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ORIGINAL ARTICLE

# Predictors of In-hospital Adverse Events in Patients with Prosthetic Valve Infective Endocarditis

**Hwee-Leong Tan, MBBS [a], Louis YA Chai, MRCP, PhD [a], Tiong-Cheng Yeo, MBBS, FACC [a,b], Boon-Lock Chia, MBBS, FRACP [a,b], Paul A. Tambyah, MBBS, MD [a], Kian-Keong Poh, MBBChir, FRCP, FACC [a,b*]**

[a]Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore
[b]Department of Cardiology, National University Heart Center, National University Health System, Singapore

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**Background** We aimed to study patients with prosthetic valve endocarditis (PVE) and analyse factors associated with in-hospital adverse events.

**Methods** A review of all patients who underwent echocardiography at a local university hospital with definite PVE (modified Duke's criteria) was performed. Adverse events of in-hospital mortality and redo valve surgery were identified.

**Results** There were 23 patients with PVE (median age 53 years (IQR:38-66), 12 males (52%)). Twelve adverse events occurred including seven (30%) in-hospital mortalities and five (21%) redo valve surgery. Factors associated with in-hospital mortality include Staphylococcus aureus-PVE (86%vs31%, p=0.027), presence of shock (86%vs19%, p=0.005) and intensive care unit admission (72%vs19%, p=0.026). Factors associated with the need for redo valve surgery include a younger median age (37vs61 years, p=0.012), longer median length of stay (58vs17 days, p=0.004), history of intravenous drug abuse (IVDA) (60%vs6%, p=0.021) and right-sided valvular involvement (40%vs0%, p=0.040). Using a composite endpoint of both outcomes, factors associated with in-hospital adverse events were a history of IVDA (36%vs0%, p=0.037) and presence of shock (64% vs17%, p=0.036).

**Conclusion** PVE carries a high risk of poor clinical outcome in terms of in-hospital mortality and the need for redo surgery.

**Keywords** Prosthetic valve • Infective endocarditis • Adverse events • Predictors • In-hospital mortality • Redo valve surgery

## Introduction

Prosthetic valve endocarditis (PVE) is a relatively uncommon clinical entity, occurring in 1% to 6% of patients with valvular prostheses [1], with a reported incidence of 0.3 to 1.2 per patient-year [2]. PVE is also of clinical importance with a mortality rate ranging from 21% to 74% [3–9]. There are several studies looking at the prognostic factors for native valve endocarditis (NVE) [10,11]. However, due to the relative rarity of PVE outside major referral centres, such studies are limited for PVE, especially in the Asia-Pacific region [12,13]. We aimed to study patients with PVE

*Corresponding author at: Department of Cardiology, National University Heart Centre, 1E, Kent Ridge Road, NUHS Tower Block, Level 9, Singapore 119228. Tel.: +65-92373289; fax: +65-68722998, Email: kian_keong_poh@nuhs.edu.sg

and analyse factors associated with in-hospital adverse events.

## Material and Methods

We studied all patients with PVE diagnosed at the National University Heart Centre, Singapore, from January 2000 to December 2011. This study was approved by the institutional ethics board. Prosthetic valve endocarditis was diagnosed in patients with mechanical or bioprosthetic valves according to the modified Duke's criteria [14]. PVE cases were further sub-categorised into early PVE and late PVE depending on whether the diagnosis was made within one year following valvular replacement surgery or thereafter respectively [15–17]. Basic demographic information, laboratory data, microbiological findings, echocardiographic features, clinical course and treatment were reviewed. We identified in-hospital mortality and the need for redo valve surgery as the two main in-hospital adverse events.

Statistical analyses were performed using SPSS 19.0. Continuous variables were analysed using the Mann-Whitney U test while nominal variables were analysed using the Fisher's exact test, with a significance level of 5% used.

## Results

A total of 23 patients had PVE, of which eight (35%) were early PVE cases. Our study population had a median age of 53 years (IQR: 38-66) and a comparable gender proportion with 12 males (52%) (Table 1). The ethnic distribution mirrors that of the local population in Singapore, with a predominance of Chinese patients. Four patients (17%) had a history of intravenous drug abuse (IVDA).

Most patients in our study (70%) had PVE involving one valve, of which eight (35%) were mitral valves, seven (30%) were aortic valves and one was the tricuspid valve (Table 1). The remaining patients had involvement of two valves, of which the majority involved the mitral and aortic valves, with one involving the mitral and tricuspid valves. In terms of valve type, eight (35%) of our patients had bioprosthetic while the remaining 15 (65%) had mechanical valves. Microbiological assessment revealed Staphylococcus aureus as the causative organism in 11 (48%) of the patients, of which six and five were methicillin-sensitive and methicillin-resistant strains respectively. Other causative organisms in our study population include Enterococci and Viridans Streptococci.

In terms of in-hospital adverse events, in-hospital mortality was documented in seven (30%) of the patients, while five (21%) required redo valve surgery.

Factors found to be significantly associated with in-hospital mortality (Table 2) include Staphylococcus aureus as the causative organism (86% vs 31%), p=0.027), the presence of shock (86% vs 19%, p=0.005) and intensive care unit admission (72% vs 19%, p=0.026).

On the other hand, factors found to be significantly associated with the need for redo valve surgery (Table 2) include a younger median age (37 vs 61, p=0.012), a history of IVDA (60% vs 6%, p=0.021), right-sided valvular involvement (40% vs 0%) and a longer median length of stay (58 vs 17 days, p=0.004).

Using a composite endpoint of both in-hospital mortality and the need for redo valve surgery, factors found to be significantly associated with in-hospital adverse events (Table 2) were a history of IVDA (36% vs 0%, p=0.037) and the presence of shock (64% vs 17%, p=0.036).

**Table 1 General characteristics of study population.**

| Characteristic | Number (%) |
|---|---|
| **Demographics** | |
| Age, years; median (IQR) | 53.0 (37.5 – 65.5) |
| Ethnicity | |
| Chinese | 14 (60.9) |
| Malay | 7 (30.4) |
| Indian | 1 (4.3) |
| Others | 1 (4.3) |
| Male gender | 12 (52.2) |
| Intravenous drug abuse | 4 (17.4) |
| **PVE characteristics** | |
| Valve(s) involved | |
| Mitral valve only | 8 (34.8) |
| Aortic valve only | 7 (30.4) |
| Tricuspid valve only | 1 (4.3) |
| Mitral and aortic valves | 6 (26.1) |
| Mitral and tricuspid valves | 1 (4.3) |
| Early PVE | 8 (34.8) |
| Valve type | |
| Bioprosthetic valve | 8 (34.8) |
| Mechanical valve | 15 (65.2) |
| Right-sided valvular involvement | 2 (8.7) |
| Staphylococcal PVE | 11 (47.8) |
| **In-hospital adverse events** | |
| In-hospital mortality | 7 (30.4%) |
| Need for redo valve surgery | 5 (21.7%) |

## Discussion

PVE has been recognised as a relatively uncommon clinical entity with significant rates of morbidity and mortality [3–9]. It is hence unsurprising that the in-hospital mortality rate of PVE in our study was 30%, comparable to the high mortality rates reported in other studies, ranging from 21% to 74% [3–9]. Another contributory cause to the grim outlook of PVE is its frequent need for redo valvular surgery for definitive treatment, with its attendant morbidity [4]. Therein lies the clinical question of whether there are subgroups of patients with PVE who are inclined to do worse, the answer to which would aid in risk-stratifying patients to optimise management following presentation with PVE.