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Case Report

Navigating Trauma's Impact on Left Ventricular Pseudoaneurysm: A Pivotal Case Report and Review

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ABSTRACT

Left ventricular pseudoaneurysm (LVP) is a rare cardiac condition with a prevalence of approximately 0.05%. It is primarily associated with myocardial infarction or cardiac surgery, although it can also occur post-trauma, accounting for less than 0.1% of cases. The diagnostic process for LVP can be challenging due to its atypical presentation, requiring a comprehensive approach for accurate identification and intervention. Surgical repair is a cornerstone of LVP treatment, given the high risk of rupture and the associated mortality. The case presented here describes a 23-year-old man who developed symptomatic LVP 6 months after a traffic collision. Diagnostic imaging, including echocardiography and computed tomography angiography, identified a 2.2 cm defect in the LV wall, leading to a large pseudoaneurysm measuring approximately 6.0 cm × 5.5 cm. Surgical intervention was successfully performed via a median sternotomy. The timely surgical management in this case not only addressed the LVP but also highlighted the critical importance of prompt intervention in preventing potential complications associated with this condition. This case review provides a comprehensive appraisal of the literature surrounding LVP. This study offers valuable insights for clinical practice by examining the prevalence, etiology, diagnostic challenges, and advancements in surgical techniques. As clinicians encounter similar clinical scenarios, combining this case with a literature review provides a strong reference for informed decision-making and optimizing patient outcomes.
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KEYWORDS: Left ventricular pseudoaneurysm, Trauma, Cardiovascular trauma, Aneurysm

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Left ventricular pseudoaneurysm (LVP) is an infrequent but severe cardiac condition characterized by an outpouching formation within the LV wall, contained by the adherent pericardium, scar tissue, or hematoma, and notably lacking myocardial tissue. [1-3] This unique pathology often arises following a rupture of the LV wall. The etiology of LVP is diverse, with the majority of cases being secondary to

myocardial infarction (55%), post-surgical complications (33%), and less frequently, traumatic events (7%). [1,2] The diagnostic challenges associated with LVP stem from its atypical presentation, prompting the need for in-depth exploration, as exemplified by the following case report of a 23-year-old man presenting with post-traumatic LVP 6 months following a traffic collision.

Case Presentation

The patient, a 23-year-old man, sought medical attention for atypical chest discomfort that was exacerbated during exertion, characterized by a palpable double impulse and a grade 2/6 mid-systolic murmur audible at the apex. Remarkably, this discomfort had commenced a month before the presentation and coincided with noticeable palpitations localized at the left mid-axillary line in the fifth intercostal space. Despite a history free of notable medical conditions, the patient had experienced a traumatic car accident 6 months earlier.

At presentation, vital signs revealed tachycardia at 120 bpm, accompanied by normal blood pressure. A thorough cardiac examination revealed a palpable double impulse and mid-systolic murmur. Cardiac troponin T and creatine kinase type M levels were within normal limits. An ECG demonstrated sinus tachycardia without ST-T changes. Transthoracic echocardiography revealed a normal LV size, an LV end-diastolic volume index of 64 mL/m^2, and a mildly reduced LV ejection fraction of 45%. Notably, a large defect (2.2 cm) was identified in the mid-portion of the LV lateral wall (Fig. 1. A), exhibiting to-and-fro bidirectional flow into a large echo-free space (Video 1), indicative of a pseudoaneurysm measuring 6.0 cm × 5.5 cm (Fig. 1. B). Further diagnostic confirmation through cardiac computed tomography angiography highlighted the presence of a large pseudoaneurysm in the mid-portion of the LV lateral wall (Fig. 2 & Video).

Given the surgical approach proposed, a coronary angiography was performed, revealing normal epicardial coronary arteries. An open surgical procedure, initiated through a median sternotomy, uncovered a large aneurysmal sac originating from the lateral portion of the left anterior descending artery and measuring approximately 7.0 cm (Fig. 3). Following the incision of this aneurysmal sac, a sizable defect (3.0 cm) in the lateral portion of the LV was identified and subsequently repaired using a GORE-TEX patch. Ten days post-operation, the patient was discharged in stable condition, and follow-up assessments at 1, 3, and 6 months indicated no complications. Postoperative echocardiography depicted the pericardial patch in the proper position in the anterolateral wall with no significant residual flow.

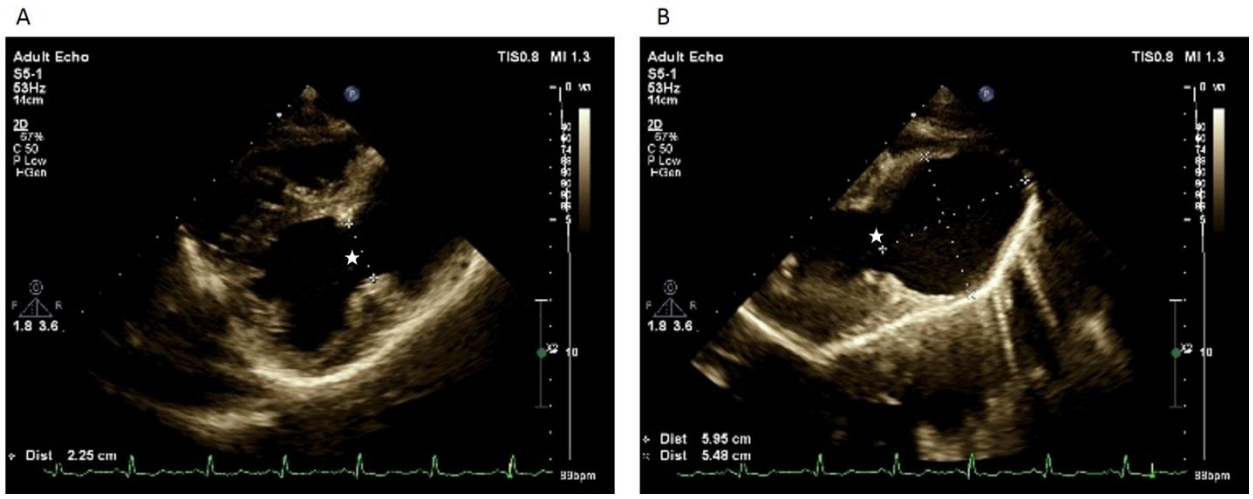

Figure 1: A) The echocardiogram reveals a well-defined defect in the lateral wall of the left ventricle measuring 2.2 cm. **B)** A large outpouching measuring about 6.0 cm × 5.5cm is seen connecting to the left ventricular cavity through the mentioned defect (narrow neck, marked with an asterisk).

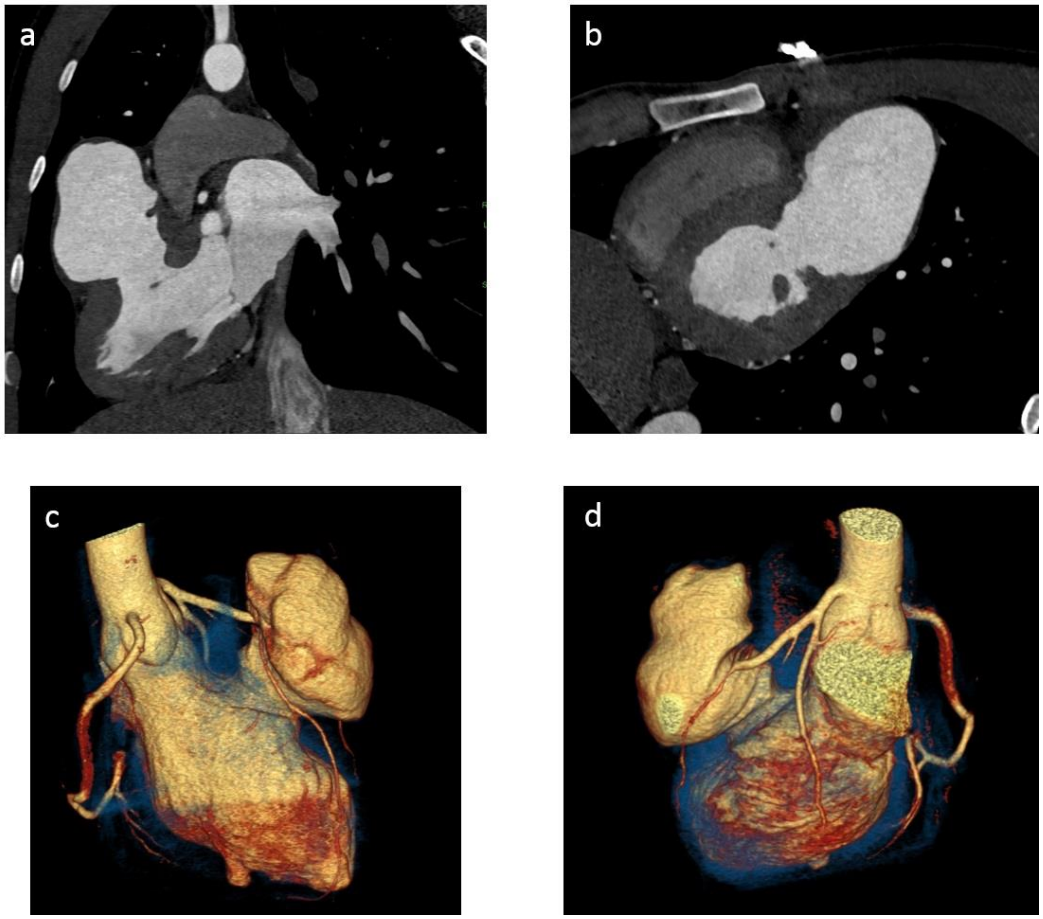

Figure 2: The cardiac computed tomography angiography scan reveals the following findings:
A & b) A large defect in the mid-anterior segment with a huge pseudoaneurysm in the 2-chamber and short-axis multiplanar reconstruction views. C & d) The VR images demonstrate a notable pseudoaneurysm. The coronary arteries appear to be in a healthy and open state. d) The pseudoaneurysm leads to widening at the point where the first diagonal artery and the left anterior descending artery branch off.

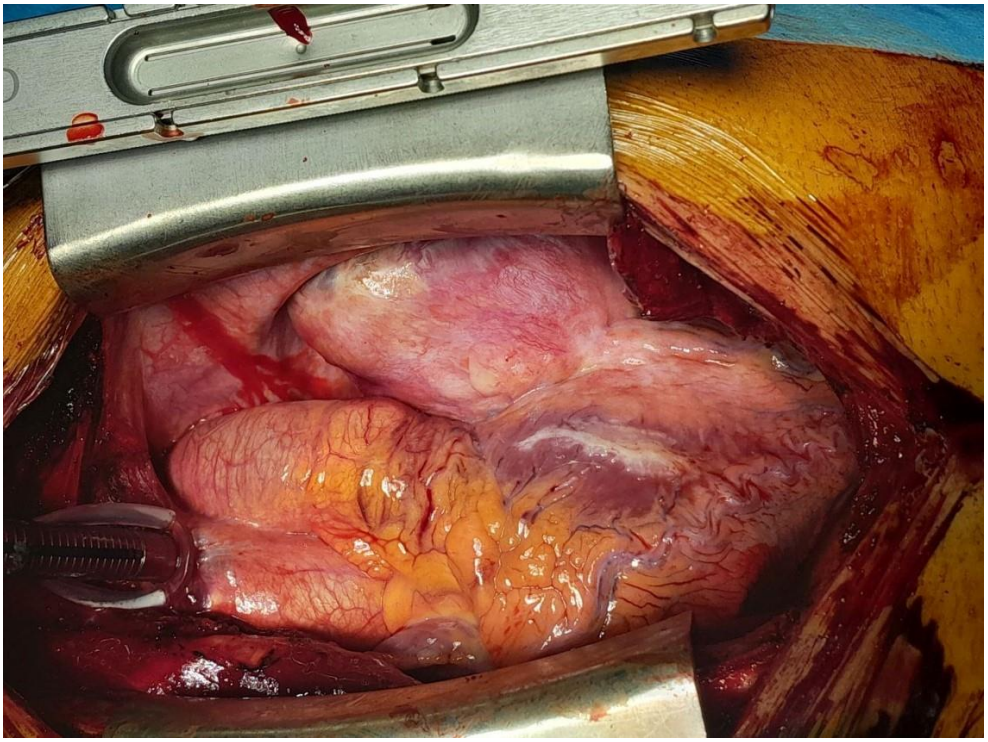

Figure 3: This illustration of the surgical procedure showcases a significant (7.0 cm) pseudoaneurysm.

DISCUSSION

Ventricular pseudoaneurysm, a cardiac disorder with a prevalence of 0.05%, is primarily associated with myocardial infarction or cardiac surgery, with less than 0.1% occurring spontaneously. [2, 4-6] However, LVP may also manifest as a consequence of penetrating or blunt trauma, infective pericarditis, or iatrogenic causes. [2, 4] Notably, rapid deceleration of the chest cavity resulting from blunt trauma, such as that experienced in a car accident, imparts excessive shearing forces on cardiac structures, leading to an acute rupture in the ventricular free wall, interventricular septum, or valve leaflets. [7]

LVP manifests as an outpouching formation enclosed by the pericardium, pericardial adhesion, or thrombi. [1, 7] The risk of sudden death due to LVP rupture, in cases where surgical intervention is not pursued, has been reported to be as high as 48%. [2, 8, 9]

As documented in the literature, 10% to 48% of LVP cases might be completely asymptomatic. The most common presentations include chest pain, dyspnea, congestive heart failure, and arrhythmias. [2, 6, 7] Less common presentations encompass sudden cardiac arrest, syncope, acute myocardial infarction, tamponade, and embolism. [10] In the present case, the patient predominantly had chest pain and sinus tachycardia.

Diagnostic Modalities

While more than 95% of patients with LVP exhibit no remarkable ECG changes, approximately 20% may display ST-T changes, usually in the form of ST elevation due to myocardial infarction. [7, 10]

Auscultation may reveal a to-and-fro murmur attributed to blood flow through a narrow orifice of the pseudoaneurysm. [11]

Chest X-ray findings typically include an increased cardiothoracic ratio and bulging in the cardiac silhouette. [7]

Transthoracic echocardiography has emerged as a valuable noninvasive diagnostic modality, with a typical feature being a sharp defect in the endocardial portion connected by a narrow orifice to the LV, distinguishing it from a true aneurysm. [7]
As represented in some studies with a small number of patients, the ratio of the maximum size of the orifice to the maximum size of the outpouching should be 0.5 or less for pseudoaneurysms; nonetheless, this ratio is between 0.9 and 1 in aneurysms. [7,9,12,13] The orifice-to-pseudoaneurysm diameter ratio, although cited as a diagnostic parameter, exhibits low accuracy, as evidenced by the current case where the ratio measured 2.2, deviating from the typical range (Fig. 1A & B). [2, 13]
Angiography of the LV and coronary arteries stands out as the modality of choice to differentiate between a false aneurysm and a true aneurysm, particularly by assessing the narrowest orifice and the anatomy of coronary arteries. The normal findings in the coronary angiography of our case further validated the diagnostic pathway. [13]
Additional imaging modalities, such as cardiac computed tomography angiography and cardiac magnetic resonance, offer comprehensive visualization of the outpouching in various planes, further confirming the diagnosis. [7, 13, 14]

Therapeutic Approaches

As reported in the literature, due to the high risk of rupture and subsequent death (45% of untreated pseudoaneurysms), surgical intervention is strongly recommended. [6] The mortality rate associated with post-traumatic LVP surgery is estimated to exceed 7%. [6, 7]
For the surgical repair of large orifice pseudoaneurysms, such as the one presented in this paper, the desirable method is implanting a patch in the orifice of the defect. [7]
Accordingly, the LV defect in our case was repaired using a GORE-TEX patch. Some authors have suggested that surgical repair using the direct suture can be a practicable surgical approach in post-traumatic LVP without myocardial diseases. [7]
Although surgical intervention is often advocated for LVP treatment, medical management may be considered in certain cases. In asymptomatic chronic cases of LVP with a defect size of less than 3 mm, medical treatment could be chosen as a therapeutic approach. This approach involves decreasing afterload and preload to alleviate the strain on the heart. [2, 8]
Still, the decision to opt for medical treatment can be controversial, as there is no universally agreed-upon protocol for the medical management of LVP. The effectiveness of medical therapy in preventing complications or promoting healing is not as well-established as surgical intervention. [1] It is crucial to note that the choice between medical and surgical management depends on various factors, including the patient's overall health, the size/characteristics of the pseudoaneurysm, and the presence of symptoms. [1, 7] In cases where surgery might pose a higher risk due to comorbidities or other factors, a carefully tailored medical treatment plan should be considered. [1]
Nevertheless, the decision regarding medical treatment should be made on a case-by-case basis, with close monitoring of the patient's condition over time. Regular follow-ups and imaging studies are essential to assess the effectiveness of medical management and to promptly detect any worsening of the pseudoaneurysm or the development of new symptoms. [7, 14, 15]

CONCLUSIONS

While surgical repair remains the primary and life-saving therapeutic approach to LVP, medical treatment may be considered in

carefully selected cases, particularly in asymptomatic individuals with smaller pseudoaneurysms. The decision should be made collaboratively between the patient and the medical team, considering the individual's overall health and specific clinical circumstances.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the content of this article. We have no financial or personal relationships with any individual or organization that could potentially bias the information presented herein.

REFERENCES

1. Inayat F, Ghani AR, Riaz I, Ali NS, Sarwar U, Bonita R, et al. Left ventricular pseudoaneurysm: an overview of diagnosis and management. Journal of investigative medicine high impact case reports. 2018; 6:2324709618792025.

2. Frances C, Romero A, Grady D. Left ventricular pseudoaneurysm. Journal of the American College of Cardiology. 1998; 32(3):557-61.

3. Meng X, Yang Y-K, Yang K-Q, Zhang Y, Lu P-P, Fan P, et al. Clinical characteristics and outcomes of left ventricular pseudoaneurysm: A retrospective study in a single-center of China. Medicine. 2017; 96(18).

4. Patanè F, Sansone F, Centofanti P, Rinaldi M. Left ventricular pseudoaneurysm after pericardiocentesis. Interactive cardiovascular and thoracic surgery. 2008; 7(6):1112-3.

5. Mahilmaran A, Nayar PG, Sheshadri M, Sudarsana G, Abraham K. Left ventricular pseudoaneurysm: caused by coronary spasm, myocardial Infarction, and myocardial rupture. Texas Heart Institute Journal. 2002; 29(2):122.

6. Yeo TC, Malouf JF, Oh JK, Seward JB. Clinical profile and outcome in 52 patients with cardiac pseudoaneurysm. Annals of internal medicine. 1998; 128(4):299-305.

7. Singh S, Puri A, Narain V, Sahni J. Post-traumatic left ventricular pseudoaneurysm. Interactive Cardiovascular and Thoracic Surgery. 2012; 14(3):359-61.

8. Atik FA, Navia JL, Vega PR, Gonzalez-Stawinski GV, Alster JM, Gillinov AM, et al. Surgical treatment of postinfarction left ventricular pseudoaneurysm. The Annals of thoracic surgery. 2007; 83(2):526-31.

9. Alapati L, Chitwood WR, Cahill J, Mehra S, Movahed A. Left ventricular pseudoaneurysm: A case report and review of the literature. World Journal of Clinical Cases: WJCC. 2014; 2(4):90.

10. Tuan J, Kaivani F, Fewins H. Left ventricular pseudoaneurysm. European Journal of Echocardiography. 2008; 9(1):107-9.

11. Currie A, Venugopal P, Hayes N, Qureshi S, Austin C. Delayed presentation of a post-traumatic left ventricular pseudoaneurysm in a child. The Annals of thoracic surgery. 2010; 89(5):1633-5.

12. Gatewood Jr RP, Nanda NC. Differentiation of left ventricular pseudoaneurysm from true aneurysm with two dimensional echocardiography. The American journal of cardiology. 1980; 46(5):869- 78.

13. Bisoyi S, Dash AK, Nayak D, Sahoo S, Mohapatra R. Left ventricular pseudoaneurysm versus aneurysm a diagnosis dilemma. Annals of Cardiac Anaesthesia. 2016; 19(1):169.

14. Hulten EA, Blankstein R. Pseudoaneurysms of the heart. Circulation. 2012; 125(15):1920-5.

15. Mujanovic E, Bergsland J, Avdic S, Stanimirovic-Mujanovic S, Kovacevic-Preradovic T, Kabil E. Surgical treatment of left ventricular pseudoaneurysm. Medical Archives. 2014; 68(3):215.