Echocardiographic Findings in Atrial Flutter

By Samuel Zonaichage, M.D., Olga Zonaichage, M.D., and Jai J. Rhee, M.D.

SUMMARY
Echocardiographic studies were performed in 22 patients with atrial fibrillation and atrial flutter. In atrial flutter, the echocardiograms consistently demonstrated regular undulatory waves of the posterior left atrial wall and upper left interventricular septum coinciding with each flutter wave of the electrocardiogram. The mitral valve was slightly reopened by each flutter wave occurring after diastolic mitral closure. The phonocardiogram simultaneously recorded with the echocardiogram showed only occasional atrial sounds. Coarse atrial fibrillation produced undulatory low frequency motion of both leaflets of the mitral valve during diastole. Atrial fibrillation with fine fibrillatory waves failed to show any significant and constant undulations of the left atrial wall and upper left interventricular septum. Echocardiographic evaluation of patients with atrial flutter could have diagnostic implications in difficult cases with nondiagnostic electrocardiograms.

PUBLISHED ECHOCARDIOGRAPHIC STUDIES have reported the presence of an undulatory pattern of the mitral valve during diastole in patients with arrhythmias.1,2 Atrial fibrillation and atrial flutter are known to produce fine and coarse diastolic oscillations of the anterior leaflet of the mitral valve (ALMV).

The purpose of this study is to describe our experience in assessing the usefulness of the echocardiographic undulating pattern of both mitral valve leaflets, left atrium and upper left interventricular septum in these arrhythmias.

Such movements, if present, may have diagnostic value in patients with atrial flutter in whom the electrocardiogram is doubtful.

Material and Methods
Twenty-two consecutive patients with atrial fibrillation and atrial flutter were studied clinically and by noninvasive graphic methods. The group consisted of 17 males and five females ranging in age from 36 to 76 years. The diagnosis was cardiomyopathy in five cases, coronary atherosclerosis in ten, hypertensive cardiovascular disease in three and mitral stenosis in four cases.

The electromyogram revealed atrial fibrillation in 15, atrial flutter in two and atrial flutter-fibrillation in five patients. Echocardiography was performed in the supine position with an Ekoline 20 Echograph S.K.I. Instruments utilizing a 0.5 inch diameter 2.25 MHz transducer focused at 10 cm with a repetition rate of 1000 impulses/sec. The ultrasound transducer was placed in the fourth or fifth left intercostal space close to the sternum. The signal from the echograph was displayed and recorded on an Electronics for Medicine VR6 stripchart multichannel oscilloscope recorder. Ultrasonic scans were obtained from apex to base and echocardiograms were recorded with rigid adherence to the technique and criteria previously established.2 Flutter movements of the left atrium and upper left interventricular septum were best obtained at the transitional area of the wall of the posterior left atrium and the posterior wall of the left ventricle. Combination electrocardiograms and phonocardiograms were recorded on all patients.

Several consecutive recordings were obtained in all cases where changes in rhythm were observed from one day to another by clinical examination and electrocardiogram.

Results
All 16 patients with “fine” atrial fibrillation failed to show any significant oscillatory movement of the left atrial wall or upper left interventricular septum. In five patients with atrial flutter-fibrillation, both leaflets of the mitral valve demonstrated a smooth undulatory low frequency motion (patient 1, fig. 1). In two patients with atrial flutter there was a consistent and regular fluttering of the left atrial posterior wall and of the upper left interventricular septum.

Patient 2 (fig. 2) shows the close relationship between the flutter waves of the electrocardiogram and the consistent and regular pattern (echocardiographic F waves) of the left atrial wall. Each echocardiographic flutter wave (F) corresponds to an F echocardiographic wave. A similar pattern is observed in the upper left interventricular septum. The phonocardiogram only occasionally reveals atrial sounds due to atrial contractions.

Patient 3 (fig. 3) shows intermittent F echocardiographic waves of the left atrial wall and in the high left interventricular septum. These waves, when present, coincide with the coarse atrial flutter-fibrillation waves of the electrocardiogram. “Finer” fibrillatory
Figure 1
Case 1, 81-year-old patient with ischemic heart disease, cardiomegaly and impure atrial flutter. The echocardiogram was recorded at the level of the mitral valve. AMV = anterior mitral valve; PMV = posterior mitral valve; PLVW = posterior left ventricular wall; L2 = lead II of the ECG in all illustrations. Phonocardiogram (PCG) recorded at apex. Time lines represent 1 sec in all illustrations.

Figure 2
Case 2, 79-year-old patient with calcific aortic stenosis and atrial flutter (250/min). Echocardiogram was recorded at the level of transitional zone between left atrium and left ventricle. PLA = posterior left atrium; F = flutter waves. PCG was recorded at apex.
waves in the electrocardiogram do not have any counterpart in the echocardiogram. The next day the patient presented slow atrial flutter after treatment with quinidine. The flutter waves are seen in the electrocardiogram recorded during carotid sinus compression (fig. 4, bottom). In the same figure, we see the close relationship between flutter (F) echocardiographic motion of the left atrial wall and upper left interventricular septum and the slow atrial rate of flutter wave in the electrocardiogram. Next day, the patient was converted medically to regular sinus rhythm, as observed on the electrocardiogram (top, fig. 5). The echocardiographic flutter (F) waves were no longer present.

Discussion

Atrial flutter in patients in whom the electrocardiogram is not typical presents, on occasion, a diagnostic problem. Atrial sounds, when present and recorded by phonocardiography, may have diagnostic value. Flutter oscillations which occur at a rate of approximately 300 per minute in the neck veins could also be helpful for diagnostic purposes. Manifest flutter waves registered by apexcardiogram and concurrently recorded with flutter waves of the electrocardiogram have been reported by Benchimol.

Though the morphology of the echocardiogram of the anterior leaflet of the mitral valve during coarse fibrillation has been described, no published observations raised the possibility of correlating precise details of movement of the left atrial wall and upper left interventricular septum to specific arrhythmias. In the present study, the presence of atrial flutter (patients 2 and 3) producing echocardiographic flutter movement of the left posterior atrial wall was diagnostic in both cases. The flutter undulations of the upper left interventricular septum seem to be less evident than those of the posterior left atrial wall.

Figure 3

Case 3, 77-year-old patient with mitral stenosis. The electrocardiogram shows coarse fibrillation. Echocardiogram was recorded at the transitional zone between left atrium and left ventricle. AVW = atrioventricular wall.
The factor responsible for the undulatory flutter waves seen in the atrial wall and in the upper left interventricular septum is probably due to regular rapid atrial contractions (fig. 2). In systole, the fluttering undulations could be seen on the atrial wall and in the upper left interventricular septum. In diastole, regular atrial contractions observed in atrial flutter slightly reopen the mitral valve (fig. 2). Impure flutter or coarse fibrillation induces undulatory waves of both leaflets of the mitral valve during diastole (fig. 1).

It would appear that echocardiographic evaluation of our patients with atrial flutter is diagnostic in demonstrating the flutter undulations in the structure of the left atrium. Such patterns, when recorded, could have diagnostic implications by adding new and significant data to those data obtained from such other graphic methods as electrocardiography, jugular pulse, apexcardiography and phonocardiography.

**Figure 4**

*Case 3. The electrocardiogram shows slow atrial flutter. The echocardiogram was recorded at the same level as in figure 3. ECG V2 (bottom panel): F waves are recorded at a rate of 200/min.*

**Figure 5**

*Same patient as in figures 3 and 4 after conversion to regular sinus rhythm.*

*Circulation, Volume 52, September 1975*
ULTRASOUND IN ATRIAL FLUTTER

Acknowledgment

The authors wish to acknowledge the assistance of Miss Ada Fanta-
troy, Mr. Floyd Jackson and Mrs. Karen Franklin in the preparation
of this manuscript.

References

1. Gabor GE, Winsberg F: Motion of mitral valves in cardiac
arrhythmias. Ultrasonic cardiographic study. Invest Radiol
5: 355, 1970

2. Feigenbaum H: Echocardiography. Philadelphia, Lea and
Febiger, 1972, p 66, p 37

3. Luisada AA: Basic principles of sound and pulse tracings. In
Non-Invasive Methods in Cardiology, edited by Zoneraich
S. Springfield, Charles C Thomas, 1974, p 171

4. Fowler NO: Diagnostic value of the jugular venous pulse wave
forms. In Non-Invasive Methods in Cardiology, edited by
Zoneraich S. Springfield, Charles C Thomas, 1974, p 157

5. Benchimol A: Clinical applications of the apexcardiogram. In
Non-Invasive Methods in Cardiology, edited by Zoneraich
S. Springfield, Charles C Thomas, 1974, p 114
Echocardiographic findings in atrial flutter.
S Zoneraich, O Zoneraich and J J Rhee

Circulation. 1975;52:455-459
doi: 10.1161/01.CIR.52.3.455

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/52/3/455

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org//subscriptions/