The leukocyte count of the pleural fluid showed 4,300 cells/cu mm, with 50 percent neutrophils.

With the normal lung scan, venograms and blood gas levels, it was believed that the patient had a viral illness rather than a pulmonary embolus. The chest pain and low-grade fever began to subside over the week after admission and she was discharged.

Over the subsequent two months the patient began having progressively more severe right-sided pleuritic chest pain, which radiated along the lower rib margins and into the right upper quadrant. A low-grade fever, nausea, vomiting and epigastric fullness then appeared over a two-week period and led to the patient's rehospitalization. On this admission, there was an increase in dullness to percussion and decreased breath sounds over the right base. There was moderate right upper quadrant tenderness without guarding or rigidity.

It was not apparent initially whether the patient's primary problem was intrathoracic or intra-abdominal. Normal or negative tests included: routine hemogram, intermediate purified protein derivative tuberculin skin test, urine culture, multiple blood cultures, lung scan, upper gastrointestinal contrast series, barium enema, cholecystogram, and intravenous pyelogram. The erythrocyte sedimentation rate was elevated to 50 mm/hour. Chest roentgenographic studies again showed a right pleural effusion and thoracoцentesis showed a protein level of 3.3 gm percent, normal chemistries, and negative bacteriologic studies.

After two weeks in the hospital the patient was noted to have tenderness in the area of the seventh and eighth thoracic vertebrae. Thoracic spinal films demonstrated lytic lesions of the end plates of the inferior portion of the seventh thoracic and the superior portion of the eighth thoracic vertebra anteriorly (Fig 1). The abnormalities had not been present in comparable films taken in December, 1974. A bone scan showed an increase of activity in the affected vertebrae.

A needle biopsy under fluoroscopic control of the affected disk interspace provided cultural material which was positive for Staphylococcus aureus of the coagulase-positive type. The patient was treated with methicillin, 12 gm intravenously per day, for six weeks. She had an additional three months of oral antibiotics and was in a body spica cast for six months. Her symptoms showed rapid resolution, and she was totally asymptomatic nine months later.

**DISCUSSION**

Disk-space infection, as illustrated by this patient, often presents a subtle and challenging diagnostic problem. The patient reported here had the sudden onset of severe pleuritic pain, a manifestation only rarely reported previously.1,4 Within two months the pain radiated to the right upper quadrant and this, together with the finding of tenderness in the same area, suggested intra-abdominal disease. Indeed, patients have developed abdominal pain of such severity that laparotomy was considered necessary.5 It was only after she experienced back pain, about three months after the onset of the illness, that the correct diagnosis was made.

Infection has infrequently been reported to spread outside the disk space, resulting in paraspinal infection.5 This would appear to be the most likely explanation of the right-pleural effusion in this patient, a very unusual complication of disk space infection.

Roentgenographic examination of the spine may be initially unrewarding since it remains normal for four to eight weeks after the onset of infection.4 This patient's lesion progressed from a normal lateral chest roentgenogram to extensive ballooning of the disk space in less than three months. Earlier diagnosis may be facilitated by the use of isotopic bone scanning.6

Since many different organisms have been reported to cause disk-space infection, it is essential to make a specific bacteriologic diagnosis. This can be made by needle aspiration of the disk space, or tissue can be obtained surgically.1,2

Treatment of disk-space infection includes the use of an appropriate intravenous antibiotic for four to six weeks. It has been suggested that oral antibiotics be continued until no further roentgenographic change is noted.1 Immobilization of the spine is indicated until stable fusion occurs.9

**REFERENCES**


**Cross-Sectional Echocardiographic Detection of Aortic Ring Abscess in Bacterial Endocarditis**

T. Joseph Mardelli, M.D.; Satoshi Ogawa, M.D.; Francis E. Hubbard, M.D.; Leonard S. Dreifus, M.D., F.C.C.P.; and Linda L. Metzell, R.D.M.S.

The diagnosis of aortic ring abscess by cross-sectional echocardiography has not been reported. In this paper, a case of bacterial endocarditis of the aortic valve extending to the aortic ring and the mitral valve is reported. The role of cross-sectional echocardiography in defining the anatomic distortion of the aortic valve in bacterial endocarditis and its complications is emphasized. This study would indicate that early diagnosis of aortic ring abscess is feasible by cross-sectional echocardiography.

*From the Departments of Medicine, Jefferson Medical College of the Thomas Jefferson University, and the Lankenau Hospital, Philadelphia.

Reprint requests: Dr. Dreifus, Lankenau Hospital, Philadelphia 19151

578 Mardelli ET AL

Chest, 74: 5, November, 1978
Aortic valve bacterial endocarditis has been studied by M-mode and cross-sectional echocardiography.\textsuperscript{1-3} In this paper we present the M-mode and cross-sectional echocardiographic observations in a case of aortic valve endocarditis complicated by a valvular ring abscess extending to the mitral valve.

**Echocardiographic Techniques**

Cross-sectional echocardiography was performed using a commercially available real time, phased-array imaging system (Varian V-3000 ultrasonograph) as previously described.\textsuperscript{4} The image was displayed in real time at a rate of 30 scans/second and permanently recorded on a 1" video cassette (International Video Corporation IVC-XV 815/818). The stored image could be subsequently reviewed in real time, slow motion or single frame presentation. Individual frames of the video tape recording were photographed using a Polaroid camera.

M-mode echocardiograms were recorded with a conventional technique using a Smith-Klein ultrasonoscope (Ekoline 20A) interfaced with a Honeywell recorder 3820.

**Case Report**

A 61-year-old man was admitted to the Lankenau Hospital with a history of chest pain of four days' duration. A heart murmur had been previously detected, but there was no history of rheumatic fever.

On admission, a harsh systolic ejection murmur, grade 3/6, and an early diastolic murmur were heard along the left sternal border. A pericardial friction rub was heard at the apex. Blood cultures grew enterococci. Aortography performed two weeks after admission revealed a heavily calcified aortic valve and 2+ aortic insufficiency, with an eccentric regurgitant jet. Subsequently, open heart surgery was performed because of worsening congestive failure and persistent fever. The aortic ring was invaded at the site of the left valve cusp. The other two valve cusps were covered with vegetation and appeared thick and inflamed. Vegetation extended from the aortic cusps to the anterior leaflet of the mitral valve. Replacement of the aortic and mitral valve was performed, but the patient could not be weaned off the cardiopulmonary bypass. The pathologic report of the surgical specimen revealed acute and erosive endocarditis of the aortic and mitral valves.

**Echocardiographic Findings**

**M-Mode Study**

M-mode echocardiograms were serially obtained. Studies performed on the 9th and 16th day of admission are shown in Figure 1. The earlier study (Fig 1, top panel) reveals aortic valve cusp thickening. Multiple irregular bands of echoes fill the aortic root in diastole (small vertical arrows). The aortic root is enlarged and the posterior wall of the aorta is widened (indicated by two large arrows). On repeated study one week later (Fig 1, bottom panel) heavy layered echoes are now noted to extend from the posterior aortic wall onto the anterior leaflet of the mitral valve (large black arrow).

**Figure 1.** M-mode echocardiograms on 9th hospital day (top panel) and 16th hospital day (bottom panel). Multiple linear echoes are recorded during diastole within aortic root (note small vertical arrows in top panel, and white arrows in bottom panel). In bottom panel, echoes are seen to extend onto anterior mitral leaflet (thick vertical arrow in bottom panel). IVS = interventricular septum; AML = anterior mitral leaflet; LV = left ventricle; PW = posterior wall; LA = left atrium. Sweep speed was 25 mm/second. Same abbreviations are used in other figures.

**Figure 2.** Cross-sectional echocardiograms obtained on 9th hospital day. Solid echo is seen in left ventricular outflow tract in diastole and in aortic root during systole (white arrows and hatched areas). Note discontinuity between anterior mitral leaflet and posterior aortic wall (two black arrows in bottom diagrams). Echo-free space posterior to left ventricular posterior wall represents pericardial effusion.

CHEST, 74: 5, NOVEMBER, 1978
In addition, heavy diastolic echoes previously not visualized, are seen in the left ventricular outflow tract (two small arrows).

Cross-Sectional Study

Real time echocardiography was performed at the time of the M-mode studies shown in Figure 1. Representative systolic and diastolic frames (long axis view) from the initial real time study are shown in Figure 2. Dense echoes suggestive of valvular calcification were identified in the area of the aortic valve. Below the point of aortic valve closure (AV in the diagram), a circular dense echo (white arrow) protrudes from the aortic valve into the left ventricular outflow tract during dias-tole and re-enters the aortic root during systole. This appearance suggests vegetation and/or flail motion of an aortic leaflet. Two separate echoes are noted in the area of the posterior aortic wall (indicated by two black arrows in both the diastic and systolic diagrams). The outer echo arises from the posterior aortic wall and its continuity with the anterior mitral leaflet is clearly disrupted. The inner echo is continuous with the anterior mitral leaflet.

The followup study (Fig 3) shows new thickening of the anterior mitral leaflet, suggesting extension of the aortic vegetation to the mitral valve (white arrows and hatched areas).

DISCUSSION

The presence of multilayered diastolic echoes in the aortic root on M-mode echocardiography is suggestive of valvular vegetation; however, congenital valvular deformity, heavy valvular calcification or myxomatous degeneration of the aortic valve may produce similar findings. If these diastolic echoes extend into the left ventricular outflow tract either flail motion of an aortic cusp or vegetation may be responsible.

In the present case, cross-sectional echocardiography (Fig 2) clearly distinguished a dense circular echo from the calcified aortic valve. Motion of this structure in and out of the outflow tract confirmed the diagnosis of valvular vegetation. Furthermore, contiguous spread of the infectious process to the anterior leaflet of the mitral valve is more convincingly demonstrated by this technique (Fig 3).

Widening of the aortic wall and aortic-mitral valve discontinuity have been reported in cases of aortic valve endocarditis complicated by abscess formation. Such M-mode findings are, however, nonspecific and indistinguishable from the echocardiographic appearance of aortic dissection. Cross-sectional echocardiography permits a two-dimensional localization of the abscess cavity which, in the present case, was clearly shown to be confined to the aortic valve ring separating the anterior mitral valve leaflet from the posterior aortic wall. Such a clear definition of a ring abscess could lead to early consideration of surgical intervention which would appear justified in light of the high mortality associated with this complication of endocarditis.

REFERENCES

9 Kisalo J, von Ramm OT, Thurstone FL: Cardiac imaging using a phased array ultrasound system. II. Clinical technique and application. Circulation 52:262-267, 1976

Figure 3. Cross-sectional echocardiograms obtained on 16th hospital day. Solid echo in aorta seen extending to anterior mitral leaflet (white arrows and hatched areas). Entire anterior mitral leaflet appears markedly thickened and its motion is significantly restricted.