CASE REPORT

Echocardiographic Diagnosis of Aortic Valve Vegetations in Candida Endocarditis

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SUMMARY
Similar echocardiographic findings in two patients with surgically confirmed Candida endocarditis of the aortic valve are described. It is suggested that echocardiography performed early in the clinical course of evaluation of drug abuse patients with suspected endocarditis, particularly in the presence of negative blood cultures and systemic embolism, may help establish the diagnosis. Once the diagnosis has been suggested by echocardiography, further steps for confirmation of the diagnosis of Candida endocarditis and therapeutic intervention may be undertaken with minimal time lag.

Additional Indexing Words:
Drug abuse Noninvasive diagnosis Ultrasound

THE RECOGNITION of exophytic lesions in patients with fungal endocarditis is critical to prompt institution of rational and effective therapy. Cardiac catheterization may be hazardous because of potential serious embolic complications. Thus, a noninvasive method, such as echocardiography, would be desirable for rapid, safe identification of the pathologic process.

Methods
Echocardiography was performed using a Unirad Ultrasonoscope and an unfocused transducer, employing piezoelectric crystal 9.5 mm in diameter with a primary resonant frequency of 2.25 MHz. The echocardiograms were recorded either on polaroid film directly from the conventional oscilloscope (case 1), or on a strip chart record, using the Honeywell model 1856 fiberoptic system.

The patients were studied in the supine position with the transducer on the anterior chest wall just to the left of the sternum in the third or fourth intercostal space. The sound beam was carefully manipulated until the characteristic pattern of motion of the anterior mitral valve leaflet was identified. The sound beam was then directed superiorly and medi ally until the parallel echoes of the aortic root were encountered. From this position the aortic cusps were identified by minor variations in transducer angulation (fig. 1, position 1) and recordings were initiated while the ultrasound beam was slowly directed infero-laterally along the major axis of the left ventricle to a point immediately distal to the mitral valve leaflets.

Case Reports
Case 1. E. B., a 23-year-old male, was admitted to Jackson Memorial Hospital with a complaint of pain in the left foot of four weeks duration. He was a known narcotic addict, taking intravenous drugs. He also gave a history of irregular fever, chills, and malaise over the two months prior to his admission. On physical examination the blood pressure was 80/50 mm Hg and the pulse rate was 95 per minute. The temperature was 100°F. The left dorsalis pedis and posterior tibial pulses were absent and the left femoral pulse was reduced. Examination of the heart revealed a systolic thrill palpable over the precordium. A grade III/VI early diastolic decrescendo murmur was audible over the aortic area and along the left sternal border. A grade IV/VI systolic ejection murmur was heard over the same area and radiated into the neck. Auscultation of the lungs revealed bilateral basilar rales. The liver and spleen were palpable and enlarged. Laboratory data included a hemoglobin of 8.5 grams % and a reticulocyte count of 2.7%. The WBC count was 31,000 per cubic mm with a differential count of 53% segs, 25% stabs, 10% lymphs, and

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10% monos. The urinalysis and electrocardiogram were normal. The chest X-ray showed slight increase in the transverse diameter of the heart. A femoral arteriogram showed complete occlusion of the left superficial femoral artery.

**Echocardiogram**

Compared with the normal (figs. 1 and 2), the patient's echocardiogram (fig. 3) demonstrated multiple punctate and linear echoes within the aortic root which were particularly prominent in diastole (fig. 3A). The anterior aortic root wall was thickened and delicate rapid lines which timed with opening and closing of the aortic cusps also were present (3A). Movement of the ultrasound beam from position 1 to position 2 (fig. 1) revealed that the abnormal echo cluster entered into the distal portion of the left ventricular outflow tract during diastole in close proximity to the proximal portion of the anterior mitral leaflet (fig. 3B). The anterior mitral leaflet appeared normal, mitral closure was not premature and the tracing therefore was not suggestive of acute aortic regurgitation (fig. 3C). The exact systolic location of the highly mobile abnormal echo cluster could not be demonstrated even with careful transducer manipulation. The diagnosis of a vegetative endocarditis involving the aortic valve was suggested.

The patient was started on oxacillin and gentamycin. Following removal of the femoral embolus, both previously obtained blood cultures and the embolus were found to be positive for Candida parapsilosis and Amphotericin B therapy was instituted. In spite of the intensive medical management the patient developed left heart failure and ten days after admission he underwent surgical intervention. A bicuspid aortic valve, deformed by bulky vegetations, was removed and replaced with a Starr-Edwards prosthesis. Histologic examination of the excised valve showed abundant fungi. The patient did well immediately postoperatively, but on the fifth postoperative day he developed intracerebral hemorrhage due to a rupture of a mycotic aneurysm. A craniotomy was performed to evacuate a left temporal lobe hematoma. He died following surgery.

Case 2, M. T., a 22-year-old male narcotic addict, was admitted to a nearby hospital with a history of crampy pain in both legs, followed by gradually progressive weakness of both lower extremities. An aortogram revealed a saddle embolus at the bifurcation of the aorta and an embolectomy was performed. Following surgery, a previously undetected heart murmur was heard and several blood cultures were positive for Candida tropicalis. The patient was transferred to Jackson Memorial Hospital on the seventh hospital day. On admission his temperature was 103°F; the pulse was 108 per minute and the blood pressure was 120/60 mm Hg. The respirations were 20 per minute. The significant physical findings were limited to the heart, where a grade III/VI low pitched systolic murmur, ejection in character but localized to the apex, was audible. The pulses were good in both lower extremities. Laboratory data included a hemoglobin of 10.1 grams %, and a WBC count of 62,000, with a differential of 64% segs, 6% stabs, and 28% lymphocytes. Urinalysis, chest X-ray and electrocardiogram were normal.
Echocardiogram

Echocardiographic findings (fig. 4) were very similar to those described in the previous patient. A cluster of echoes, prominent in diastole, were identified in and appeared to fill the aortic valve region. The abnormal echoes were restricted to the proximal aorta and distal left ventricular outflow. We were unable to locate their exact systolic position. The highly mobile, bulky characteristic of the abnormal process was indicated by complete filling of the aortic root with echoes in the anterior-posterior plane during diastole, and their disappearance during systole. In addition, during diastole the abnormal echo cluster entered into the distal left ventricular outflow tract in close association with the base of the anterior mitral leaflet similar to case 1. The mitral valve appeared normal and there was no indirect evidence of aortic regurgitation present in its movement. The impression was vegetative involvement of the aortic valve.

A clinical diagnosis of fungal endocarditis involving the aortic valve was made and the patient was treated with Amphotericin B. He underwent surgery the following day, and the aortic valves were observed to be deformed with large greyish white vegetation (fig. 5). The cusps were excised and the valve was replaced with a Bjork-Haley aortic valve prosthesis. The patient had an uneventful postoperative course and was discharged on the 15th postoperative day.

Figure 3

(Case 1, E. B.) A) Aortic root. Ultrasound beam in position 1. Abnormal cluster of echoes seen associated with the anterior wall of the aortic root (Ao Ant). Abnormal echoes within the aortic root are particularly evident in diastole. The rapid opening and closing lines of the aortic cusps can also be seen. B) Sweep of the ultrasound beam from position 1 to position 2. Abnormal echoes are restricted to the region of the aortic root and distal left ventricular outflow tract in close association with the base of the anterior mitral leaflet. C) Ultrasound beam slightly more infero-lateral in position. Anterior mitral valve leaflet (AMV) is normal in echographic appearance. Abbreviations as in figure 1.

Figure 4

(Case 2, M. T.) Continuous sweep of the ultrasound beam from position 1 through position 3. Abnormal cluster of echoes can be seen (arrow pairs) in diastole in the aortic root and subaortic distal left ventricular outflow tract. Abnormal echoes are not seen in systole. Both the anterior and posterior mitral leaflets move normally. Interventricular septal (IVS) motion is increased and the left ventricle (LV) is dilated. PLV = posterior left ventricular wall. Abbreviations as in figure 1.
ECHO DIAGNOSIS OF AORTIC VEGETATIONS

Discussion

Candida endocarditis carries a serious prognosis and may present clinically with minimal auscultatory and hemodynamic findings. Recent reports emphasize the importance of early surgical replacement of the diseased valve and document the relative safety of the early surgical procedure, despite the presence of active infection and "inadequate" blood levels of antifungal agents.\textsuperscript{1, 2} This aggressive therapeutic approach has resulted in decreased morbidity and mortality.\textsuperscript{1, 3, 4}

Candida endocarditis was first reported as an autopsy finding by Friedman and Donaldson in 1939.\textsuperscript{5} In the following year the first clinically diagnosed case of Candida endocarditis was reported in a narcotic addict.\textsuperscript{6} During recent years, however, there has been an increasing frequency of this disease. The reasons may include the following: 1) improved diagnostic techniques, such as immunologic tests for Candida antibodies;\textsuperscript{5, 7, 8} 2) superinfection resulting from prolonged use of antibiotics, steroids and immunosuppressants;\textsuperscript{9} 3) the increasing incidence of narcotic addiction.\textsuperscript{3} The accepted methods of diagnosis are blood cultures and Candida antibody testing. However, it is clearly documented that repeated blood cultures may be negative in the presence of extensive vegetation. Kay\textsuperscript{1} has stressed that Candida endocarditis must be suspected whenever the clinical picture of endocarditis is associated with negative blood cultures for bacteria and large systemic emboli. He has reported surgical cure in three of his four cases.\textsuperscript{1} Subsequently, there have been several reports confirming his observations.\textsuperscript{2, 3, 10}

The specificity and sensitivity with which bacterial lesions of cardiac valvular structures can be detected echographically has not been established. However, the ability to demonstrate reliably bacterial vegetations of the aortic valve cusps has been shown to be, at least in part, dependent upon a lesion size in excess of 3 mm.\textsuperscript{11} Since the numerous vegetations of bacterial endocarditis are frequently small, it is reasonable to assume that these may escape echographic detection.

Aortic valve perforation with severe valvular regurgitation resulting in cardiac failure is the usual cause of death in aortic bacterial endocarditis.\textsuperscript{12} In these patients premature closure of the mitral valve resulting from rapid increase in left ventricular volume has been demonstrated echographically.\textsuperscript{13} In contrast, in Candida endocarditis, the pathologic process involving the valve is proliferative and bulky;\textsuperscript{4} the regurgitant volume may not constitute a prominent hemodynamic problem; and the friable lesions, as illustrated by the two cases presented, have a marked tendency for embolization. The characteristic bulkiness of the lesion appears to facilitate echographic identification. We have observed similar echographic pictures associated with very advanced and partially treated cases of bacterial endocarditis but no case of bacterial endocarditis in our experience has demonstrated the bulky cluster of echoes filling the aortic root as seen in the cases presented here. It is also probable however, that large bacterial lesions would mimic the findings described here. The fact that these patients were young and had no significant prior history of valvular disease was important in avoiding a potential source of misinterpretation. The highly mobile, mass-like character of the lesions demonstrated in these echocardiograms could have been masked by thickened, poorly mobile cusps associated with pre-existing aortic stenosis.

The value of a rapid, noninvasive method, such as echocardiography, to detect the presence of vegetative involvement of the aortic valve is threefold: 1) early diagnosis allows early institution of surgical therapy to reduce the incidence of systemic embolization (the prognosis with medical treatment alone is extremely grave); 2) prior knowledge of the presence of exophytic lesions provides a distinct advantage when performing any necessary cardiac catheterization; and 3) bedside examinations are possible in seriously ill patients.

The echographic detection of fungal vegetations involving a Starr-Edwards prosthesis was reported by Shelbert and Mueller,\textsuperscript{14} but to our knowledge our

\begin{figure}[h]
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\caption{Excised specimen of aortic valve from second patient (M. T.) demonstrates bulky, exophytic character of fungal vegetations.}
\end{figure}
report represents the first documented cases of echographically demonstrated fungal lesions involving natural aortic valve structures.

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