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An Interesting Penetrating Cardiac Injury and Massive Transfusion: A Case Report

İlginç Bir Penetran Kalp Yaralanması ve Masif Transfüzyon: Olgu Sunumu

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Abstract

The right ventricle is often injured in the penetrating cardiac injuries (PCIs). The most common place of intracardiac injury is interventricular septum. Symptoms vary depending on the type of injury, patients' transportation time, the size of the myocardial laceration, presence of pericardial tamponade, and the associated organ injury and the amount of blood lost. Compensation of blood loss during surgery is vital. Massive transfusion is a method which is used to compensate for blood loss and can sometimes cause metabolic side effects. Herein, we report a case who was operated three times due to a PCI within 24 hours and underwent massive transfusion.

Key words: *Penetrating cardiac injuries, sternotomy, massive transfusion.*

Özet

Penetran kalp yaralanmalarında (PKY) sıklıkla sağ ventrikül yaralanmaktadır. En sık intrakardiyak yaralanma yeri interventriküler septumdur. Semptomlar, yaralanmanın tipine, hastanın transport süresine, miyokarddaki laserasyonun boyutuna, perikardial tamponadın varlığına, yandaş organ yaralanmalarına ve kaybedilen kanın miktarına bağlıdır. Cerrahiyle birlikte kaybedilen kanın karşılanması hayati öneme sahiptir. Masif transfüzyon, kan kaybını karşılamada kullanılan bazen metabolik yan etkilere neden olabilen bir tedavi yaklaşımıdır. Burada, PKY nedeniyle 24 saat içinde üç kez ameliyat edilen ve masif transfüzyon yapılan olguyu paylaşmayı amaçladık.

Anahtar Sözcükler: *Penetran kalp yaralanması, sternotomi, masif transfüzyon.*

Heart is frequently injured due to its localization during blunt and penetrating thoracic trauma (1). Additionally, the localization of injury is closely associated with mortality (2).

The most preferred incisions in surgery are median sternotomy and anterolateral thoracotomy (3). Sometimes, additional fluid supply is required, due to intravascular fluid loss in surgery. Massive transfusion, one of these processes, includes giving transfusion which is equal to total blood volume, supplying more than 10 units of total blood, and giving more than 20 units of erythrocyte suspension within 24 hours (4).

In this study, we present a case who was operated three times due to a PCI and underwent massive transfusion. This case is reported to highlight that multiple injuries may occur with one incision in heart, sternotomy is the preferred method in the treatment of PCIs, and massive transfusion should be conducted without hesitation, if necessary

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CASE

An 18-year-old male patient (80 kg, 183 cm) who was admitted to our emergency service due to stab injuries (SI) was examined. About 2cm SI entry hole was seen in the anterosuperior right hemithorax, 2cm below the clavicle and between midclavicular line and sternum. During the chest X-ray, there was an opaque appearance in right baseline, suggesting a pneumothorax line at the apex, and diaphragmatic thrust. Additionally, right subcutaneous emphysema and hemopneumothorax were observed in the computed tomography (Figures 1 and 2a and b). Tube thoracostomy from the sixth right intercostal space was performed to the patient with hypotension and tachycardia. He had 1000cc drainage and developed confusion and underwent emergency surgery.

Figure 1: *A chest x-ray of the patient*

In addition to standardized anesthesia monitoring, invasive arterial and central venous catheters were inserted. A 500-600 cc hematoma was drained from the thorax through right posterolateral thoracotomy. While parenchymal laceration (1-1.5cm) in the upper lobe of the right lung was repaired, we identified sudden bleeding in the right atrium. Using 5/0 polypropylene, the place of injury in lateral right atrium was repaired. After bleeding and air leakage were controlled, we put a thoracic drain (28F - 32F) and closed thorax appropriately. The patient was, then, taken to the intensive care unit. With varying hourly drainage values and 1000 cc drainage in total within five hours after operation, he was re-operated. We reached thorax through the previous incision. Hemorrhagic fluid was drained by opening the pericardium. We found that there was a bleeding in the repaired location of the distal in right atrium and we repaired it again.

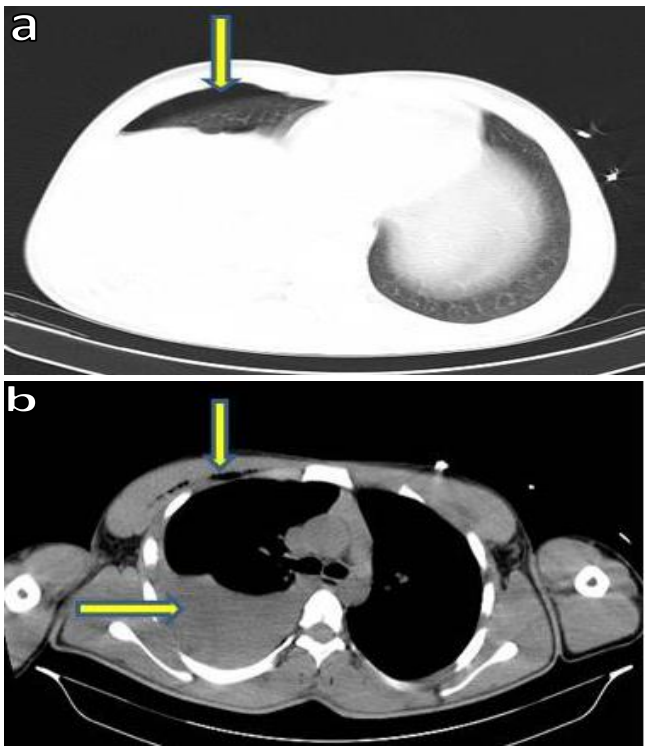

Figure 2a and b: *A computed tomography of the patient*

The patient whose thorax was closed after bleeding control was re-taken to the intensive care unit. With varying hourly drainage values and 1800 cc drainage value within eight hours, he was operated for the third time. We performed median sternotomy by considering other injuries. Hemorrhagic fluid in the pericardium was drained. The stab entered in the right atrium through the lateral, and exited close to the inferior of atriocaval junction (approximately 0.5cm). It was the bleeding section. The patient whose operation completed after primary repair was re-taken to the intensive care unit.

He underwent two thoracotomies and one sternotomy within the first 24 hours. According to the vital signs (arterial pressure, central venous pressure), complete blood count (hemoglobin, hematocrit, platelets) and blood gas (metabolic acidosis and electrolyte abnormalities), 33 units of erythrocyte suspension, 30 units of platelets, 18 units of fresh frozen plasma and 28 pieces of gelatin 500 cc were given. Additionally, to avoid possible complications such as hemolysis, fever, allergy, or anaphylaxis, 500 mg of prednisolone and ampicillin-sulbactam (6 to 12g intravenously) treatment, recommended by infectious diseases department, were initiated.

The patient was followed for 24 hours after the third operation under mechanical ventilation. The mean arterial pressure was 70 mmHg, and central venous pressure (CVP) was between 6 and 10 hours. The patient regained his consciousness after 36 hours and had normal metabolic status. Then, he was extubated after t-tube and mobilized in the 48th hour. The drainage tubes, located in mediastinum and right hemithorax baseline, were terminated on Day 3. The patient was taken to ward on Day 5, and the second chest tube was terminated on Day 6. Finally, the patient was discharged in the postoperative ninth day.

DISCUSSION

Myocardial contusion, coronary arteries injuries, cover ruptures, aneurysm, and conduction defects can be seen in blunt cardiac injury. On the other hand, in PCIs, the right ventricle is often injured. The most common intracardiac injury is ventricular septal defect (1). The most common cause of PCIs is gunshot wounds (FAIs) and stab wounds (SWs). Campbell et al. (5) reported that 1,128 of 1,198 patients with PCIs (94%) died, only 70 (6%) were admitted to the hospital, while 35 of them died. Asensio et al. (6) also reported that 65% of a total of 105 patients with PCIs were FAIs and 35% were SWs. In addition, 71 of these patients underwent emergency thoracotomy; however, 10 survived. In FAIs, the rate of survival was 61%, while it was 33% in SWs.

Location of the injury is closely related to mortality in heart injuries. Tyburs et al. (2) reported that the survival rate was 13% in multiple heart chambers or intrapericardial vascular injuries, while the survival rate was 51% in one heart chamber injury. The most common places of injury are the right ventricle, the left ventricle, the right atrium and left atrium. The mortality rate is low in the right ventricular injury. Cardiac tamponade which occurs in PCIs involving only the right ventricle may have a positive effect on survival by limiting bleeding. The survival rate of PCIs affecting the right side and left side of the heart is 79%, and 28%, respectively (7). Our case had hematoma in the pericardium in all operations.

In heart injuries, symptoms may vary depending on the type of injury, transportation time to emergency room, the degree of laceration in myocardial, the presence of pericardial tamponade, associated organ injury, and the amount of lost blood (2). Penetrating injuries which affect the heart chambers may cause acute pericardial tamponade, hemothorax, and eventually death. In certain cases who were able to reach hospital and survive, it was seen that pericardium remained intact, preventing blood loss. However, acute cases depending on tamponade can be also seen (7).

Medical history, physical examination, injury location, and clinical findings may be sufficient for the diagnosis. Heart injuries should be suspected in case of injuries which are in front of the chest, between the nipples, between the sternum jugular notch and upper abdomen (2). In precordial SWs, involuntary defecation is a symptom of cardiac injury and needs an urgent intervention (7). Chest radiography and computed tomography imaging are the most useful diagnostic methods. Echocardiography also provides detailed information about pericardium, atrium, ventricle, and valves (2).

The preferred incisions in the treatment are median sternotomy and anterolateral thoracotomy. Median sternotomy is appropriate in hemodynamically stable cases with a SW in the front of the chest. The left anterolateral thoracotomy is often applied in the resuscitation patients (3,8). Our case underwent standard posterolateral thoracotomy. We detected a heart injury and we were able to view the incision in the atriocaval region through sternotomy, as there was a limited vision. It supported the superiority of median sternotomy in cardiac injury.

Massive transfusion includes supplying transfusion which is equal to the amount of total blood volume, giving more than 10 units of total blood, and giving more than 20 units of erythrocyte suspension within 24 hours. Although it helps saving lives, it may cause some metabolic side effects (metabolic acidosis, hyperkalemia, and hypocalcemia), hypothermia, dilution and pulmonary micro-embolization (4). However, we successfully performed massive transfusion to our case. We observed no complications.

In conclusion, it should be considered that the heart may have multiple injuries with a single incision in case of PCIs. Sternotomy should be the primary surgical approach and massive transfusions should be conducted without hesitation, if necessary.

CONFLICTS OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

Concept - M.Ç., M.N.K., A.D., B.Ö., S.K.; Planning and Design - M.Ç., M.N.K., A.D., B.Ö., S.K.; Supervision - M.Ç., M.N.K., A.D., B.Ö., S.K.; Funding - M.Ç., S.K.; Materials - M.Ç., A.D., B.Ö.; Data Collection and/or Processing - M.Ç., A.D., M.N.K., S.K.; Analysis and/or

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