Assessment of left atrial function in patients with type 2 diabetes mellitus with a disease duration of six months

Oyku Gulmez, Hulya Parildar, Ozlem Cigerli, Nilgun Demirağ

Abstract

Introduction: Changes in left atrial (LA) size and function are associated with adverse clinical events. Recently, duration of diabetes mellitus (DM2) has been found to be positively associated with increased LA volume and impaired LA function. This study was performed, using two-dimensional echocardiography, to evaluate the changes in LA volume and function in patients with DM2 with a disease duration of six months, and to assess the parameters that affect LA volume and function.

Methods: Fifty-six patients (28 male, age: 52.6 ± 6.5 years) with DM2 and 56 controls (24 male; age: 50.1 ± 7.0 years) were enrolled in the study. Each subject underwent conventional two-dimensional echocardiography to assess LA volume (indexed maximal LA volume: \( V_{\text{max}} \), pre-atrial contraction volume: \( V_{\text{pre}} \), minimal LA volume: \( V_{\text{min}} \)) and LA function (passive emptying volume – passive emptying fraction (PEV – PEF), active emptying volume – active emptying fraction (AEV – AEF); total emptying volume – total emptying fraction (TEV – TEF)).

Results: LA diameter, indexed \( V_{\text{max}} \), \( V_{\text{pre}} \), \( V_{\text{max}} \) and \( V_{\text{AEV}} \) were significantly correlated with HbA1c level, body mass index (BMI), high-sensitivity C-reactive protein and uric acid levels, mitral A wave, E/E′ ratio and A′ wave. According to multivariate analysis, age and BMI had a statistically significant effect on LA volume.

Conclusion: Impaired LA function may be present in patients with newly diagnosed DM2. BMI and increasing age caused LA enlargement and LA volumes that were independent of the effects of hypertension and DM2.

Keywords: left atrial volume, left atrial function, diabetes mellitus, transthoracic echocardiography

Methods

Fifty-six patients (28 male, mean age 52.6 ± 6.5 years) with DM2, according to the American Diabetes Association (ADA) 2013 criteria, with a disease duration of a maximum of six months (recruited from the endocrinology and metabolism departments) and 56 age-matched healthy volunteers (24 male, mean age 50.1 ± 7.0 years) (recruited from the cardiology department) were included in the study. A detailed medical history, physical examination and 12-lead electrocardiography were obtained from the study population.

All subjects underwent a treadmill exercise test according to the Bruce protocol, or myocardial perfusion scintigraphy to rule out latent ischaemia. Patients with evidence of ischaemia, arrhythmia on an electrocardiogram (ECG), LV dysfunction with an ejection fraction (EF) of < 50%, significant valvular disease, history of coronary artery disease, suspicion of secondary hypertension, uncontrolled hypertension, thyroid disorder, pulmonary disease and renal failure (defined as decreased glomerular filtration rate of < 60 ml/min/1.73 m² for at least three months), type 1 DM, electrolyte imbalance, and technically
insufficient echocardiographic and electrocardiographic data were excluded.

The local ethics committee approved the study. All participants provided written, informed consent prior to participation in the study.

Transthoracic echocardiographic examinations were performed using a commercially available cardiac ultrasound scanner (Acuson Sequoia 512 system with 2.5–4.0 MHz transducer, Siemens Mountain View, California, USA) in the left lateral position, according to the criteria of the American Society of Echocardiography.16 During echocardiography a continuous one-lead ECG recording was done.

Left ventricular end-diastolic and end-systolic volumes were determined in the apical view, and stroke volume and EF were measured using the modified Simpson's equation.15 LV mass (LVM) was calculated with the Devereux formula as:

\[
\text{LVM (g)} = 1.04 \times [(\text{LVID} + \text{PWT} + \text{IVST})^3 - \text{LVID}^3] - 14
\]

Where LVID = LV internal dimension; PWT = posterior wall thickness; IVST = interventricular septum thickness. LVM was indexed to body surface area (BSA) by dividing LVM by BSA.

Peak early diastolic (E) velocity, atrial contraction (A) velocity and E-wave deceleration time (DT) were measured from the transmitral pulsed-wave Doppler spectra, and the E/A ratio was calculated. Pulsed-wave tissue Doppler imaging (TDI) was performed in an apical four-chamber window with a sample volume of 5 mm and the monitor sweep speed was set at 100 mm/s to optimise the spectral display of myocardial velocities. All Doppler spectral velocities were averaged over three consecutive beats. The average pulsed-wave TDI-derived early (E') diastolic myocardial velocity was obtained from the lateral and septal sides of the mitral annulus. Then the E/E’ ratio was calculated to provide an estimation of LV filling pressures.17

The TDI-derived late-diastolic wave (A') was obtained from the mitral lateral annulus.

LA diameter was measured from the parasternal long axis M-mode echocardiography. LA volumes were traced and calculated by means of the modified Simpson's method from apical four- and two-chamber views, according to the guidelines of the American Society of Echocardiography and European Association of Cardiovascular Imaging.16 LA volumes were measured as: (1) just before the mitral valve opening, at end-systole (maximal LA volume or \(V_{max}\)); (2) at the onset of the P wave on electrocardiography (pre-atrial contraction volume or \(V_{pap}\)); and (3) at mitral valve closure, at end-diastole (minimal LA volume or \(V_{min}\)). From these, the following measurements were calculated:

- LA passive emptying volume (PEV) = \(V_{max} - V_{pap}\)
- LA passive emptying fraction (PEF) = \(PEV/V_{max} \times 100\)
- LA active emptying volume (AEV) = \(V_{pap} - V_{min}\)
- LA active emptying fraction (AEF) = \(AEV/V_{max} \times 100\)
- LA total emptying volume (TEV) = \(V_{max} - V_{min}\)
- LA total emptying fraction (TEF) = \(TEV/V_{max} \times 100\).

Left atrial volumes were indexed to BSA in all patients.16

### Statistical analysis

Statistical analyses were performed with the MedCalc Statistical Software version 12.7.7 (MedCalc Software bvba, Ostend, Belgium; 2013). All continuous variables are expressed as mean ± standard deviation and median (minimum–maximum). All categorical variables are defined as frequency and percentage. All continuous variables were checked with the Kolmogorov–Smirnov normality test to show their distributions. Continuous variables with normal distributions were compared using the unpaired Student’s t-test, while continuous variables with abnormal distributions were compared using the Mann–Whitney U-test. For categorical variables, the chi-squared test was used.

Pearson or Spearman's correlation analyses were used to determine the associations between LA volume and function, and various laboratory parameters and 2D echocardiographic diastolic parameters. Multivariate evaluations were performed using linear regression analysis. The confounders that were found to have a statistically significant impact on the dependent variable on univariate analysis were described as the independent variables in a multivariate linear regression analysis model. The \(p\)-values less than 0.05 were considered significant.

Sample size justification: according to the article ‘Effects of diabetes mellitus on left atrial volume and functions in normotensive patients without symptomatic cardiovascular disease,’ the \(V_{max}\) value for DM2 patients was 40.9 ± 11.9 ml, and for the control group, 34.6 ± 9.3 ml. The mean difference was assumed as 6.3 ml; the standard deviation of the DM2 group was 11.9 ml and of the control group, 9.3 ml. With the assumption of 5% of type I error (a) and 80% power (1-b), the sample size was calculated at 46 patients for each group. With a 20% drop-out rate, a minimum of 56 patients (112 in total) would have to be enrolled in the study.

### Results

The study population consisted of 112 subjects (52 male, mean age 51.7 ± 7.0 years). Patient characteristics, analysed according to the two groups, are shown in Table 1. The groups were similar regarding age and gender. In the DM2 group, 44 (78.6%) patients were hypertensive and 33 (58.9%) were receiving insulin and oral anti-diabetic agents. Patients in the DM2 group were also taking more medications, such as acetylsalicylic acid, angiotensin converting enzyme inhibitors, beta-blockers and statins than the control group.

Body mass index (BMI) and levels of triglycerides (TG), high-sensitivity C-reactive protein (hsCRP), uric acid, fasting glucose and HbA\(_1c\) were significantly higher in the DM2 group compared with the control group (\(p < 0.05\)). There were no significant differences regarding total cholesterol and low-density lipoprotein (LDL) cholesterol levels between the groups (\(p > 0.05\) (Table 1).

Table 2 reports the results of 2D echocardiographic parameters reflecting diastolic function with preserved systolic function. Twelve (21.4%) subjects in the control group and 29 (51.8%) patients in the DM2 group had some degree of diastolic dysfunction. Mitral A wave, E/E’ ratio and mitral A’ wave were significantly higher, and mitral E’ wave was significantly lower in the DM2 group compared with the controls (\(p < 0.05\)).

There were no significant differences between the groups regarding EF, mitral E wave and E/A ratio (\(p > 0.05\)). LA diameter, and indexed \(V_{pap}, V_{min}, \text{AEV}, \text{TEV}\) were found to be significantly higher in the DM2 group compared with the controls (\(p < 0.05\)). PEF was significantly lower in the DM2 group compared with the controls (\(p < 0.05\)). Between the two
groups, there were no significant differences in indexed PEV, AEF and TEF (p > 0.05) (Table 3).

Patients in the DM2 group were divided according to presence of diastolic dysfunction. There were no significant differences within the DM2 group regarding LA volume and function (p > 0.05) (Table 4).

To determine the influential factors for LA volume, we examined the potential variables that we thought to be echocardiographically and clinically relevant: mitral A wave, E’/E ratio, BMI, and fasting glucose, HbA1c, hsCRP and uric acid levels. There were weak positive correlations between all indexed LA volumetric parameters and all the variables except indexed PEV and BMI, fasting glucose, HbA1c, hsCRP and uric acid levels, mitral A wave, E/E’ ratio and mitral A’ wave. There was a weak negative correlation between all indexed LA volumetric parameters and all the variables except indexed PEV and mitral E’ wave (Table 5).

Univariate analysis showed that DM2, hypertension, age, BMI, and hsCRP and uric acid levels had a statistically significant impact on LA diameter, and indexed Vmax, Volp, Vmin, AEV and TEV. According to multivariate analysis when adjusted with other confounders, hypertension, age and BMI had a statistically significant effect on LA volume; age and BMI had a statistically significant effect on indexed Vmax; age, BMI and uric acid level had a statistically significant effect on indexed Vmin; uric acid level had a statistically significant effect on indexed Vmax; age had a statistically significant effect on indexed AEV; and age and BMI had a statistically significant effect on indexed TEV (Table 6).

Discussion

Diabetes mellitus can lead to changes in LA volume and function. In most studies, LA function is determined by performing real-time three-dimensional (3D) echocardiography, cardiac magnetic resonance imaging (CMRI), and strain and strain rate tests. However, in general practice, LA function can be easily and non-invasively determined by performing 2D echocardiography. In our study, we showed that even if LA size and volume were within normal limits, LA dysfunction may be present in patients

| Parameters | Control group (n = 56) | DM2 group (n = 56) | p-value |
|------------|------------------------|-------------------|---------|
| EF (%)     | 61.9 ± 5.0             | 60.6 ± 4.4        | 0.14    |
| Left ventricular mass (g/m²) | 93.2 ± 8.4           | 102.3 ± 8.0       | < 0.001 |
| Mitral E (cm/s) | 79.1 ± 14.1          | 81.2 ± 16.7       | 0.47    |
| Mitral A (cm/s) | 66.4 ± 13.2           | 80.8 ± 18.8       | < 0.001 |
| E/A ratio (cm/s) | 1.2 ± 0.3             | 1.2 ± 0.9         | 0.68    |
| Deceleration time (s) | 199.0 ± 17.9        | 222.8 ± 19.7      | < 0.001 |
| Mitral E’ (cm/s) | 18.5 ± 4.3            | 15.3 ± 3.3        | < 0.001 |
| Mitral A’ (cm/s) | 14.0 ± 3.2            | 16.1 ± 5.0        | 0.011   |
| E/E’ ratio (cm/s) | 4.4 ± 1.0             | 5.5 ± 1.7         | < 0.001 |
| Diastolic dysfunction, n (%) | 12 (21.4)             | 29 (51.8)         | 0.002   |

DM: diabetes mellitus; LA: left atrium; PEV: passive emptying volume; AEV: active emptying volume; TEV: total emptying volume.

| Table 3. The echocardiographic parameters for the LA function of the study groups |
|-----------------------------|-----------------------------|--------------------------------|
| Parameters | Control group (n = 56) | DM2 group (n = 56) | p-value |
|--------------------------------|-----------------------------|-----------------------------|
| LA diameter (mm) | 33.3 (26–46) | 37.5 (27–56) | < 0.001 |
| Indexed Vmax (ml/m²) | 19.8 ± 4.6 | 24.8 ± 6.6 | 0.001 |
| Indexed Vmin (ml/m²) | 11.8 (4.6–23.6) | 16.1 (9.5–30) | < 0.001 |
| Indexed Vp (ml/m²) | 7.2 (2.8–14.0) | 9.5 (3.8–24.5) | < 0.001 |
| Indexed PEV (ml/m²) | 7.4 ± 3.4 | 7.5 ± 3.2 | 0.66 |
| Indexed AEV (ml/m²) | 5.0 (0.7–16.4) | 6.6 (2.4–15.1) | < 0.001 |
| Indexed TEV (ml/m²) | 12.5 ± 3.7 | 14.6 ± 4.1 | 0.004 |
| LA passive emptying fraction (%) | 35.5 ± 14.4 | 30.0 ± 11.1 | 0.003 |
| LA active emptying fraction (%) | 39.9 ± 13.5 | 42.0 ± 11.8 | 0.386 |
| LA total emptying fraction (%) | 60 (33.8–76.1) | 63.9 (29.0–81.8) | 0.05 |

DM: diabetes mellitus; LA: left atrium; PEV: passive emptying volume; AEV: active emptying volume; TEV: total emptying volume.

| Table 4. Comparison of echocardiographic parameters regarding diastolic dysfunction for the LA function in the DM2 group |
|--------------------------------|-----------------------------|-----------------------------|
| Parameters | Diastolic dysfunction (+) (n = 29) | Diastolic dysfunction (−) (n = 27) | p-value |
|--------------------------------|-----------------------------|-----------------------------|---------|
| LA diameter (mm) | 37.7 ± 5.1 | 36.4 ± 5.8 | 0.548 |
| Indexed Vmax (ml/m²) | 25.8 ± 6.9 | 23.5 ± 6.2 | 0.196 |
| Indexed Vmin (ml/m²) | 18.1 ± 5.8 | 16.1 ± 4.7 | 0.168 |
| Indexed Vp (ml/m²) | 10.8 ± 4.6 | 9.2 ± 3.7 | 0.168 |
| Indexed PEV (ml/m²) | 7.6 ± 3.2 | 7.3 ± 3.4 | 0.735 |
| Indexed AEV (ml/m²) | 7.3 ± 2.8 | 6.8 ± 2.6 | 0.555 |
| Indexed TEV (ml/m²) | 14.9 ± 4.1 | 14.2 ± 4.0 | 0.505 |
| LA passive emptying fraction (%) | 29.5 ± 10.9 | 30.5 ± 11.5 | 0.751 |
| LA active emptying fraction (%) | 41.1 ± 11.1 | 43.0 ± 12.7 | 0.541 |
| LA total emptying fraction (%) | 58.7 ± 9.8 | 60.9 ± 9.4 | 0.402 |

DM: diabetes mellitus; LA: left atrium; PEV: passive emptying volume; AEV: active emptying volume; TEV: total emptying volume.
Table 5. Correlation analysis of LA volume and function with 2D echocardiographic parameters and laboratory findings

| Parameters                      | Indexed $V_{min}$ (ml/m²) | Indexed $V_{vol}$ (ml/m²) | Indexed PEV (ml/m²) | Indexed AEV (ml/m²) | Indexed TEV (ml/m²) |
|--------------------------------|---------------------------|---------------------------|---------------------|---------------------|---------------------|
| Glucose (mg/dl)                |                           |                           |                     |                     |                     |
|                                | $r$                       | $P$                       |                     |                     |                     |
|                                | 0.153                     | 0.252                     | 0.182               | -0.034              | 0.204               | 0.075               |
| HbA1c (%)                      |                           |                           |                     |                     |                     |
|                                | $r$                       | $P$                       |                     |                     |                     |
|                                | 0.288                     | 0.367                     | 0.294               | 0.006               | 0.301               | 0.192               |
| BMI (kg/m²)                    |                           |                           |                     |                     |                     |
|                                | $r$                       | $P$                       |                     |                     |                     |
|                                | 0.430                     | 0.441                     | 0.368               | 0.135               | 0.340               | 0.325               |
| TG (mg/dl)                     |                           |                           |                     |                     |                     |
|                                | $r$                       | $P$                       |                     |                     |                     |
|                                | 0.152                     | 0.248                     | 0.136               | -0.047              | 0.259               | 0.089               |
| hsCRP (mg/l)                   |                           |                           |                     |                     |                     |
|                                | $r$                       | $P$                       |                     |                     |                     |
|                                | 0.110                     | 0.008                     | 0.153               | 0.625               | 0.011               | 0.350               |
| Table 6. Univariate and multivariate analysis for predictors of LA volume and function of the study population

| Parameters                      | DM2 | HT  | HL  | BMI | hsCRP | Uric acid | DM2 | HT  | HL  | BMI | hsCRP | Uric acid |
|--------------------------------|-----|-----|-----|-----|-------|-----------|-----|-----|-----|-----|-------|-----------|
| LA diameter (mm)                |     |     |     |     |       |           |     |     |     |     |       |           |
|                                | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ |
| Indexed $V_{min}$ (ml/m²)      |     |     |     |     |       |           |     |     |     |     |       |           |
|                                | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ |
| Indexed $V_{vol}$ (ml/m²)      |     |     |     |     |       |           |     |     |     |     |       |           |
|                                | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ |
| Indexed PEV (ml/m²)            |     |     |     |     |       |           |     |     |     |     |       |           |
|                                | 0.66         | 0.268         | 0.291         | 0.171         | 0.164         | 0.281         | 0.190         |       |     |     |           |
| Indexed AEV (ml/m²)            |     |     |     |     |       |           |     |     |     |     |       |           |
|                                | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ |
| Indexed TEV (ml/m²)            |     |     |     |     |       |           |     |     |     |     |       |           |
|                                | 0.004       | 0.001       | 0.051       | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ | $<0.001$ |
| LA passive emptying fraction (%)| 0.003       | 0.052       | 0.011       | 0.169       | 0.044       | 0.065       | 0.338       | 0.150   |       |     |           |
| LA active emptying fraction (%) | 0.386       | 0.769       | 0.499       | 0.393       | 0.718       | 0.430       | 0.968       |       |     |     |           |
| LA total emptying fraction (%)  | 0.05        | 0.117       | 0.162       | 0.293       | 0.148       | 0.395       | 0.363       |       |     |     |           |

DM: diabetes mellitus; HT: hypertension; HL: hyperlipidaemia; BMI: body mass index; hsCRP: high-sensitivity C-reactive protein; LA: left atrium; PEV: passive emptying volume; AEV: active emptying volume; TEV: total emptying volume.
demonstrated that DM2 was independently associated with LA PEV, AEV, TEV and PEF, AEF and TEF from V max, Vmin and analysis, age and BMI were the independent predictors of LA findings, we speculate that although diabetes was an independent each 10 years' duration of diabetes. Moreover, this finding underlines the importance LA volume and function with 2D echocardiography was an additional limitation of our study.

In our study, in accordance with the study of Huang et al., we found reduced conduit, and increased pump and reservoir function in diabetic patients compared with the controls. The possibly inconsistent results with previous studies may have been due to different cardiovascular imaging techniques used for the determination of LA function, small sample sizes, different baseline characteristics, and different diabetes durations of the study populations.

There are some limitations to our study. As this was a cross-sectional study, follow up of the patients for clinical endpoints such as AF and heart failure could not be done. Therefore, our study results cannot be used to direct standard clinical care. Moreover, as the population size was relatively small, our study does not permit any causal inferences and analysis on the effect of medications on LA volume and function. For this reason, long-term follow up and large-scale prospective studies are needed to determine the clinical predictive value of early LA functional impairment in this population. Evaluation of LA volume and function with 2D echocardiography was an additional limitation of our study.

Conclusion

The results of our study showed impaired LA function may be present in patients with DM2 with a disease duration of a maximum of six months. BMI and increased age caused LA enlargement and LA volumes that were independent of the effects of hypertension and DM2. Further studies with larger sample sizes are needed to better define the underlying mechanisms.

The authors thank Arzu Baygul from MedStats Consulting and Prof Sale Oktay, MD, PhD from Kappa Consulting, Tranning and Limited Research Ltd for statistical analysis and interpretation of the results.

References

1. Ryde'n L, Standl E, Bartnik M, et al. Guidelines on diabetes, pre-diabetes, and cardiovascular diseases: executive summary, the task force on diabetes and cardiovascular diseases of the European Society of Cardiology (ESC) and of the European Association for the study of Diabetes (EASD). Eur Heart J 2007; 28: 88–136.
2. Freire CM, Moura AL, Barbosa Mde M, et al. Left ventricular diastolic dysfunction in diabetes: an update. Arq Bras Endocrinol Metab 2007; 51(2): 168–175.
3. Poulsen MK, Henriksen JE, Dahl J, et al. Left ventricular diastolic function in type 2 diabetes mellitus. Prevalence and association with myocardial and vascular disease. Circ Cardiovasc Imag 2010; 3: 24–31.
4. Kadappu KK, Boyd A, Eshoo S, et al. Changes in left atrial volume in diabetes mellitus: more than diastolic dysfunction. Eur Heart J 2010; 13: 1016–1023.
5. Muranaka A, Yuda S, Tsuchihashi K, et al. Quantitative assessment of left ventricular and left atrial functions by strain rate imaging in diabetic patients with and without hypertension. Echocardiography 2009; 26: 262–271.
6. Huang G, Zhang L, Xie M, Fu M, Huang J, Lv Q. Assessment of left atrial function in diabetes mellitus by left atrial volume tracking method. J Huazhong Univ Sci Technol 2010; 30: 819–823.
7. Tadic M, Cuspidi C. The influence of type 2 diabetes on left atrial remodeling. Clin Cardiol 2015; 38: 48–55.
8. Atas H, Kepez A, Atas DB, et al. Effects of diabetes mellitus on left atrial volume and functions in normotensive patients without symptomatic cardiovascular disease. J Diabetes Complicat 2014; 28: 858–862.
9. To ACY, Flamm SD, Marwick TH, Klein AL. Clinical utility of multimodality LA imaging: assessment of size, function, and structure. J Am Coll Cardiol Cardiovasc Imag 2011; 4: 788–798.
10. Vaziri SM, Larson MG, Benjamin EI, Levy D. Echocardiographic predictors of nonhemodynamic atrial fibrillation: the Framingham Heart Study. Circulation 1994; 89: 724–730.
11. Benjamin EJ, D’Agostino RB, Belanger AJ, Wolf PA, Levy D. Left atrial size and the risk of stroke and death: the Framingham Heart Study. Circulation 1995; 92: 835–841.
12. Modena MG, Muia N, Sgura FA, Molinari R, Castella A, Pessi R. Left atrial size is the major predictor of cardiac death and overall clinical outcome in patients with dilated cardiomyopathy: a long-term follow up study. Clin Cardiol 1997; 20: 553–560.
13. Simek CL, Feldman MD, Haber HL, Wu CC, Jayaweera AR, Kaul S. Relationship between left ventricular wall thickness and left atrial size: comparison with other measures of diastolic function. J Am Soc Echocardiogr 1995; 8: 37–47.
14. Zoppini G, Bonapace S, Bergamini C, et al. Evidence of left atrial remodelling and left ventricular diastolic dysfunction in type 2 diabetes mellitus with preserved systolic function. Nutr Met CV Dis 2016; 26: 1026–1032.
15. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care 2013; 36(Suppl 1): S67–74.
Smartphone apps launched for atrial fibrillation patients and their healthcare providers

Novel smartphone and tablet applications (apps) for atrial fibrillation patients and healthcare professionals have been launched by heart experts. The objectives and design of the apps are outlined in an article published online recently in EP Europace, with a summary published in the European Heart Journal.

Atrial fibrillation is the most common heart rhythm disorder and significantly increases the risk of stroke and death. One in four middle-aged adults in Europe and the US will develop atrial fibrillation, and the incidence and prevalence are rising.

‘Around two-thirds of people in Europe and the US have a mobile device and use it as their main way of accessing online information,’ said lead author Dr Dipak Kotecha, a clinician scientist in cardiovascular medicine at the Institute of Cardiovascular Sciences, University of Birmingham, UK. ‘This presents a big opportunity to improve self-management and shared decision making in atrial fibrillation.’

The My AF app and AF Manager app were designed by the European Society of Cardiology (ESC) Guidelines Task Force on Atrial Fibrillation and the CATCH ME consortium, of which the ESC is a partner. The apps were developed over the last two years in tandem with the writing of the 2016 ESC guidelines on atrial fibrillation. Both apps are freely available for Android and iOS devices through the Google Play, and Apple stores.

My AF is for patients with atrial fibrillation. It provides information about the condition, the risk of stroke, atrial fibrillation treatments, and tips on improving lifestyle. Patients can record symptoms and quality of life in a diary which can be shared with a nominated health professional before each consultation to maximise face-to-face time.

Developed in collaboration with patients and patient support groups, My AF provides high-quality information in a simple format that is suitable for adults of all ages. Work is underway to translate the app into several languages.

Dr Kotecha said: ‘The app aims to encourage active patient involvement in the management of their condition. There is evidence that patient education can improve self-care, adherence to therapy, and long-term outcomes.’

AF Manager is for doctors, nurses and other healthcare professionals. It is the first app of its kind to be submitted for CE certification and is in the final stages of approval. AF Manager imports information shared by the patient and allows the healthcare professional to amend details and enter other medical information, such as electrocardiogram or echocardiography data. The Treatment Manager tool within the app then suggests individualised treatment options based on ESC guidelines. After a consultation, the notes, treatment decisions and medication dosages can be entered and then shared with the patient.

‘Many studies have shown that when clinicians follow guideline recommendations, patients have better outcomes,’” said Dr Kotecha. ‘All of the decision aids in AF Manager are based on ESC guidelines so we hope this will encourage guideline implementation. Patients will have the option to anonymously donate their data, which will enable us to assess the guideline adherence rate.’

The apps are linked to allow transfer of data between patients and healthcare professionals via a secure server at the University of Birmingham, UK. Patients control who can view and edit their data. When data sharing is enabled, updates are synced on both apps. All shared information is encrypted and password protected.

Dr Kotecha said: ‘We know that effective management of atrial fibrillation is suited to shared decision making and we have created the apps in the hope of facilitating this process. Sharing information should save clinicians time and enable them to devote consultations to choosing the best treatments.’

He concluded: ‘The dynamic nature of this technology will allow us to modify and update the features and content to reflect feedback from users, as well as future versions of the ESC atrial fibrillation guidelines.’

Source: European Society of Cardiology Press Office