

Case Report

Traumatic Tricuspid Insufficiency Requiring Valve Repair in an Acute Setting

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Tricuspid insufficiency due to penetrating cardiac trauma is rare. Patients with tricuspid insufficiency due to trauma can tolerate this abnormality for months or even years. We report a case of a 66-year-old female with penetrating cardiac trauma on the right side of her heart that required tricuspid valve repair in an acute setting. She sustained cut and stab wounds on her bilateral forearms and in the neck and epigastric region. She had cardiac tamponade and developed pulseless electrical activity, which required emergency surgery. The right ventricle and superior *vena cava* were dissected approximately 5 cm and 2 cm, respectively. After these wounds had been repaired, the patient's inability to wean from cardiopulmonary bypass suggested right-sided heart failure; transesophageal echocardiography revealed tricuspid insufficiency. Right atriotomy was performed, and a detailed examination revealed that the tricuspid valve septal leaflet was split in two. There was also an atrial septal injury that created a connection with the left atrium; these injuries were not detected from the right ventricular wound. After repair, weaning from cardiopulmonary bypass with mild tricuspid insufficiency was achieved, and she recovered uneventfully. This case emphasized the importance of thoroughly investigating intracardiac injury and transesophageal echocardiography.

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Tricuspid insufficiency due to penetrating cardiac injury is uncommon. Most of the reported cases of traumatic tricuspid insufficiency are due to blunt trauma, and this abnormality is considered to be tolerable for months or even years. Based on other case reports, some authors recommended initial repair of life-threatening injuries, followed by delayed repair of tricuspid insufficiency, if clinically indicated. We report a case of penetrating cardiac injury that required tricuspid valve repair to transition from cardiopulmonary bypass in an acute setting.

Case presentation

A 66-year-old woman sustained multiple cuts and stab wounds on bilateral forearms and in the neck and epigas-

tric region. The patient called an ambulance by herself and was brought to our emergency room within 45 minutes after the call. Initial evaluation revealed hypotension of 70 mmHg, cut wounds on bilateral forearms and in the neck, approximately 5-10 cm in length, and stab wounds in the neck and epigastric region. Apart from the epigastric wound, all were bleeding wounds, and blood pressure was stabilized with only fluid resuscitation of 1000 mL. Consequently, a focused assessment with sonography for trauma (FAST) was performed over time and revealed a few pericardial effusions without evidence of cardiac tamponade (Figure 1). The chest X-ray indicated no pneumothorax. Wound treatment and follow up was then indicated. Approximately 100 minutes after arrival, the patient suddenly developed

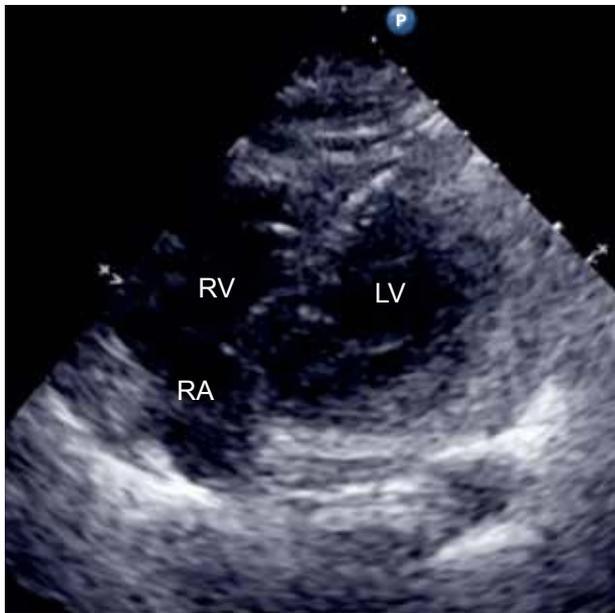


Figure 1. Transthoracic echocardiogram recorded in the emergency room showing a few pericardial effusions without any sign of cardiac tamponade. LV – left ventricle; RA – right atrium; RV – right ventricle.

pulseless electrical activity (PEA). After a resuscitative maneuver with intravenous injection of 1 mg of adrenaline and cardiac massage, with spurting of blood from the epigastrium wound, sinus rhythm was regained. Cardiac tamponade was suspected and surgical repair was indicated.

While waiting for the preparation of the operating room, the patient sustained a second PEA 124 minutes after arrival and was resuscitated. Approximately 134 minutes after arrival, she was taken to the operating room. Under general anesthesia, a median sternotomy was performed after establishing cardiopulmonary bypass with right femoral arterial perfusion and right femoral venous drainage. Because of the massive bleeding in the operating field, right atrial drainage was added to gain access to the surgical field: two wounds were noted. The right ventricle was dissected approximately 5 cm, and the superior *vena cava* (SVC) was dissected approximately 2 cm (Figure 2), whereas gross examination from the right ventricular wound revealed no injury in the cardiac chamber. These wounds were repaired by direct suture closure using a Teflon felt.

As it appeared that the operation had been completed successfully, weaning from cardiopulmonary bypass was attempted, but failed because of right atrial distension, increase of central venous pressure to 20 mmHg, and hypotension <60 mmHg. Transesoph-

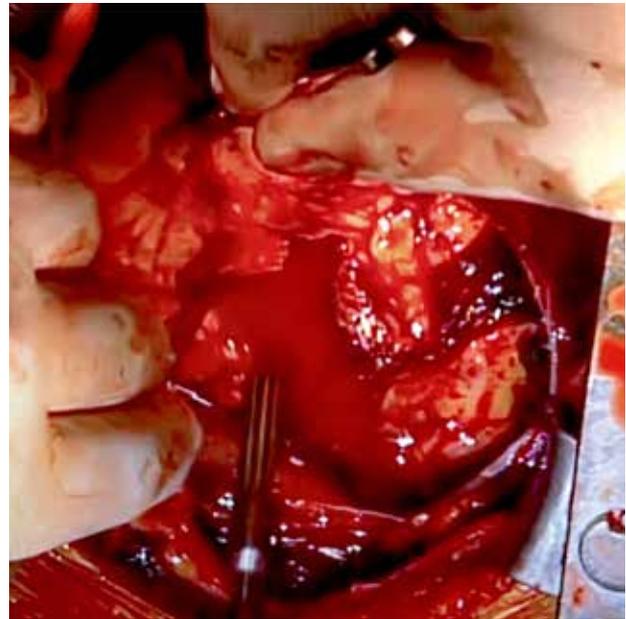


Figure 2. Intraoperative view showing dissected right ventricle. A suction cannula was inserted into the right ventricle.

ageal echocardiography revealed severe tricuspid insufficiency. Cardiopulmonary bypass was reinitiated, this time with bicaval drainage, and a right atriotomy was performed. The septal leaflet of the tricuspid valve was completely dissected from the edge nearly to the annulus, and the atrial septum, which had caused the septal leaflet injury, was also dissected to approximately 3 cm in length and connected with the left atrium (Figures 3, 4). A 5-0 polypropylene interrupted stitch was used to suture the septal leaflet, and De Vega's tricuspid annuloplasty was performed, after which a continuous 4-0 polypropylene suture was used to close the atrial septum. The heart appeared to have been stabbed once with a knife from the right ventricle to the SVC with cutting of the septal leaflet and atrial septum.

Finally, weaning from cardiopulmonary bypass was uneventful, with a decrease of central venous pressure to 10 mmHg. Transesophageal echocardiography demonstrated mild tricuspid regurgitation and no residual left-to-right-shunt. The postoperative course was uneventful, and consequently the patient was referred to orthopedics for surgical repair of her forearm without neurological impairment on the 22nd postoperative day. After 58 days from the operation she was discharged with only mild tricuspid insufficiency revealed by a repeat echocardiogram.

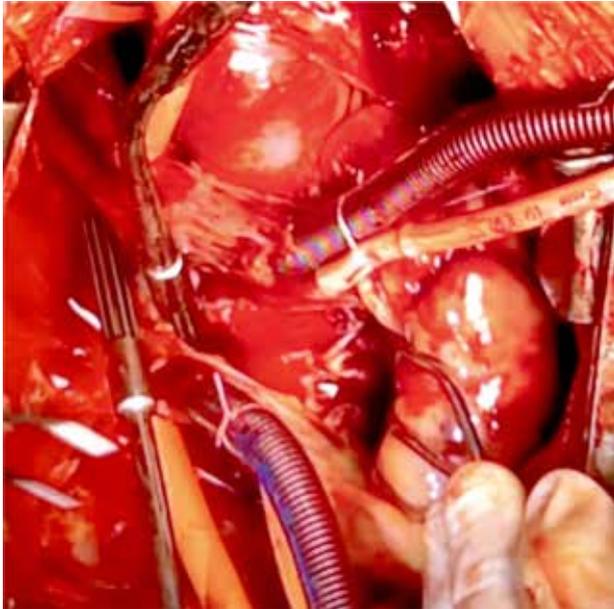


Figure 3. The right atrium was opened and the tricuspid valve was exposed. The septal leaflet of the tricuspid valve was dissected.

Discussion

Tricuspid insufficiency due to penetrating cardiac injury is a rare condition. Most cases of traumatic tricuspid insufficiency are due to blunt trauma.¹ Traumatic tricuspid insufficiency is usually detected from a few weeks to decades after injury, instead of at the time of injury, because of symptom progression.² These reports indicated that acute tricuspid insufficiency could be well tolerated, even for years. As a consequence, some authors recommend initial repair of life-threatening injuries, followed by delayed repair of septal defects and valvular injuries, if clinically indicated.³ We believe that the need for repair of acute traumatic tricuspid insufficiency has never been reported previously. In our patient, intracardiac examination from the right ventricular wound did not detect intracardiac injuries, and weaning from cardiopulmonary bypass was attempted. However, acute tricuspid insufficiency resulted in right-side heart failure that was confirmed by transesophageal echocardiography. Consequently, weaning from cardiopulmonary bypass was impossible. Injury of the atrial septum and gaping of the right ventricle itself may cause worsening of right-side heart failure. However, if weaning from cardiopulmonary bypass had been possible without the intracardiac injuries being noticed or repaired, long-term sequelae of this injury might have developed.^{2,4} The importance of intraoperative examination of the valve has been previously emphasized.⁴

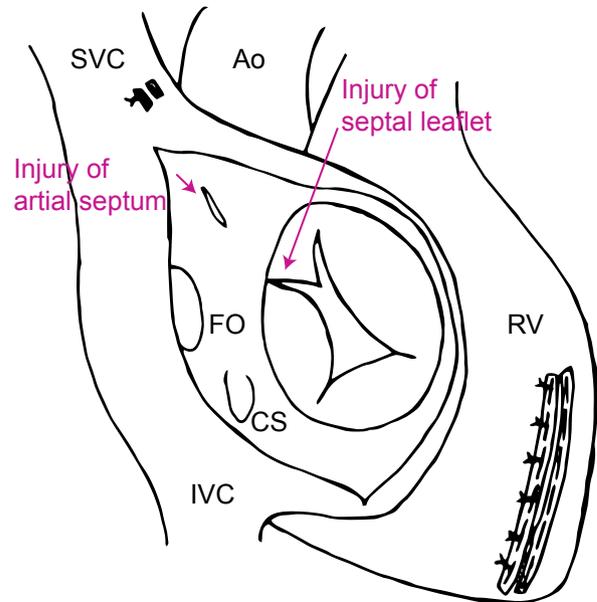


Figure 4. Diagrammatic representation of the operative findings. The septal leaflet of the tricuspid valve was completely dissected. The atrial septum was also dissected to approximately 3 cm in length and connected with the left atrium. Ao – aorta; CS – coronary sinus; FO – fossa ovalis; IVC – inferior vena cava; RV – right ventricle; SVC – superior vena cava.

As a procedure for tricuspid insufficiency, disappointing results of the De Vega technique, which implied a recommendation for ring annuloplasty, have been reported.⁵ We used an interrupted suture of the septal leaflet and De Vega's annuloplasty without an annuloplasty ring to repair the tricuspid valve for the following reasons: 1) we had to complete the operation immediately and to treat the bleeding from other wounds; and 2) the cause of tricuspid insufficiency was not annular dilatation but injury of the septal leaflet; annuloplasty was only a reinforcement.

Penetrating cardiac traumas are life-threatening injuries. Campbell et al reported that only 6% of patients could reach a hospital alive.⁶ In the case of our patient, the trauma was to the right side of the heart, which is a low-pressure system. During hypovolemic shock, clotting and hemostasis could probably have occurred. This condition was suggested by FAST, with no evidence of cardiac tamponade and with only a few pericardial effusions. Sudden PEA in the emergency room after stabilization of blood pressure with fluid resuscitation was probably due to collapse of the clot.

In summary, acute tricuspid insufficiency due to penetrating cardiac trauma resulted in right-sided heart failure, with deterioration of hemodynamic sta-

tus, inability to wean from cardiopulmonary bypass, and the need for repair of the valve at the time of initial exploration. We believe that, although investigation for multiple cardiac injuries should be performed, intraoperative transesophageal echocardiography can be helpful for the identification of intracardiac injuries.

References

1. Vayre F, Richard P, Ollivier JP. [Traumatic tricuspid insufficiency]. *Arch Mal Coeur Vaiss.* 1996; 89: 459-463.
2. Ma WG, Luo GH, Sun HS, Xu JP, Hu SS, Zhu XD. Surgical treatment of traumatic tricuspid insufficiency: experience in 13 cases. *Ann Thorac Surg.* 2010; 90: 1934-1938.
3. Shahidnoorai S, Ameli M. Post traumatic tricuspid insufficiency: when to intervene? *J Cardiovasc Surg (Torino).* 1991; 32: 585-588.
4. Doty JR, Cameron DE, Elmaci T, Salomon NW. Penetrating trauma to the tricuspid valve and ventricular septum: delayed repair. *Ann Thorac Surg.* 1999; 67: 252-253.
5. Lazopoulos G, Kampitakis E, Pavlopoulos D, Chalkiadakis G. Giant right atrium late after left-sided heartvalve replacement: re-do cardiac surgery for severe tricuspid regurgitation. *Hellenic J Cardiol.* 2015; 56: 181-183.
6. Campbell NC, Thomson SR, Muckart DJ, Meumann CM, Van Middelkoop I, Botha JB. Review of 1198 cases of penetrating cardiac trauma. *Br J Surg.* 1997; 84: 1737-1740.