

# Cardiogenic Shock Resulting From MitraClip Embolization: A Retrieval and Retrospective Review

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## INTRODUCTION

- MitraClip implantation is a viable treatment option for severe mitral regurgitation with low procedural complication rates.
- We discuss a case of clip embolization and subsequent management; current literature regarding other documented cases is also reviewed.
- Documented MitraClip embolization noted upon literature review has significant heterogeneity, with outcomes ranging from incidental discovery to acute clinical decompensation/expiration..
- MitraClip embolization is poorly understood due to event rarity.

## CASE DESCRIPTION

### History

- A 52-year-old male with medical history of hypertension, type 2 diabetes, ischemic cardiomyopathy with ejection fraction of 40%, severe mitral regurgitation with MitraClip implantation, atrial fibrillation on Eliquis, coronary artery disease with chronic total occlusion (CTO) of the left anterior descending artery (LAD), diabetes, and gout presenting with acute dyspnea 12 hours post hospital discharge after successful staged CTO revascularization of his LAD.
- He had additionally undergone successful edge-to-edge MitraClip repair 6 weeks prior with implantation of two XTW MitraClips for P2 flail leaflet.
- Single leaflet detachment of the anterior MitraClip was seen on angiography 5 weeks after implantation and again at time of PCI (6 weeks) (Fig. 3A-B).

### Initial Evaluation

- Vitals: tachycardic to the 90s, tachypnea with a rate of 30 breaths/minute, SpO2 94% on room air, hypotensive (82/42 mmHg) shortly after presentation.
- Laboratory results were significant for leukocytosis (18.6 k/mm<sup>3</sup>, lactic acid 11.4 mmol/L, Tnl 0.18 ng/mL, beta-natriuretic peptide 1510 pg/mL, blood urea nitrogen 26 mg/dL, creatinine 2.1 mg/dL (baseline 1.1 mg/dL), potassium 5.8 mmol/L, bicarbonate 10 mmol/L, and anion gap 22.
- EKG noted new onset right bundle branch block and left posterior fascicular block pattern in contrast to baseline EKG earlier that week (Fig. 1).

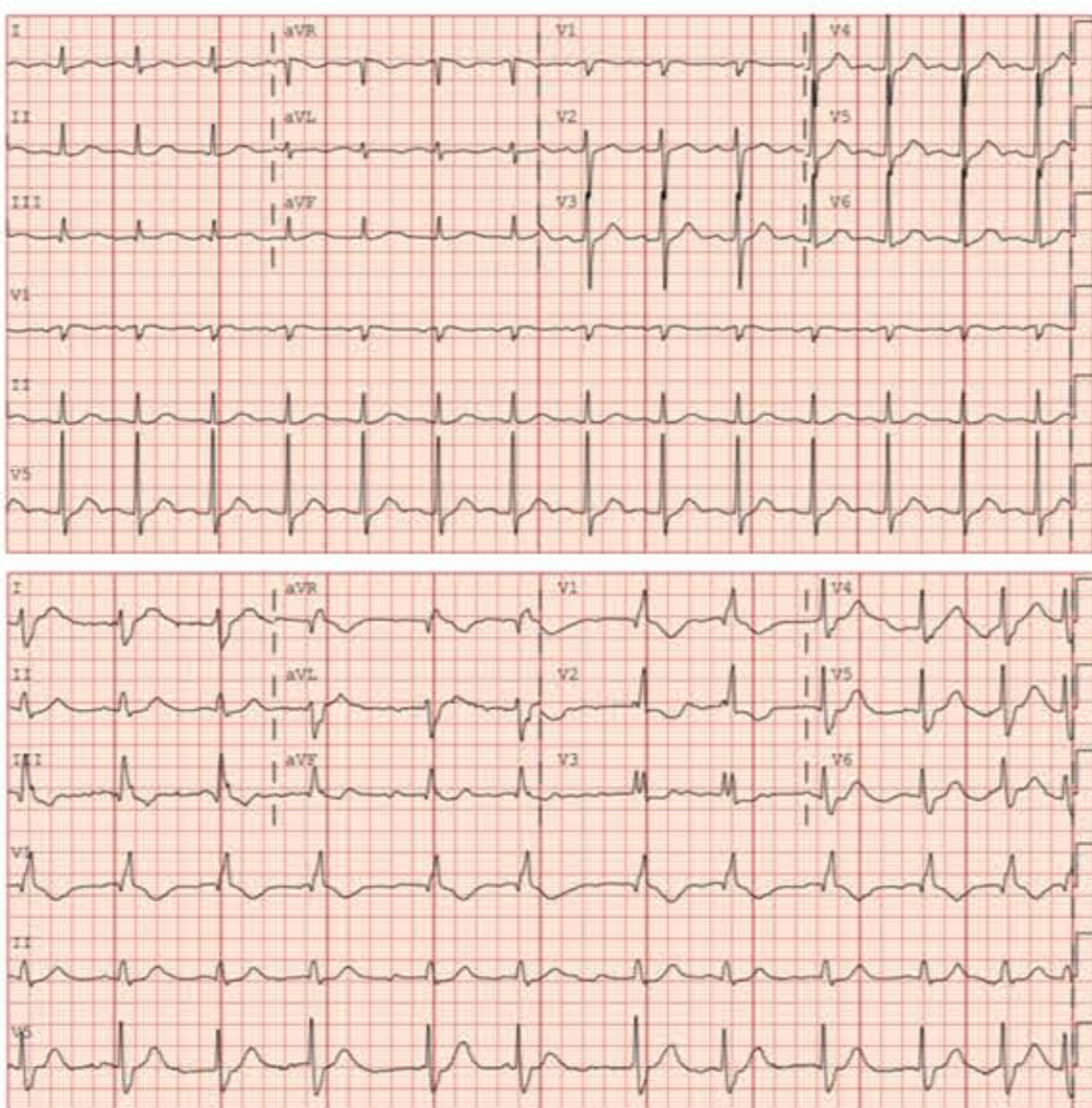
### Imaging

- ED chest X-ray was significant for MitraClip positioning over the right sternoclavicular joint, with Computerized Tomography showing the MitraClip within the right subclavian artery (Fig. 2C-D).

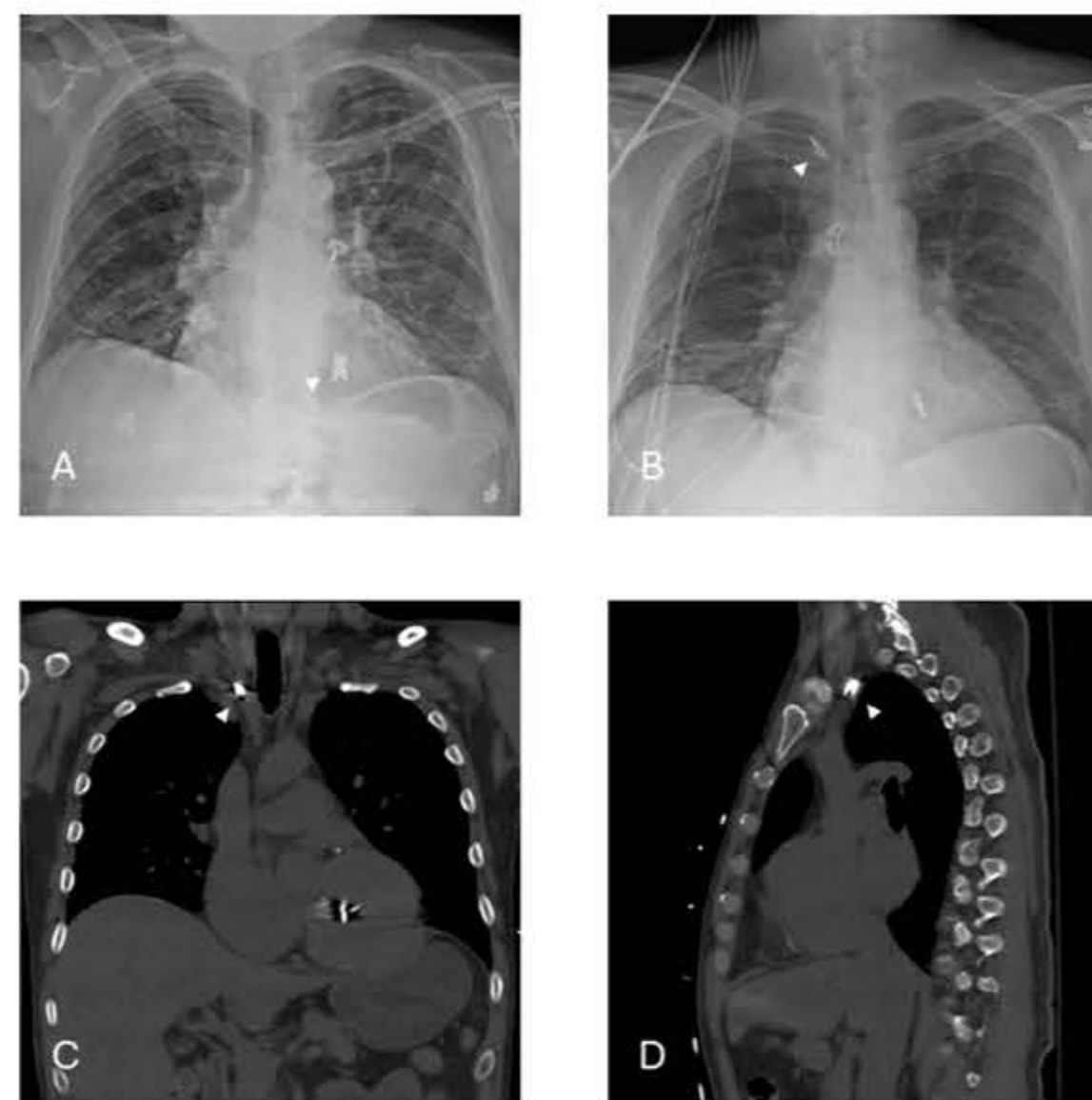
### Catheterization

- A 6 Fr sheath was placed into the left common femoral artery (CFA) and an 8 Fr sheath was placed into the right CFA. A 14 Fr sheath was then advanced over a stiff wire up the left CFA to the aorta.
- A 7 Fr multipurpose guide catheter was advanced to the right innominate artery. A 9-15 mm trilobar snare (EN Snare, Merit Medical) was utilized through the guide catheter, which lodged between the frictional element on the MitraClip (Fig. 3C), after which the catheter was advanced to complete the process of snaring the MitraClip. This was then pulled to the 14 Fr sheath in the left CFA (Fig. 3D).
- Through the 8 Fr sheath in the right CFA, a 7 Fr IMA guide catheter (Medtronic) was advanced, and a second snare (Amplatz 4 Fr 10mm Gooseneck) was used to capture the “nose” of the MitraClip device (Fig 4A), which was brought down the right CFA.
- A cutdown incision was made over the 8 Fr system and carried deep through the subcutaneous tissue. The 8 Fr sheath was withdrawn from the vessel and the arteriotomy puncture site was elongated longitudinally, proximally, and distally.
- The MitraClip was identified in the vessel and extracted. The snare was then cut and withdrawn through the contralateral leg. An acellular xenograft ellipsoid patch was then sewn as a patch angioplasty over the arteriotomy site with running 6-0 Prolene suture. The anastomosis was deaired and the suture line was completed.
- Angiography with runoff in the common iliac artery from the contralateral vessel showed no obstruction or injury to the iliac and femoral system (Fig. 3D).
- An Impella CP was placed via the 14 Fr sheath with 3.3 L/min of flow measured at P8. The patient was then transferred to the intensive care unit for further care.

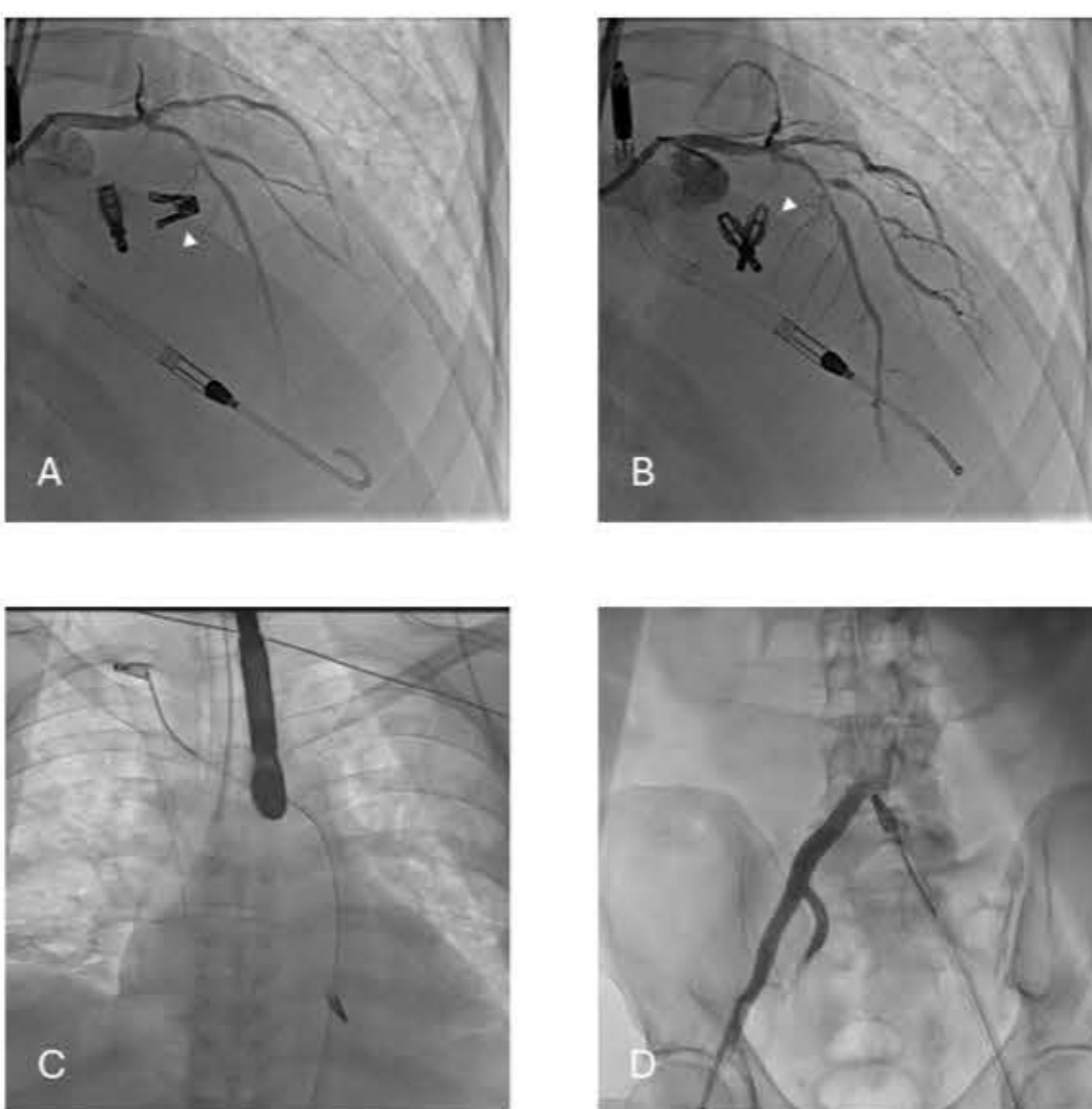
## FIGURES



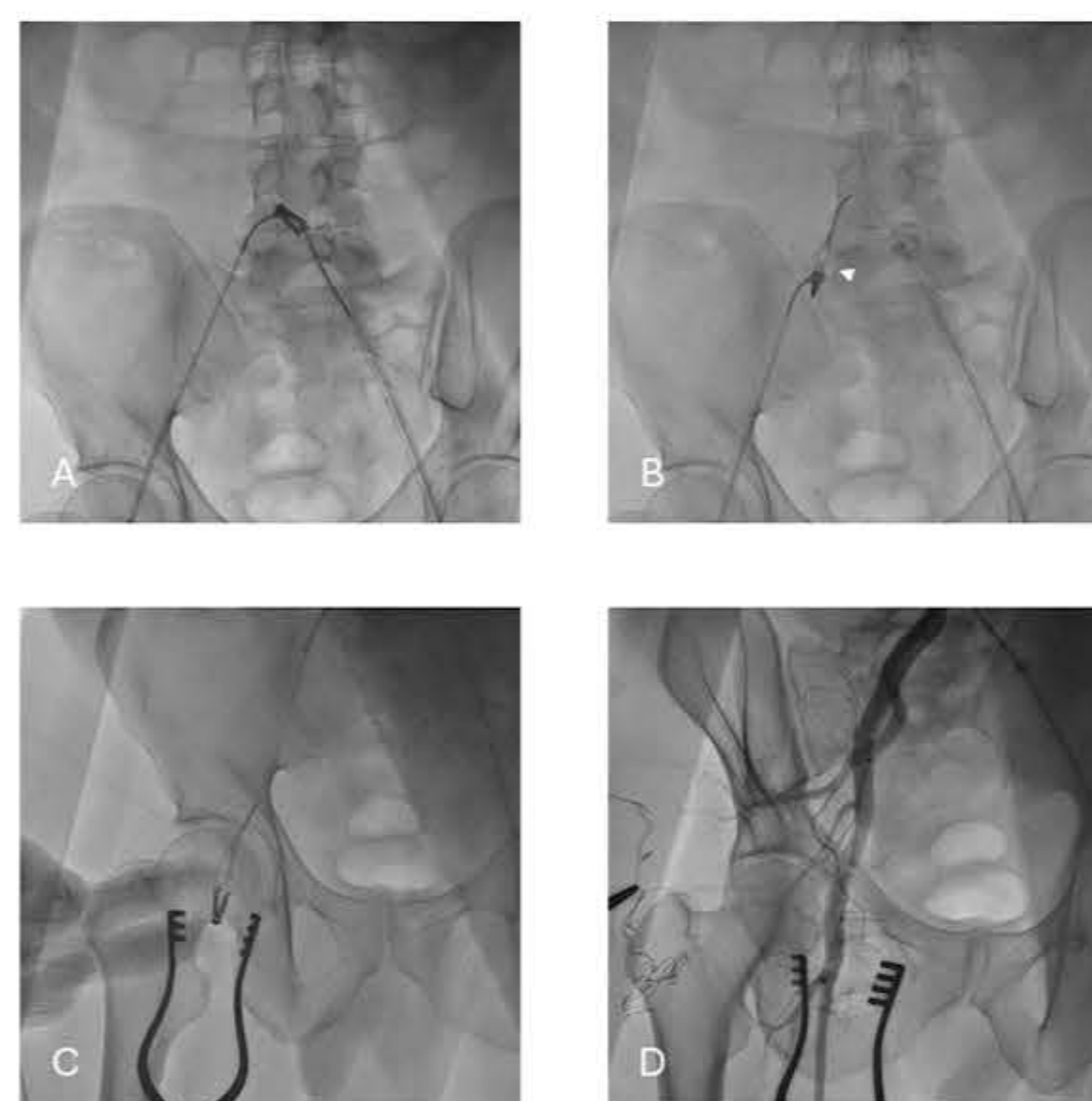
**Figure 1:**  
Top. Baseline EKG approximately one week prior to presentation.  
Bottom. EKG upon presentation to the emergency department. New onset right bundle branch and left anterior posterior fascicular block pattern is seen.



**Figure 2:**  
A. Chest X-ray day of discharge with MitraClips in proper position.  
B. ED chest X-ray. MitraClip is positioned anomalously over right sternoclavicular joint (arrow).  
C. Coronal CT view of MitraClip in right subclavian artery (arrow).  
D. Sagittal CT view of MitraClip in right subclavian artery (arrow).



**Figure 3:**  
A. Flail motion of anterior clip (arrow) seen on percutaneous coronary intervention (PCI) 2 days prior.  
B. Flail motion of anterior clip (arrow) on prior PCI 2 days prior.  
C. Initial snaring of MitraClip in right subclavian artery.  
D. MitraClip positioned in right common iliac artery prior to second snare use.



**Figure 4:**  
A. Second snare is seen gripping the “nose” of the embolized MitraClip.  
B. Portions of the trilobar snare are seen caught within the MitraClip’s frictional element (arrow).  
C. MitraClip position prior to femoral arteriotomy extraction.  
D. Angiography after successful patch angioplasty showing no vessel damage.

Patient Demographics	
Documented age	94.1% (16/17)
Average Age (StDev)	71.6 (16.4)
Male gender	55.6% (10/18)
Documented cardiac comorbidities	70.6% (12/17)
Noncardiac comorbidities documented	29.4% (5/17)

Time after implantation <sup>a</sup>	
Intraprocedural	7.1% (1/14)
During index hospitalization	42.9% (6/14)
Within 4 weeks	71.4% (10/14)

Inpatient presentation	
Asymptomatic	60% (3/5)
Cardiogenic shock	20% (1/5)
Life-threatening arrhythmia <sup>†</sup>	20% (1/5)
Laboratory abnormalities	20% (1/5)

Outpatient presentation	
Symptomatic	87.5% (7/8)
Cardiogenic shock	37.5% (3/8)
STEMI	25% (2/8)
Life-threatening arrhythmia <sup>†</sup>	25% (2/8)

**Table 1.**  
Patient demographics, time after implantation, and relevant presentation characteristics.  
<sup>a</sup>Patients with remaining lock line attachment were excluded.  
<sup>†</sup>Defined as severe bradycardia or ventricular arrhythmia.

Management approaches		n=14
Percutaneous		6 (42.9%)
Surgical		6 (42.9%)
Mitral valve replacement rate		33% (3/8)
Conservative		2 (14.3%)

**Table 3.**  
Relative management rates for true embolization events and associated outcomes.  
<sup>a</sup>Early and late embolization events are defined as less than four weeks and greater than four weeks respectively.

Embolization Sites		Number
Left Ventricle		4
Aortic sinus		4
Right coronary sinus		2
Noncoronary sinus		2
Right subclavian artery		1
Right axillary artery		1
Left common femoral vein		1
External iliac vein (unspecified laterality)		1
Renal artery (unspecified laterality)		1
Right renal vein		1

Proximal embolization	57.1% (8/14)
Distal embolization	42.9% (6/14)
Proximal embolization <sup>a</sup> intervention rate	100%
Distal embolization intervention rate	50%
Antegrade embolization	78.6% (11/14)
Retrograde embolization	21.4% (3/14)
Antegrade conservative management rate	9.1% (1/11)
Retrograde embolization conservative management rate	33% (1/3)

**Table 2.**  
Documented embolization sites, and further classification based on relevant events.  
<sup>a</sup>Proximal embolization is defined as occurring within the bounds of the aortic sinus and the right atria.

Outcomes		
Mortality rate		21.4% (3/14)
Inpatient mortality rate		67% (2/3)
Early embolization mortality rate <sup>a</sup>		0% (0/10)
Late embolization mortality rate <sup>a</sup>		75% (3/4)
Percutaneous mortality rate		33% (2/6)
Surgical mortality rate		0% (0)
Conservative mortality rate		50% (1/2)
Follow-up after hospitalization		27.3% (3/11)

## DISCUSSION

- Chest X-ray morning of discharge showed both MitraClips in normal position (Fig. 2A)
- The clip was also dislodged by Impella placement 2 days prior during CTO PCI, as evidenced by worsening of flail motion.
- MitraClip single leaflet detachment (SLD) prevalence is currently estimated as ~1.7<sup>1</sup>. SLD is hypothesized to increase embolization risk but has not been formally studied.
- 14 true examples of MitraClip embolization (as defined by lock line detachment) were found.
- ~43% occurred during the associated hospital stay, with ~71% occurring within four weeks. The majority (87.5%) of cases presenting after discharge were symptomatic (*Table 1*).
- MitraClip embolization may cause intravascular hemolysis detectable on labs; one patient was noted to have anemia, thrombocytopenia, and elevated bilirubin with identification of clip embolization as the underlying etiology.
- Most cases (~57%) involved proximal embolization, as defined by the bounds of the aortic sinus and the right atria (*Table 2*). Retrograde embolization occurred in ~21% of the cases<sup>10,13,14</sup>. In the absence of arteriovenous fistulas, embolization within the venous system is hypothesized to occur from retrograde travel through the iatrogenic septal defect present from device implantation.
- 31% (4/13) of the cases presented with cardiogenic shock and life-threatening arrhythmia.
- Mitra Clip embolization can result in life-threatening acuity secondary to acutely worsening MR, coronary ischemia secondary to ostial occlusion, and direct mechanical stimulation resulting in ventricular arrhythmia.
- The invasive intervention (surgical and/or percutaneous) rate was ~86% (*Table 3*).
- True embolization cases were associated with a mortality rate of ~21.4% (*Table 3*).
- Reported comorbidities and follow-up were limited, with only ~27% of eligible cases documenting outcome after hospital discharge. Only three cases had follow-up spanning 12 months, with the greatest duration being 39 months<sup>4,5,9</sup>.
- Review of available patient registries notes embolization rates of MitraClip devices varies from 0.1-0.8%<sup>15,16</sup>. The STS/ACC TVT Registry's prevalence of 0.1% is most accurate due to the greater sample size (n=12,334)<sup>16</sup>.
- A predefined team likely comprised of interventionalists, cardiothoracic surgeons, intensivists, and other relevant specialties (electrophysiology, advanced heart failure, and interventional radiology) is needed for prompt evaluation and management.

## CONCLUSION

- MitraClip embolization is rare with presentations ranging from incidental discovery on follow-up to acute clinical deterioration and expiration.
- Observed treatment modalities include percutaneous retrieval, surgical repair, and conservative management.
- Embolization proximal to the aortic sinuses was associated with a greater intervention rate (100% vs 50%), and late embolization (greater than four weeks post-procedure) was associated with significantly increased mortality. In observed cases, patients with distal embolization sites generally had favorable prognoses.
- There are no consensus recommendations regarding optimal management of MitraClip embolization due to event rarity (approx. 0.1%)
- Considering the potential acuity, high morbidity, and a wide array of potential embolization sites, acute multidisciplinary evaluation is critical for cases of MitraClip embolization.
- Future research on available treatment modalities is needed to optimize patient outcomes.

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