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Infective Endocarditis: Diagnostic and Therapeutic Issues – Should Transoesophagal Echocardiography be Performed in all Patients? – Position Pro

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Infective endocarditis remains a diagnostic and therapeutic challenge associated with a high mortality. Early diagnosis and prompt therapy are necessary to improve outcome and prognosis. Because echocardiography shows vegetations, abscesses and complications of infective endocarditis, it represents the diagnostic imaging technique of choice in this serious illness. The two modalities are transthoracic (TTE) and transoesophageal (TEE) echocardiography with a specificity around 95 % for both techniques. Relating to sensitivity, TEE surpasses TTE with values reaching 100 %, while TTE ranges between 30 % and 69 %. The reported results refer to native as well as prosthetic heart valves. With its high sensitivity TEE allows monitoring of the infectious process and enables the guidance of therapy. Increasingly the impending question of economy must be answered also: TEE is the more economic strategy in the evaluation of patients with suspected infective endocarditis. *J Clin Basic Cardiol 2001: 157–159*.

Key words: infective endocarditis, transoesophageal echocardiography, Duke criteria

E chocardiographic demonstration of vegetations in infective endocarditis (IE) was first described in 1973 [1]. There is no doubt about the impact of echocardiography on the diagnosis of IE [2]. But disagreement might arise which diagnostic procedure should be preferred:

- Transthoracic echocardiography (TTE) followed by transoesophageal echocardiography (TEE) according to a selected approach or
- TEE in every case of suspected infective endocarditis?

TEE is semiinvasive and needs a fasting time longer than four hours. The examination is easily performed by trained personnel with minor discomfort and minimal risk for the patient [3]. The patient must be informed concerning possible side effects like hypoxia, bronchospasm, arrhythmias, bleeding, vomiting, buckling or intolerance of the probe. The assistance of skilled health care personnel for monitoring of blood pressure and oxygenation is reasonable. The superb image quality of TEE is based on the anatomical situation with the oesophagus directly adjacent to the posterior surface of the heart. Thus it is possible to use high frequency probes with the result of a marked increase in physical resolution. The gain in quality refers to every cardiac structure. However shadowing of prosthetic valves, as known from TTE, remains a problem also with TEE. Doppler studies of native or prosthetic valves or shunt-lesions, mainly with colour Doppler, are improved by TEE, thus leading to a better detection and characterisation of regurgitant jet flows or flows across a shunt-lesion. While the transthoracic visible phenomenon of rocking of a prosthetic valve occurs when the dehiscence affects at least 40 % of the prosthetic ring, the transoesophageal colour Doppler study demonstrates the early dehiscence.

False Negative or False Positive Studies

Most clinicians appreciate the high specificity and sensitivity of TEE, reflecting the superior diagnostic value. In early stages of the disease, positive echocardiographic results might give the only hint of IE. Identification of vegetations or misinterpretation of valvular abnormalities like myxomatous changes, rheumatoid valve disease, annular calcification, non-specific valve thickening, a tumour attached to a valve or Lambl's excrescences or strands is a problem of both, TTE and TEE. Vegetations are identified with a specificity of 97.3 % by TTE and of 96.8 % by TEE [4– 7]. The sensitivity of TEE ranges between 87 % and 100 %, the sensitivity of TTE ranges between 30 % and 69 % as shown in different studies [4–8]. The difference in sensitivity between TTE and TEE depends on image quality due to physical resolution and on the vegetation size: 25 % of vegetations < 5 mm, 69 % of vegetations < 6–10 mm and all vegetations were identified by TEE [9]. TTE failed to show aortic root abscesses in more than half of the patients (sensitivity of 36 %), whereas all



Figure 1. These abscesses were detected by TEE in a patient with IE of the aortic valve due to Staphylococcus lugdunensis. The infectious process extended from the aortic valve to the tissue between the aorta and the lateral border of the left atrium adjacent to the left atrial appendage.

LA = left atrium; RA = right atrium; AV = aortic valve; MV = mitral valve; PA = pulmonary artery.

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For personal use only. Not to be reproduced without permission of Krause & Pachernegg GmbH. Homepage Journal of Clinical and Basic Cardiology: http://www.kup.at/JClinBasicCardiol these abscesses could be visualised with TEE (sensitivity of 100 %) [10]. Figure 1 and 2 show the intracardiac spread of the infection with formation of abscesses, only seen by TEE. In patients with bioprosthetic or mechanical valves in the mitral or aortic position the sensitivity of TEE is also superior to TTE. In a surgery or autopsy proved study, false negative or questionable cases of IE were described in 63 % by TTE and in only 18 % by TEE [11].

"Rule out endocarditis" in case of low clinical suspicion is one frequent request. This question has been addressed recently in a cost-effectiveness analysis [12]. In otherwise unexplained bacteriaemia the probability of infective endocarditis ranges from 4-40 % (intermediate risk of infective endocarditis). Most patients belong to the group with intermediate risk of infective endocarditis. In patients with persistent bacteriaemia and a predisposing heart disease the probability of infective endocarditis is greater than 50 % (high risk of infective endocarditis) and nearly 100 % when a new heart murmur occurs. The probability of infective endocarditis is less than 2 % (low risk of infective endocarditis) with gramnegative bacteriaemia or with a clear non-cardiac source of infection. The authors conclude that patients with a high risk of IE should be treated for endocarditis regardless of the echocardiographic results. Patients with a low risk of IE should not be evaluated with echocardiography. In patients with an intermediate risk of IE TEE represents the diagnostic strategy of choice [12].



Figure 2. This abscess formed lateral and posterior of the aorta adjacent to the right atrium in a patient with IE due to Staphylococcus aureus. LA = left atrium; RA = right atrium; SVC = superior Vena cava.

When Should TEE be Performed in the Course of IE?

Since it takes about ten days for the vegetations to develop, a very early TEE might end in a false negative result. However, IE usually has reached an advanced stage at the time of hospital admission, therefore prompt diagnostic testing is required at this time in the course of the disease.

How Often Should TEE be Repeated During the Clinical Course?

IE remains a clinical diagnosis. A complicated course with persistent fever despite antibiotic therapy, development of heart failure and repeated thromboembolic events requires an immediately repeated TEE study. In the clinical practice control studies are performed in an interval of approximately eight to ten days. To avoid a missed diagnosis a repeat examination after ten days must be performed in patients with a negative TEE result if IE cannot be completely excluded. If the infection is caused by highly destructive microorganisms (eg Staphylococcus aureus, Streptococcus pneumoniae, Staphylococcus lugdunensis) a brief interval of two days for follow up studies is mandatory to guide the timing of surgical intervention. Definitive diagnosis might not be possible in all cases by TEE or repeated TEE alone. Structural changes, as mentioned above, or very little vegetations, due to Coxiella burnetii or legionella, may be the reason [2]. In this situation it is judicious to comprise clinical, laboratory and non-specific echocardiographic findings, summarised (see Table 1) as Duke criteria [13]. The diagnosis of IE can be made with considerable accuracy if two major criteria, one major and three minor criteria or five minor criteria are met. The high mortality of infective endocarditis is particularly related to late diagnosis. Therefore it is necessary to take into account these criteria for the initialisation of early therapy [14].

Conclusion

The superior image quality of TEE has proven to be more sensitive then TTE. TTE and TEE are equal with respect to specificity. TTE is an excellent method for the evaluation of cardiac morphology and ventricular or valvular function, but TEE is the method of choice to visualise vegetations or complications of IE. The cost-effectiveness analysis also gives priority to TEE, except for the clear-cut cases with a low or high

Table 1. Duke criteria. The diagnosis of IE is definitive, when two major criteria or one major and three minor criteria or five minor criteria are present

Major criteria	Minor criteria
Positive blood culture (Viridans streptococci, Streptococcus bovis, HACEK group, community acquired Staphylococcus aureus or enterococci)	Microbiology (neither typical nor persistent bacteraemia)
Positive echocardiogram: • oscillating mass • abscess • new dehiscence of a prosthetic valve	Echocardiographic abnormalities consistent with IE which do not meet definitions for a major criterion
	Vascular phenomena (eg arterial emboli, mycotic aneurysms, Janeway lesions)
	Immunologic phenomena (eg Osler's nodes, Roth spots, glomerulonephritis)
	Fever (≥ 38 °C)
	Predisposition: predisposing heart condition or intravenous drug abuse

risk of IE. The mortality rate of 15 % in infective endocarditis increases with delayed diagnosis, therefore we are urged to use the best imaging technique available - TEE.

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