

Severe Tricuspid Valve Regurgitation Due to Chordal Rupture Following Blunt Chest Trauma: A case report

Abstract

Aims: Tricuspid valve injuries from blunt chest trauma are rare but can have serious consequences. The incidence of these injuries has significantly increased due to the high rate of road accidents and diagnostic progress. Despite this increase, these injuries **continue** to be underdiagnosed, which affects the timing and quality of treatment outcomes. The aim of this report is to highlight the importance of early diagnosis and intervention for tricuspid valve injuries, even when symptoms are not immediately evident.

Presentation of Case: We report a case of a 56-year-old male with no significant medical history who developed severe tricuspid regurgitation following a motor vehicle accident. Initially, the patient exhibited no cardiac symptoms and was referred for cardiac evaluation only after a **CT CAP** (Chest, Abdomen, Pelvis) scan, performed 10 days after the accident, revealed minimal pericardial effusion. Echocardiography revealed severe eccentric tricuspid regurgitation due to anterior leaflet chordal rupture, along with moderate right ventricular dilation. Despite the recommendation for surgical repair, the patient declined surgery due to the absence of symptoms.

Conclusion: This case emphasizes the importance of considering potential cardiac complications, even when symptoms are not specific. Rapid, accurate diagnosis and early surgical intervention can significantly improve prognosis and reduce long-term cardiac complications.

Keywords: *Blunt chest trauma, Cardiac valve injury, Traumatic tricuspid insufficiency, Chordal rupture*

1. Introduction

Cardiac valve injuries, particularly those involving the tricuspid valve, resulting from blunt chest trauma are rare[1], but they deserve attention due to their potentially serious long-term consequences, even in asymptomatic patients. **Untreated Traumatic Tricuspid Insufficiency (TTI) can lead to complications such as progressive right heart failure, arrhythmias, and pulmonary hypertension, which can severely impact a patient's long-term prognosis and quality of life.** Over the past few decades, the incidence of traumatic tricuspid regurgitation has increased significantly, largely due to the rising number of road accidents and advancements in diagnostic techniques, especially echocardiography[2]. Despite this increase, TTI continues to be underdiagnosed, which can affect the timing and quality of treatment outcomes. This report presents the case of severe tricuspid regurgitation secondary to rupture of the anterior leaflet tendon chord following non-penetrating chest trauma.

2. Case Presentation

We report the case of a 56-year-old male with no significant medical history, referred to our cardiology unit following a body scan performed as part of an evaluation after a motor vehicle accident. The accident involved a thoraco-abdominal impact ten days prior to consultation. The patient reported localized parietal pain and discomfort in the right hypochondrium, without dyspnea or other associated symptoms.

On physical examination, the patient was eupneic, with normal blood pressure (120/70 mmHg) and tachycardia at 110 bpm. Cardiovascular auscultation revealed a holosystolic murmur best heard at the left sternal border, radiating to the right lower sternal border and intensifying during inspiration. Bilateral thoracic ecchymoses were also noted.

The electrocardiogram (ECG) showed sinus tachycardia at 120 bpm with negative T waves in the inferior leads. **A CT CAP scan** revealed bilateral moderate pleural effusion, more pronounced on the left side, causing underlying pulmonary collapse with bilateral basal atelectasis bands. It also showed minimal pericardial effusion and fractures of the anterior arch of the 5th and 6th right ribs, as well as the 2nd, 3rd, 4th, 5th, 6th, and 7th left ribs. No evidence of pneumothorax or pneumomediastinum was detected (Figure 1).

Transthoracic echocardiography revealed severe eccentric tricuspid regurgitation secondary to flail of the anterior tricuspid leaflet (Figures 2–3), moderate right ventricular dilation with

preserved systolic function, and a dilated right atrium. Left ventricular dysfunction with segmental wall motion abnormalities and a reduced ejection fraction (LVEF) of 45% was also observed. The mitral, aortic, and pulmonic valves appeared structurally and functionally normal, with no significant regurgitation. **Minimal pericardial effusion was again noted.**

Laboratory investigations were unremarkable, with high-sensitivity troponin levels within the normal range (0.02 ng/L). In view of the moderate left ventricular dysfunction, coronary angiography was performed, which revealed normal coronary arteries.

The final diagnosis was severe tricuspid regurgitation secondary to rupture of the anterior leaflet chordae. Surgical repair of the tricuspid valve was recommended due to the severity of the regurgitation. However, the patient declined surgery, as he was asymptomatic, despite detailed counseling regarding the benefits of early intervention.

Given the patient's decision to forgo surgery, close monitoring was initiated to track any progression of symptoms or changes in cardiac function. Follow-up assessments were planned to ensure timely detection of any clinical deterioration.

The patient expressed full understanding of his condition and the rationale for the recommended surgical intervention but opted against surgery due to his current lack of symptoms. He appreciated the comprehensive explanations provided by the medical team.

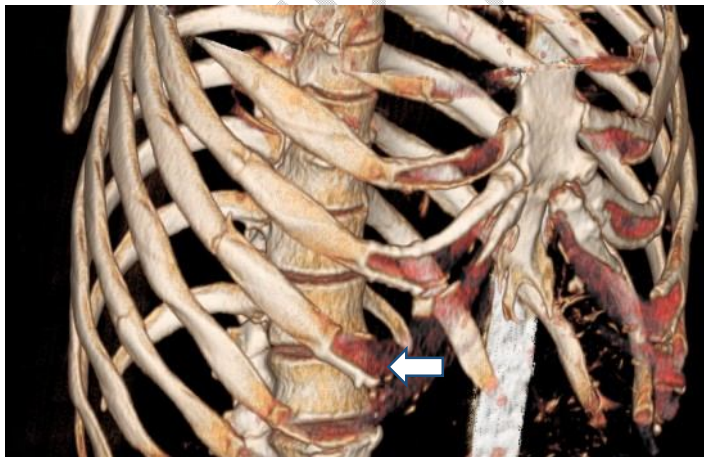


Figure 1 : Thoracic CT scan with 3D reconstruction showing rib fractures (arrow)

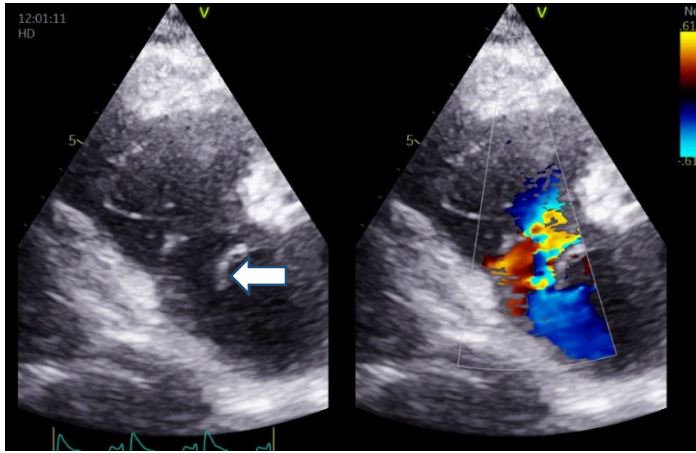


Figure 2 : Two-dimensional transthoracic echocardiography with simultaneous color Doppler revealed tricuspid chordae tendinae rupture, with the anterior leaflets of the tricuspid valve turning over into the right atrium during systole (arrow), along with significant tricuspid regurgitation

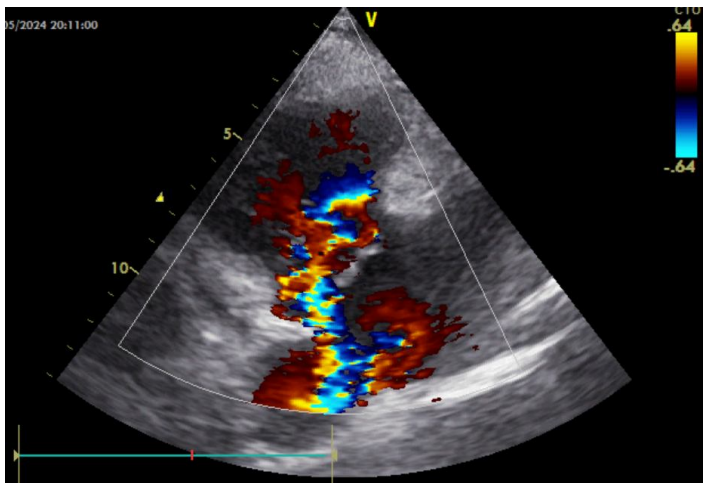


Figure 3 : Color Doppler echocardiography demonstrated severe tricuspid regurgitation

3. Discussion

Cardiac injuries resulting from blunt chest trauma have become more commonly encountered in clinical settings over the past decade. Despite this increase, damage to heart valves, particularly the tricuspid valve, remains rare. This rarity can lead to underdiagnosis because the condition often progresses slowly and can present with atypical or asymptomatic clinical features, resulting in an underestimated incidence rate[1].

3.1 Mechanism of Injury : Among the four cardiac valves, the aortic valve (AV) is generally considered to be at the greatest risk of injury, followed by the mitral valve (MV), tricuspid valve (TV), and pulmonary valve (PV) [3]. The anatomical positioning of the right ventricle, situated behind the sternum, makes it particularly vulnerable to injuries from anteroposterior compressive forces. During deceleration events, the transmission of force through the

ventricle, especially at end-diastole, can precipitate the rupture of the chordae tendineae or papillary muscles. This can lead to acute tricuspid insufficiency, highlighting the intricate relationship between cardiac anatomy and traumatic forces[4]. The most frequently reported mechanism of tricuspid valve injury is chordal rupture, followed by rupture of the anterior papillary muscle and tears in the leaflets, primarily affecting the anterior leaflet[5].

3.2 Associated Cardiac Lesions in Blunt Chest Trauma : Blunt chest trauma (BCT) encompasses a spectrum of cardiac injuries that can be easily overlooked, particularly in the acute setting. The range of possible injuries includes rhythm abnormalities, myocardial contusions, septal or free wall ruptures, coronary artery dissections, and extracardiac injuries such as aortic dissections or pericardial injuries[3]. The underdiagnosis of these injuries is partly due to their subtle or asymptomatic presentation, and the existing literature on BCT is largely confined to case reports and a few retrospective studies[5].

Myocardial contusions, one of the more frequently reported injuries, may present with signs of left ventricular dysfunction [3], which was observed in our patient, who exhibited left ventricular dysfunction likely due to a myocardial contusion. Despite normal troponin levels measured 10 days post-accident, the initial injury could have resolved, leading to the normal readings. Coronary angiography performed in our patient returned normal results, reinforcing the hypothesis that the dysfunction was trauma-related rather than ischemic.

3.3 Diagnostic Challenges and Echocardiography : Transthoracic echocardiography (TTE) is the initial diagnostic method of choice for all patients with chest trauma, especially when cardiac injury is suspected[6]. Early diagnosis and surgical treatment can increase the feasibility of tricuspid valve repair and prevent progressive deterioration of right ventricular function. However, performing TTE on patients who have blunt thoracic trauma can be very difficult due to coexisting injuries. In such cases, transesophageal echocardiography (TEE) can safely offer extensive information regarding heart anatomy, particularly in circumstances involving traumatic tricuspid regurgitation[7]. Physicians should consider TEE when TTE results are inconclusive or if there is a strong suspicion of cardiac injury.

In our case, TTE was sufficient to assess the tricuspid valve anatomy and provided the necessary information for diagnosis and management planning, although TEE can be a valuable second-line examination for further confirmation and detailed assessment.

3.4 Underdiagnosis and Delayed Presentation : Tricuspid regurgitation frequently goes undiagnosed following blunt chest trauma because of its often asymptomatic nature, in some cases, several or even more than ten years can elapse before a diagnosis is made. The diagnosis may be missed acutely due to coexisting multisystem involvement and the subtleness of physical signs. Due to the compliant nature of the right ventricle, tricuspid regurgitation may be tolerated well in the early phase, and patients may present much later with heart failure, retrospectively linked to blunt force trauma. [6,8]

In our case, the patient initially had no symptoms directly suggestive of cardiac injury, and the diagnosis was missed. This case exemplifies how the diagnosis can be easily overlooked, especially in asymptomatic patients whose primary complaints are related to other injuries, such as rib fractures.

3.5 Surgical Management : The timing of the operation depends on the clinical situation. Surgical treatment of traumatic tricuspid insufficiency via either valve repair or replacement can be performed with low perioperative morbidity and mortality. Early surgery is recommended to achieve a successful valve repair and preserve right ventricular function[8,9]. Currently, there is no consensus regarding the management of TTI. Although surgery has been widely adopted as a major treatment option, several important issues, such as indications for surgical intervention and the optimal timing for operative valve repair or replacement, remain controversial. Van Son et al. concluded from experience with 13 patients with traumatic tricuspid valve injury that earlier diagnosis and surgical treatment provide better flexibility, prevent progressive right ventricular dysfunction, and increase the possibility of maintaining normal sinus rhythm. In any instance, surgery should be performed before right ventricular function deteriorates and patients develop therapy-refractory symptoms of right heart failure. Prognosis after successful surgical treatment is generally favorable[10].

In our case, given the patient's decision to forgo surgery, a strategy of close monitoring was implemented to detect any potential progression of symptoms or changes in cardiac function.

4. Conclusion

Valvular complications following blunt chest trauma are relatively rare and often unrecognized. This case highlights the importance of considering these potential cardiac complications, even in the absence of specific symptoms. We strongly suggest that emergency department physicians remain vigilant for this potential issue and subject all patients with

blunt chest trauma to thorough echocardiographic evaluation (TTE or TEE) for accurate diagnosis. Rapid, accurate diagnosis and early surgical intervention can significantly improve prognosis and reduce long-term cardiac complications.

Authors' contributions :

Hamza Karmouchi, Lamia Tlohi and Maha Bouziane(MD) performed a literature review and drafted the manuscript. Abdenasser Drighil edited the manuscript.

All the authors have read and agreed to the final manuscript.

Consent :

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

References

- 1) Lin SJ, Chen CW, Chou C J., Liu KT, Su HM, Lin TH, et al (2006). Traumatic tricuspid insufficiency with chordae tendinae rupture: a case report and literature review. *The Kaohsiung journal of medical sciences*, 22(12), 626–629.
[https://doi.org/10.1016/S1607-551X\(09\)70363-8](https://doi.org/10.1016/S1607-551X(09)70363-8)
- 2) Eranki A, Villanueva C, Wilson-Smith A, & Seah P (2021). Traumatic tricuspid valve regurgitation: A two case series. *Trauma case reports*, 37, 100593.
<https://doi.org/10.1016/j.tcr.2021.100593>
- 3) El-Andari R, O'Brien D, Bozso SJ ,& Nagendran J (2021). Blunt cardiac trauma: a narrative review. *Mediastinum (Hong Kong, China)*, 5, 28.
<https://doi.org/10.21037/med-21-19>
- 4) Thekkudan J, Luckraz H, Ng A, & Norell M. (2012). Tricuspid valve chordal rupture due to airbag injury and review of pathophysiological mechanisms. *Interactive cardiovascular and thoracic surgery*, 15(3), 555–557.
<https://doi.org/10.1093/icvts/ivs244>

- 5) Schuster I, Graf S, Klaar U, Seitelberger R, Mundigler G & Binder T (2008). Heterogeneity of traumatic injury of the tricuspid valve: a report of four cases. *Wiener klinische Wochenschrift*, 120(15-16), 499–503. <https://doi.org/10.1007/s00508-008-1012-7>
- 6) Bamira DG, Dwivedi A, Bhatla P, Halpern D, Vainrib AF, et al (2020). Unusual Cause of Severe Tricuspid Regurgitation: Tricuspid Leaflet Annular Tear Following Remote Motor Vehicle Accident. *JACC. Case reports*, 2(14), 2156–2161. <https://doi.org/10.1016/j.jaccas.2020.07.056>
- 7) Nishimura K, Okayama H, Inoue K, Saito M, Nagai T, Suzuki J, et al (2010). Visualization of traumatic tricuspid insufficiency by three-dimensional echocardiography. *Journal of cardiology*, 55(1), 143–146. <https://doi.org/10.1016/j.jicc.2009.04.007>
- 8) Acar B, Suleymanoglu M, Burak C, Demirkan BM, Guray Y, Tufekcioglu O, et al (2015). Severe Tricuspid Regurgitation Diagnosed 13 Years after a Car Accident: A Case Report. *The journal of Tehran Heart Center*, 10(1), 50–52.
- 9) Zhang Z, Yin K, Dong L, Sun Y, Guo C, Lin Y, et al (2017). Surgical management of traumatic tricuspid insufficiency. *Journal of cardiac surgery*, 32(6), 342–346. <https://doi.org/10.1111/jocs.13156>
- 10) van Son JA, Danielson GK, Schaff HV, & Miller Jr FA (1994). Traumatic tricuspid valve insufficiency. Experience in thirteen patients. *The Journal of thoracic and cardiovascular surgery*, 108(5), 893–898.