

Atrial Stunning Masquerading as Restrictive Doppler Flow Pattern: A Case of Mitral Inflow “Pseudorestriction”

Glenn P. Kelley, M.D.,* Ghassan A. Dalati, M.D.,* Frederick R. Helmcke, M.D.,* Neeraj Jain, M.D.,* Mohammed Al-Bataineh, M.D.,* D. Luke Glancy, M.D.,* and Edmund Kenneth Kerut, M.D.,†,‡

*Section of Cardiology, Department of Medicine, Louisiana State University Health Sciences Center, New Orleans, Louisiana †Heart Clinic of Louisiana, Marrero, Louisiana ‡Departments of Physiology and Pharmacology, Louisiana State University Health Sciences Center, New Orleans, Louisiana

(*ECHOCARDIOGRAPHY*, Volume 23, February 2006)

pseudorestriction, restrictive, Doppler, echocardiography

A 59-year-old woman presented for elective radiofrequency ablation (RFA) of typical, counterclockwise, isthmus-dependent, atrial flutter. Spontaneous conversion to sinus rhythm occurred the evening before the procedure obviating the need for pacing or direct current cardioversion during the electrophysiologic study. After successful RFA, no recurrence of the atrial arrhythmia was noted. Transthoracic echocardiography (TTE) was performed 5, 10, and 30 days after the RFA procedure (Table I; Figs. 1–3). Measured diastolic parameters included mitral inflow early filling velocity (E), filling velocity due to atrial contraction (A), E deceleration time (DT), E/A ratio, pulmonary vein diastolic and systolic filling velocities (PVd and PVs, respectively), PVs/PVd ratio, tissue Doppler early and late diastolic descent of the mitral annulus (E' and A', respectively), and E/E' ratio.

Initially, mitral inflow by TTE was consistent with a restrictive filling pattern (E = 1.2 m/sec, A = 0.24 m/sec, E/A = 5.0, DT = 154 msec, PVs = 24 cm/sec, PVd = 101 cm/sec, PVs/PVd = 0.24) which was not altered by left ventricular preload reduction (Valsalva maneuver), thus meeting defined criteria for grade IV diastolic dysfunction.^{1,2} Moderate mitral regurgitation, moderate tricuspid regurgitation, and pulmonary hypertension (60 mmHg) were also noted. Ten days post RFA procedure pulmonary artery pressures returned to normal. Repeat

TTE at 30 days demonstrated a normal diastolic filling pattern (E = 0.95 m/sec, A = 0.73 m/sec, E/A = 1.3, DT = 192 ms, PVs = 52 cm/sec, PVd = 54 cm/sec, PVs/PVd = 0.96). The left ventricular systolic ejection fraction (68% ± 4%) and heart rate (64 ± 4 beats/min) did not vary significantly between examinations.

Restoration of sinus rhythm after prolonged atrial fibrillation or, to a lesser degree, atrial flutter often results in depressed left atrial (LA) contractility despite normal electrical activity.^{3–5} A TTE performed after restoration of sinus rhythm, regardless of the mode of conversion, frequently shows an increased E-wave and depressed or absent A-wave, which may persist for days to weeks.⁴ This pattern is often seen with left ventricular diastolic dysfunction with elevated left heart preload, termed “restriction to filling.”¹ However, in an animal model, this transmitral filling pattern has also been noted as a consequence of increased LA pressure resulting from depressed LA mechanical function, rather than impaired left ventricular compliance. Thus the term “pseudorestriction” has been coined recently.⁶

In practical terms, it is important to recognize that the pseudorestrictive Doppler flow pattern may be observed after termination of sustained atrial fibrillation or flutter. Two important summary points about the pseudorestrictive mitral filling pattern include: (1) recognition of this pattern avoids misdiagnosis of irreversible, restrictive physiology and (2) when observed, may suggest the presence of an occult atrial tachyarrhythmia.

Address for correspondence and reprint requests: Glenn P. Kelley, M.D., LSU Health Sciences Center, Section of Cardiology, 2025 Gravier St., Suite 606, New Orleans, LA 70112. Fax: 504-568-5845; E-mail: gkelle1@lsuhsc.edu

MITRAL PSEUDORESTRICTION

TABLE I

Diastolic Parameters from Serial TTE Examinations Performed 5, 10, and 30 days after successful RFA for isthmus-dependent atrial flutter. Normal values are age adjusted.² The values referenced are for subjects from 41 to 60 years old.

	5 Days	10 Days	30 Days	Normal Values
E (m/sec)	1.2	1.0	0.95	0.71 ± 0.13
A (m/sec)	0.24	0.38	0.73	0.57 ± 0.13
E/A	5.0	2.6	1.3	1.28 ± 0.25
PVs (cm/sec)	24	33	52	49 ± 8
PVd (cm/sec)	101	78	54	41 ± 8
PVs/PVd	0.24	0.42	0.96	1.39 ± 0.47
DT	154	172	192	181 ± 19
E' (m/sec)*	0.07	0.08	0.11	
A' (m/sec)*	0.03	0.05	0.06	
E/E'	17	13	8.6	

*Tissue Doppler data acquired from the apical four-chamber view with the sample volume at the lateral mitral annulus.

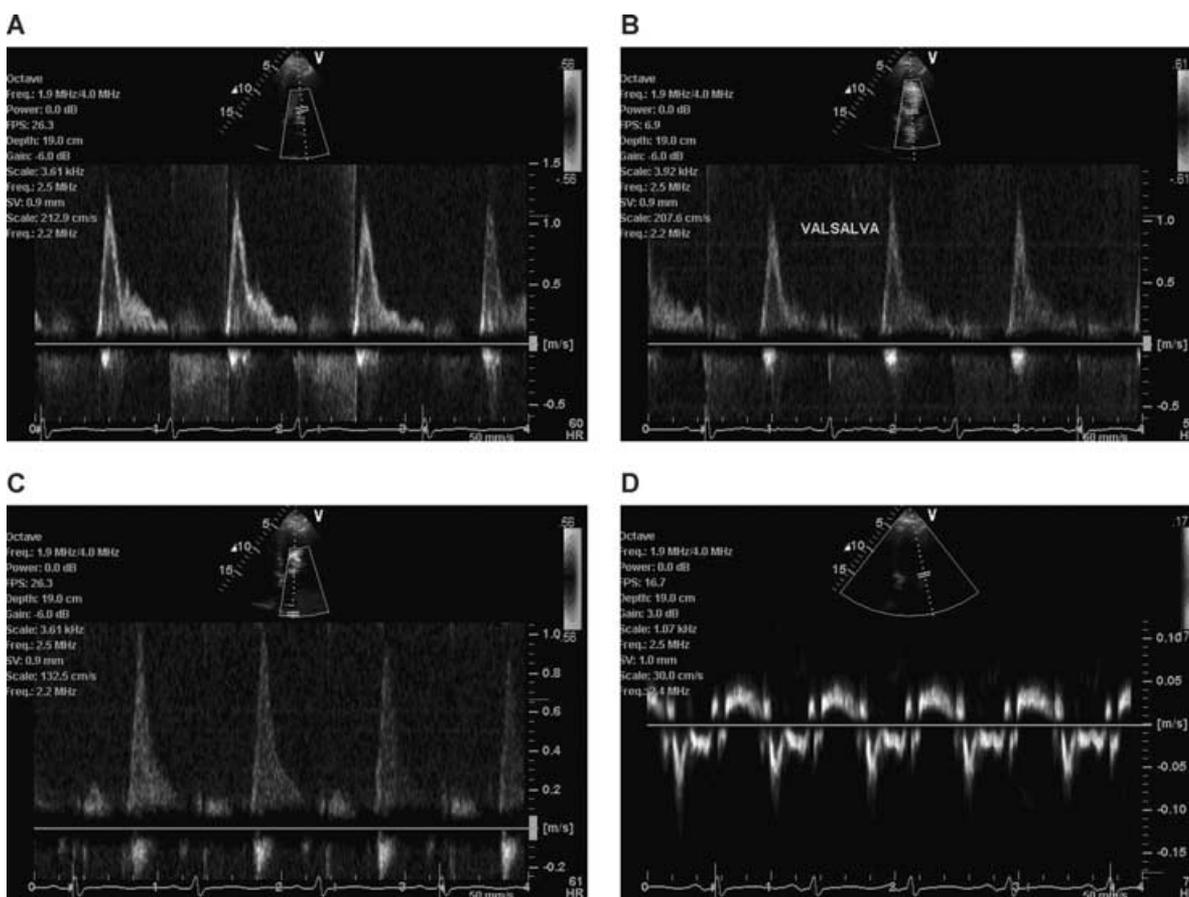


Figure 1. Pulsed-wave spectral Doppler from TTE performed 5 days after RFA showing transmittal inflow during held mid-expiration (A), with Valsalva maneuver (B), left atrial filling (C), and tissue Doppler sampled at the lateral mitral annulus (D). Note the increased E velocity, steep deceleration time of the early ventricular filling, absence of systolic forward flow in the pulmonary vein, and markedly increased diastolic filling velocities in the pulmonary vein. The transmittal inflow pattern does not change with ventricular preload reduction (Valsalva).

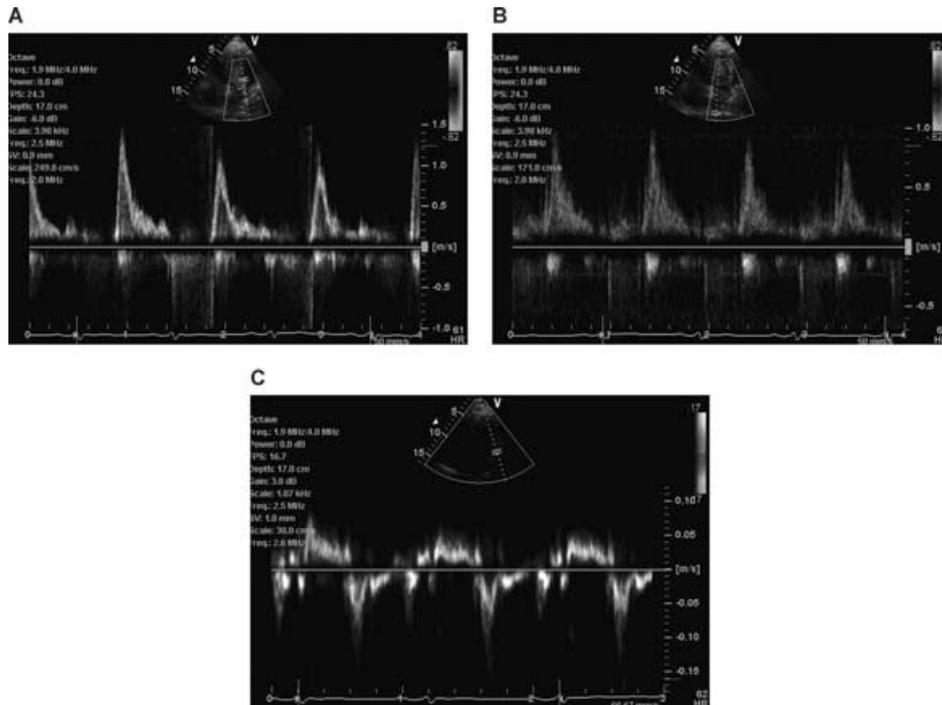


Figure 2. Pulsed-wave spectral Doppler from TTE performed 10 days after RFA showing transmitral inflow (A), left atrial filling (B), and tissue Doppler (C). The restrictive filling pattern persists.

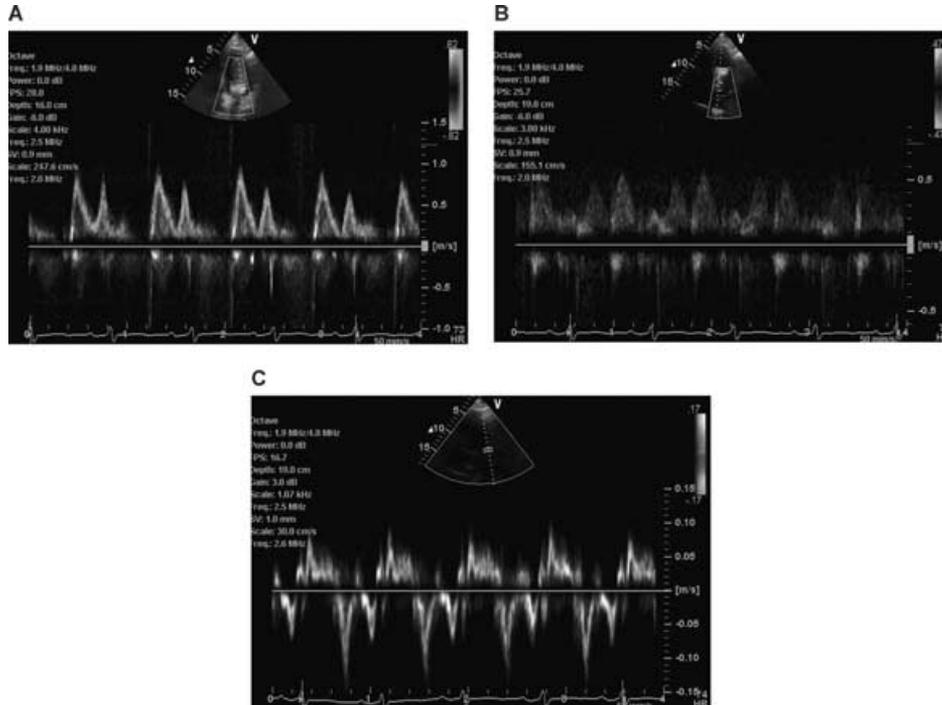


Figure 3. Pulsed-wave spectral Doppler from TTE performed 30 days after RFA showing transmitral inflow (A), left atrial filling (B), and tissue Doppler (C). The ventricular and atrial filling profiles are normal.

References

1. Kerut EK, Mellwain EF, Plotnick GD: *Handbook of Echo-Doppler Interpretation, 2nd ed.* Armonk, NY, Futura Publishing Co., Inc., 2004, pp. 64–80.
2. Oh JK, Seward JB, Tajik AJ: *The Echo Manual, 2nd ed.* Lipincott, Philadelphia, 1999, pp. 45–57.
3. Sparks PB, Jayaprakash S, Vohra JK, et al: Left atrial “stunning” following radiofrequency catheter ablation of chronic atrial flutter. *J Am Coll Cardiol* 1990;32:468–475.
4. Manning WJ, Silverman DI, Katz SE, et al: Impaired left atrial mechanical function after cardioversion: Relation to the duration of atrial fibrillation. *J Am Coll Cardiol* 1994;23:1535–1540.
5. Grimm RA, Stewart WJ, Arheart KL, et al: Left atrial appendage “stunning” after electrical cardioversion of atrial flutter: An attenuated response compared with atrial fibrillation as the mechanism for lower susceptibility to thromboembolic events. *J Am Coll Cardiol* 1997;29:582–589.
6. Yamada H, Donal E, Kim Y, et al: The pseudorestrictive pattern of transmitral Doppler flow pattern after conversion of atrial fibrillation to sinus rhythm: Is atrial or ventricular function to blame? *J Am Soc Echo* 2004;17:813–818.