International Journal of Current Research and Review
DOI: doi.org/10.31782/IJCRR.2025.172201

Case Report

IJCRR
Section: Healthcare



# Post MI Chordae *Tendinae* Rupture Diagnosis Using Blender 3D Assisted Frame-Rate Control and an Overview of Myocardial Ruptures" - A Case Report

**Chandra Shekara Reddy G.B.[1], Arun Srinivas[2], Guruprasad H.P.[3]**

[1]Junior Consultant Cardiologist, MBBS, PGDCC (Clinical Cardiology), Dept. of Cardiology, Apollo BGS Hospital, Adichunchanagiri Road, Kuvempunagar - 570023, Mysuru, Karnataka, India; [2]Interventional Cardiologist, MBBS, MD, DM (Card), FESC, FACC - HOD, Dept. of Cardiology, Apollo BGS Hospital, Adichunchanagiri Road, Kuvempunagar - 570023, Mysuru, Karnataka, India; [3]Interventional Cardiologist, MBBS, DNB (Card), Dept. of Cardiology, Apollo BGS Hospital, Adichunchanagiri Road, Kuvempunagar - 570023, Mysuru, Karnataka, India

## ABSTRACT

**Introduction:** Post–myocardial infarction (MI) mechanical complications remain catastrophic and require early detection. Conventional 2D echocardiography may be limited in tachycardic or critically ill patients due to inadequate frame rates.

**Case Report:** A middle-aged man aged 55-year-old with hypertension, hypothyroidism, and prior above-knee amputation presented with NSTEMI, evidenced by ST depression in V2–V6 and elevated Troponin I. Initial 2D echocardiography was normal. Coronary angiography showed single-vessel LAD disease with branch involvement, and OCT-guided PCI with two drug-eluting stents and a drug-eluting balloon was successfully performed. Despite initial stability, he developed sudden pulmonary edema, cardiogenic shock, and a new pansystolic murmur, suggesting a post-MI mechanical complication. Persistent tachycardia hindered adequate echocardiographic visualization. A novel "Frame Rate Control" technique using Blender 3D software was applied to generate high-quality slow-motion reconstructions of the echo loops, enabling clearer assessment. This technique confirmed ruptured chordae tendineae with severe mitral regurgitation.

**Results:** The patient's respiratory failure progressed from oxygen therapy to BiPAP and ultimately mechanical ventilation. Emergency high-risk mitral valve replacement was undertaken, but he could not be weaned from cardiopulmonary bypass and required massive transfusion due to recent antiplatelet and anticoagulant therapy. He died on postoperative day one.

**Discussion:** This case underscores the need for prompt detection of post-MI mechanical complications and demonstrates the first documented clinical use of Blender 3D software to optimize echocardiographic frame-rate limitations. Such techniques may aid diagnosis when conventional imaging is inadequate, especially in hemodynamically unstable patients.

**Key Words:** Mechanical Complication of MI, Cardiogenic Shock, Cardiac Catastrophy, Chordae Tendinae Rupture, Blender 3D Software, Frame Rate Control

## INTRODUCTION

The mitral valve apparatus is a complex three–dimensional functional unit that is critical to unidirectional heart pump function.[1] The main mitral valve apparatus components are: 1) mitral annulus, 2) mitral valve leaflets, 3) chordae tendineae and 4) papillary muscles.[1] Tight sealed mitral leaflet coaptation depends on the balance of systolic tethering and closing forces on the valve and on the amount of leaflet tissue available.[1] The chordae tendineae were seen to have different microstructures according to chordal type.[2] The presence of vessels characterized the chordae tendineae as complex living components that work in coordination with the papillary muscles and mitral valve leaflets to prevent mitral valve prolapse and regurgitation.[2] They may also function to supply nutrients to the valve leaflets.[2] Primary tear and infective endocarditis are leading etiologies of ruptured chordae tendineae in hospitalized patients.[3] MI is one of the rarer causes of Chordae Tendinae Rupture of Mitral Valve. Echocardiography is ideally suited to examine the mitral valve apparatus and has provided insights into the mechanism of mitral valve disease.[1]

## CASE REPORT

A 55-year-old male with hypertension, hypothyroidism and prior left above-knee amputation presented with 4 hours of typical anginal chest pain. Initial evaluation showed tachycardia,

**Corresponding Author:**
**Dr. Arun Srinivas,** HOD, Dept. of Cardiology, Apollo BGS Hospital, Adichunchanagiri Road, Kuvempunagar - 570023, Mysuru, Karnataka, India; Email: arunsrinivascpubs@gmail.com

**ISSN:** 2231-2196 (Print) **ISSN:** 0975-5241 (Online)
**Received:** 13.10.2025 **Revised:** 06.11.2025 **Accepted:** 21.11.2025 **Published:** 29.11.2025

mild pulmonary crepitations, ST depressions in V2-V5, positive Troponin I and a normal TTE with preserved LVEF. He was diagnosed with non-ST elevation acute coronary syndrome and prepared for urgent coronary angiography. For complete clinical course see **Video 1.**

CAG on **Day 2** revealed LAD single-vessel disease, and OCT-guided PCI with two drug-eluting stents and a drug-eluting balloon was performed. Soon after, the patient developed cardiogenic shock, pulmonary edema and a new pansystolic murmur. Repeat TTE showed a flail mitral leaflet with moderate MR. Respiratory distress worsened, requiring escalation from oxygen therapy to BiPAP and then to mechanical ventilation, along with inotropes and anti-failure therapies.

By **Day 3**, persistent tachycardia and hypoxia prompted reassessment. Tachycardia determines the quality of 2D Echo. Tachycardia provides 2D Echo AV clip with High Frame Rate. With this, normal eyes we cannot appreciate sequence of cardiac cycle events. To overcome this, "Frame Rate Control" by using Blender 3D software was applied to generate high-quality slow-motion clips, allowing clearer visualization. This technique confirmed ruptured chordae tendineae with severe mitral regurgitation and document the same. Bedside TTE suggested possible chordae tendineae rupture with severe MR. TEE performed on **Days 4-5** confirmed ruptured chordae causing severe MR. Cardiothoracic surgery planned high-risk emergency mitral valve replacement.

During **Days 6-7**, the patient continued to deteriorate with refractory pulmonary edema, elevated procalcitonin, and persistent ventilator dependence, though cultures remained negative. CT chest on **Day 8** showed bilateral pleural effusion, lower-lobe consolidation, ground-glass opacities, and septal thickening consistent with pulmonary edema. An episode of ET tube obstruction by blood clots caused transient unconsciousness.

On **Day 9**, emergency mitral valve replacement was performed. Intraoperatively, ruptured chordae of the anterolateral papillary muscle were confirmed. The postoperative course was complicated by severe hypoxia, hypotension, bleeding, and difficulty weaning from cardiopulmonary bypass. Multiple transfusions and maximal vasopressor and inotropic support - including IABP were required. Despite all interventions, the patient developed refractory shock and died **on Day 10**.

## DISCUSSION

The mitral valve (MV) apparatus is a complex 3D structure responsible for maintaining unidirectional blood flow.[1] Its functional integrity depends on the anterior and posterior leaflets, chordae tendineae and papillary muscles.[2] To understand pathophysiology of any of these structures, one must have better knowledge of both anatomy and blood supply. **Figure 1 (A to H)**. Here gross anatomy of complete sub-mitral valve apparatus shown in **Figure 1A**, Microscopic view depicted in **Figure 1B**, Nutritional supply diagrammatically shown in Figure **1C & 1D** and Histological features mentioned in **Figure 1E** for Chordae Tendinae. Inter Ventricular Septum (IVS) is a very important structure for anatomical and function integrity. Figure 1 also diagrammatically shows blood supply across coronal section in Figure 1F and cross section in **Figure 1G** of IVS. In addition, **Figure 1H** shows mentions IVS sites for collateral circulation.

Anatomically, the posterior leaflet - having a smaller surface area and orientation perpendicular to systolic flow, is more susceptible to stress. Chordae tendineae rupture (CTR) was first described by Corvisart in 1806.[3] In contemporary practice, it is recognized as a significant cause of acute MR.[1] Clinical presentation typically includes a new-onset systolic murmur.[4] For specific 2D Echo findings, see **Video 2**.[5] Echocardiography remains a cornerstone for diagnosis, with 2D echo offering a diagnostic sensitivity of 65-85%.[6] In ischemic settings, CTR often results from infarction of the papillary muscles. The anterolateral papillary muscle has dual supply (LAD and LCX), making it more resistant to ischemia compared to the posteromedial papillary muscle, which is supplied solely by the RCA.[6] This explains the rarity of anterolateral muscle rupture as in our case. Ischemic CTR generally follows inferior wall MI (IWMI) and occurs within 5 days post-infarct due to strain forces exceeding the chordae's tensile capacity.[7] Non-ischemic causes include infective endocarditis, connective tissue disorders, and trauma.[7]

### Overview of Ventricular Septal Rupture (VSR) and Free Wall Rupture (FWR)

The interventricular septum (IVS) plays a vital role in cardiac conduction and is predominantly supplied by penetrating branches of the LAD, with minor contributions from the posterior descending artery (PDA).[8] It is also a site of extensive collateral circulation.[8] Cardiac rupture (CR) includes VSR and FWR both are lethal post-MI complications.[9] Without surgical intervention, mortality approaches 100%.[9] There are several types of CR showed in **Video 2**. Urgent surgery offers the best survival odds, with some studies showing a reduction in mortality from near-total to around 50%.[9] Risk factors include first MI, anterior infarction, female sex, and age >70 years.[9] Use of ECMO or IABP can serve as bridging therapy. Delaying surgical repair by 2 - 3 weeks post-rupture, when tissue becomes fibrotic and firmer, may improve outcomes.[10]

**Blender 3D Software and its Utility**[11]**:** Blender three-dimensional software It is an open-source, free software and freely downloadable from Internet (www.blender.org and used 4.0 version), which is released under General Public

License (GPL). We used "Frame Rate Control" and "BEST test" technique developed from Blender 3D software to generate high-quality motion AV clips without losing the quality of AV Clip and **Video 3**. "BEST test" technique provides surface elevation with customized color application to provide Realistically Rendered Real time images.[11] This allows clearer visualization. With these techniques, in our case we confirmed ruptured chordae tendineae with severe mitral regurgitation and document the same.

**Uncommon findings in our case are:** Presented with

- NSTEMI with Trop I +ve.
- Delayed Pan Systolic Murmur appeared after 2 days later.
- Initial anterior lead ST depression, later normalized ECG.
- No RWMA by 2D Echo with Papillary Muscle Rupture.
- Combined Pulmonary edema with LRTI / Sepsis (Procalcitonin 14).
- Anterior Papillary Muscle rupture (although it has dual blood supply).

## ACKNOWLEDGEMENT

We acknowledge the immense help received from the scholars whose articles are cited and included in in references of this manuscript. We also grateful to authors / editors / publishers of all those Articles, Journals and Books from where the literature has been reviewed and discussed. Special thanks to Senior Sonographers - Mr. Samuel and Mr. Pradeep (for Echo data), Senior Cathlab Technician (for Cath data) - Mr. Raju, Senior Consultant CTVS Surgeon - Dr. Yusuf and Senior Cardiac Anaesthetist - Dr. Girish (for OT data).

**Conflicts of Interest** : None

**Source of Funding** : Nil

**Authors' Contributions:** Chandra Shekara Reddy – Provides all data collection, preparation editing and submission of complete manuscript, Arun Srinivas helps to provide complete proof of correction and Guru Prasad provides complete conceptualization and guidance.

**Abbreviations:** ABG = Arterial Blood Gas: ACS = Acute Coronary Syndrome: AML = Anterior Mitral Leaflet: BiPAP = Bilevel Positive Airway Pressure: BP = Blood Pressure: CAG = Coronary Angiography: CABG = Coronary Artery Bypass Graft: CPB = Cardio Pulmonary Bypass: CR = Cardiac Rupture: CTR = Chordae Tendinae Rupture: CTVS = Cardio Thoracic Vascular Surgery: CT = Computerized Tomography: DEB = Drug Eluting Balloon: ECG = Electrocardiogram: ECMO = Extra Corporeal Membrane Oxygenation: FFP = Fresh Frozen Plasma: FWR = Free Wall Rupture : HR = Heart Rate: IABP = Intra-Aortic Balloon Pumping: I/O = Intake / Output: IVS = Inter Ventricular Septum: IWMI = Inferior Wall MI: LAD = Left Anterior Descending: LCX = Left Circumflex: LRTI = Lower Respiratory Tract Infection: LVEF = Left Ventricular Ejection Fraction: MV = Mitral Valve: MVP = Mitral Valve Prolapse: MVR = Mitral Valve Repair: MI = Myocardial Infarction: OAC = Oral Anti Coagulation: OCT = Optical Coherence Tomography: PM = Papillary Muscle: PSM = Pan Systolic Murmur: PRBC = Packed Red Blood Cells: PTCA = Percutaneous Transluminal Coronary Angioplasty: PCI = Per Cutaneous Intervention: RDP = Random Donor Platelets: RWMA = Regional Wall Motion Abnormality: RCA = Right Coronary Artery: VSR = Ventricular Septal Rupture: SVD = Single Vessel Disease: SaO2 = Oxygen Saturation: TEE = Trans Esophageal Echocardiography: 2D = 2 Dimensional: RTA = Road Traffic Accident

## REFERENCES

1. Dal-Bianco JP, Levine RA. Anatomy of the mitral valve apparatus–role of 2D and 3D echocardiography. Cardiol Clin. 2013 Apr 15; 31(2):10-16. DOI: 10.1016/j.ccl.2013.03.001. https://pmc.ncbi.nlm.nih.gov/articles/PMC3856635/
2. Ritchie J, Warnock JN, Yoganathan AP. Structural characterization of the chordae tendineae in native porcine mitral valves. Ann Thorac Surg. 2005 Jul 1;80(1):189-97. DOI 10.1002/clc.4960211106 Hyperlink - Clinical characteristics of ruptured chordae tendineae in hospitalized patients: Primary tear versus infective endocarditis - Portugese - 1998 - Clinical Cardiology - Wiley Online Library
3. Portugese S, Amital H, Tenenbaum A, Bar-Dayan Y, Levy Y, Afek A et al. Clinical characteristics of ruptured chordae tendineae in hospitalized patients: primary tear versus infective endocarditis. Clin Cardiol. 1998 Nov;21(11):813-6. DOI: doi/pdf/10.1002/clc.4960211106 https://onlinelibrary.wiley.com/doi/abs/10.1002/clc.4960211106
4. Menges Jr He, Ankeney J L, Hellerstein H K. The clinical diagnosis and surgical management of ruptured mitral chordae tendineae. Circulation. 1964 Jul;30(1):8-16. DOI: 10.1161/01.cir.30.1.8 https://www.ahajournals.org/doi/abs/10.1161/01.CIR.30.1.8
5. SWEATMAN T, SELZER A, KAMAGAKI M, COHN K, Basford J. Echocardiographic diagnosis of mitral regurgitation due to ruptured chordae tendineae. Circulation. 1972 Sep;46(3):580-6. DOI: 10.1161/01.CIR.46.3.580 https://www.ahajournals.org/doi/abs/10.1161/01.cir.46.3.580
6. Fradley MG, Picard MH. Rupture of the posteromedial papillary muscle leading to partial flail of the anterior mitral leaflet. Circulation. 2011 Mar 8;123(9):1044-5. DOI: 10.1161/CIRCULATIONAHA.110.984724. https://www.ahajournals.org/doi/full/10.1161/CIRCULATIONAHA.110.984724
7. Gabbay U, Yosefy C. The underlying causes of chordae tendinae rupture: a systematic review. Int J Cardiol. 2010; 143(2):113-8. DOI: 10.1016/j.ijcard.2010.02.011. https://pubmed.ncbi.nlm.nih.gov/20207434/
8. James TN, Burch GE. Blood supply of the human interventricular septum. Circulation. 1958 Mar;17(3):391-6. DOI: /pdf/10.1161/01.CIR.17.3.391. https://www.ahajournals.org/doi/abs/10.1161/01.CIR.17.3.391

9. Honda S, Asaumi Y, Yamane T, Nagai T, Miyagi T, Noguchi T, et al. Trends in the clinical and pathological characteristics of cardiac rupture in patients with acute myocardial infarction over 35 years. J Am Heart Assoc. 2014 Oct 20; 3(5):e000984. DOI: 10.1161/JAHA.114.000984. https://www.ahajournals.org/doi/full/10.1161/JAHA.114.000984
10. Abedi-Valugerdi G, Gabrielsen A, Fux T, Hillebrant CG, Lund LH, Corbascio M. Management of left ventricular rupture after myocardial infarction solely with ECMO. Circ Heart Fail. 2012 Jul; 5(4):e65-7. DOI: 10.1161/CIRCHEARTFAILURE.111.965764. https://www.ahajournals.org/doi/full/10.1161/CIRCHEARTFAILURE.111.965764
11. Reddy CS, Srinivas A, Bharadwaj N, Prasad G, Chawath SK. BEST Test—The game changer of non-invasive cardiac imaging. Heart India. 2025; 13(2):123-31.DOI: 10.4103/heartindia.heartindia_8_25. https://journals.lww.com/htin/fulltext/2025/05000/_best__test___the_game_changer_of_noninvasive.8.aspx. (LWW/Wolters Kluwer; verified from prior query as Heart India's publisher site)

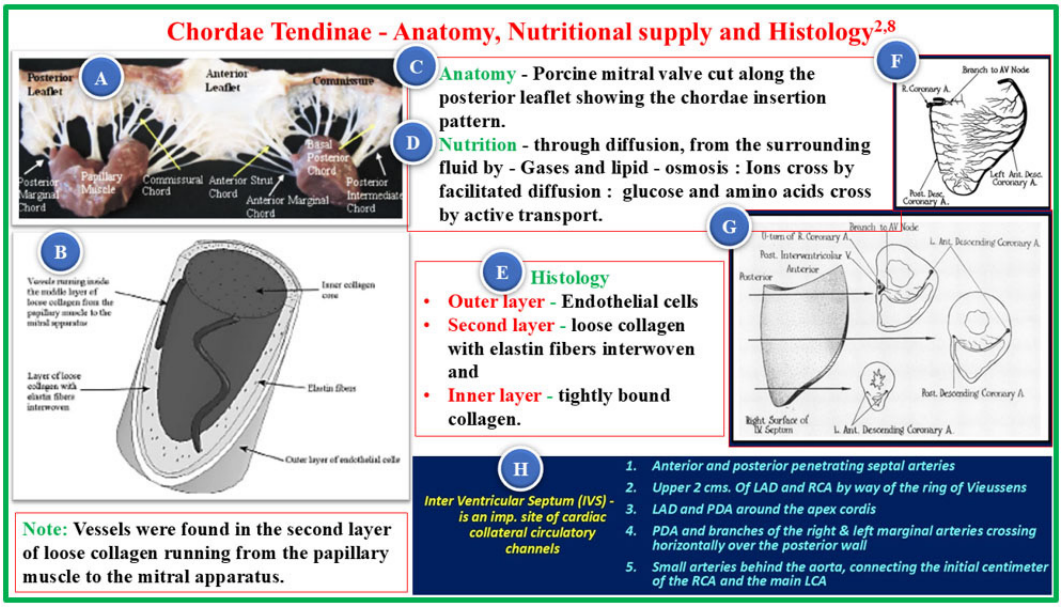


**Figure 1 A. & C.:** Unfolded anatomical view of Sub Mitral Valve Apparatus (includes Mitral Valve Leaflet, Chordae Tendinae and Papillary muscles). **B. & D.:** Microscopic view of Chordae Tendinae and its Nutritional supply. **E.:** Represents histological arrangements. **F. & G.:** Showing important Inter Ventricular Septal (IVS) Coronary Arteries and its collaterals. **H.:** List of important collateral channels around IVS.

**Video 1 -** Complete chronology of events.

- **ECG - ST** depression in Posterior wall changed Normal
- **2D Echo**cardiography - MR by TTE suspecting Flial MVP becomes Chordae Tendinae Rupture (CTR)
- **Later as**sociated with Intractable Pulmonary edema and LRTI (confirmed with series of Chest X rays and CT Chest) - requiring Mechanical ventilation support complicated with ET Tube bleed.
- **Summary** of initial PCI visuals and Intra Operative CTR visuals.

**Video 2 -** Chordae Tendinae Ruptures

- **Part A -** sequence of images representing CTR.
- **Part B -** represents major features of CR (Cardiac Ruptures)
- **Part C -** showing Pre and post PCI CR
- **Part D -** Other types of clips of Myocardial Ruptures

**Video 3 -** Frame Rate Controle and BEST Test.[11]