rural areas. There are a lot of creative ways to tackle the problems, such as the on-the-go healthcare service which can reduce the susceptibility of the patient getting complications after sustaining a stabbed wound. Recruitment and training new specialized healthcare professionals and communities, can help in dealing with workforce shortage. Strengthening these areas will improve patient outcomes as well as the overall efficiency and resilience of healthcare delivery.

CONCLUSION

This case showed a 25-year-old male who survived a penetrating cardiac injury resulting in right ventricular rupture and notable pericardial tamponade, given the high mortality rate associated with such injuries. This patient's survival underscores the importance of early recognition and timely surgical intervention. Despite the delay from injury to definitive care, the patient remained hemodynamically stable upon admission, likely due to the contained nature of the pericardial effusion, which temporarily prevented exsanguination. However, such compensatory mechanisms are not indefinite solutions, and timely surgical intervention remains essential to prevent rapid deterioration.

Conflict of Interest

The authors affirm no conflict of interest in this study.

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