CORD-LIKE VEGETATION BY ECHO/Yoshikawa et al.

References

Cord-like Aortic Valve Vegetation in Bacterial Endocarditis
Demonstration by Cardiac Ultrasonography.
Report of a Case

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SUMMARY The ultrasonic features in a case of bacterial endocarditis in which a highly mobile, cord-like vegetation, attached to the noncoronary cusp of the aortic valve, are reported. The echocardiogram demonstrated abnormal echo patterns in the left ventricular outflow tract in diastole which were continuous with similar echoes in the aortic root. While these findings did not differ from the previously reported manifestations in cases of flailing aortic valve leaflets, the cardiac ultrasonogram distinguished this vegetative growth. Cardiac ultrasonography revealed a cord-like characteristic, showed the movement of the entire growth into the left ventricular outflow tract in diastole and into the aorta in systole, and allowed estimation of the size of the vegetation. We conclude that cardiac ultrasonography can help in differentiating aortic valve leaflet flail and vegetations in endocarditis.

EARLY RECOGNITION OF ENDOCARDITIS and its complications should lead to improved mortality and morbidity figures. Aggressive surgical intervention in selective cases may alter the catastrophic consequence of aortic valve destruction.¹ ² Cardiac catheterization may be hazardous because of potential serious embolic complications. Therefore, noninvasive methods such as echocardiography and cardiac ultrasonography must be developed for safe, reliable identification of the pathologic process. This report illustrates the use of these techniques to demonstrate a highly mobile, cord-like aortic valve vegetation in a case with bacterial endocarditis.

Ultrasonic Techniques
All cardiac echograms were performed with an Aloka SSD-90 echograph using a 2.25 MHz transducer of 10 mm diameter. Records of sector M-mode scan were made with a Fukuda Denshi ECO-125 strip chart recorder.
Cardiac ultrasonograms were performed utilizing an ultrasonic contact scanner gated to an electrocardiogram. The plane of the scanning arm was adjusted to correspond to the cardiac long axis. A gating circuit triggered by the patient's electrocardiogram was used to activate the recording storage oscilloscope for a preselected brief interval during successive cardiac cycle. A permanent record was made on 35 mm film from the oscilloscope image.

Case Report
A 31-year-old woman was admitted to the Kobe Municipal Central Hospital on August 23, 1975, for progressive dyspnea. She had been hospitalized two times in that year because of apparent congestive heart failure and fever, which had been alleviated by treatment with digitalis, diuretics, and antibiotic agents. There was no known prior history of rheumatic fever or chest trauma.

Physical examination on admission revealed an agitated woman in respiratory distress, with a blood pressure of 140/40 mm Hg and a pulse rate of 90/min. The neck veins were distended and carotid pulses were bounding and had a typical collapsing quality (fig. 1). The cardiac apex was displaced to the left, and a grade 4/6 blowing diastolic murmur was heard at the left sternal border and cardiac apex. The first heart sound was diminished and a high-pitched ejection systolic murmur was heard at the upper left sternal border. The liver edge was palpable two finger breadths beneath the

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right costal margin and was not tender. There was no splenomegaly and no other peripheral stigmata of endocarditis. Crepitant rales were heard at the lung bases bilaterally. The chest film revealed generalized cardiomegaly and pulmonary congestion. The electrocardiogram showed left ventricular hypertrophy.

The echocardiogram recorded on August 23 (fig. 2) demonstrated abnormal echo patterns, characterized by fine fluttering in the left ventricular outflow tract in diastole, which were continuous with similar echo patterns in the aortic root. In addition, multiple linear echoes within the aortic root were observed in diastole, as the transducer was angled slightly upward. By tilting the transducer farther upward into the aorta, it was possible to record abnormal echo patterns showing coarse fluttering in systole. The remainder of echocardiographic examination revealed very active motion of the interventricular septum and marked enlargement of the left ventricular cavity. The anterior mitral leaflet exhibited diastolic fluttering and slight decrease in velocity of the downslope from the E point.

The cardiac ultrasonogram recorded on September 1 (fig. 3) demonstrated a cord-like character of the lesion, appearing to enter the aorta completely with each systole and to be flung back entirely into the left ventricle during diastole. The lesion appeared to be continuous with the edge of the posterior cusp, though the entire posterior cusp was not fully visualized. The calculated size of this lesion was 3 cm. Thus, it was suggested that the patient had a large, highly mobile aortic valve vegetation. Cardiac catheterization prior to surgery was not performed.

At operation, two forms of vegetations were found: granular lesions typical of vegetative bacterial endocarditis and a cord-like vegetation of 3 cm length attached to the ventricular surface of the noncoronary cusp. The former were present on all aortic valve cusps. The noncoronary cusp had three perforations and was partially destroyed. The aortic valve fragments were excised, and an 8-A Starr-Edwards ball valve was inserted. Microscopic examination of the valve fragments showed chronic inflammation, and bacterial cultures of the valve were negative. The postoperative studies demonstrated disappearance of the abnormal echo patterns (fig. 4). However, the mitral valve echoes suggested that the patient also had mitral valvular disease. The patient may have had rheumatic heart disease with both mitral and aortic valvular involvement.

**Discussion**

The value of echocardiography in the diagnosis of aortic valve vegetations in bacterial endocarditis has been well documented.3-5 Shaggy or fuzzy echoes from the region of the aortic valve have been found to be suggestive evidence of vegetative aortic bacterial endocarditis. The echocardiographic features in the present case included these echo patterns, and typical vegetations of aortic valve endocarditis were found at operation.

The additional echocardiographic features were the abnormal echo patterns in the left ventricular outflow tract in

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**Figure 1.** Simultaneous recordings of phonocardiogram and carotid pulse. Systolic and diastolic murmurs, typical of aortic regurgitation, are seen in the phonocardiograms recorded over the third left intercostal space (3L). The transmitted diastolic murmur of aortic regurgitation is recorded over the cardiac apex. The carotid pulse displays a steep initial ejection slope and a prominent midystolic cleft. The dicrotic notch is not apparent. CAR = carotid pulse; L, M, and H indicate low, medium, and high frequency phonocardiogram.

**Figure 2.** M-mode scan from the mitral valve to the aorta. Abnormal echoes showing fine fluttering (small arrows on left) are seen in the left ventricular outflow tract and aortic root in diastole. Multiple linear echoes within the aortic root (large arrow) are observed in diastole, as the transducer is angled slightly upward. By tilting the transducer farther upward, abnormal echo patterns demonstrating coarse fluttering (small arrows at right) are seen in systole. RV = right ventricle; IVS = interventricular septum; LV = left ventricle; MV = mitral valve; LA = left atrium; Ao = aorta.
Figure 3. Ultrasonic cross-sections obtained in mid-diastole (left panel) and in mid-systole (right panel). Echoes from the aortic valve vegetation are seen in the left ventricular outflow tract in diastole. The vegetation echoes are continuous with the posterior cusp and enter the aorta in systole. The calculated size of the vegetation is 3 cm. The arrows indicate the vegetation echoes. IVS = interventricular septum; LV = left ventricle; MV = mitral valve; LA = left atrium; Ao = aorta.

diastole which were continuous with identical echoes in the aortic root, and the appearance of the abnormal echo patterns showing coarse systolic fluttering in the aorta. These echocardiographic patterns of a large aortic valve vegetation should be differentiated from normal phenomena, echoes due to other diseases, and artifacts. Care must be taken with the gain and reject controls to minimize artifacts. Systolic fluttering, consisting of regular oscillations of the aortic valve cusps, may be recorded from normal subjects or patients with myocardial dysfunction. Aortic valve echograms in patients with obstructive cardiomyopathy may reveal closing and reopening of the cusps during systole. In aortic stenosis multiple linear echoes may be recorded, indicating a thickened valve. However, none of these patterns resembles the aortic valve echoes in the present case. Furthermore, it seems unlikely that the echocardiographic patterns of a cord-like vegetation would be confused with certain other abnormal echoes recorded from the outflow tract of the left ventricle as recently reported in discrete subvalvular aortic stenosis and in a sinus of Valsalva aneurysm.

Wray recorded quite similar echocardiographic pictures from the flailing aortic valve leaflets in bacterial endocarditis. When abnormal echo patterns in the left ventricular outflow tract are observed, two diagnostic possibilities should be considered: the flail aortic valve leaflets and highly mobile, large aortic valve vegetations. It should thus be emphasized that echocardiography alone does not

Figure 4. Above) Postoperative M-mode scan from the mitral valve to the aorta. The abnormal echoes are no longer present. Left) Postoperative cross-sections obtained in mid-diastole (far left) and in mid-systole. The abnormal echoes disappear and echoes from the Starr-Edwards ball valve (Pr) are seen. IVS = interventricular septum; MV = mitral valve; LV = left ventricle; PLVW = posterior left ventricular wall; LA = left atrium; Ao = aorta.
distinguish these two entities. However, cardiac ultrasonography demonstrated an abnormal cord-like lesion, attached to the posterior cusp, as long as 3 cm, which moved freely between the left ventricular outflow tract and the aorta. If the echoes had been due to flailing aortic valve leaflets, the hinge point of the lesion should be the aortic wall and the size of the lesion much less than 3 cm.

Cardiac ultrasonography has been shown to be of value in the diagnosis of congenital abnormalities, such as transposition of the great vessels, ventricular septal defect, atrial septal defect, and endocardial cushion defects. It has also been utilized to estimate left ventricular volume and to detect left ventricular aneurysm and left atrial myxoma. This report shows that this technique is also capable of demonstrating large aortic valve vegetations in bacterial endocarditis. In addition, the exact size of the vegetation can be estimated.

Cardiac ultrasonography may have some limitations. Other pre-existing abnormal aortic valve echoes may mimic small aortic valve vegetations. Excessive amplification degrades lateral resolution and the size of a vegetation will be overestimated. It is evident that this technique is limited by the anatomic position of the heart. The ultrasonic window increases with cardiac enlargement and decreases with pulmonary emphysema. Cardiac structures parallel to the sound beam do not produce fine echoes. Cardiac arrhythmias may negate the stop-action effect of the gating circuit. In spite of these limitations, it is clear that this technique can produce cross-sectional images of the heart of good quality and these images may reveal useful anatomic information including aortic valve changes in bacterial endocarditis.

When bacterial endocarditis is present, we believe that echocardiography is a useful tool in detecting various forms of aortic valve vegetations. However, the echocardiographic patterns of large aortic valve vegetations may be confused with the findings in flailing aortic valve leaflets. The size, mobility, degree of organization, and inhomogeneity of the vegetations themselves may prevent a certain diagnosis. Cardiac ultrasonography, which is capable of delineating both anatomic and spatial orientation and dynamic motion, may resolve some of these difficulties. We conclude that echocardiography combined with cardiac ultrasonography is necessary in the delineation of the aortic valve changes in bacterial endocarditis.

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