Echocardiographic characteristics in relation to systemic embolic events in infective endocarditis

A Thesis Submitted for Partial Fulfillment of Masters Degree of Cardiology

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Abbreviation list

IE: Infective endocarditis

EE: Embolic event

TTE: Transthoracic echocardiography

TEE: Transesophageal echocardiography

HAE: Health-care associated endocarditis

CAE: Community-acquired endocarditis

CT: Computed tomography

MA: Mycotic aneurysm

ICMA: Intracranial mycotic aneurysm

ECMA: Extracranial mycotic aneurysm

PVE: Prosthetic valve endocarditis

NVE: Native valve endocarditis

RR: Relative risk

ROC curve: Receiver operator characteristic curve

SPSS: Statistical package for social sciences

S. aureus: Staphylococcus aureus

HEEPF: Higher Education Enhancement Project Fund

CRP: C-reactive protein

LVEDD: Left ventricular end-diastolic diameter

LVESD: Left ventricular end-systolic diameter

EF: Ejection fraction

MRI: Magnetic resonance imaging

MRA: Magnetic resonance angiography

CTA: Computed tomography angiography

OR: Odds ratio

CI: Confidence interval

SD: Standard deviation

NYHA: New York Heart Association

Veg: Vegetation

Ig: Immunoglobulin

Abstract

1. **Stating the problem:** As one of the complications of (IE), embolization has a great impact on the patient's prognosis. Early identification of patients prone to develop major arterial embolization during hospitalization would reduce morbidity and mortality, and may warrant early surgical intervention.

2. **Aim of the study**: To assess the value of echocardiography in predicting embolic events and in-hospital mortality in patients with definite endocarditis.
3. **Methods:** The study involved 99 patients with definite IE according to the modified Duke criteria for the diagnosis of IE. Two thirds of the patients were recruited from the prospective IE database of Cairo University Hospitals while one third of the patients were newly admitted.
4. **Results:**

-Embolic events: Embolization occurred in 40.4% of patients during index hospitalization. Female gender was a highly significant risk factor for embolization. Vegetation length was a useful predictor of embolization.
A cut-off value of 2.095 cm was most useful in predicting embolization.
-Mortality: Atrial fibrillation/flutter was a powerful predictor of mortality as compared to sinus rhythm. Surgery decreased the risk of mortality, even if PVE was excluded from the analysis. The presence of heart failure functional class III/IV or fulminant sepsis necessitating inotropic support were significant predictors of mortality. The only echocardiographic parameter useful in predicting embolization was the presence of valvular stenosis.

5. **Conclusion:** This study clearly shows that female gender is a highly significant risk factor for embolization, and that vegetation length is a useful predictor of embolization in females, but not in males. Vegetation length is a

useful predictor of embolization in NVE but not in PVE. Atrial fibrillation/flutter, not having surgery, embolization, heart failure functional class III/IV and fulminant sepsis are all useful predictors of mortality, which allows identification of high-risk patients in whom an aggressive strategy will be potentially useful.

Key Words: Echocardiography – Infective endocarditis – Systemic embolization

Introduction

As one of the complications of infective endocarditis (IE), embolization has a great impact on the patient's prognosis. Systemic embolization is said to occur in 22% -50 % of cases of IE [1-5]. Early identification of patients prone to develop major arterial embolization during hospitalization would reduce morbidity and mortality, and may warrant early surgical intervention.

Prediction of an individual patient's risk of embolization has proven to be very difficult. Emboli can occur before diagnosis, during treatment or after therapy is completed, although most emboli occur within the first 2 to 4 weeks of antimicrobial therapy [6]. Of note, 2 independent studies have confirmed that the rate of embolic events (EEs) drops dramatically during or after the first 2 to 3 weeks of successful antimicrobial therapy. In a study by Steckelberg et al in 1991, the embolic rate dropped from 13 to <1.2 EEs per 1000 patient-days during that time [86]. In a more recent study, Vilacosta et al confirmed the reduced frequency of embolization after 2 weeks of therapy[6].

Previous studies that attempted to identify baseline predictors of embolism led to conflicting results. In particular, despite the key role played by echocardiography in IE diagnosis [7], its prognostic value has been questioned, specifically that of vegetation characteristics, namely, vegetation length and mobility. Whereas some authors reported an increased risk of EE in patients with large and mobile vegetations, others did not find such a correlation. Subsequently, no general agreement emerges from currently available guidelines, which give discordant recommendations with regard to surgical indications on the basis of vegetation characteristics.

With known decrease in the incidence of embolization after 2 weeks of antimicrobial therapy, the benefit of surgery in avoiding major EEs would be greatest early in the course of IE. Early surgical intervention may preclude an EE but exposes the patient to immediate and long term risks of valve replacement. At this time, the strategy for surgical intervention to avoid systemic embolization in IE remains specific to the individual patient, with benefit being greatest in the early phase of IE when embolic rates are highest and other predictors of a complicated course (ie, recurrent embolization; congestive heart failure; aggressive, antibiotic-resistant organisms; or prosthetic valve IE) are present [(8)].

Aim of the Work

The aim of this study is to assess the value of echocardiography in predicting systemic embolization and mortality in patients with left-sided definitive IE.

Chapter I

Embolic sites in infective endocarditis

Emboli often involve major arterial beds including the lungs, coronary arteries, spleen, bowel and extremities. Up to 65% of EEs involve the central nervous system, and >90% of central nervous system emboli lodge in the distribution of the middle cerebral artery [(5)].

The frequencies of different embolic sites in a study by Vilacosta et al. were as follows: CNS (52%), superior extremities (9%), inferior extremities (21%) and renal and splenic circulation (18%) [(6)].

Splenic Abscess: [(8)]

Splenic abscess is a well-described but rare complication of IE. This infection develops by 1 of 2 mechanisms: bacteremic seeding of a bland infarction, created via splenic arterial occlusion by embolized vegetations, or direct seeding of the spleen by an infected embolus also originating from an infected valvular vegetation . Although splenic infarction is a common complication of left-sided IE (≈40% of cases), it is estimated that only ≈5% of patients with splenic infarction will develop splenic abscess [(9-11)]. Reflecting their overall high frequencies in IE, viridans streptococci and Staphylococcus aureus (S. aureus) each account for ≈40% of cases in which splenic abscess cultures are positive, whereas enterococci account for 15% of cases. Aerobic Gram-negative bacilli and fungi are isolated in <5% of cases. Clinical splenomegaly, which is present in up to 30% of cases of IE, is not a reliable sign of splenic infarction or abscess. Splenic infarction delineated by imaging techniques often is asymptomatic [(11)]; pain in the back, left flank, or left upper quadrant, or abdominal tenderness may be associated with either splenic infarction or abscess [(10,11)]. Splenic rupture with hemorrhage is a rare complication

of infarction. Persistent or recurrent bacteremia, persistent fever, or other signs of sepsis are suggestive of splenic abscess, and patients with these findings should be evaluated via one or more of the imaging studies discussed below.

Abdominal CT and MRI appear to be the best tests for diagnosing splenic abscess, with both sensitivities and specificities ranging from 90% to 95%. On CT, splenic abscess is frequently seen as single or multiple contrast-enhancing cystic lesions, whereas infarcts typically are peripheral low density, wedge-shaped areas. On ultrasonography, a sonolucent lesion suggests abscess. 99mTc liver-spleen scans, labeled white blood cell scans, and gallium scans have become obsolete in the diagnosis of splenic abscess.

Differentiation of splenic abscess from bland infarction may be difficult. Infarcts generally are associated with clinical and radiographic improvement during appropriate antibiotic therapy. Ongoing sepsis, recurrent positive blood cultures, and persistence or enlargement of splenic defects on CT or MRI suggest splenic abscess, which responds poorly to antibiotic therapy alone. Definitive treatment is splenectomy with appropriate antibiotics, and this should be performed immediately unless urgent valve surgery also is planned. Percutaneous drainage or aspiration of splenic abscess has been performed successfully [12, 13], and this procedure may be an alternative to splenectomy for the patient who is a poor surgical candidate. A recent report emphasized the use of laparoscopic splenectomy as an alternative to formal laparotomy approaches [14]. If possible, splenectomy should be performed before valve replacement surgery to mitigate the risk of infection of the valve prosthesis as a result of the bacteremia from the abscess.