Normalization of the External Carotid Pulse Tracing of Hypertrophic Subaortic Stenosis during Muller’s Maneuver*

Haim Bartall, M.D.; Saul Amber, M.D.; Kenneth B. Desser, M.D., F.C.C.P.; and Alberto Benchimol, M.D., F.C.C.P.

Distinct patterns in the tracing of the external carotid arterial pulse have been well documented in cases of idiopathic hypertrophic subaortic stenosis.1 The characteristic midsystolic retraction and late systolic wave associated with this disease have been noted to appear or become exaggerated during performance of Valsalva’s maneuver.6,8 We describe herein the “normalization” of a diagnostic carotid arterial pulse tracing during deep inspiration against a closed glottis (Müller’s maneuver) in a patient with subaortic stenosis.

Figure 1 shows the external carotid pulse tracing and phonocardiograms from a 77-year-old woman with obstructive cardiomyopathy proven at catheterization. The left panel indicates a classic midsystolic incisura of the carotid pulse contour recorded during breath-holding at midexpiration. A systolic ejection murmur was recorded in conjunction with the external tracing. The center panel shows exaggeration of both the abnormal external carotid arterial pulse tracing and the murmur during voluntary execution of Valsalva’s maneuver. When the patient was instructed to inspire against a closed glottis (right panel), there was a striking normalization of the configuration of the carotid pulse tracing, with complete disappearance of the “spike-and-dome” deflection. Additionally, there was a diminution in the intensity of the murmurs recorded and heard at the aortic

Figure 1. Phonocardiograms of mitral area (MA), tricuspid area (TA), pulmonic area (PA), and aortic area (AA), external carotid pulse tracing (CT), and lead 2 (LII) of ECG from 77-year-old woman with idiopathic hypertrophic subaortic stenosis. Left, Control tracings. Center, Exaggeration of abnormalities during Valsalva’s maneuver. Right, Normalization of carotid pulse tracing during Müller’s maneuver. 1 and 2, First and second heart sounds, respectively; SR, systolic retraction; DN, dicrotic notch; SM, systolic murmur; and SB, systolic bulge.
and pulmonic areas. Cessation of Müller's maneuver produced findings identical to those shown in the control tracings in the first panel.

It has been clearly demonstrated that any physiologic maneuver that alters the length of the left ventricular myocardial fibers may influence functional obstruction of the left ventricular outflow tract in subjects with idiopathic hypertrophic subaortic stenosis. The hemodynamic consequences attendant to Valsalva's maneuver are such that there is an augmentation of the left ventricular intracavitary pressure gradient, along with a more prominent abnormality of the carotid pulse tracing and a greater intensity of the murmur. Since Müller's maneuver represents the physiologic antithesis of Valsalva's maneuver, it was reasoned that reverse changes might transpire. This intriguing phenomenon was initially suggested by Buda et al, who studied such patients by means of invasive techniques, echocardiograms, and phonocardiograms. These investigators demonstrated that inspiratory afterloading associated with Müller's maneuver lowered the gradient in the left ventricular outflow tract, reduced systolic anterior motion of the anterior mitral valvular leaflet, and diminished the intensity of the murmur. The heightened afterload was considered a result of inspiratory increase in left ventricular transmural pressure. Findings described herein represent the external pulsatile counterparts of these hemodynamic changes.

Normalization of the contour of the external carotid pulse tracing after performance of Müller's maneuver provides a noninvasive graphic method for diagnosing dynamic subvalvular aortic stenosis. Such alterations also provide insight into the basis for the obstructive component of this disease.

ACKNOWLEDGMENT: We gratefully acknowledge the assistance of Ms. Kathy Tustison, Ms. Carole Crevier, Ms. Sydney Peebles, Ms. Betty Kjellberg, Ms. Joanne Riley, and Ms. Bettie Jo Massey.

REFERENCES