



Cardiovascular

SURGICAL MANAGEMENT OF LEFT VENTRICULAR ANEURYSM AS A COMPLICATION OF ACUTE MYOCARDIAL INFARCTION - A SINGLE SURGEON EXPERIENCE

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ABSTRACT

Left ventricular aneurysm is a localized area of the myocardium, with abnormal outward bulging and deformation during systole and diastole, which may be an akinetic, dyskinetic hypokinetic segment. It is due to the weakening of the muscle wall. The aim of this study is the assessment of the Left Ventricular aneurysm, its clinical presentation, Repair technique, and surgical outcome of patients presented with Acute Myocardial infarction with Ventricular wall complications. A retrospective study of the case scenarios that have undergone LV aneurysm repair in a tertiary care hospital facility over four years (2015-2019) after being diagnosed with Acute and evolved Myocardial infarction, which has been rehabilitated by medical management and then referred from cardiology. The Cases with aneurysm were diagnosed by 2d- echocardiography, examined for window period, taken up for surgery, which is re-vascularisation and surgical ventricular remodeling. Of the 6 cases operated, the results were as follows. The mean age of presentation is early for patients with co-morbidities like diabetes and hypertension. Female preponderance is seen. Habitual alcohol consumption causes an early presentation of symptoms. Severe LV dysfunction due to occlusion of the Left coronary artery causes this aneurysm. The most frequent site of aneurysm is the anterior wall with an apex. Apex or Distal anterior wall involvement is repaired by Dor or Linear repair. A septal aneurysm is repaired by septal exclusion by linear Dacron. To conclude, acute MI due to Single or Triple vessel disease can lead to LV aneurysm, which can be Akinetic or Dyskinetic segment. LV Aneurysm as a complication can have a varied presentation, including an Anterior wall, Apex, Apex, and variable extent of the septum and posterior wall, with varied ventricular function with organic valvular MR or Functional MR. Patients with Hypertension and Habitual alcohol consumption have an early age of presentation.

KEYWORDS : Left ventricular aneurysm, Acute Myocardial Infarction, Surgical ventricular reconstruction.

INTRODUCTION

One of the most frequent complications occurring post-myocardial infarction is a ventricular aneurysm. It is an outpouching of the weakened muscle wall following a full-thickness infarct. The muscle is replaced by fibrous tissue. This part of the muscle can no longer contribute to the heart's normal contractility, causing abnormal (paradoxical) movement during the systole and diastole. One complete occlusion of the Left anterior descending artery and delay in revascularization of the infarcted segment is responsible for aneurysm formation.² True aneurysm is formed by full-thickness bulging of the ventricular wall, but a false aneurysm is formed by the pericardium sealing the ruptured ventricle.³ Various other causes of aneurysm can also be found, which are mentioned below.⁴

1. Ischemic: Almost 90% of the ventricular aneurysms occur in the setting of acute anterior wall myocardial infarction.
2. Traumatic: They occur due to either accidental or surgical wounds.
3. Infective: Common causes include infective endocarditis, rheumatic fever, syphilis, tuberculosis, septic emboli, polyarteritis nodosa, etc.
4. Idiopathic: A ventricular aneurysm of idiopathic etiology usually occurs in Africans and less commonly in the American and fair-skinned population. It is an unusual aneurysm often arising close to the mitral ring in the form of an annular subvalvular aneurysm. It stretches the mitral ring and interferes with the function of the papillary muscle, chordae tendinae, and cusps of the mitral valve.
5. Other causes: systemic hypertension, steroids, and NSAIDs use may predispose to aneurysm formation. Other causes include Chagas disease, sarcoidosis, etc.⁵

Two principal mechanisms are involved in ventricular remodeling, early expansion phase and late remodeling phase.⁷ Early Expansion Phase is characterized by a true left ventricular aneurysm following acute myocardial infarction occurring as fast as within 48 hours or two weeks post-infarction. The late Remodeling Phase is characterized by remodeling of the myocardium beginning with the appearance of highly vascularized granulation tissue about 2 to 4 weeks post-infarction.

It is replaced by fibrous tissue 6 to 8 weeks post-infarction. As myocardium becomes replaced by fibrous tissue, it greatly decreases the ventricular wall thickness due to the loss of myocytes.⁵ Complications like Arrhythmias, heart failure, Ischemia, thromboembolism, ventricular rupture, and cardiac tamponade may occur after left ventricular aneurysm formation.⁶

AIMS & OBJECTIVES

Assessment of Left Ventricular aneurysm, its clinical presentation, Repair technique, and surgical outcome of patients presented with Acute Myocardial infarction with Ventricular wall complications.

METHODS

A retrospective study of the case scenarios that have undergone LV aneurysm repair in a tertiary care hospital facility over four years (2015-2019) after being diagnosed with Acute and evolved Myocardial infarction, which has been rehabilitated by medical management and then referred from cardiology. The Cases with aneurysm were diagnosed by 2d- echocardiography, examined for window period, taken up for surgery, which is re-vascularisation and surgical ventricular remodeling.

RESULTS

Six cases were operated on, and the results were as follows. The mean age of presentation is 55.66years. Female preponderance is seen, i.e., 66.66%. The mean symptomatic period is 5.44 months, with the earliest presentation in 20 days and the latest in 12 months. The patients with diabetes are about 66.66%. The patients with hypertension are about 66.66%. 50% of patients had both diabetes and hypertension. One patient (16.66%) had only diabetes, with the age of presentation being 56 years, and one patient (16.66%) had only hypertension with the age of presentation 45yrs. Habitual alcohol consumption is seen in 33.33% of the patients, in whom the mean age of presentation is 43.5yrs. History of old MI is seen in 50%, and Acute MI is seen in 50% of the study group. Severe LV dysfunction is seen in 50% of the population.

LAD is totally occluded in 50% of the population, 80% occluded in 33.33% population, 70% occluded in 16.66% of the study group. RCA is totally occluded in 16.66%, 80% occluded in 16.66%, 50% occluded in 16.66%, but normal in 50% of study group. LV clot is seen in 33.33%, and severe MR is seen in 16.66% of the study group.

Site of aneurysm was posterior septum in one patient, Anterior septum with the posterior septum and anterior wall in one, Anterior wall with the apex in 2 patients, Anterior wall with VSD in one patient, anterior wall with Severe MR in one patient. The repair technique is selected as per the operative findings. Apex or Distal anterior wall involvement is repaired by Dor or Linear repair. A septal aneurysm is repaired by septal exclusion by linear Dacron.

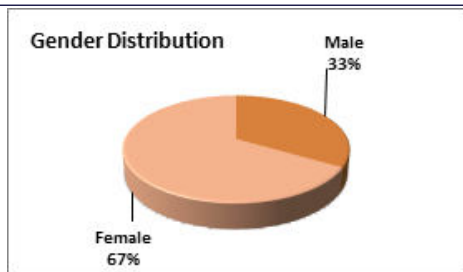


Figure1 Gender Distribution Of Cases

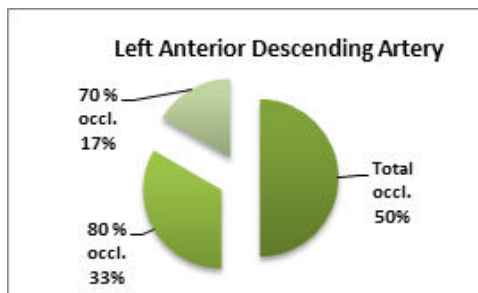


Figure 2: Percentage Of Individuals Affected With Occlusion Of The Left Anterior Descending Artery.

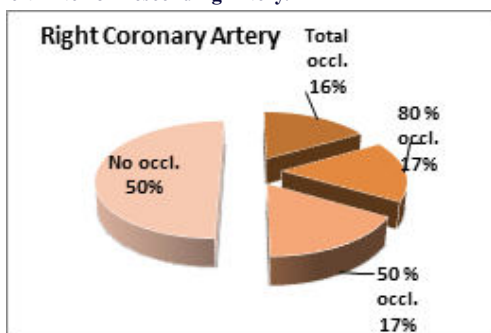


Figure 3: Percentage Of Individuals Affected With Occlusion Of Right Coronary Artery

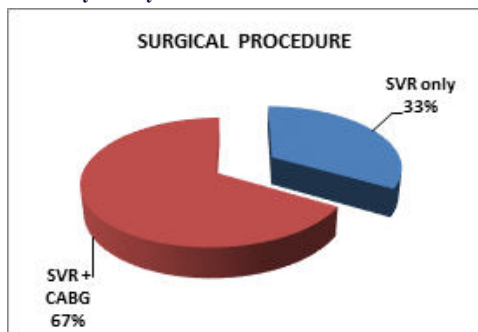


Figure 4: Percentage Of Individuals Subjected To Surgical Ventricular Reconstruction (SVR) And Coronary Artery Bypass Graft (CABG)

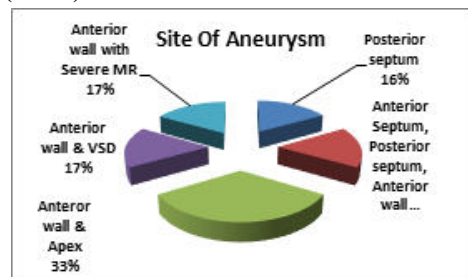


Figure 5: Distribution Of Site Of The Aneurysm

Table 1: Results Of The Study

| | |
|--------------------------|-----------|
| Complaint of SOB | 100% |
| Mean Age Of Presentation | 55.66 yrs |

| | |
|--|-------------------------|
| Mean Symptomatic Period | 5.44 Months E:20d L:12m |
| Age of presentation in Diabetics | 56 yrs |
| Age of presentation in Hypertensive patients | 45yrs |
| Age of presentation in Alcoholics | 43.5yrs |

Table 2: Patients With Co-morbidities

| | |
|--|--------|
| Patients with Diabetes | 66.66% |
| Patients with Hypertension | 66.66% |
| Patients with both Diabetes and Hypertension | 50% |
| Habitual alcohol consumption | 33.33% |
| Severe LV dysfunction | 50% |

DISCUSSION

Diabetes and LV aneurysm

In this study, diabetic individuals have a late age of presentation than the mean age of presentation.

The outcomes of this study are comparable with those conducted elsewhere.

The reduction in Ejection fraction and wall motion abnormality is more in non-diabetics when compared to people with diabetes in the study by Dini FL et al.⁸

Left ventricular aneurysm formation is a life-threatening complication of myocardial infarction, which is seen in diabetic individuals. It is also associated with increased global and segmental dysfunction as per the study by Dini FL et al.⁸

Arterial occlusion and LV aneurysm

Patients with occlusion in the left anterior descending artery are at increased risk of aneurysm formation in the present study.

This is in similar accord with the studies conducted by Shen WF et al., Forman MB et al., Runar Lundbal et al., Dubreuil D et al.

Surgical procedure performed

Surgical ventricular reconstruction is the surgery of choice for Left ventricular aneurysm. It is usually performed with Coronary artery bypass graft (CABG), as there is associated occlusion of the coronary artery.

The outcomes of surgical ventricular reconstruction and CABG, in terms of improvement in Newyork Heart Association (NYHA) functional class, reduced end-diastolic volume (EDV), and improvement in Ejection fraction.

This result is harmonious with the studies conducted elsewhere, like Marchenko A et al.; Michler RE et al.

CONCLUSION

1. Ventricular Remodelling occurs after Acute MI due to single or triple vessel disease, which leads to LV aneurysm formation, characterized by akinetic or dyskinetic or hypo-kinetic segment.
2. The natural course of a disease leads to thinning of the myocardium and subsequent Dilated Cardiomyopathy, leading to progressive Ventricular failure.
3. The last resort for such patients is Cardiac Transplantation, which is preventable if timely intervened by Surgical ventricular reconstruction.
4. Acute extensively evolved Myocardial infarction, with ventricular septal rupture, chordal rupture with severe mitral regurgitation, massive progressive infarction, carry a poor prognosis, as the mortality is very high.
5. These patients are surgical candidates with high risk and mortality and should be operated on as an emergency.
6. Acutely symptomatic patients are treated by medical management, which acts as the bridge between MI and Surgical Ventricular Reconstruction.
7. After optimal resuscitation, the patient is taken up for surgical ventricular reconstruction (SVR) with re-vascularisation.
8. SVR can lead to normal or increased ventricular function.

REFERENCES

1. Kutty RS, Jones N, Moorjani N. Mechanical complications of acute myocardial infarction. *Cardiol Clin.* 2013 Nov;31(4):519-31, vii-viii.
2. Albuquerque KS, Indiani JMC, Martin MF, Cunha BMER, Nacif MS. Asymptomatic apical aneurysm of the left ventricle with intracavitary thrombus: a diagnosis missed by echocardiography. *Radiol Bras.* 2018 Jul-Aug;51(4):275-276.

3. Oyedeji AT, Lee C, Owojori OO, Ajegbomogun OJ, Akintunde AA. Successful medical management of a left ventricular thrombus and aneurysm following failed thrombolysis in myocardial infarction. *Clin Med Insights Cardiol.* 2013;7:35-41.
4. Sharma A, Kumar S. Overview of left ventricular outpouchings on cardiac magnetic resonance imaging. *Cardiovasc Diagn Ther.* 2015 Dec;5(6):464-70.
5. Ruzza A, Czer LSC, Arabia F, Vespignani R, Esmailian F, Cheng W, De Robertis MA, Trento A. Left Ventricular Reconstruction for Postinfarction Left Ventricular Aneurysm: Review of Surgical Techniques. *Tex Heart Inst J.* 2017 Oct;44(5):326-335.
6. Sui Y, Teng S, Qian J, Zhao Z, Zhang Q, Wu Y. Treatment outcomes and therapeutic evaluations of patients with left ventricular aneurysm. *J Int Med Res.* 2019 Jan;47(1):244-251.
7. Cacciapuoti F, Tirelli P, Cacciapuoti F. Left Ventricular Postinfarction Pseudoaneurysm: Diagnostic Advantages of Three-Dimensional Echocardiography. *J Cardiovasc Echogr.* 2017 Apr-Jun;27(2):74-76.
8. Dini FL, Volterrani C, Azzarelli A, Lanciani A, Lunardi M, Bernardi D, Micheli G. Left ventricular size and function in patients with noninsulin-dependent diabetes and postinfarction total or subtotal coronary occlusions. *Angiology.* 1998 Dec;49(12):967-73. doi: 10.1177/000331979804901202. PMID: 9855371.
9. Shen WF, Tribouilloy C, Mirode A, Dufossé H, Lesbre JP. Left ventricular aneurysm and prognosis in patients with first acute transmural anterior myocardial infarction and isolated left anterior descending artery disease. *Eur Heart J.* 1992 Jan;13(1):39-44. doi: 10.1093/oxfordjournals.eurheartj.a060045. PMID: 1577029.
10. Forman MB, Collins HW, Kopelman HA, Vaughn WK, Perry JM, Virmani R, Friesinger GC. Determinants of left ventricular aneurysm formation after anterior myocardial infarction: a clinical and angiographic study. *J Am Coll Cardiol.* 1986 Dec;8(6):1256-62. doi: 10.1016/s0735-1097(86)80294-7. PMID: 3782632.
11. Repair of Left Ventricular Aneurysm: Surgical Risk and Long-Term Survival , Runar Lundblad, MD, Michel Abdelnoor, PhD, and Jan L. Svennevig, MD ; *Ann Thorac Surg* 2003;76:719–25.
12. Dubreuil D, Gosselin G, Hébert Y, Perrault LP. Contained rupture of left ventricular false aneurysm after acute myocardial infarction secondary to left anterior descending artery embolism. *Can J Cardiol.* 2008 Dec;24(12):e94-5. doi: 10.1016/s0828-282x(08)70701-3. PMID: 19052682; PMCID: PMC2643244.
13. Marchenko A, Chernyavsky A, Efendiev V, Volokitina T, Karaskov A. Results of coronary artery bypass grafting alone and combined with surgical ventricular reconstruction for ischemic heart failure. *Interact Cardiovasc Thorac Surg.* 2011 Jul;13(1):46-51. doi: 10.1510/iccvs.2010.253716. Epub 2011 Mar 14. PMID: 21402600.
14. Michler RE, Rouleau JL, Al-Khalidi HR, Bonow RO, Pellikka PA, Pohost GM, Holly TA, Oh JK, Dagenais F, Milano C, Wrobel K, Pirk J, Ali IS, Jones RH, Velazquez EJ, Lee KL, Di Donato M; STICH Trial Investigators. Insights from the STICH trial: change in left ventricular size after coronary artery bypass grafting with and without surgical ventricular reconstruction. *J Thorac Cardiovasc Surg.* 2013 Nov;146(5):1139-1145.e6. doi: 10.1016/j.jtcvs.2012.09.007. Epub 2012 Oct 27. PMID: 23111018; PMCID: PMC3810307.