The left atrial and appendage function changes following successful electric cardioversion in atrial fibrillation.

Rajat Sharma¹, Honey Sharma², Jagmohan Singh Varma³. Ashita Sharma³, Deepali⁴,
¹Cardiac electrophysiology division, Fortis Hospital, Mohali
²Cardiology division, Fortis hospital, Mohali
³Clinical biochemistry and research, Medical writer
⁴Observer department of cardiology, Fortis Hospital, Mohali

ABSTRACT

Background: External direct current cardioversion remains the most widely used and cost-effective method to restore sinus rhythm (SR).¹ Successful cardioversion of atrial fibrillation usually results in left atrial (LA) and LA appendage (LAA) stunning that may last up to a few weeks and is observed after all methods of cardioversion. It is responsible for an increased incidence of thromboembolic events following DC cardioversion, this despite restoration of sinus rhythm.²

Echocardiography is an unique and important tool in the assessment of cardiac structure and function, risk stratification, and is increasingly helpful in guiding the management of AF.³ The mitral A-wave velocity and LA emptying fraction can be assessed easily by the conventional transthoracic echocardiography (TTE) to evaluate the contractile function of the LA.² The pulsed Doppler technique is again an important tool for the assessment of changes in left atrial functions after successful cardioversion in atrial fibrillation.⁴

Transoesophageal echocardiography is a modality suitable for the assessment of the LAA function and also for detecting left atrial and LAA thrombi. LAA mechanical function including LAA emptying velocities, can be assessed by the TEE using pulsed wave Doppler.

New myocardial imaging tools such as tissue Doppler and strain rate imaging may provide further insight to understand atrial contractile function in such AF populations. Such information may be of value in predicting the likelihood of recurrent atrial fibrillation, with obvious implications for the selection of patients for anti-arrhythmic strategies.⁵

Information pertaining to assessment of LA functional changes in atrial fibrillation post direct current cardioversion using echocardiography has been documented by studies but is limited. So, the current study was undertaken to analyse in detail, the effects of sinus rhythm restoration in AF following direct current cardioversion on various left atrial functional parameters.

Materials and methods: This prospective observational study was conducted starting from July 2017 to September 2018 on 50 consecutive patients with non-valvular AF who underwent successful CV to sinus rhythm. The Echocardiographic assessment of LA by TTE and TEE was done pre and post direct current cardioversion at 0, 1, 3- and 6-months interval and various parameters of LA function were analyzed. Parameters assessed on TTE were LVEF, LAEF, A wave velocity, A’ velocity, LAaV, LA peak systolic strain and LAFI. TEE was done to rule out LA/LAA clot and assess LAAeV and SEC. All echocardiographic images/data were stored digitally and analysed offline later. 2 patients were lost to follow up and 4 patients who had recurrence of atrial fibrillation were excluded from final analysis.

Results- The LVEF improvement was linear and from a baseline value of 48.55% it improved to 50.08% immediately following successful ECV and it improved further to 52.00 % at 1 month, 53.57% at 3 month and 55.45 % at 6 months (p =0.000). LAEF also similarly improved to 30.64% immediately following successful ECV from a baseline 29.85%, to 33.31% at 1 month, 35.61% at 3 month and 39.05% at 6 months (p =0.000). The mitral A(cm/s) velocity increased from a baseline 36.16 (cm/s) in patients after successful ECV in 44 out of 50 patients to 53.55 cm/s at 1 month and incrementally thereafter in 3 and 6 months to 56.55 and 58.28 respectively (p =0.000). Atrial improved following a successful cardioversion from 20.05% immediately post ECV and to 31.66% at 1 month and 38.15%, 40.51 % at 3 and 6 months respectively (p =0.000). The Left atrial reversal velocity increased from 18.98 cm/s immediately post cardioversion to 24.95 cm/s at 1 month. It subsequently improved to 26.99 cm/s at 3 months and 27.91 cm/s at 6 months respectively (p =0.000). The mitral annular A’ velocity, which reflects the global LA function was 4.16 cm/s improved
following a successful electrical cardioversion and incrementally improved thereafter at 1 month to 6.04 cm/s and 7.44 cm/s, 8.19 cm/s at 3 month and 6 months respectively (p =0.000). Grade of SEC before cardioversion was 0.20 and grade increased immediately after cardioversion to 0.34. There was disappearance of SEC in the further follow up period as indicated by value of 0.07 at 1 month. SEC completely disappeared at 3 month and 6 months (p =0.036). A low LAAeV (<20 CM/S) correlates strongly with presence of SEC and thrombus, while a LAAeV (>40 cm/sec) predicts a greater likelihood of sustained sinus rhythm on long term. The LAAeV declined initially post ECV from a baseline 32.69 cm/s to 22.79 cm/s, but later improved at 1 months onwards to 38.21 cm/s to 45.63 and 51.41 cm/s at 3 month and 6 months respectively (p =0.000). The left atrial strained imaging revealed a Left atrial peak systolic strain was 11.00% during atrial fibrillation. It improved marginally to 11.99% and subsequently to 19.50% at first month following successful cardioversion. But subsequently there was a significant increase at 3 months to 30.91% and incremental The increase of LA peak systolic strain continued at 6 months to 38.40% (p =0.00). Pre ECV LAFI-did improved immediately following a successful cardioversion from 0.10 to 0.14 immediately post cardioversion. The LA peak systolic strain which is a measure of LA reservoir function progressively improves after first month following cardioversion. LAFI which combines analogues of LA volume, its reservoir function and the LV stroke volume, is an expression of atrial function independent of baseline rhythm. LAFI showed significant increase after successful cardioversion.

**Conclusion** - The Systolic function of left atrium (left atrial emptying fraction) improved after a successful cardioversion and continued thereafter. The doppler echocardiographic parameters of LA function (A velocity, Atrial filling fraction and Left atrial reversal velocity) improved in a linear manner following successful cardioversion. Tissue Doppler assessment of global LA function (by late mitral annulus velocity A’) progressively increase after a successful electrical cardioversion. Left atrial appendage emptying velocity decreases immediately following cardioversion, and later recover on maintenance of sinus rhythm. SEC intensity tends to worsen immediately following a cardioversion, possibly due to atrial stunning, and later improves or disappears following maintenance of sinus rhythm. LA peak systolic strain which is a measure of LA reservoir function progressively improves after first month following cardioversion. LAFI which combines analogues of LA volume, its reservoir function and the LV stroke volume, is an expression of atrial function independent of baseline rhythm. LAFI showed significant increase after successful cardioversion.

**Abbreviations:**
- LAFI - Left atrial function index
- LArV - Left atrial reversal velocity
- LAAeV - Left atrial appendage late emptying velocity
- SEC - Spontaneous echo contrast
- ECV - Electric cardioversion
- LAA - Left atrial appendage

**References:**


**Corresponding author:**
Dr Rajat Sharma, MD, FACC
Cardiac electrophysiologist,
Heart rhythm and cardiac pacing division,
Fortis hospital, Mohali, India 160062
Phone no: +918283812952
rajat.dr@gmail.com