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Isolated Right Atrial Appendage Rupture from Blunt Chest Trauma: A Case Report

Tran Thuc Khang[1, *], Huynh Khiem Huy[2], Bui Trong Dat[1], Dang Le Hong Ngan[1], Trinh Cong Dong[1], Tran Quang Thai[1]

[1]Department of Cardiovascular and Thoracic Surgery, Xuyen A Hospital, Ho Chi Minh, Vietnam

[2]Cardiovascular Centre, Tam Anh Hospital, Ho Chi Minh, Vietnam

Email address:

khangchircardio@gmail.com (Tran Thuc Khang)

[*]Corresponding author

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Abstract: *Background:* Right atrial appendage rupture from blunt trauma is very uncommon, but is associated with a high mortality rate. Moreover, due to the paucity in available literature, our knowledge of the condition is still limited. *Purposes:* To emphasize a high degree of clinical suspicion in a case of cardiac tamponade after blunt chest trauma, quick diagnostic confirmation and urgent optimal management of such cases to save the patient and to avoid unnecessary and unacceptable delays. *Case presentation:* The author reports a 22-year-old female involved in a blunt chest trauma who was initially misdiagnosed and delayed management in a regional hospital, then transferred to our institution in a status of severe hypovolemic shock and cardiac tamponade with unconsciousness, intubation and mildly dilated and weakly reactive eyes/pupils. Fortunately, the patient was saved with quick diagnostic confirmation, urgent sternotomy and surgical repair of atrial appendage laceration for hemostasis associated with intra- and post-operatively intensive resuscitations. *Conclusion:* The important key to right atrial rupture diagnosis is a high degree of clinical suspicion in a case of cardiac tamponade following blunt chest trauma, especially with a hemodynamically unstable or compromised status. Aggressive resuscitation, prompt diagnosis, and urgent operation to repair the cardiac lesions are cornerstones to achieving an optimal outcome.

Keywords: Isolated Right Atrial Appendage Rupture, Right Atrial Rupture, Cardiac Rupture, Blunt Chest Trauma, Cardiac Tamponade

1. Introduction

Isolated right atrial rupture is a rare but potentially life-threatening condition that occurs secondary to blunt chest trauma [1]. The majority of blunt cardiac injuries associated with laceration are caused by penetrating trauma while cardiac wall laceration from blunt trauma is a highly uncommon presentation. As compared to penetrating cardiac injuries, few blunt cardiac injuries make it to the hospital alive, and there is about 2.2% of blunt cardiac injuries reach the hospital alive as compared to 33.7% of penetrating cardiac injuries [2, 3]. Blunt cardiac rupture of the right atrium has a reported incidence between 0.2–0.5% and occurs concomitantly with blunt chest trauma of another cardiac chamber [4-6]. Only 10% of patients survive long enough to make it to a hospital. While there are case reports and small series describing isolated right atrial rupture from blunt chest trauma, it is generally considered a very rare occurrence [4, 8]. Symptoms may include chest pain, shortness of breath, rapid heartbeat, low blood pressure, and signs of shock. Diagnosis can be challenging, as symptoms may be non-specific and can mimic other conditions which can delay time for life-saving operations. Successful management of this condition requires a high degree of clinical suspicion with early diagnosis facilitated by ultrasonography linked to timely operative intervention [1, 9].

The author reports the case of a female patient involved in a chest blunt trauma with an isolated right atrial injury

resulting in a pericardial effusion associated with severe hemodynamic shock and cardiac arrest threatening while taken into operating theatre who was immediately operated to save her life with median sternotomy, closure of right atrial rupture and intensive resuscitation.

2. Observation

2.1. Patient's History and Data

(i) In regional hospital

A 22-year-old female was brought to a regional hospital after her chest was hit by an iron door falling. It was unknown whether trauma mechanisms were or the exact time took place. Reported on arriving at the hospital, she was still conscious with complaints about chest pain and orthopnea. Her blood pressure and heart rate were reported 90/70mmHg and 130 bpm, respectively. Her hemoglobin concentration was 3.3 mg/dL. Then she benefited from a thorax Scanner with a contract product that notes a large pericardial effusion. She lost 3 hours at that hospital where she was misdiagnosed with an unknown pericardial effusion thinking of an autoimmune cause associated with severe anemia. The patient soon fell into a hemodynamic shock, and severe dyspnea, and therefore she was intubated, transfused blood, infused with noradrenaline and then quickly transferred to our institution.

(ii) In our institution

Rapidly reported on admittance, the patient was pale, unconscious, intubated with weak and sinus tachycardia, immeasurable blood pressure, and mildly dilated and weakly reactive eyes/pupils. In particular, there was no remarkable signs on her chest wall caused by chest trauma. Moreover, through rapid reference of thoracic imaging on that hospital's Picture Achieving and Communication System (PACs) before the patient's arrival, the author noted that the patient had a large pericardial effusion circumferentially with contrast product extravasation into pericardial space (figure 1).

The patient was then taken directly to the operating room for urgent operation with a diagnosis of a cardiac rupture following blunt chest trauma resulting in cardiac tamponade and severe hypovolemic shock. We were all available and ready for urgent sternotomy with nearby stand-by extra-corporeal circulation and a great deal of blood.

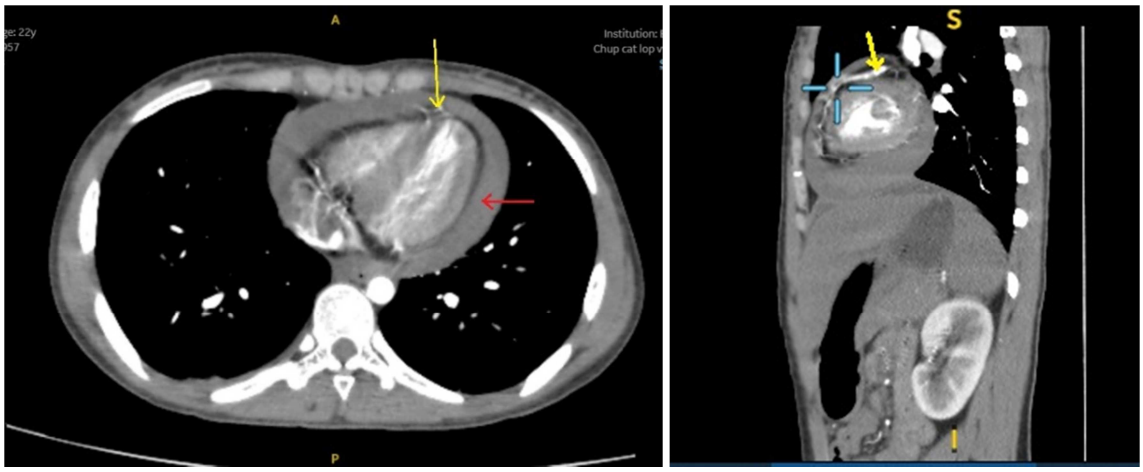

Figure 1. *Computed tomography scan with contrast product shows an abundant pericardial effusion (red arrow) with contrast product extravasation into pericardial space (yellow arrows).*

2.2. Intra-Operative Features

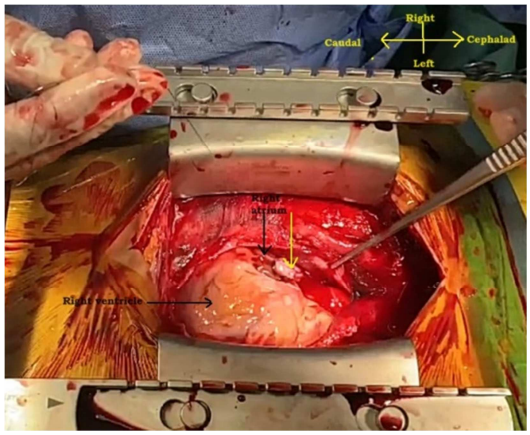

Figure 2. *Showing the right atrial appendage rupture that was closed with pledgeted sutures with 5/0 cardionyl (yellow arrow).*

Some data were noted in the operating room such as sinus tachycardia at 140-150 bpm, systolic blood pressure at 40 – 50 mmHg and severe acidosis with serum lactate at 6.0 mmol/L. Under general anesthesia, a median sternotomy was performed, pericardial space was opened, lots of blood and thrombus evacuated (about 3000ml), and a 2 cm long laceration at the right atrial appendage with active bleeding noted (figure 2).

A vascular clamp was applied for temporary hemostasis and the lesion was closed with pledgeted sutures with 5/0 cardionyl. Her systolic pressure was raised immediately after definitive hemostasis and intensive resuscitation with 6 units of red blood cells, 3 units of fresh plasma and one unit of plaquette and some crystalloid solutions. There was no cardiac hypokinesis as well as other associated cardiac lesions discovered intraoperatively.

2.3. Post-Operatively

All disorders were corrected within 24 hours with stable hemodynamic status under a low dose of nor-adrenaline, regular sinus rhythm, good urine output, preserved cardiac function and no associated intracardiac abnormalities on echocardiography, without hemostasis disorders. After 30 hours under sedative agents, the patient was awakened with complete consciousness and without any neurological deficits. She was extubated postoperative day 2. All thoracic drains were removed post-operative day 4 and a follow-up echocardiography was performed which showed no abnormalities. She was discharged home uneventfully on postoperative day 12.

3. Discussion

Cardiac trauma is a relatively less common consequence of blunt injury, occurring in less than 10% of trauma admissions; however, it is associated with high rates of morbidity and mortality. Approximately 25% of traumatic deaths occur due to cardiac-related injuries [9, 10]. Isolated right atrial rupture from blunt chest trauma is a rare (0,5% of blunt chest trauma cases) but serious condition that requires prompt diagnosis and treatment and it can occur in the absence of any external signs of trauma. If misdiagnosed or delayed, it is associated with a mortality rate nearing 80% or more [7, 11, 12]. The majority of cases involve the right atrium. It is thought that the right atrium is a thin-wall structure that is susceptible to injury from blunt chest trauma, particularly in cases of high-impact trauma [4, 5, 13]. Theoretically, when faced with a case of blunt chest trauma associated with cardiac tamponade, and unstable hemodynamic status, one must immediately think of an intrathoracic surgical lesion (such as heart, great vessels) [1, 6, 7]. Cardiac rupture presents sometimes with massive hemothorax (in case of traumatic pericardiac laceration, post-operative pericardiotomy or traumatic associated rib fractures), and in this situation, it is difficult for the chest surgeon to estimate the origin of bleeding that suspects cardiac rupture, and as a result delayed diagnosis leads to poor prognosis [8, 14-16]. Even in the absence of overt clinical signs of cardiac tamponade, pericardial free fluid coupled with the appropriate mechanism of injury raises suspicion for tamponade and/or chamber rupture [17, 5, 7, 8]. In this case, there was a serious mistake in the initial diagnosis, that resulted in a life-threatening delay in management. They probably ignored the factor of blunt chest trauma when seeing no clinical signs that appeared on the patient's chest wall. Thereby, it is necessary to re-emphasize a high level of clinical suspicion in a case of cardiac tamponade after blunt chest trauma (even mild), to make a quickly positive diagnosis and an early optimal decision in such cases as well as to avoid unacceptable delays.

According to Pinni S., et al. [11], the commonest site of cardiac rupture is the right atrium (40.6%), followed by the right ventricle (31%), left atrium (25%) and left ventricle (12%). The right atrium is a thin-walled structure that is susceptible to injury from blunt chest trauma, particularly in cases of high-impact trauma. Autopsy studies have proved that the right atrial appendage is thinner than the right atrial wall and hence theoretically is more susceptible to rupture [5, 15]. Moreover, the initial symptoms may be non-specific and can mimic other conditions and there is no universally accepted diagnostic criteria for the assessment of atrial rupture as there have been many documented presentations for such an injury in the literature [18]. The diagnosis of blunt cardiac injury remains difficult due to other associated injuries that divert the physician's attention, as well as the lack of specific physical findings and the lack of clinical suspicion of a specialized physician in an emergency room for the diagnosis of such an injury [10, 6]. According to Muna Al Ayyan et al [6], it is worth mentioning that the experience of a general surgeon who works in a hospital lacking a surgical cardiovascular section plays a vital role in evaluating and determining the proper treatment for patients experiencing cardiac and/ or vascular issues.

According to many authors [10, 6, 9, 12], imaging studies such as echocardiography, CT scans, and MRI can help confirm the diagnosis and determine the extent of the injury if the hemodynamic status is stable. This patient initially had a stable status that was permitted to carry out a thoracic CT scan with contrast agent showing the sign of extravasation into pericardial space that is extremely clear and specific sign of cardiac rupture. However, this sign was not noted and was completely ignored at the first evaluation and management in a regional hospital. As a result, a misdiagnosis was made.

Prompt diagnosis and treatment can improve the chances of survival by nearly 80% for patients suffering from this type of devastating injury [6]. In case of cardiac rupture suspected, median sternotomy is the approach most commonly utilized as it allows for quick, easy and adequate exposure of the heart and great vessels [3, 10, 11]. This approach can be useful in case of extracorporeal circulation is needed, in particular complex cardiac injuries such as multiple lacerations, ventricular ruptures, atrio- vena cava junction tear or coronary injuries, etc. [3, 19]. Fortunately, the surgical management for this case was simpler due to an isolated right atrial appendage rupture, that was typically managed with direct closure. The author used the pledgeted sutures to reinforce the laceration where the atrial tissue was contused.

4. Conclusion

Isolated right atrial appendage is rare but a life-threatening condition. The important key to cardiac rupture diagnosis is a high degree of clinical suspicion in a case of cardiac tamponade following blunt chest trauma even if that is very vague and unclear with hemodynamically unstable or compromised status. Aggressive resuscitation, prompt diagnosis, and urgent operation with median sternotomy to repair the cardiac lesions are cornerstones to achieving an optimal outcome.

Declaration

The authors declare that they have no competing interests.

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