INFECTIVE ENDOCARDITIS OF THE AORTIC VALVE — DEMONSTRATION OF VALVULAR VEGETATIONS BY M-MODE AND CROSS-SECTIONAL ECHOCARDIOGRAPHY

W.H.NG

SUMMARY

The ability to visualise valvular vegetations by echocardiography is a significant advantage in the management of patients with infective endocarditis. In this report the M-Mode and Cross-Sectional echocardiographic appearances of infective endocarditis affecting the aortic valve are described. The uses and limitations of echocardiography are discussed.

INTRODUCTION

Infective endocarditis is still a serious, potentially fatal disease despite newer anti-microbial agents. Drug treatment of infective endocarditis is frequently instituted on a presumptive diagnosis based on strong clinical suspicion and usually prior to bacteriological confirmation. The ability to visualise valvular vegetations by echocardiography serves as a useful aid in the diagnosis and management of patients with infective endocarditis. Being a non-invasive procedure echocardiography presents no risk to the patient. It may be performed on critically ill patients and repeated examinations are easily carried out with no additional risks.

W.H. Ng, A.M., M.R.C.P. (U.K.)
Department of Medicine
School of Medical Sciences
Universiti Sains Malaysia
Penang

Demonstration of heart valve vegetations by M-Mode echocardiography was first described by Dillon *et al.* (1973). Since then there have been other reports on the echocardiographic appearances of infective endocarditis (Martinez *et al.*, 1974, Roy *et al.*, 1976, Wann *et al.*, 1976). With the advent of Cross-Sectional echocardiography, a new technique emerged which permitted the evaluation of valvular vegetations in real-time, two dimensional images and which allows spatial resolution of the cardiac structures in the lateral and axial dimensions. This would provide useful information regarding the size, shape and mobility of the vegetations (Gilbert *et al.*, 1977, Wann *et al.*, 1979).

This is a case report of infective endocarditis involving the aortic valve of a 32 year old Malay man. The M-mode and Cross-Sectional echocardiographic appearances are described and illustrated. Role of echocardiography and its limitations are discussed.

CASE REPORT

M.Y., a 32 year old Malay postman, was admitted in February 1981 for breathlessness and fever of 2 weeks duration. In the past he had been on follow up at the Kajang District Hospital for "heart disease". Physical examination on admission revealed he was in cardiac failure. He was febrile (100.5°F) and anaemic. The blood pressure was 110/30 mm.Hg, with a regular heart

rate of 105 per minute. There was cardiomegaly and auscultatory findings of gross aortic incompetence. No clubbing of the fingers or toes were detected, but septic spots were seen on the skin and blot haemorrhages in the fundi. The spleen and liver were enlarged and palpable.

The haemoglobin was 8.5 grams per cent and total white count 23,500 per mm^3 with 89% neutrophils. Three consecutive blood cultures and culture from septic spots on the skin grew *Staphylococcus aureus*. M-Mode echocardiography revealed normal dimensions of the left atrium and aortic root. Dense, shaggy, irregular echoes suggestive of vegetations were seen attached to both cusps. The vegetations were more prominent during diastole. Aortic valve opening was brisk and not reduced in excursion (Fig. 1). With the echo beam directed towards the left ventricular outflow

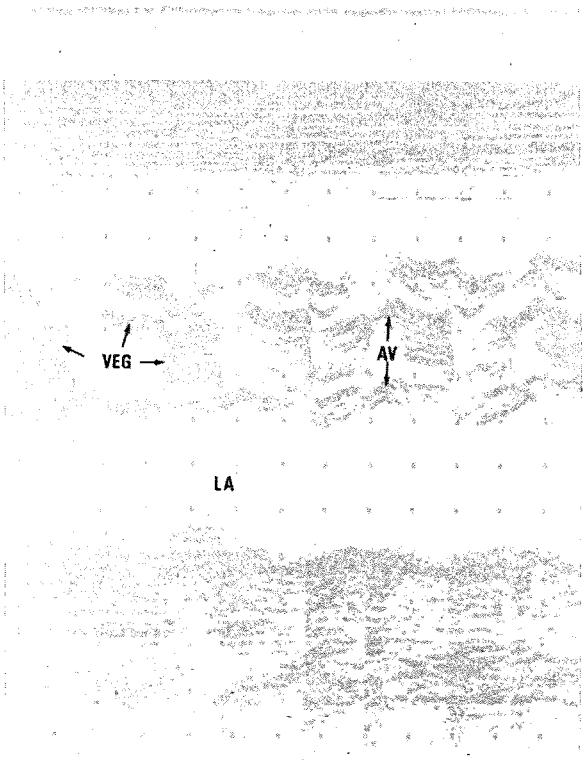

Fig.1 Echocardiogram of the aortic valve of the patient. Vegetations are present on both cusps and are more prominent during diastole where the echoes occupy almost the entire aortic lumen. Aortic valve opening is not restricted.
(LA-left atrium, AV-aortic valve, VEG-vegetations)

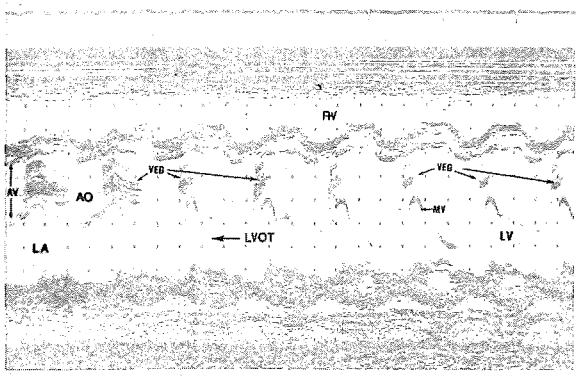

Fig.2 Echocardiographic scan from the aortic root to the mitral valve. Vegetations arising from the aortic valve prolapse into the left ventricular outflow tract during diastole and appear anterior to the mitral valve.
(AO-aorta, RV-right ventricle, MV-mitral valve, LV-left ventricle, LVOT-left ventricular outflow tract)

tract, the vegetations were seen to prolapse from the aortic valve into the left ventricular outflow tract in diastole (Fig. 2). Cross-Sectional echocardiography in the long-axis view revealed dense, irregular, oscillating clumps of vegetations on the aortic valve leaflets. In systole, the vegetations moved up into the aortic root above the aortic valve (Fig. 3), and prolapsed down from the aortic valve into the left ventricular outflow tract in diastole (Fig. 4). In the short-axis view of the aortic root, the vegetative mass was seen only in systole emerging above the valve orifice (Fig. 5) but disappeared from view in diastole when it prolapsed down into the outflow tract (Fig. 6). (M-Mode echocardiographic recordings were done with Ekoline 20A(SKI) system which was interphased to a Ekoline 21 strip-chart recorder. Hand probe used was a 2.25MHz medium focus transducer. Cross-Sectional echocardiographic examinations were performed with the Ekosector I (SKI) system using a 81° sector angle probe. Recordings were on video tape for playback analysis).

On admission he was started on intensive anti-microbial therapy with penicillin, cloxicillin and gentamycin. Digoxin and frusemide were prescribed for cardiac failure. He however remained in cardiac failure and expired from acute pulmonary oedema 3 days after admission. Request for post-mortem was not granted.

DISCUSSION

Valvular vegetations of the aortic valve at M-

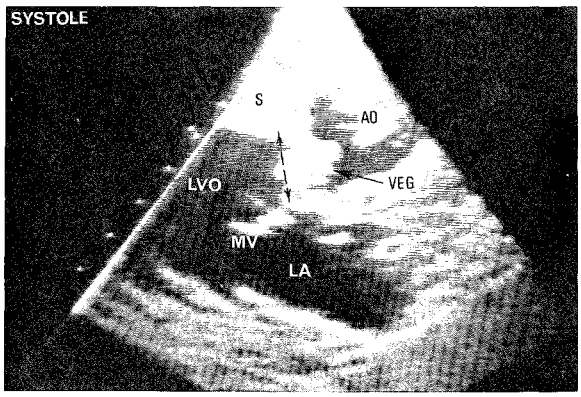

Fig. 3 Cross-sectional echocardiogram in the long-axis view. In this systolic frame, vegetations appear as a mass in the aortic root above the aortic valve.
(S-interventricular-septum, AO—aorta, LA-left atrium, MV-mitral valve, LVOT-left ventricular outflow tract, VEG-vegetations)

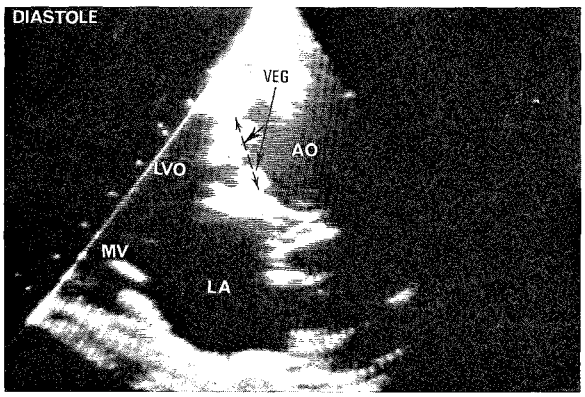

Fig. 4 Diastolic frame in the long-axis view. Vegetations here are seen to prolapse below the aortic valve into the left ventricular outflow tract.

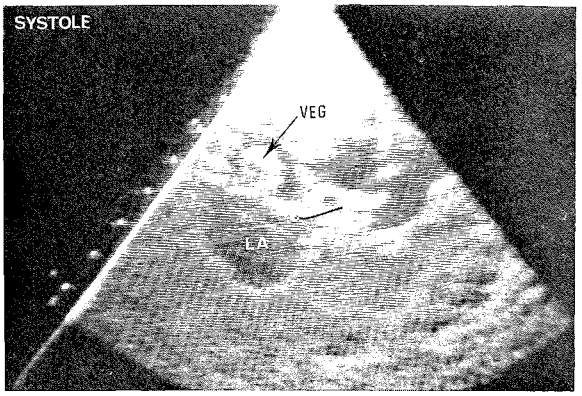

Fig. 5 Cross-sectional echocardiogram in the short-axis view. In this systolic frame, and irregular mass of vegetations is visible in the aortic root.

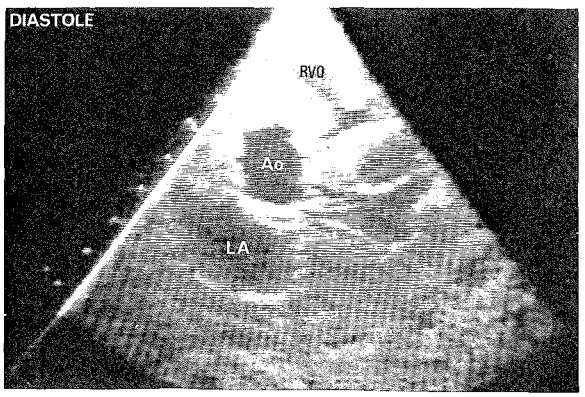

Fig. 6 Cross-Sectional echocardiogram during diastole in the short-axis view. In diastole, the vegetative mass disappears from view when it prolapses down into the left ventricular outflow tract.
(RVO-right ventricular outflow tract, AO-aortic root)

Mode echocardiography appear characteristically as irregular, shaggy, non-uniform masses attached to the leaflets. They appear only in systole or diastole, or may be seen throughout the cardiac cycle. Despite the apparent thickening of the leaflets, the valve opening excursion during ventricular systole is not restricted. In addition, pedunculated vegetations may be seen to prolapse down from the aortic valve into the left ventricular outflow tract in diastole (Fig. 2). The two-dimensional appearances of vegetations are striking when viewed in the real-time format. Morphologically they appear as amorphous irregular masses which are either sessile or pedunculated. The recordings also provide details regarding the size, shape and mobility of the vegetations. In addition to the ability of visualizing valvular vegetations, echocardiography provides further information regarding the state of the pre-existing valve lesions, dimensions of the cardiac chambers and secondary effects of the infective process on the heart. These effects include ruptured or flail aortic leaflets (Chia *et al.*, 1979), fine diastolic fluttering of the anterior mitral leaflet in aortic incompetence, early mitral valve closure in aortic incompetence indicating a rapid rise of left ventricular pressure of recent onset (Botvinick *et al.*, 1975), and recent increase in the dimensions of the left ventricular cavity with features of volume overload. As definite criteria for valve replacement in infective endocarditis is ill defined, such findings assist in the decision to early surgical intervention

(Hurley *et al.*, 1967, Hancock *et al.*, 1971).

It has been shown that patients with echocardiographically detectable vegetations are associated with a higher incidence of complications such as recurrent systemic embolization, refractory cardiac failure and persistent uncontrolled septicaemia (Roy *et al*, 1976, Sutton *et al.*, 1976). The prognosis in infective endocarditis is dependent on whether such patients develop these complications. Thus, echocardiography, by providing direct visualization of valvular vegetations and additional data on the secondary effects of the infective process on the heart, enables the clinician to initiate therapy with greater confidence. Further, one is unable to depend on cardiac catheterization and angiographic studies for evaluation as the risks of serious embolic complications are high in such patients.

There are limitations to the use of echocardiography in the management of patients with infective endocarditis. Recognition of these limitations are necessary if the information obtained is to be used effectively. Echocardiography does not differentiate active from healed lesions. The vegetative lesions usually persist beyond the period of clinical and bacteriological cure (Wann *et al.*, 1976, Steward *et al.*, 1980). A normal echocardiogram does not exclude the diagnosis of infective endocarditis, whereas the presence of vegetations strongly supports the diagnosis. Inability to demonstrate vegetations may be because small vegetations may not be detected, or because the vegetations appear on a part of the valve that is not recorded. With the present resolution capabilities of existing equipment, only lesions 2 mm or larger are detectable echocardiographically. In addition, timing of an echocardiographic examination is important as vegetations may not be detected if an examination is performed too early in the clinical course of the disease. Serial examinations serve to overcome this limitation. False positive examinations occur with misinterpretation of other disease states such as myxomatous valvular degeneration, tumours, ruptured or flail leaflets and fibrosis. These conditions may mimic the appearances of valvular vegetations (Thomson *et al.*, 1977).

ACKNOWLEDGEMENT

The author would like to thank the staff of the Departments of Medical Illustration, Universiti Kebangsaan Malaysia and Universiti Sains Malaysia for their assistance in the preparation of the illustrations.

REFERENCES

Botvinick, E.H., Schiller, N.B., Wickramasekaran, R. *et al.* (1975) Echocardiographic demonstration of early mitral valve closure in severe aortic insufficiency: its clinical implications, *Circulation,* **51,** 836 - 847.

Chia, B.L., Ee, B., Koh, T.H., *et al,* (1979) Echocardiographic findings in acute rupture of the aortic valve due to infective endocarditis, *Proceed. XIV Malaysia-Singapore Congress of Medicine,* Academy of Medicine, Singapore, July 1979, 116-123.

Dillon, J.C., Feigenbaum, Konecke, L.L. *et al.,* (1973) Echocardiographic manifestations of valvular vegetations, *Am. Heart J.,* **86,** 698-704.

Gilbert, B.W., Haney, R.S., Crawford, F. *et al.,* (1977) Two-Dimensional echocardiographic assessment of vegetative endocarditis, *Circulation,* **55,** 346-353.

Hancock,, E.W., Shumway, N.E., Remington, J.S. (1971) Valve replacement in active bacterial endocarditis, *J. Infect. Dis.,* **123,** 106-109.

Hurley, E.S., Eldridge, F.C., Hultgren, H.N. (1967) Emergency replacement of valves in endocarditis, *Am. Heart J.,* **73,** 798-803.

Martinez, C.E., Burch, G.E., Giles, T.D. (1974) Echocardiographic diagnosis of vegetative aortic bacterial endocarditis, *Am. J. Cardiol.,* **34,** 845-849.

Roy, P., Tajik, A.J., Guilani, E.R. *et al.* (1976) Spectrum of echocardiographic findings in infective endocarditis, *Circulation,* **53,** 474-482.

Steward, J.A., Silimperi, D., Harris, P. *et al.* (1980) Echocardiographic documentation of vegetative lesions in infective endocarditis; clinical implications, *Circulation,* **61,** 374-379.

Sutton, R., Petch, M., Parker, J. (1976) Echocardiography in infective endocarditis, *Br. Heart J., 38, 312.*

Thomson, K.R., Nanda, N., Gramiak, R., (1977) The reliability of echocardiography in the diagnosis of infective endocarditis, *Radiology,* **125,** 473-478.

Wann, L.S., Dillion, J.C., Weyman, A.E. (1976) Echocardiography in bacterial endocarditis, *N.Engl. J. Med.,* **295,** 135-139.

Wann, L.S., Hallam, C.C., Dillon J.C. *et al,* (1979) Comparison of M-Mode and Cross-Sectional echocardiography in infective endocarditis, *Circulation,* **60,** 728-733.