Blunt cardiac rupture in a toddler

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Abstract

Blunt cardiac rupture is typically a fatal injury with overall mortality exceeding 90%. Most of the patients never reach the hospital alive. In pediatric patients, only 0.03% of cases following blunt trauma admissions have a cardiac injury. This report presents a rare survivor of 16-months old toddler injured in a domestic accident suffering a right atrial rupture repaired through a median sternotomy. To the best of our knowledge this is the youngest case reported in the literature.

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1. Case presentation

A 16-month old male toddler was brought in to Emergency Department by ambulance after a blunt trauma. The patient was struck between a glass table and a floor while attempting to climb the table. The patient had seizures following the injury per EMS report. However, the body region injured was unknown and no external injuries were observed at the scene of injury. The pre-hospital vital signs were as follows: SpO2 74%, respiratory rate (RR) 13 per minute, heart rate 175 beats per minute (bpm), systolic blood pressure (SBP) 60 mm Hg, and Glasgow Coma Scale (GCS) score was 4 (E1,M2,V1). During the transportation additional O2 at a flow rate of 10 L/min was administered. The overall pre-hospital time from the EMS alert to hospital admission was 59 min.

On admission, the SBP was 80 mm Hg and heart rate was 175 bpm. GCS score was 5 and the patient was intubated. Physical examination revealed slight upper torso cyanosis, however, no external injuries were noted. A focused assessment with sonography for trauma (FAST) revealed 5 mm pericardial effusion. The patient had a metabolic acidosis with pH at 7.04. Initial lactate and base excess were 5.22 mmol/L and 21.4, respectively. First measured hemoglobin was 144 g/L. ECG showed sinus tachycardia with normal voltage QRS-complexes. The right subclavian vein was cannulated and the toddler was directed to the computed tomography (CT) scan, which showed pericardial effusion without contrast extravasation (Fig. 1). Also, some free fluid was visualized in the peritoneal cavity. The patient was emergently taken to the operating theatre for median sternotomy.

While preparing for surgery, prior to skin incision, the patient sustained a ventricular fibrillation. Immediate sternotomy and pericardial decompression revealed a massive pericardial tamponade with venous hemorrhage. Blood was evacuated and direct cardiac massage restored cardiac activity. About 5 mm long right atrial rupture was identified and controlled with Satinsky clamp (Fig. 2). The injury was repaired using 4-0 polypropylene running suture (Fig. 3). The right chest was drained and a Penrose drain was left in the pericardial sac followed by closure of the sternotomy with interrupted non-absorbable sutures. Also, due to free fluid noted on the CT scan, an exploratory laparotomy was performed without any injuries detected. The patient was admitted to the pediatric intensive care unit (PICU). Post-operative bedside esophagoscopy and bronchoscopy were performed observing no tracheal or esophageal injuries. The patient was extubated on post-operative day 2 and a transthoracic echocardiography depicted no valvular or septal lesions. The post-operative course was uneventful and the child was discharged on the 7th post-operative day in a good condition.

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The overall injury severity score (ISS) of the patient was 25.

2. Discussion

Blunt cardiac rupture is frequently a fatal injury with mortality rates exceeding 90% [1]. Most of the patients succumb at the injury scene and rarely reach the hospital alive [2]. Desforges et al. published the first successful management of a blunt cardiac laceration in 1955 describing closure of a right atrial perforation following a motor vehicle accident [3]. The right atrium is the most frequently injured chamber in both clinical and autopsy series [2,4].

The incidence of cardiac injuries in pediatric population is reported to be 0.03% based on the National Trauma Data Bank review, however, the majority of the blunt cardiac injuries are myocardial contusions [5]. In the age group of 1–3 years, most of the patients with cardiac injury have a GCS <9 on admission, similarly to our patient, and 50% are hypotensive. The mean ISS reported in the literature is 34.7 following blunt cardiac injuries, which is significantly higher compared to our patient indicating that the majority of cases sustain a severe injury burden [5]. Nevertheless, some anecdotal case series have reported that patients may present with a relatively isolated cardiac injury [6,7].

Upper torso cyanosis as a result of superior vena cava flow obstruction has been described as a frequent clinical sign in patients with blunt cardiac rupture [8] was also observed in our patient. The FAST exam is a key component of the primary survey, however, there are no large studies evaluating sensitivity and specificity in blunt cardiac lacerations. In our case, the FAST depicted a slight pericardial effusion, however, the lack of precise pre-hospital history and external signs of severe trauma, the CT scan was requested to evaluate patient’s injuries. CT scan revealed no intracranial injuries and confirmed the pericardial effusion. Also, a formal transthoracic or transesophageal echocardiography in the operating theatre is a possible option for the final confirmation of the diagnosis.

The optimal exposure for an isolated cardiac injury is achieved by a median sternotomy [9]. The access to the heart is likewise possible through the left thoracotomy, however, for right-sided injuries this exposure is suboptimal and may mandate a trans-sternal extension to a clamshell thoracotomy.

The possible mechanism of injury in our case may be a significant compression of the heart between the sternum and vertebral column secondary to direct and severe precordial impact [9]. The sudden compression in the end-systole of the right ventricle, while the tricuspid valve is closed and the right atrium is filled, may increase the intraluminal pressure to the extent that the right rupture occur.

3. Conclusion

This case report presents a rare survivor of a blunt cardiac rupture in a 16-months old toddler. To the best of our knowledge, this is the youngest case presented in the literature.

Conflict of interest

There are no conflicts of interest associated with the publication of this article.

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References