Tricuspid Endocarditis in a Drug Addict; Detection of Tricuspid Vegetations by Two-Dimensional Echocardiography*

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Endocarditis is an increasingly frequent complication of drug addiction. Precise localization of the site of involvement is necessary should antibiotic therapy fail and surgical therapy become indicated. This is a report of a patient with Pseudomonas endocarditis in whom the site of involvement was accurately localized noninvasively to the tricuspid valve by two-dimensional echocardiography. This was confirmed at the time of excision of the tricuspid valve.

Endocarditis is becoming increasingly common in drug addicts. Involvement of the tricuspid valve is much more frequent in the addict than in the nonaddict. Detection of the injured valve is relatively easy in aortic or mitral valve involvement, but tricuspid valve involvement may be more difficult to ascertain. We have recently excised successfully the tricuspid valve without replacement in a narcotic addict in whom tricuspid involvement was detected preoperatively, noninvasively, by two-dimensional echocardiography.

METHODS

Echocardiographic Imaging System

Two-dimensional echocardiograms were performed on this patient using a previously described, real-time imaging system developed in the Duke University Biomedical Engineering Department that is currently undergoing clinical evaluation at Duke University Medical Center. This imaging system uses a hand-held, 16 element transducer array that measures 14 x 24 mm at the site of skin contact and relies upon phased array principles to electronically steer and focus the sound beam through the structures under investigation. Real-time, cross-sectional images of cardiac structures are presented in a circular sector format, 50, 60, or 90 degrees in azimuth at a frame rate of 30 per second. Images are permanently recorded on video tape for later playback and analysis. Photographic reproductions of single frames for illustrations do not represent true image quality.

Echocardiographic Technique

Real-time, two-dimensional echocardiograms were performed in the long axis of the left ventricle and serial short axis views at the level of the aortic root, mitral valve, papillary muscles and ventricular apex using previously described techniques. In addition, scans through the long axis of the tricuspid valve were performed by first locating the long axis of the left ventricle, then rotating the transducer counterclockwise until the characteristic rapidly moving echoes from the tricuspid valve were located.
Case Report

A 20-year-old black man was admitted to the Fayetteville (N.C.) VA Hospital on January 3, 1976, with a brief history of spiking fevers, chills, malaise and pleuritic chest pain. He gave a past history of intravenous injection of heroin. Physical examination showed normal findings. The chest x-ray film showed bilateral pulmonary infiltrates. He was started on ampicillin, but was switched to cephalothin (Keflin) 48 hours later. He continued to be febrile to 40° C (104.0° F), and blood cultures grew Pseudomonas. Subsequent temperature elevations and antibiotics administered are shown in Figure 1. Because of persistent fever and positive blood cultures, the patient was transferred to Durham VA Hospital on February 10. On admission, vital signs included temperature 39.5° C. (103.1° F), blood pressure 130/80 mm Hg, pulse 100, and respiratory rate 30. The chest was clear on auscultation. A grade 3/6 holosystolic murmur, which did not vary with respiration, was heard. There was no jugular venous distention or liver pulsation and no signs of peripheral emboli. Laboratory data included: Hct 26, WBC 6,000, bilirubin 1.1, alkaline phosphatase 169, SCOT 516, and LDH 431. Treatment with tobramycin was begun. Electrocardiogram, liver scan, bone scan, intravenous pyelogram and bone marrow showed normal findings. Standard echocardiogram showed normal aortic and mitral valves and the pulmonary and tricuspid valves were not visualized due to chest wall configuration. Lung scan showed perfusion defects in the left upper lobe. Pseudomonas continued to grow in blood cultures and the patient remained febrile. On February 16, a two-dimensional echocardiogram was performed that demonstrated a large mass lesion on the atrial surface of the posterior leaflet of the tricuspid valve that moved into the valve orifice in diastole and returned to the right atrium in systole (Fig 2). In mid to late diastole, rapid oscillations of the lesion could be appreciated. Slight lateral angulation of the transducer showed the septal tricuspid leaflet to be normal. On February 22, the patient developed new pleuritic chest pain with dyspnea and repeat lung scan showed a new perfusion defect. Repeat of the two-dimensional echocardiogram showed that the large vegetation previously demonstrated on the tricuspid valve was now absent and this was presumed the source of his pulmonary emboli. The tips of the anterior and posterior tricuspid leaflets appeared thickened. Because of the patient's continued downhill febrile course with persistently positive blood cultures despite prolonged antibiotic therapy, tricuspid valve excision was recommended.

On February 25, 1976, the tricuspid valve was excised. Plaquelike vegetations were present on the anterior and posterior leaflets of the tricuspid valve and extended down to all the tips of the papillary muscles (Fig 3). The valve was excised and the cavity was irrigated with Tobramycin solution. The patient immediately became afebrile and remained so throughout his postoperative course (Fig 1). Digoxin and furosemide (Lasix) were started and Tobramycin was continued for six weeks postoperatively and then discontinued. Blood cultures were never positive following operation. At the time of discharge, the patient was totally asymptomatic and there was no jugular venous distention, hepatomegaly, or peripheral edema.

Discussion

Endocarditis is being recognized with increasing frequency in drug abusers. Menda and Gorbach were able to document 23 cases in only 18 months in a single hospital. When the infecting organism is predominantly Pseudomonas, medical therapy alone has resulted in high mortality. Replacement of infected valves during active endocarditis has been performed with good results. However, valve replacement in drug addicts with Pseudomonas endocarditis, has not been as success-

Figure 2. Serial stop-frame photos and schematic diagrams of the anterior and inferior tricuspid valve leaflets of the patient in this report. Panels A and B: vegetation seen in systole on the atrial surface of the tricuspid valve. Panels C and D: vegetation seen moving through tricuspid orifice in early diastole. Panels E and F: vegetation seen on inferior tricuspid leaflet in late diastole. TV=tricuspid vegetation; PTL=posterior tricuspid leaflet; RA=right atrium; IAS=interatrial septum; ATL=anterior tricuspid leaflet; LA=left atrium; IVS=interventricular septum.
ful, Arbulu and associates have established the principle of excision of the tricuspid valve without prosthetic replacement in such patients. Although involvement of the aortic and the mitral valves is detected readily by physical examination, tricuspid valve involvement may be easily overlooked. Cardiac catheterization may or may not be helpful in determining tricuspid involvement and it risks possible injury and resulting involvement of other normal valves. In 1974, Lee and coauthors reported the first patient in whom a standard echocardiogram was used to detect tricuspid involvement. Unfortunately, the tricuspid valve could not be visualized by m-mode methods in our patient.

This report demonstrates the value of a new ultrasonic imaging technique—real-time, two-dimensional echocardiography, in the detection of the site of infective endocarditis of the heart. This system provides wide cross-sectional images of moving cardiac structures. Several different types of systems have been developed and include linear arrays, mechanical sector scanners, and a phased array system, the subject of this report. This system is unique in that its operation is controlled by a digital computer that electronically steers and focuses the sound beams, resulting in high resolution (1.5 mm in both azimuth and range) throughout the field of view. The resultant wide sector arc, therefore, provides access to substernal structures not easily seen by standard echocardiographic methods.

Although the clinical presentation of this patient was strongly suggestive for the presence of bacterial endocarditis, there were no specific physical or laboratory findings that localized the site of infection. Real-time two-dimensional echocardiography was utilized to examine all four cardiac valves to detect the presence of a mass lesion on the tricuspid valve. Thus, this new imaging technique provided important information noninvasively that was not available from any other source. Moreover, the fact that the mass lesion was not visualized on repeat two-dimensional echocardiographic examination implicated the vegetative lesion as the source of the pulmonary embolus. This serial echocardiographic information, coupled with the patient’s clinical deterioration, resulted in a decision in favor of immediate removal of the infected tricuspid valve.

By providing spatial orientation to ultrasonic images of the heart, two-dimensional echocardiography seems particularly suited for the clinical documentation of valvular anatomic defects such as bacterial endocarditis. Experience with these systems is still limited, however, and it remains to be seen what the ultimate clinical utility of this technique will be for the detection of these lesions. Nevertheless, this approach to cardiac imaging provides a potential means for not only documenting the presence of vegetative lesions, but in addition, serially following anatomic changes that occur in valvular or vegetative tissue in response to various modes of therapy.

References