Volume 9, Issue 9, September – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

The Significance of Echocardiographic Evaluation in Atrial Fibrillation

Ramya.S[1],
[1]M.Sc. Echocardiography II Year, School of
Allied Health Sciences, Salem, Tamil Nadu.

Abstract:- The echocardiographic examination has emerged as an essential part in the evaluation of atrial fibrillation (AF) patients. When evaluating and treating patients with atrial fibrillation, transthoracic echocardiography continues to be important. TEE gives an excellent view of the atrium and amply illustrates or rules out thrombus. For the purpose of determining the dimensions and function of the left atrium and left ventricle, as well as the various conditions that may predispose to atrial fibrillation, such as cardiomyopathy, pericardial disease, and congenital heart defects, transthoracic echocardiography (TTE) must be used in conjunction with two-dimensional (2D) and Doppler studies in the initial evaluation of all patients with atrial fibrillation.

Keywords:- *Transesophageal Echocardiography, Transthoracic Echocardiography and Atrial Fibrillation.*

I. INTRODUCTION

The most prevalent cardiac arrhythmia in clinical practice is atrial fibrillation (AF), which has a 0.4% population survival rate on average. Atrial fibrillation is more common as people age, rising from 3.8% in those 60 and older to 9% in those 80 and older. The incidence of atrial fibrillation is predicted to drop below 1% among individuals under 65, and both its incidence and prevalence are rising, as the proportion of elderly people continues to rise in many societies. Women develop atrial fibrillation later in life than males do. Compared to Blacks, Whites are more affected. A lower quality of life and reduced physical activity are also experienced by those who have atrial fibrillation. Two factors that increase the risk of arrhythmia development are smoking and alcohol use. Atrial enlargement, obstruction of the nodal arteries, and damage to the coronary and central arteries are among the causes of atrial fibrillation. Atrial fibrillation in its early stages is characterized by rapid fibrillation waves. Echocardiography is one of many diagnostic procedures that is useful for assessing the anatomy and function of the heart as well as for determining the risk of atrial fibrillation. The aim of this study was to determine the echocardiographic features of patients with atrial fibrillation.

II. ATRIAL FIBRILLATION

Atrial fibrillation is a supraventricular tachyarrhythmia in which atrial activity is uncoordinated, causing mechanical and electrical function failure within the atria. The electrocardiogram is characterized by low-amplitude simple oscillations (known as fibrillatory or F waves) and irregular ventricular rhythms (300 to 600 beats per minute) that change in amplitude, shape, and time.

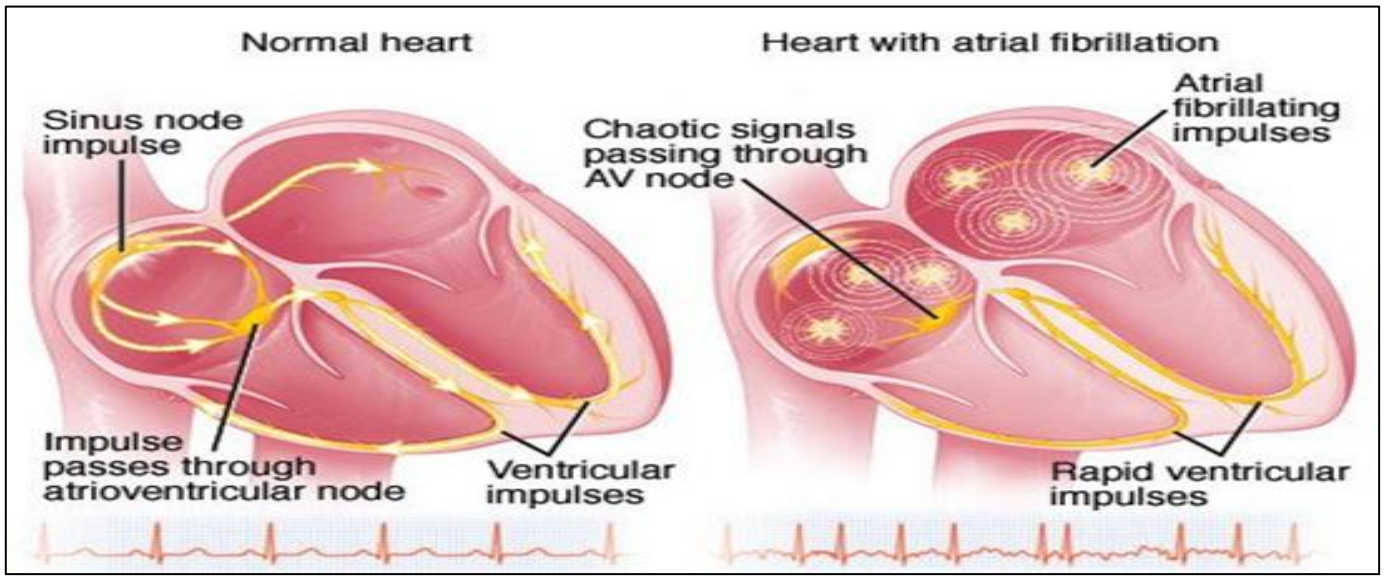

Fig 1: Cardiac Conduction Changes in Atrial Fibrillation

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

III. HISTORY

Atrial fibrillation has a long history, influencing the work of many of the best doctors and scientists of the 20th century. The first description of atrial fibrillation was found in the book "Huang ti Nei ching Su wen: Harmony and Health." Everyone knows the word "fibrillation" since William Harvey (1578-1657) determined fibrillation in animals. Jean Baptist de Senac (1693-1770) described the relationship between palpitations and mitral stenosis. In 1827, Robert Adams (1791-1799), the " Dublin master of clinical signs," suggested a relationship between irregular pulses and mitral stenosis. William Withering (1741-1799) noted that the leaves of digitalis, discovered in 1785, reduced the symptoms of heart disease and atrial fibrillation. Sir Thomas Lewis (1881-1945), the "father of modern electrocardiography," described the features of atrial fibrillation in 1906, as did William Einthoven (1860-1927), whose basic technique was electrical stimulation. Many of the treatments and therapies of the 20th century came from Karel Fredrick Wenkebach (1864-1940), Gordon Moe (1915-1989), Bernhord Lown, and Maurits Alllessie.

IV. MECHANISM OF ATRIAL FIBRILLATION

Atrial fibrillation has a very complex mechanism. The event that results might not be the same as the one that controls the mechanism. In addition, due to alterations and various clinical situations including heart failure, atrial strain and ischemia, sympathovagal impact, inflammation, and fibrosis, paroxysmal, persistent, and long-term clinical phenotypes have varied electrophysiological features.

The two mechanisms behind AF are as follows: One or more micro-re-entrant, triggered, or automated foci that fire rapidly, resulting in fibrillation

The wavelets that are regenerating via the atrial and maintaining the fibrillation are destroyed and renewed by several re-entry circuits.

Each mechanism can occur simultaneously and alternate with atrial remodelling. This technique reveals the rotor and focal parts. a mean of 2.1 sites were found in 97% of 101 patients, 70% of which were rotor and 30% focal. this is more common for long-term AF than for normal AF. This is why pulmonary vein isolation is particularly effective in eliminating paroxysmal atrial fibrillation. In persistent atrial fibrillation, changes within the atrial matrix, such as interstitial fibrosis leading to slow, discontinuous and isotropic conduction, can complicate fractionated atrial electrocardiography (CFAE) and re-entry. Thus, isolation of atrial fibrillation alone is usually not sufficient to rule out persistent atrial fibrillation.

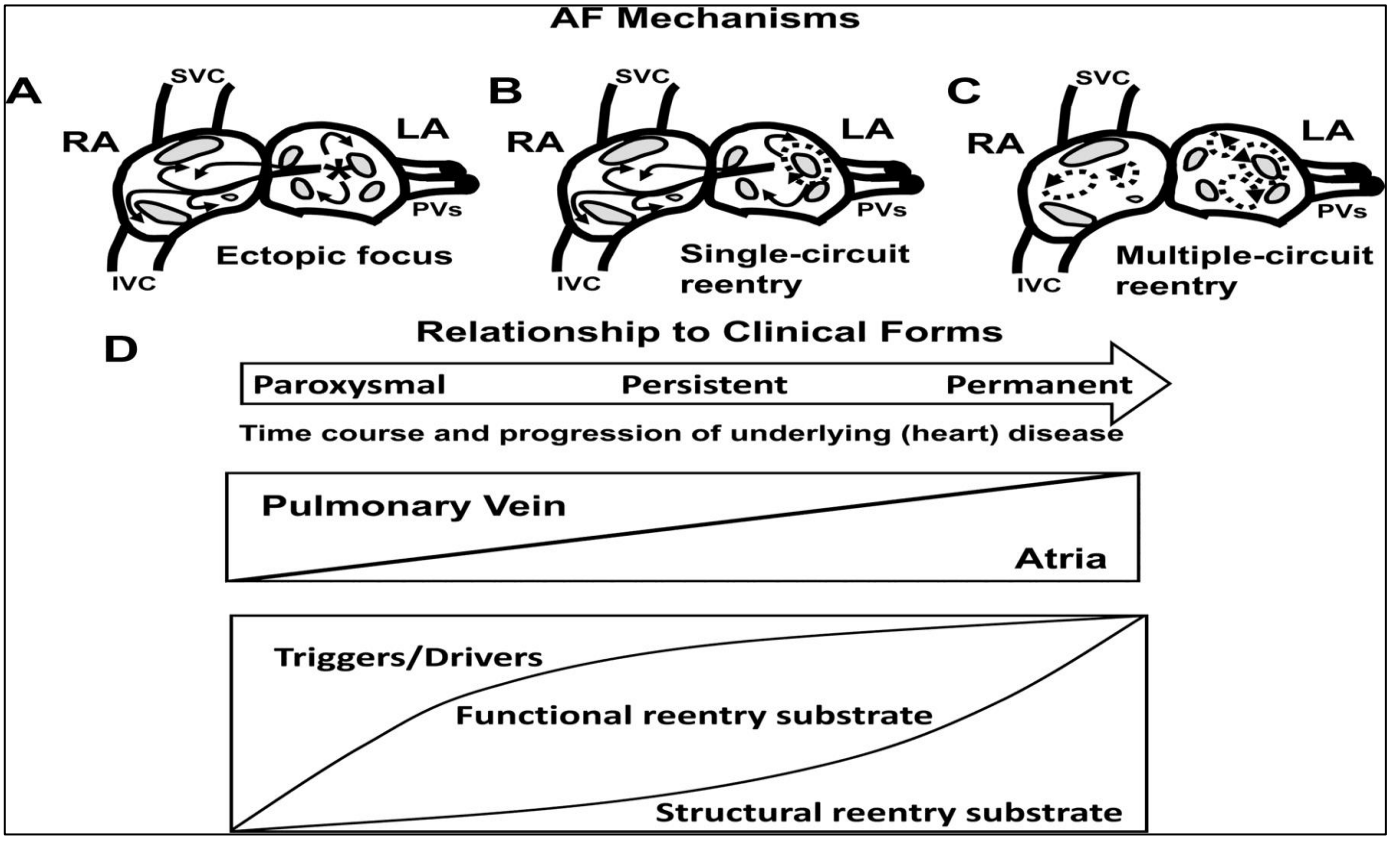

Fig 2: Types of Clinical and Pathological Changes in AF

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

V. CLASSIFICATION OF AF

Atrial fibrillation has been classified as a simple procedure, which was changed by the 2006 AF Complete Guideline Update.

According to the rate, Frequency, duration of atrial rhythm abnormalities. We have classified the AF types as 5 categories,

the following table has clinical importance, namely that we will predict the treatment results such as catheter ablation, which is better for paroxysmal AF than for persistent AF, even after treatment with sinus cardioversion, duration of treatment. The onset of AF is not clear, and in some patients paroxysmal and persistent AF may occur simultaneously.

Lone or undetermined AF - is AF that occurs in the following conditions: people below the age of 60, without heart disorder or high blood pressure.

Table 1: Types of Atrial Fibrillation

Term	Definition
Paroxysmal AF	• AF that terminates spontaneously or with intervention within 7 d of onset. • Episodes may recur with variable frequency.
Persistent AF	• Continuous AF that is sustained >7 d.
Long-standing persistent AF	• Continuous AF >12 mo in duration.
Permanent AF	• The term "permanent AF" is used when the patient and clinician make a joint decision to stop further attempts to restore and/or maintain sinus rhythm. • Acceptance of AF represents a therapeutic attitude on the part of the patient and clinician rather than an inherent pathophysiological attribute of AF. • Acceptance of AF may change as symptoms, efficacy of therapeutic interventions, and patient and clinician preferences evolve.
Nonvalvular AF	• AF in the absence of rheumatic mitral stenosis, a mechanical or bioprosthetic heart valve, or mitral valve repair.

VI. ETIOLOGY AND COMPLICATION OF ATRIAL FIBRILLATION

Atrial fibrillation can occur without disease, in which case it is called idiopathic atrial fibrillation. Isolated atrial fibrillation is a term used to describe atrial fibrillation in patients who have no heart disease and who have an echocardiogram. This term is often used for younger patients with AF, under the age of 60. Atrial fibrillation can be caused by atrial flutter or other atrial tachycardias. Cardiovascular diseases associated with atrial fibrillation include coronary artery disease, valvular disease, heart failure, and hypertension. Atrial fibrillation may occur after surgery. Alcohol and caffeine can cause atrial fibrillation. Family history is dangerous for AF.

The outcome of atrial fibrillation is called secondary atrial fibrillation. In some patients with atrial fibrillation, atrial fibrillation is unlikely to return after treatment for causes such as AMI, pericarditis, myocarditis, or pulmonary embolism. However, atrial fibrillation can also occur independently of other conditions such as hypothyroidism, even if the underlying disease has been treated.

Stroke or thromboembolic complications are common at first presentation. It can also cause left ventricular failure and ventricular rhythm abnormalities. Atrial fibrillation causes decompensation of ventricular function and increases the risk of atrial fibrillation in congestive heart failure.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

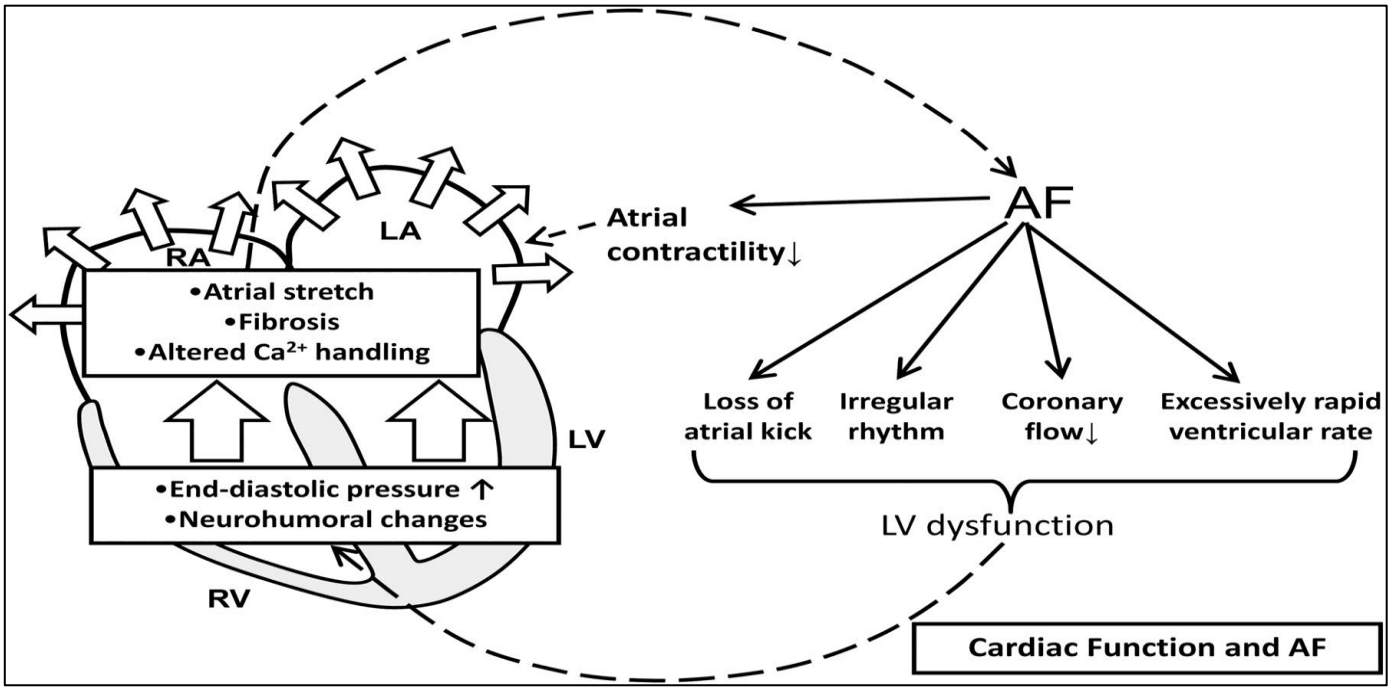

Fig 3: In the Course of AF Dynamic Interaction among Atrial and Ventricle Function.

The most vital problem of atrial fibrillation is thromboembolism associated with stroke. The formation of thromboembolism in adults is shown in the image under.

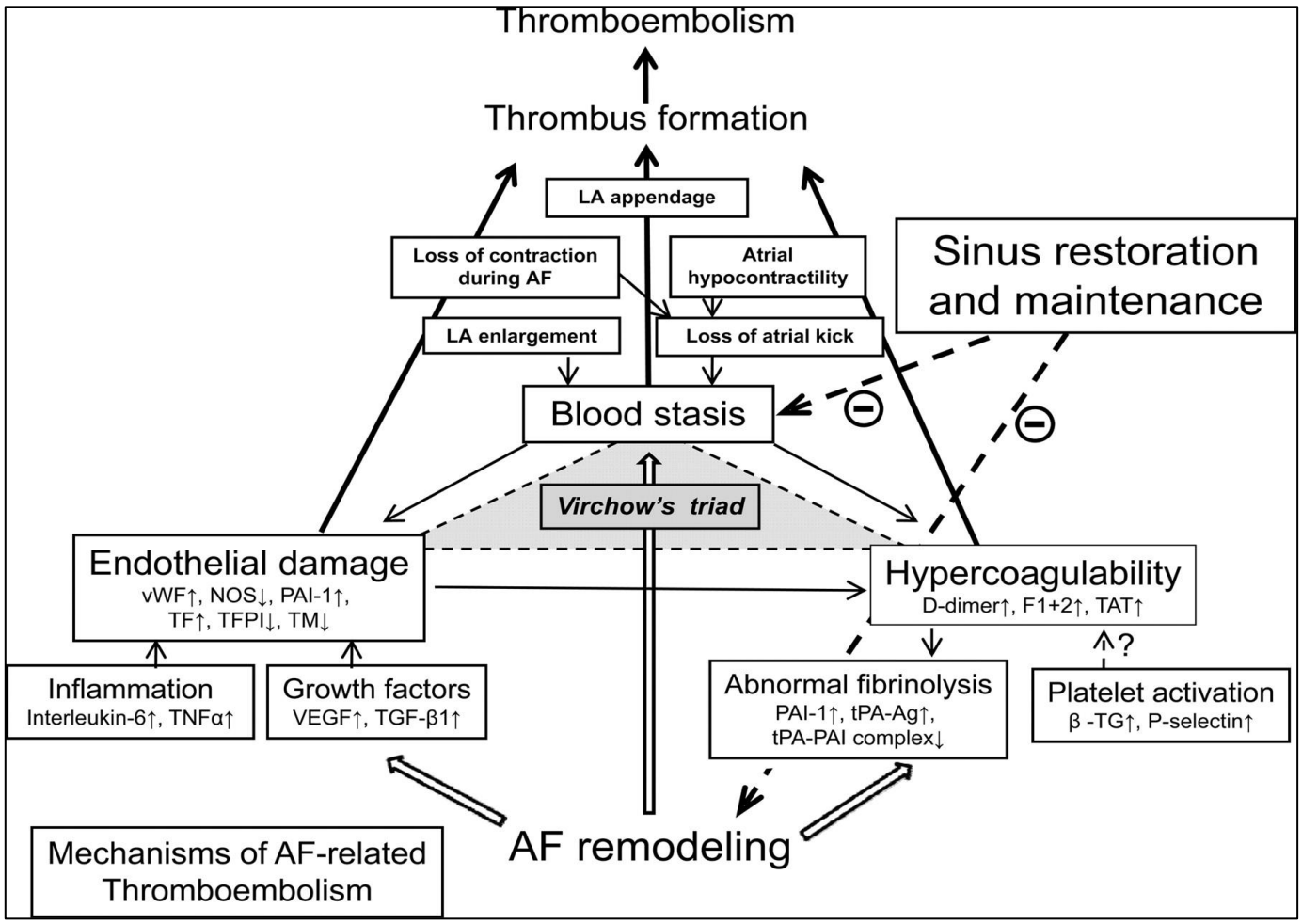

Fig 4: Mechanism of AF Related to Thromboembolism, vWF-von Willebrand factor NOS-Nitric Oxide Synthase; -β1; F1 + 2-Prothrombin Fragment 1+2; TAT-Thrombin/Antithrombin Complex; tPA-Ag-Tissue Plasminogen Activator-Antigen;

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

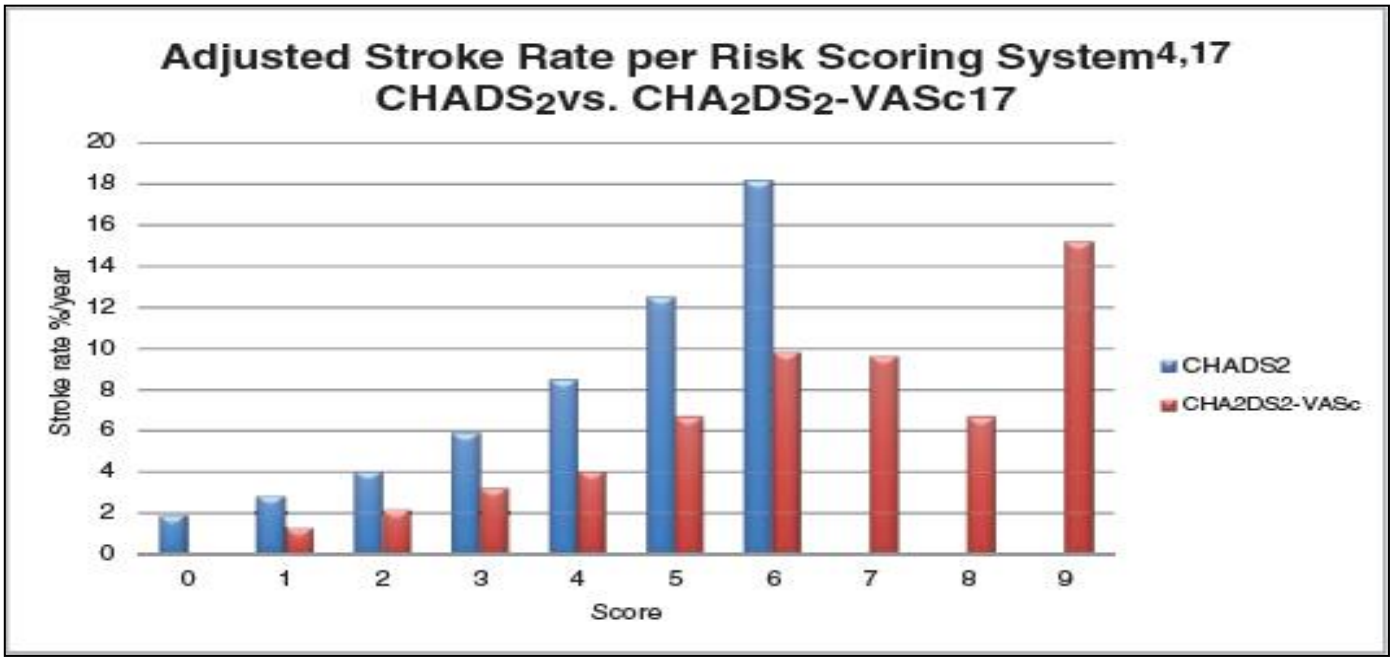

Fig 5: Annualized Risk of Stroke According to CHADS2 and CHA2DS2-VASc Scores (Percent Annualized Risk). (Lip GY: Based on the Effect of CHA2DS2-VASc and HAS-BLED Scores on Thromboprophylaxis in Atrial Fibrillation.

VII. BASIC DIAGNOSTIC TESTS FOR ATRIAL FIBRILLATION

A. Electrocardiogram (ECG):

➢ *ECG Plays a Crucial Role in Diagnosing and Confirming Atrial Fibrillation. The ECG Characteristics of Atrial Fibrillation Include:*

- Presence of abnormal and disorganized atrial activity, which manifests as fibrillatory waves referred to as F waves, accompanied by irregular R-R intervals.
- The regularity of the ventricular response is determined by the number of atrial impulses that reach the atrioventricular (AV) node, typically resulting in a narrow QRS complex unless there are underlying abnormalities, preexcitation, or bundle branch block.

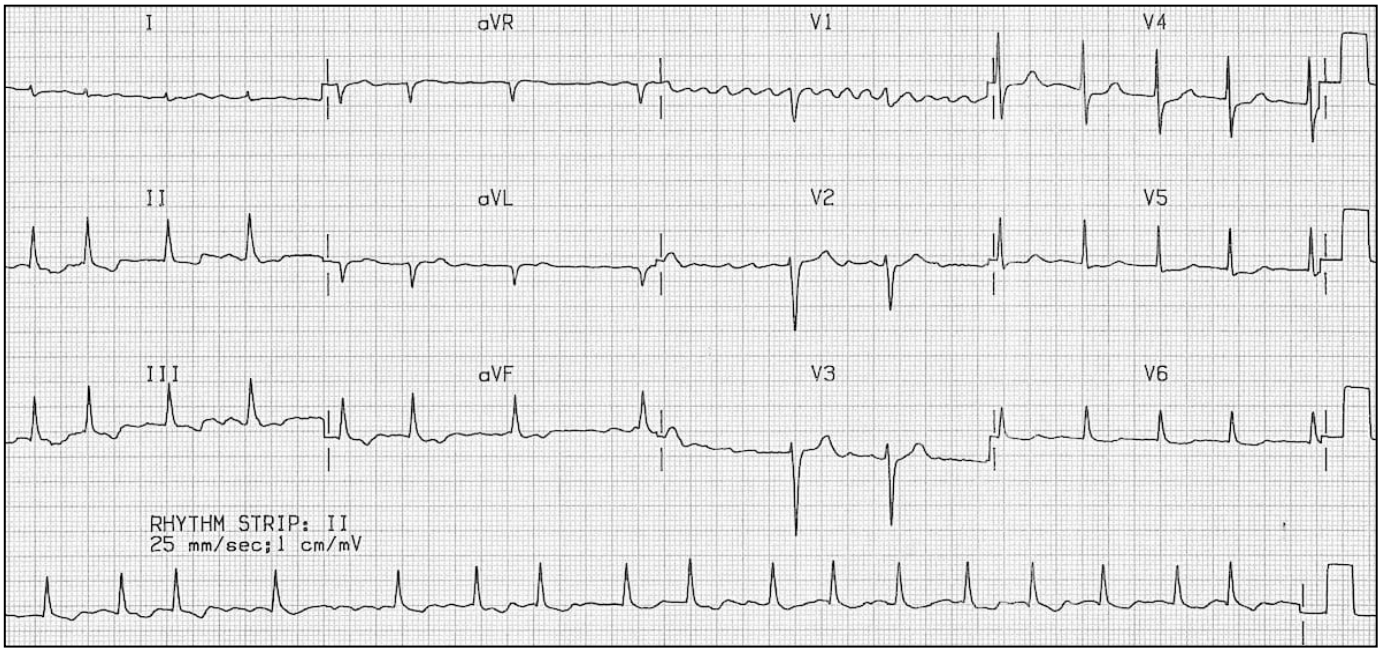

Fig 6: Electrocardiogram in Atrial Fibrillation

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

B. Chest X-Ray:

A chest X-ray is performed to identify suspected pulmonary pathology causing atrial fibrillation, to determine heart failure, and to check cardiac chamber size.

VIII. ECHOCARDIOGRAPHY EVALUATION

Echocardiography plays a significant role in managing and assessing the risk of patients with atrial fibrillation (AF). It is an integral part of treatment for those with AF, particularly in clarifying systemic thromboembolic mechanisms. Transthoracic echocardiography (TTE) is valuable for the initial evaluation of AF patients, providing insights into the underlying causes and enabling physicians to initiate and modify treatment plans. Numerous studies have demonstrated its effectiveness in guiding preventative measures in complex cases. The following parameters can be assessed using TTE:

- Valvular heart disease
- Left atrial (LA) and right atrial (RA) size
- Left ventricular (LV) and right ventricular (RV) size and characteristics
- Left ventricular hypertrophy
- Left atrial thrombosis (with high sensitivity)
- Pericardial disease.

LV systolic dysfunction in patients with atrial fibrillation independently predicts an increased risk of stroke. Regarding the development of atrial fibrillation, cardioversion is less effective when the left atrial (LA) size exceeds 4.5 cm^2, and an LA size greater than 4.0 cm^2 increases the risk of embolism. Framingham study demonstrated that a 5 mm increase in LA size is associated with a 39% increase in the risk of subsequent atrial fibrillation. Additionally, cardiac function and the risk of thromboembolism are elevated.

In patients with sinus rhythm, severe LV diastolic dysfunction correlates with a higher risk of atrial fibrillation and heart failure. Septal thickness (IVSD) and left ventricular posterior wall thickness (LVPWD) are significant determinants of atrial fibrillation.

A. Assessment of the LA in AF

TTE is a reliable method for determining the anatomy of the LA. The measurement of the LA anteroposterior diameter in the parasternal long-axis or short-axis window is commonly done in clinical practice using the M-mode. Due to the non-spherical shape and frequently asymmetric size of the LA, this method tends to underestimate the true LA size. Consequently, a measurement of LA size can be obtained from the LA volume analysis using Simpson's method or the biplane area-length method. The infundibulum of the mitral leaflets should not be included in the LA area, and the horizontal line should be drawn in the mitral annular plane (Figure 7). The intersection of the LAA and PV is not included in the measurement when following the contour of the LA. By using 2D echocardiography, the maximum LA volume was 22 ± 6 mL/m2. LA volume is currently measured using 3-dimensional (3D) echocardiography, which has been demonstrated to correlate well with biplane 2D measurements. It has been determined that LA size is a predictor of both overall outcome and cardiovascular disease. The Framingham study found that a 39% chance of developing AF later on was linked to a 5 mm increase in LA size. According to Psaty et al., subjects with sinus atherosclerosis and a LA larger than 5.0 cm were about four times more likely to develop AF at follow-up. Increased LA volume (and the same LA size) also predicts AF. In patients with AF, increased LA is linked to a lower success rate for cardioversion or sinus rhythm maintenance. AF recurrence following RFCA is predicted by an elevated LA volume index.

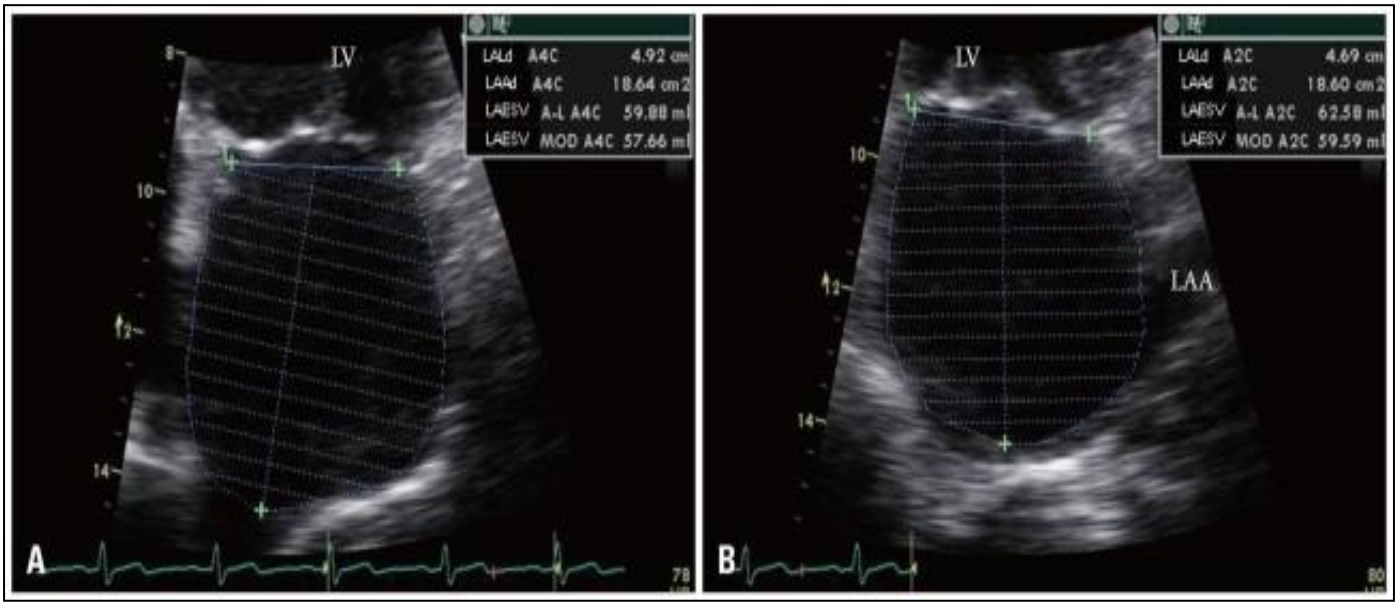

Fig 7: Bi-Plane Volume Measurement of LA - TTE Apical 4 Chamber (a) and Apical 2 Chamber (b) View. LV: Left Ventricle, LAA: Left Atrial Appendage.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

When evaluating atrial function, echocardiography is helpful tool. Due to high LA pressure to maintain arterial pressure during early LV filling in atrial fibrillation (AF), there is an increase in the LA-LV pressure gradient. Loss of LA compliance and volume during the development of AF worsens cardiac function and raises the risk of thromboembolism. Echocardiography can noninvasively assess changes in the LA by using new technologies like tissue Doppler imaging (TDI) and strain imaging, in addition to a variety of modalities such as mitral valve blood flow, LA area, and volume changes.

pulse wave Doppler provides patterns of mitral inflow that reflect on LA function. Peak mitral inflow velocity, which is frequently used due to the absence assess LA function during late diastolic filling wave (A), cannot be measured in atrial fibrillation (AF) of an atrial waveform. Peak A-wave velocity is employed in AF patients to continuously monitor LA function following cardioversion and RFCA. TDI quantifies the relative burden of left ventricular systolic and diastolic dysfunction by measuring the low-velocity, high-amplitude, long-axis intrinsic myocardial velocity during systole and diastole function. An accurate and quick indicator of atrial function is the peak velocity of the mitral annulus at end diastole following atrial contraction, also known as the A or Aa pace. This velocity is connected to the atrial fraction, atrial ejection force, and peak mitral flow A velocity, among other atrial parameters. Total tissue motion velocity is calculated by TDI, and the degree of tissue deformation is represented by strain and strain rate, respectively (Fig 8). Patients with AF have been demonstrated to have decreased thickness of the LA wall, impaired function of the LA reservoir, and loss of booster pump function through the use of TDI and/or strain imaging. To validate and accept these parameters, more investigation and testing are required for routine clinical use.

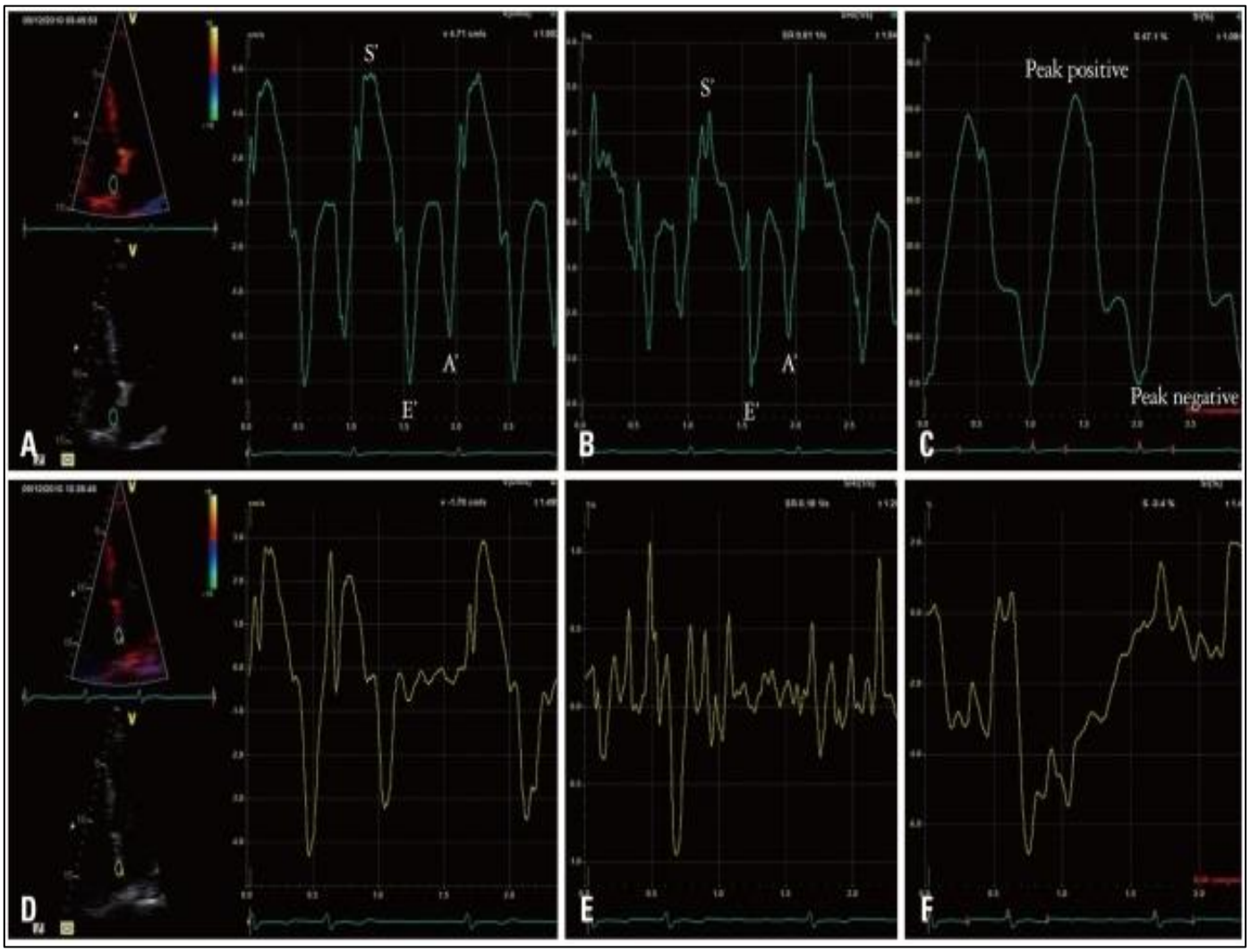

Fig 8: Representative Velocity Flutter of the Left Atrial Myocardium Using Strain Rate (SR), Strain Curves, and Tissue Doppler Imaging (TDI) from Patients with Atrial Fibrillation (D, E, and F, Respectively) and Normal Cases (A, B, and C). The Interatrial Septum's Center was where the Sample Volume was Placed. Atrial Contraction did not Cause a Decrease in SR in AF Patients; However, the AF Wave Caused a Small Amplitude Phase Noise to be Recorded. It was Shown that the LA Mechanical Function is Decreased in AF, which is Characterized by Decreased S' and/or E' Waves in the Absence of End-Diastolic A' Waves, using TDI-Derived Velocity and SR Parameters. A' Wave is the Late Diastolic Wave, E' Wave is the Early Diastolic Wave, and S' Wave is the Ventricular Contraction Wave.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

B. Assessment of Left Ventricular Diastolic Function in Atrial Fibrillation

The presence and severity of diastolic dysfunction are related to a higher risk of atrial fibrillation and heart failure in patients with atrial fibrillation. further, the risk of heart failure increases significantly when atrial fibrillation takes place. evaluation of diastolic function in patients with atrial fibrillation stays a challenge in clinical practice due to poor left atrial mechanical function and changes in cycle length that make diastolic function difficult to control. Many new methods had been brought to measure diastolic dysfunction in AF patients. All echocardiographic parameters obtained in AF should be measured and should be within the range of 5 to 10 beats. Early mitral deceleration time (DT) can accurately assess left ventricular diastolic function in AF. Matsukida et al. showed that a mitral DT threshold of 100 ms predicted a mean pulmonary capillary wedge pressure (MCWP) of 18 mmHg with a sensitivity of 80% and a specificity of 85%. measurement of mitral inflow in atrial fibrillation typically consists of LV peak diastolic filling velocity (E) and DT of 5 to 10 beats. The cycle length is similar to the heart rate, 60 to 80 beats/min, with an interval of 70 ms between the end of mitral inflow and the beginning of the QRS complex (figure 9). the peak E velocity relies upon on LV relaxation and LA pressure. the peak E velocity can be used to correct for LV diastole and can be compared to early diastolic mitral annular velocity using tissue Doppler (e') (figure 10). TDI measurements of E velocity are independent of LA pressure. E/e' (septal) > 15 and E/e' (lateral) > 10 were shown to be precise for maintaining LV filling pressures. E/e' has been validated for LV diastolic filling pressures. M-mode color Doppler measurement of mitral inflow velocity (Vp) gives visualization of flow propagating in time and area from the annular region to the apex of the left atrium along a single scan line throughout diastole. Vp < 45 cm/s is consistent with the presence of diastolic disorder. mean PCWP has a negative impact. An increase in IVRT is an indication of left ventricular diastolic dysfunction. the short IVRT represents for left ventricular chamber stiffness. In atrial fibrillation, regional differences in diastolic filling may also arise depending on the response of the left ventricle to the fibrillating atrium. therefore, regional value assessment should be a promising method for the evaluation of diastolic dysfunction in AF. but, in addition research is needed before it can be used clinically in AF patients.

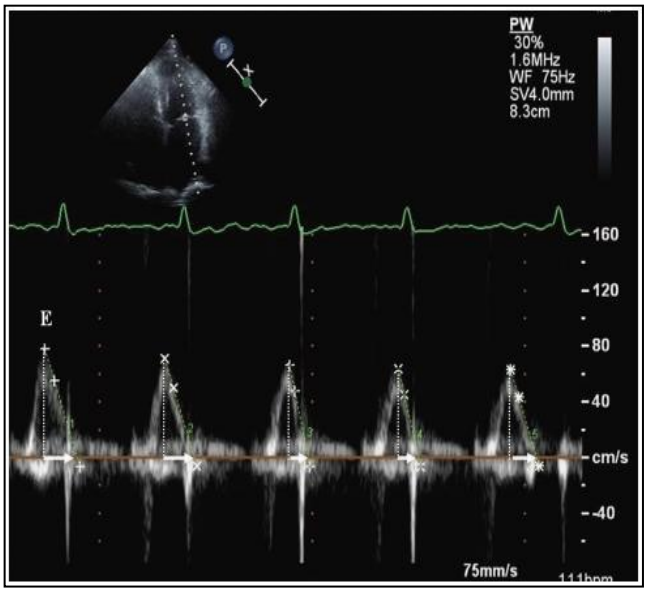

Fig 9: PW Doppler Shows Transmitral Inflow in Atrial Fibrillation. Arrows Indicate Early Mitral Flow Deceleration Time (DT). Peak E Velocity and DT Vary with Cycle Length. (E Represents the Peak Left Ventricular Diastolic Filling Velocity).

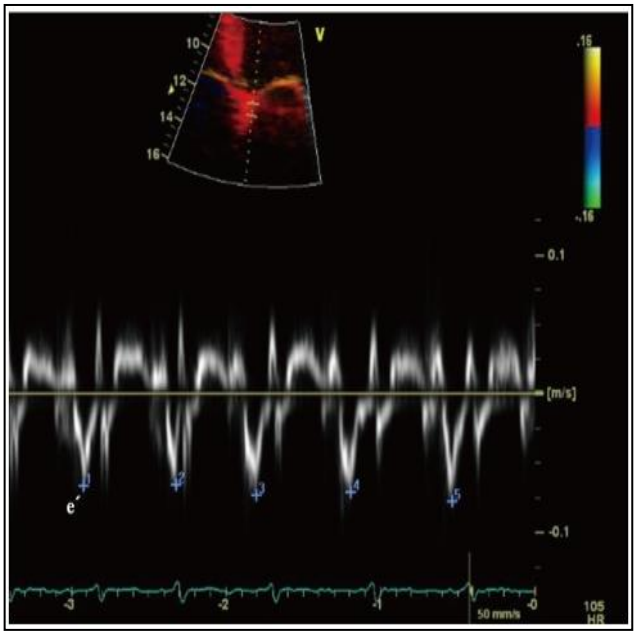

Fig 10: TDI of Septal Mitral Annular Velocity e' in Patients with AF.

C. Assessment of Pulmonary Vein Flow in AF

The pulsatile features of pulmonary venous flow (PVF) are associated with left atrial pressure and function, left ventricular compliance, and mitral valve function. In atrial fibrillation, an echocardiogram can be useful in defining blood flow. AF is characterized by early onset of systolic blood pressure, early onset of systolic blood pressure reversal flow, decreased systolic blood pressure, and greater diastolic blood pressure than systolic blood pressure. Loss of left atrial function is synonymous with loss of atrial reversal flow. Additionally, it has been demonstrated that left atrial appendage dysfunction and echo-contrast (SEC) formation

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

are linked to decreased systolic PVF. It seems that variations in LA function, particularly atrial compliance, are reflected in changes in PVF in AF. When using RFCA to correct sinus rhythm or monitor functional recovery following cardioversion, the PVF mode can be a useful tool. Recurrence of atrial fibrillation is linked to low systolic PVF attained during the fibrillation, which occurs six and twelve months after electrical cardioversion, respectively. For the purpose of estimating the diastolic left ventricular filling pressure in atrial fibrillation (AF), pulmonary venous diastolic pressure (DT) is important. The time interval between peak diastolic velocity and peak deceleration slope extrapolated to zero baseline is used to calculate pulmonary venous DT (Fig 11). Typically, five to ten lengthy cycles, or a heart rate of sixty to eighty beats per minute, are needed for measurements. Matsukida and associates. It has been demonstrated that in patients with AF, pulmonary vein DT ≤ 150 ms can predict PCWP ≤ 18 mm Hg with 100% sensitivity and 96% specificity. Detecting PV stenosis following AF RFCA, which affects 1% to 3% of current patients, is one application of PVF screening. There will be pressure and slight changes if the diagnosis is limited to the maximum PV velocity (±110 cm/s) (Figure 12). PV stenosis is diagnosed with TTE both before and after AF RFCA. It is now widely acknowledged, however, that TTE and TEE are less effective with a narrow field of view and PV field and are constrained by their inability to see all 4 PVs deeply.

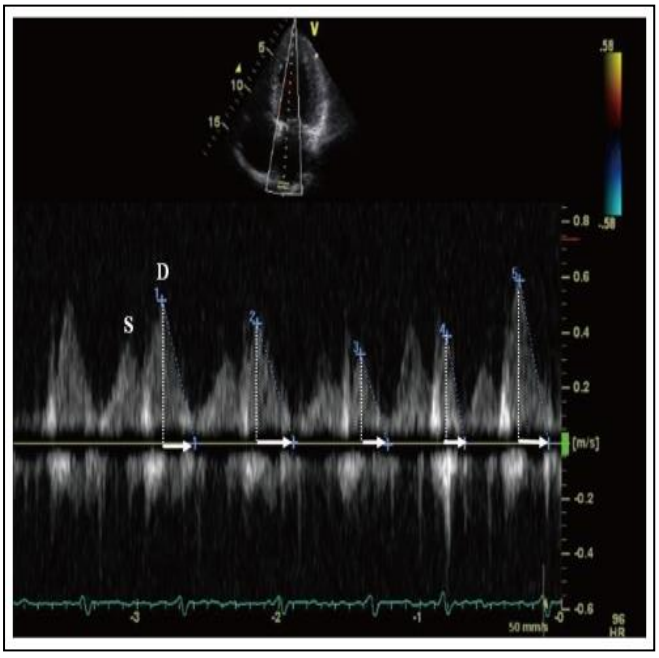

Fig 11: PVF Patterns on TTE of AF. Arrows Indicate Pulmonary Venous Diastolic Deceleration Time

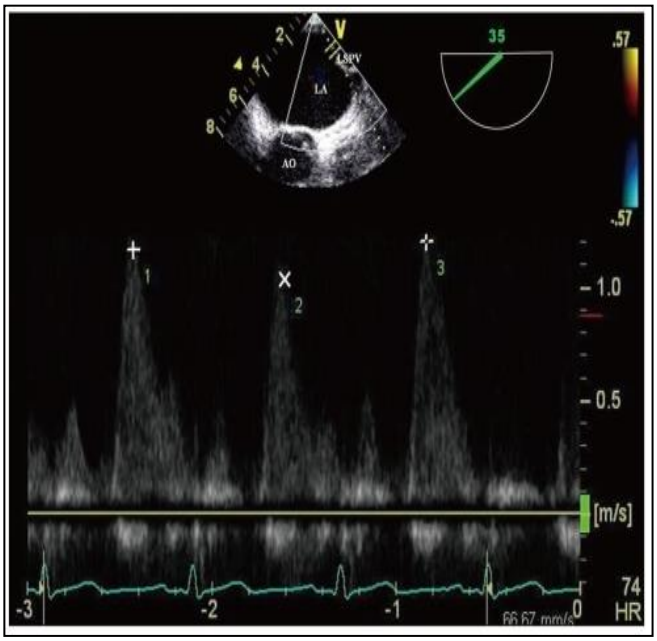

Fig 12: TEE Shows Significant Pulmonary Vein (PV) Stenosis. PW Doppler with PV inflow > 110 cm/s which Confirms Significant Stenosis

D. Assessment of LA and LAA Thrombi in AF

TOE evaluation of la and LAA thrombus is good for the evaluation of the LAA and for the detection of left atrial and LAA thrombus (figure 13 A). modern multiplane TOE can detect thrombus with about 95% to 100% sensitivity and specificity. In patients with documented thrombus, TOE should be used first to confirm resolution of the thrombus after cardioversion. up to 80% of left atrial thrombi disappear after 7 weeks of anticoagulant therapy. TOE also distinguishes between solid debris (SEC or "smoke") and "sludge." LAA smoke (figure 13 B) is considered an alternating echogenicity of the LAA and left atrium and is a sign of stasis and possible thrombus. severe SEC or smoke is associated with LAA thrombosis and subsequent embolism. The left atrial appendage sludge (Fig. 3 C) is solid, but the echogenicity of the left atrial appendage is poor and there's no obvious thrombosis. even though this distinction is arbitrary and subjective, the sludge represents another stage of the thrombotic process and appears to be more important than the plume. LAA mechanical functions, including LAA emptying velocity, were measured by TOE using a Doppler pulse wave with sample volumes positioned 1 cm from the junction and sensors at angles between 45° and 120°. A low LAA speed (<20 cm/s) is associated with spontaneous echo contrast and thrombosis, whereas an LAA emptying velocity >40 cm/s predicts a higher risk of developing sinus rhythm 1 year after cardioversion. The concept of LAA stunning is particularly important after direct modern-day (DC) cardioversion. TOE earlier than and straight away after direct cardioversion has been shown to decrease atrial and left atrial appendage function and increase smoking in many patients. New LAA thrombosis has been observed immediately following DC cardioversion.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

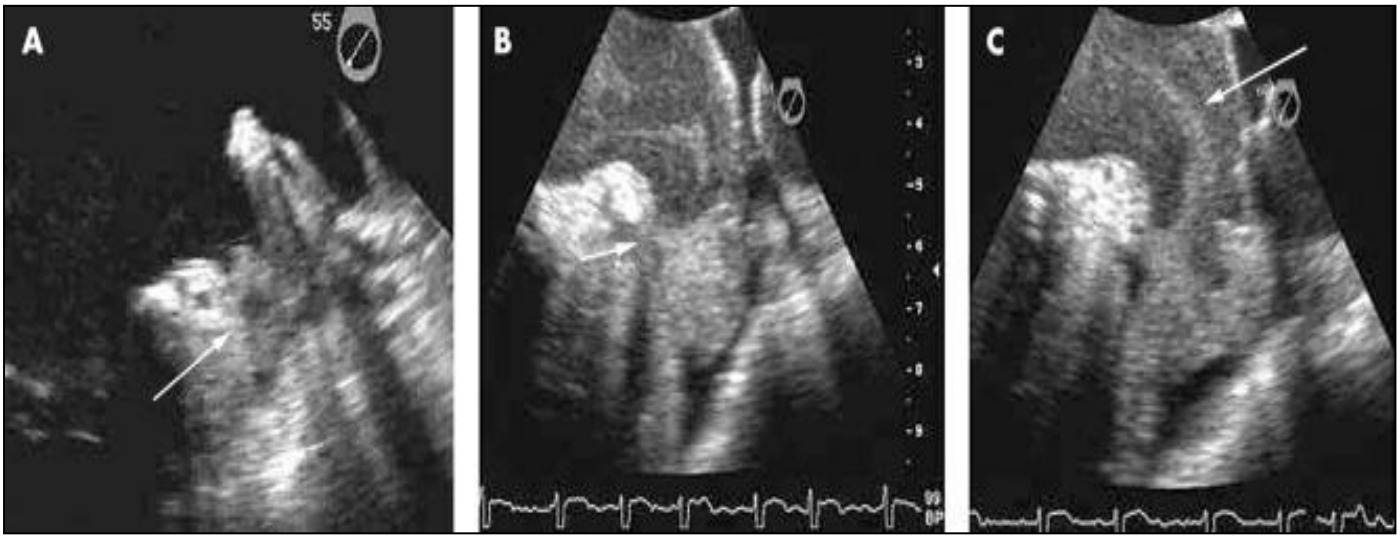

Fig 13: LA and LAA depicting the spectrum of flow stasis and thromboembolic risk from 'smoke' through thrombus. (A) LAA thrombus on TOE in a patient with AF. note-smooth, rounded edge of the thrombus (arrow). (B) A "sludge" detected at the apex of the LAA by TOE in a patient with AF. note- meniscus (arrow) at the superior edge of the sludge. (C) TOE detection of spontaneous echo-contrast or "smoke" swirling in the LAA and LA in patients with AF.

Table 2: Thromboembolism - Clinical and Echocardiographic Determinants

Recent history of systemic thromboembolism
Increased atrial size
Left atrial appendage thrombus or sludge
Severe spontaneous echo contrast
Left atrial appendage emptying velocity < 20cm/s
Left ventricular systolic dysfunction
Complex aortic atheroma

IX. CONCLUSION

Because TTE and TEE are widely available, noninvasive or minimally invasive, do not expose patients to harmful radiation, and have few contraindications, they are important for providing information about heart disease and function. Echocardiography has the benefit of making risk stratification, complication diagnosis, and anticoagulant therapy easier for atrial fibrillation patients. Atrial fibrillation patients have left atrial diameter is greater than 4.0 cm. Atrial fibrillation patients frequently experience thromboembolic events, and mitral valve disease may affect any patient. Further advances in echocardiographic imaging and analysis will increase the use of echocardiography in the assessment and treatment of atrial fibrillation patients.

REFERENCES

[1]. Journal of Cardiovascular Ultrasound 19 | June 2011-Role of Echocardiography in Atrial Fibrillation | Tae-Seok Kim and Ho-Joong Youn.
[2]. Flaker, Greg C., et al. "Clinical and echocardiographic features of intermittent atrial fibrillation that predict recurrent atrial fibrillation." The American journal of cardiology 76.5 (1995): 355-358.
[3]. Echocardiographic Parameters to Predict Atrial Fibrillation in Clinical Routine—The EAHsy-AF Risk Score-Sieweke et al.
[4]. Benjamin EJ. Status of the epidemiology of atrial fibrillation. MedClin North Am. 2008 Jan;92(1):17-40, ix.
[5]. Journal of internal medicine| Dec 2022-A study of clinical profile, etiology and echocardiographic profile in AF at a tertiary care hospital | AM Athar.
[6]. Journal of Nepal medical association | Jan 2021-'echocardiographic findings in patients with atrial fibrillation in a tertiary care center of Nepal: a descriptive cross-sectional study' | Dr Smriti Shakya.
[7]. Journal of Cardiovascular disease research | June 2021-clinical profile of atrial fibrillation with reference to echocardiography|Dr. Akshita Subhash Sonawalal.
[8]. Mohan G et al. "The study of clinical and echocardiographic assessment of patients with atrial fibrillation". International journal of advances in medicine 2019 aug;6(4):1041-1045.
[9]. Richard W Troughton,1 Craig R Asher,2 and Allan L Klein2. "The role of echocardiography in atrial fibrillation and cardioversion". Heart. 2003 Dec; 89(12): 1447–1454.
[10]. Vaziri SM, Larson MG, Benjamin EJ, Levy D. Echocardiographic pre-dictors of nonrheumatic atrial fibrillation. The Framingham Heart Study. Circulation 1994; 89:724-30.
[11]. Tani T, Tanabe K, Ono M, Yamaguchi K, Okada M, Sumida T, Konda T, Fujii Y, Kawai J, Yagi T, Sato M, Ibuki M, Katayama M, Tamita K, Yamabe K, Yamamuro A, Nagai K, Shiratori K, Morio-ka S. Left atrial volume and the risk of paroxysmal atrial fibrillation in patients with hypertrophic cardiomyopathy. J Am Soc Echocardiography 2004; 17:644-8.
[12]. Psaty BM, Manolio TA, Kuller LH, Kronmal RA, Cushman M, Fried LP, White R, Furberg CD, Rautaharju PM. Incidence of and risk factors for atrial fibrillation in older adults. Circulation 1997; 96:2455-61.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP138

[13]. Dittrich HC, Erickson JS, Schneiderman T, Blacky AR, Savides T, Nicod PH. Echocardiographic and clinical predictors for outcome of elective cardioversion of atrial fibrillation. Am J Cardiol 1989; 63:193-7.
[14]. Srimannarayana, J., et al. "Prevalence of left atrial thrombus in rheumatic mitral stenosis with atrial fibrillation and its response to anticoagulation: a transesophageal echocardiographic study." Indian heart journal 55.4 (2002): 358-361.
[15]. Sanfilippo AJ, Abascal VM, Sheehan M, et al. Atrial enlargement as a consequence of atrial fibrillation. Circulation 1990; 82:792-97.
[16]. Vaziri SM, Larson MG, Benjamin EJ, Levy D. Echocardiographic predictors of nonrheumatic atrial fibrillation. The Framingham Heart Study. Circulation. 1994; 89:724 730. [PubMed].
[17]. Tischler MD, Le TH, Andrew KAM, et al. Clinical echocardiographic and doppler correlates of clinical instability with onset of atrial fibrillation. Am J Cardiol 1990;66:721-24.
[18]. Kannel WB, Abott RD, Savage DD, McNamara PM. Epidemiological features of chronic atrial fibrillation: The Framingham study. N Engl J Med 1982; 306:1018-22.