

Clinical Image

Dynamic Left Ventricular Outflow Tract Obstruction during Non-Cardiac Surgery

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Dynamic Left Ventricular Outflow Tract (LVOT) obstruction with Systolic Anterior Motion of the mitral valve (SAM) was first reported in hypertrophic cardiomyopathy but is now increasingly recognized as a cause of hemodynamic instability [1]. Echocardiographic hallmarks of SAM include systolic bending of the mitral valve leaflets across the LVOT, late systolic peaking flow velocity in the LVOT, mid-systolic closure of the aortic valve, and posteriorly directed mitral valve regurgitation. SAM is thought to result from the combination of predisposing anatomical factors such as septal hypertrophy, abnormal chordae insertion, elongated mitral valve leaflets, and anterior displacement of the anterolateral papillary muscle and precipitating conditions. Precipitating conditions include hypovolemia, vasodilation, tachycardia, and increased contractility [2]. They are frequently encountered during surgery as a result of blood loss, anesthetics-induced vasodilation, mechanical ventilation, and catecholamine surge. Treatment of SAM with dynamic LVOT obstruction includes volume administration and use of vasopressors to increase the after load. β -blockers can be used in the most severe cases to slow down the heart rate and decrease contractility.

The accompanying images are from a 72-year-old man who underwent bilateral nephrectomy for infected renal cysts resulting in a septic shock state and developed profound hypotension following the loss of 1.5 liter of blood over a short period. A rescue transoesophageal echo was performed because both the administration of a massive amount of fluid, blood and blood products and an infusion of noradrenaline at $0.3 \mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ failed to correct blood pressure. Based on the diagnosis of SAM, the administration of β -blockers (esmolol) was decided and resulted in hemodynamic stabilization within minutes.

References

1. Sherrid MV, Balam S, Kim B, Axel L, Swistel DG. The Mitral Valve in Obstructive Hypertrophic Cardiomyopathy: A Test in Context. *J Am Coll Cardiol.* 2016; 67: 1846-1858.

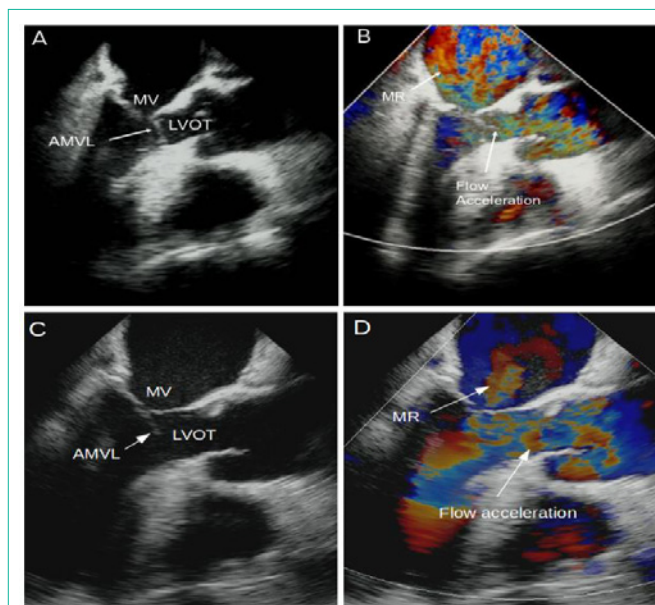


Figure 1: A. Mid-esophageal long-axis view showing the bending of the MV across the LVOT.

B. Mid-Esophageal long-axis view with color flow Doppler revealing a massive mitral regurgitation posteriorly directed. The mosaic appearance in the LVOT reflects flow acceleration related to dynamic obstruction of the left ventricular outflow tract.

C. Mid-esophageal long-axis view after the initiation of β -blockers. The MV still bends across the LVOT but no longer comes in apposition with the interventricular septum.

D. Mid-Esophageal long-axis view with color flow Doppler after the administration of β -blockers. There is less MR and flow acceleration into the LVOT than in B. The Nyquist limit was set at 43.4cm/sec for all the color flow Doppler images. Video 1 and 2, available as supplementary online material show mid-papillary short-axis transgastric view and mid-esophageal long-axis view with and without color flow Doppler before and after the administration of β -blockers, respectively.

MR= Mitral Valve Regurgitation; MV= Mitral Valve; AMVL= Anterior Mitral Valve Leaflet; LVOT= Left Ventricular Outflow Tract.

2. Slama M, Tribouilloy C, Maizel J. Left ventricular outflow tract obstruction in ICU patients. *Curr Opin Crit Care.* 2016; 22: 260-266.