The left atrial function index: a rhythm independent marker of atrial function

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Aims This study evaluates a simple echocardiographic rhythm independent expression of left atrial (LA) function, ‘the left atrial function index’ (LAFI).

Background Quantitation of LA function is challenging and often established parameters including peak A are limited to sinus rhythm (SR). We hypothesized that atrial function could be characterized independent of rhythm by combining analogues of LA volume, reservoir function and LV stroke volume.

Methods Seventy-two patients with chronic atrial fibrillation (CAF) were followed for six months post cardioversion (CV). Thirty-seven age matched healthy subjects were controls. The LAFI = LAEF x LVOT-VTI/LAESVI (LAEF = LA emptying fraction, LAESVI = maximal LA volume indexed to BSA, LVOT-VTI = outflow tract velocity time integral).

Results The LAFI pre-CV in the CAF group was depressed vs controls (0.10 ± 0.05 vs 0.54 ± 0.17; P = 0.0001). Post-CV, LAFI was lower in persistent AF than in those restored to SR (AF vs SR: 0.08 ± 0.03 vs 0.15 ± 0.08; P = 0.0001), improved progressively in SR and was unchanged when AF persisted.

Conclusion The LAFI, a simple, rhythm independent expression of atrial function, appears sensitive to differences between individuals in AF and those restored to SR and justifies clinical and investigative applications.

KEYWORDS Echocardiography; Atrial function; Atrial fibrillation

The left atrium (LA) serves multiple functions acting as a conduit (for blood from the pulmonary veins to the left ventricle) during early diastole, as an active contractile chamber that augments left ventricular filling in late diastole, as a suction source that refills itself in early systole and as a reservoir during ventricular systole.¹ Overall, atrial contraction contributes about 30% to cardiac output.²,³

Several echocardiographic parameters have been developed to evaluate atrial function. They include the peak A wave velocity of transmitral flow in late diastole obtained by pulsed wave Doppler and its velocity time integral (VTI).⁴,⁵ From transmitral flow, the fraction of atrial contribution⁶ estimated as the A wave VTI as a fraction of total mitral inflow VTI, has also been an established marker of atrial function. More recently the A’ velocity using Doppler tissue imaging has been used as a global measure of atrial function.⁷,⁸ The peak A’ velocity represents intrinsic atrial contractility and has been reduced in atrial dysfunction similar to the peak A wave velocity. However, these parameters can only be easily measured in SR and are therefore often not evaluated in AF. Thus the comparison of atrial function in subjects in sinus rhythm (SR) and those in atrial fibrillation (AF) is often difficult.

The aim of this study was to describe and examine an echocardiographic rhythm independent measure of atrial function, the LA function index (LAFI) that could be used to observe the course of LA function before and after cardioversion. The LAFI is a ratio that incorporates analogues of cardiac output, atrial reservoir function and LA size and is calculated as LAFI = LAEF x LVOT-VTI/LAESVI (LAEF = LA emptying fraction, LAESVI = maximal LA volume indexed to BSA, LVOT-VTI = velocity time integral across the left ventricular outflow tract in cm and LAESVI is the largest LA volume measure in ventricular systole (LAESV) in ml indexed to body surface area or ml/m² (Figure 1). Thus the LAFI increases proportionally to LA reservoir function and stroke volume, but is inversely proportional to LA size.⁹,¹⁰ The index is based on the fact that in the normal subject the atrium maintains a normal size (when indexed to body surface area) during normal cardiac output and contributes to that output by its ability to transfer most of its contents to the left ventricle with each cardiac cycle. Thus a healthy
Atrial function index

\[ \text{Left atrial function} = \frac{\text{LA emptying fraction} \times \text{LVOT VTI (cm)}}{\text{LAESV indexed to BSA (cc/m²)}} \]

LAFI = Left atrial function index, LAESV = maximal left atrial volume in end systole (cc), LVOT VTI = velocity time integral of the left ventricular outflow tract (cm), BSA = body surface area

As two examples of sample computations, in a healthy individual whose stroke volume is normal (20cc/m²), LA reservoir function is preserved (0.65) and LAESVI is small (20cc/m²), the index would be relatively large (e.g., 0.65 × (20/20) = 0.65 cm³/cm² or 0.65 units). Conversely, in the worst case where left ventricular stroke volume is poor (10cc/m²), reservoir function is reduced (0.20) and LAESVI is increased (100cc/m²), the functional index would be relatively small (e.g., (0.20 × (10/100) = 0.02 cm³/cm² or 0.02 units).

**Figure 1** Derivation of LAFI.

Atrial function incorporates in addition to atrial reservoir function (LAEF), analogues of cardiac output, and indexed atrial size that are indirect reflectors of atrial dysfunction and are rhythm independent. Therefore, the LAFI is an index that incorporates in addition to atrial reservoir function (LAEF), analogues of cardiac output and indexed atrial size that are indirect reflectors of atrial dysfunction and is rhythm independent.

Based on these considerations, we hypothesized that (1) LAFI is decreased in persons with AF, (2) that the LAFI is unchanged or worsened in persistent AF, and (3) conversely, LAFI is decreased in persons with AF. While atrial contraction is a major contributor to LA function, this index does not depend on it per se. Thus a normal sized LA that empties well in diastole could, in theory, have a normal LAFI, despite AF. Therefore, the LAFI is an index that incorporates in addition to atrial reservoir function (LAEF), analogues of cardiac output and indexed atrial size that are indirect reflectors of atrial dysfunction and is rhythm independent.

**Methods**

Study approval was obtained from the Committee for Human Research at our institution. Consecutive patients (n = 148) with chronic AF who underwent electrical cardioversion (CV) comprised the study cohort. By institutional protocol, all were screened with a transoesophageal echocardiogram (TEE) to exclude LA thrombus prior to CV. One of the authors, L.T., performed the TEE guided CV. Prior to the TEE, L.T. offered each patient enlistment in the prospective longitudinal arm of this study and a subgroup of 72 patients were recruited into long term follow up (Figure 2).

All 72 had a transthoracic echocardiogram (TTE) within 4 h post-CV during recovery from sedation. Those in SR (60/72) were evaluated at 1 week post-CV with an ECG and history to identify the subset that had reverted to AF within the first week after CV (n = 16). The remaining 44 were studied again at 1 and 6 months. The subjects not restored to SR with the initial CV (n = 12) were also reevaluated by echocardiograms at 1 and 6 months. Thus 44 were cardioverted and maintained in SR (CNVR-SR) for 6 months while 28 were in persistent AF or reverted to AF within 1 week (CNVR-AF) (Figure 2)

The study cohort was also compared to a cohort of 37 age matched normal subjects. They were recruited by advertising for normal volunteers during the study period and were representative of the normal population in that none had a history of ischaemic heart disease, significant valvular disease, peripheral vascular or cerebrovascular disease, and hypertension or diabetes. None of the normal subjects were on cardioactive medications.

**Transmural echocardiogram**

Doppler, M-mode and two-dimensional echocardiography were performed according to established clinical laboratory practice using commercially available instruments (System 1: Agilent/Philips Sonos 5500, System 2: General Electric/Vingmed System 5 and off-line measuring station Echopac) using harmonic 3.5 MHz variable frequency phased array transducers. Left atrial LA anteroposterior size was estimated by M-mode measurement in the parasternal long axis view.

**LA volumes and mechanical function**

LA volumes were measured at 2 time points: (i) just before mitral valve opening (maximal LA volume or LAESV); (ii) at mitral valve closure (minimal LA volume or LAEDV). All volumes were calculated from apical 4- and 2-chamber zoomed views using the biplane method of discs. Following LA emptying function parameters were derived: LA reservoir volume ml = (LAESV – LAEDV); LA emptying fraction %, LAEF = [(LAESV – LAEDV)/LAESV] × 100. The maximal left atrial volume was indexed to body surface area (LAESV ml/m²).

**Parameters of atrial function: transmitral flow and Doppler tissue imaging**

Mitril inflow velocity m/s was obtained by pulsed wave Doppler examination at a sweep speed of 100 mm/s from the apical 4-chamber view by placing the sample volume at the tips of the mitral leaflets. Peak velocity of atrial contraction in diastole (A wave velocity m/s) was measured as an average of 3 beats. The velocity time integral in cm (VTI) of the A wave was measured by planimetry and the fraction of atrial contribution estimated as A VTI divided by the total VTI of mitral inflow.

Doppler tissue imaging was used to acquire the peak velocity in early diastole (E’ velocity) and following active atrial contraction (A’ velocity cm/s) in late diastole respectively. E’ and A’ velocities were acquired by placing the sample volume at the junction of the basal atrial septum with the mitral annulus, recording at a sweep speed of 100 mm/s and measured as an average of 3 beats.

**Left atrial function index**

The LAFI is a ratio that incorporates analogues of cardiac output, atrial reservoir function and LA size (Figure 1). The LVOT-VTI was measured as an average of 3 beats. The heart rate in all enrolled patients and normal volunteers was between 70 and 100 bpm during the TTE.
Observer agreement
In 10 randomly selected studies (5 from each group), 2 readers independently calculated the LAFI. One observer remeasured the same 10 studies at a separate time to determine intraobserver agreement.

Analysis
All values are expressed as a mean ± SD. Differences between 2 groups were examined using the Student's two-sample t test and by analysis of variance for multiple group comparisons. Repeated measures ANOVA was performed to estimate within patient changes for the group enrolled in long term follow up. Correlation coefficients were used to quantify the association between LAFI and various traditional parameters of atrial function. ROC analysis was carried out at baseline (immediately post-CV) and at 6 months to compare the performance of LAFI to parameters of atrial function including the peak A velocity, A wave VTI and fraction of atrial contribution.

Results
A total of 148 consecutive patients with chronic AF, of whom 72 enrolled for prospective follow up, constituted the study cohort. Sixty of the 72 were initially restored to SR, while 12 remained in persistent AF. At one week follow up, 16/60 initially restored to SR were in AF. All 72 were followed up at 1 and 6 months after CV (Figure 2). The chronic AF group at baseline, prior to CV, was compared to 37 age matched normal subjects. The mean values for demographic, clinical, Doppler and echocardiographic variables of the 2 groups are listed in Table 1. There were significant group differences, with the resting heart rate, height, weight and BSA higher in the AF cohort.

Of the chronic AF group, 29 had hypertension, 15 had ischaemic heart disease, 7 had a history of strokes and 3 had heart failure. Twenty-seven were on digoxin, 13 on beta-blockers, 23 on amiodarone and 13 on sotalol. None had heart failure. Twenty-seven were on digoxin, 13 on beta-blockers, 23 on amiodarone and 13 on sotalol. None of the normal subjects were on cardioactive medications.

LA dimensions were significantly larger in the chronic AF group as demonstrated by the LA M-mode diameter and LAESV (Table 1). As atrial size is thought to be altered with gender, varying BSA and heart rate, a separate statistical analysis was performed to compare the chronic AF and normal group, adjusting for gender, BSA and heart rate as covariates. However, significant differences between the 2 groups in LA size (LAESV, LAEDV, LA M-mode) remained even after correcting for the effect of gender, BSA and heart rate.

LA function was significantly decreased with a lower LAFI in the chronic AF group when compared to normal subjects. The mean ± SD for LAFI in the normal cohort was 0.54 ± 0.17 (range: 0.22–0.96) and in the AF cohort was 0.10 ± 0.05 (range 0.01–0.21). All chronic AF patients had a LAFI < 0.22. Other parameters of atrial function such as the peak A velocity, A wave VTI, the fraction of atrial contribution and the A’ velocity could not be ascertained in patients in AF.

LAFI pre- and post-cardioversion
Comparison of patients at baseline and immediately post-CV demonstrated no difference in LAFI in the group in persistent AF but a significant improvement in the LAFI was observed in those restored to SR (Table 2A and B). Of note, heart rate was significantly lower in the CNVR-SR group following restoration of SR and comparison between groups adjusting for heart rate as a covariate, yielded similar results. The LAFI did not, however, predict the individuals that were to be restored or maintained in SR.

LAFI and other parameters of atrial function
The LAFI was compared to traditional parameters of atrial function in the 60 persons restored to SR and the 37 normal controls. The LAFI showed a significant moderate correlation with the peak A wave velocity (r = 0.58; P = 0.0001), fraction of atrial contribution (r = 0.6; P = 0.0001) and the A’ velocity (r = 0.74; P = 0.0001) (Figures 3A–C).

Factors that influence LAFI
Univariate and multiple linear regression analysis were performed to determine the independent predictors of LAFI. Input variables assessed included age, BSA, heart rate, drug therapy (amiodarone, sotalol, digoxin and beta blockers), coexistent heart disease (ischaemic heart disease, hypertension and diabetes), duration of AF, previous CV for AF, LA M-mode diameter at baseline and the rhythm at 6-month follow up.

Significant univariate predictors of the LAFI were rhythm (SR = positive correlation) and age, LA M-mode at baseline and treatment with digoxin (negative correlations). In multiple regression analysis, only rhythm, age and LA M-mode remained independent predictors of the LAFI. The best-fit

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Chronic AF (n = 72)</th>
<th>Normal controls (n = 37)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>65.9 ± 11</td>
<td>65.1 ± 7</td>
<td>0.69</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>82.2 ± 18</td>
<td>73.01 ± 19</td>
<td>0.008</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>162.5 ± 10</td>
<td>172 ± 10</td>
<td>0.0001</td>
</tr>
<tr>
<td>BSA</td>
<td>1.95 ± 0.24</td>
<td>1.77 ± 0.25</td>
<td>0.0001</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>79 ± 15</td>
<td>71 ± 13</td>
<td>0.003</td>
</tr>
<tr>
<td>LA M-mode (mm)</td>
<td>47.5 ± 5.5</td>
<td>36.2 ± 5.5</td>
<td>0.0001</td>
</tr>
<tr>
<td>LAESV (ml)</td>
<td>80.7 ± 21</td>
<td>40.4 ± 11</td>
<td>0.0001</td>
</tr>
<tr>
<td>LAEDV (ml)</td>
<td>61.3 ± 18</td>
<td>19.2 ± 5</td>
<td>0.0001</td>
</tr>
<tr>
<td>LASV (ml)</td>
<td>19.3 ± 9</td>
<td>21.7 ± 8.2</td>
<td>0.11</td>
</tr>
<tr>
<td>LAEF (%)</td>
<td>24 ± 10</td>
<td>52 ± 7</td>
<td>0.0001</td>
</tr>
<tr>
<td>LAFI</td>
<td>0.10 ± 0.05</td>
<td>0.54 ± 0.17</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Data presented as mean ± SD.
HR = heart rate, LA = left atrium, LAEDV = left atrial end diastolic volume or minimal left atrial volume, LAEF = left atrial emptying fraction, LAESV = left atrial end systolic volume or maximal LA volume, LAFI = left atrial function index, LASV = left atrial stroke volume.
Atrial function index

The LA function index was: \( \text{LAFI} = 76.6 + 13 \times \text{rhythm} - 0.35 \times \text{age} \) (LA M-mode at baseline).

Thus, the LA size at baseline and age had a negative association with the LAFI, while sinus rhythm had a significant positive association.

Inter- and intraobserver variability

Bland–Altman analysis was performed for LAFI. The mean differences and their 95% CIs are reported in Table 3. There was no significant intra- or interobserver variation.

Temporal change in atrial function

The LAFI was lower in the CVNR-AF compared to the CNVR-SR group and both were decreased when compared to the normal subjects (Table 4). The baseline LAFI prior to CV was similar in the CNVRSR and CNVR-AF cohorts. Temporal follow up in the CNVR-SR and CNVR-AF groups demonstrated an increase in the LAFI in the CNVR-SR cohort with no change noted in the CNVR-AF group at 1 and 6 months (Figure 4). While a majority of the improvement in the LAFI occurred in the first month in the CNVR-SR cohort, a further significant improvement was noted at 6-month follow up.

Repeated measures ANOVA was used to determine the effect of rhythm in the subset restored and maintained in SR compared to the group in persistent AF and demonstrated that changes in atrial function were dependent on time and the presence of sinus rhythm. This effect remained significant even after adjusting for heart rate.

ROC analysis was performed as a means of comparing the relative ability of LAFI and other indices of LA function (peak A velocity, A wave VTI and fraction of atrial contribution) in discriminating a normal control in sinus rhythm from subjects with a history of AF now cardioverted to sinus rhythm. For this purpose, the normal controls were compared to the cardioverted subjects at baseline and at 6-month follow up (Figures 5A and B). The area under the curve of the ROC at baseline was highest for LAFI (0.99), compared to the peak A velocity (0.96), A VTI (0.87) and the fraction of atrial contribution (0.96) indicating that all parameters distinguished atrial function in normal controls from patients in AF in the majority of cases. However, at 6-month follow up the LAFI was superior to other parameters of atrial function (area under the curve of the ROC for LAFI = 0.92, peak A velocity = 0.55, A VTI = 0.60 and the fraction of atrial contribution = 0.73). Most importantly, the analysis demonstrated that the LAFI was at least as effective as the other markers of atrial function immediately

Table 2 Comparison of parameters of atrial function in the CNVR

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline in AF</th>
<th>Post-CV in SR</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (bpm)</td>
<td>80 ± 15</td>
<td>67 ± 12</td>
<td>0.005</td>
</tr>
<tr>
<td>LASV (ml)</td>
<td>19.3 ± 9.5</td>
<td>23 ± 9.5</td>
<td>0.0008</td>
</tr>
<tr>
<td>LAEF (%)</td>
<td>24 ± 10</td>
<td>30 ± 9.3</td>
<td>0.0001</td>
</tr>
<tr>
<td>LAFI</td>
<td>0.11 ± 0.07</td>
<td>0.15 ± 0.08</td>
<td>0.0001</td>
</tr>
<tr>
<td>L VOT-VTI (cm)</td>
<td>15.13 ± 4.2</td>
<td>16.9 ± 4.1</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

B. AF group (n = 12)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline in AF</th>
<th>Post-CV in AF</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (bpm)</td>
<td>74 ± 12</td>
<td>77 ± 13</td>
<td>0.1</td>
</tr>
<tr>
<td>LASV (ml)</td>
<td>19.9 ± 6.7</td>
<td>21 ± 17.7</td>
<td>0.43</td>
</tr>
<tr>
<td>LAEF (%)</td>
<td>25 ± 8</td>
<td>25 ± 11.5</td>
<td>0.96</td>
</tr>
<tr>
<td>LAFI</td>
<td>0.11 ± 0.04</td>
<td>0.08 ± 0.03</td>
<td>0.2</td>
</tr>
<tr>
<td>L VOT-VTI (cm)</td>
<td>17.1 ± 3.9</td>
<td>17.1 ± 4.7</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Data presented as mean ± SD.

HR = heart rate, LAEF = left atrial emptying fraction, LAFI = left atrial function index, LASV = left atrial stroke volume.

Figure 3 (A) Correlation of the LA function index to A velocity \( y = 0.01x + 0.26; r = 0.58; P = 0.0001 \). (B) Correlation of LA function index to fraction of atrial contribution \( y = 0.41x + 20.17; r = 0.6; P = 0.0001 \). (C) Correlation of the LA function index to A’ velocity \( y = 0.11x + 2.99; r = 0.74; P = 0.0001 \).
post-cardioversion, and that at 6 months post-cardioversion, the LAFI was superior.

Discussion

We have demonstrated that the LAFI, a rhythm independent parameter of atrial function, is decreased in a cohort with chronic AF when compared to age matched controls. The LAFI progressively improved over 6 months with the restoration and maintenance of SR. Further, the LAFI correlates with other traditional parameters of atrial function, is easy to obtain and the intra- and interobserver variabilities are small.

Left atrial function index

The LAFI is an index of atrial function that incorporates analogues of cardiac output (LVOTVTI), atrial reservoir function and indexed atrial size (LAESVI). The index is based on the assumption that reduced atrial function will be associated with smaller cardiac output, poorer atrial reservoir function and larger atrial size (Figure 1).

Our study has demonstrated that the LAFI is perhaps a more sensitive marker of atrial function than the peak A velocity, A wave VTI and the fraction of atrial contribution. ROC analysis demonstrated that the LAFI was similar to these parameters at baseline but that at 6-month follow up a more highly significant difference was noted in segregating normal subjects from patients cardioverted to SR from AF.

LA function with restoration of sinus rhythm

Several investigators have evaluated the recovery of atrial function with the restoration of SR using invasive and noninvasive techniques. These studies confirmed the electromechanical dissociation of atrial recovery after successful CV with improvement in atrial function with restoration of SR. Our data on the effects of restoration of SR on the LAFI, a rhythm independent measure of atrial function, are concordant with these findings. While LAFI improved in the CNVR-SR group after CV, no significant difference was noted in the CNVR-AF group. This finding would imply that restoration of SR in patients with chronic AF does improve atrial function even within 4 h of SR. However, this improvement is modest when compared to normal subjects.

Temporal changes in atrial function with maintenance of SR

Follow up of patients after CV with maintenance of SR has demonstrated an improvement in atrial function. These studies demonstrated an improvement in atrial function in the first 3–4 weeks following CV. It is as yet unclear, how much of the improvement in atrial function is due to recovery of atrial stunning and how much is related to the change in atrial mechanical function and decrease in atrial size associated with the maintenance of SR.

A major limitation of published studies is the absence of a suitable control group for comparison with the group restored to SR. The control comparator group in previous reports consisted of normal subjects with preserved atrial function measured with traditional markers like the peak A velocity, A wave VTI and fraction of atrial contribution which can only be evaluated in SR. In contrast, we evaluated the effect of the restoration of SR on atrial function using the LAFI that can be assessed irrespective of atrial rhythm. Maintenance of SR did improve the LAFI post-CV,
with a significant improvement in the first month following CV. This substantial improvement in atrial function in the first 4 weeks endorses the rationale to continue anticoagulation for 4 weeks after CV and restoration of SR. A small but significant additional improvement in atrial function was also noted at 6-month follow up.

More recently, our group evaluated LAFI as a tool to measure outcomes in 989 patients with stable coronary artery disease.20 Subjects with a lower LAFI had a higher incidence of cardiovascular events (myocardial infarction, heart failure or coronary heart disease related death) compared to subjects with a higher LAFI.

**Effects of age, atrial size and rhythm**

A negative correlation was observed between the LA M-mode diameter and age and the LAFI. Left atrial size has previously been demonstrated to be increased in AF21 and larger atria are thought to be markers of impaired atrial function. AF increases significantly with age22 and it would be the reasonable next step to assume therefore that atrial dysfunction is likely more evident in older individuals with an increased propensity to develop AF. Rhythm (SR vs AF) had a positive correlation to the LAFI. This positive correlation is proof of concept that restoration and maintenance of SR result in improved atrial function. Thus, while rate control may be an option in management of AF, restoration of SR improves atrial function and on that basis may be a preferred treatment option especially in symptomatic patients or in those with significant LV dysfunction.

**Limitations**

Only 72/148 patients who underwent initial cardioversion agreed to participate in long term follow up. The others declined participation in the follow up arm usually because of comorbidities (e.g., advanced age, heart failure) that made return visits burdensome. We evaluated a cohort with chronic and not paroxysmal AF. Further study comparing acute and paroxysmal AF by LAFI is under way. All subjects recruited to participate in the long term follow up had undergone TEE guided CV. Thus the group with LA thrombus was excluded. The subgroup with LA thrombus may in fact represent the group with maximally impaired LA function and thus this subgroup has, as an unintended by-product of design, been excluded. The reference standards for comparison of atrial function were previously validated echocardiographic parameters. Performance of invasive tests like the direct measurement of atrial pressure or MRI was beyond the scope of this study. AF recurrence was not evaluated by Holter monitoring as this was beyond the scope of the present study. Patients were evaluated by an ECG and history at the times of follow up (1 week, 1 and 6 months). Finally, subjects enrolled as the normal cohort were enrolled on the basis of a detailed history and normal echocardiogram. Exercise stress tests were not performed to evaluate the subjects more specifically for exercise capacity or coronary artery disease.

**Conclusions**

There is no single measure to evaluate atrial function and several traditional parameters are rhythm dependent. The LAFI is a rhythm independent measure of atrial function that additionally incorporates an analogue of cardiac output and BSA. The LAFI accentuates differences between groups as compared to traditional parameters of atrial function. The LAFI may be a more sensitive marker of changes in atrial function over time including in persons in whom atrial function deteriorates such as those in AF, and in whom atrial function would be expected to improve, such as after successful CV. Furthermore, LAFI should provide a tool for investigating the influence of antiarrhythmic medication on atrial function, the duration of anticoagulation after CV and candidacy for CV.

![Atrial function index](https://academic.oup.com/ehjcimaging/article-abstract/9/3/356/2400006/361)
References


