A retrospective comparison of native valve endocarditis and prosthetic valve endocarditis in a large tertiary care teaching hospital from 2007-2015

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Introduction

Infective endocarditis (IE) was first recognized in 1885, and still confers a high morbidity and mortality rate (1). With the utilization of penicillin and institution of surgical options, the mortality decreased to as low as 10% in the 1960s (2). Higher risk for IE is now being found in patients that are elderly, chronically ill, have prosthetic valves, are on chronic hemodialysis, have indwelling vascular catheters or an intracardiac device. Currently the mortality rate of IE is reported around 14-37% (3,4,5,6,7,8,9).

In our literature review, we found only two studies comparing risk factors, microbiology, and mortality between prosthetic valve endocarditis (PVE) and native valve endocarditis (NVE). Of the two studies, only Luk *et al* addressed the North American population in the past decade.

A larger number of patients with prosthetic heart valves are surviving and entering the general population, and the risk factors for developing IE may differ from those with native valves. This retrospective study aims to identify differences in both risk factors and outcomes between PVE and NVE, in the Hampton Roads, Virginia population.

Materials and Methods

Medical records from Sentara Norfolk General Hospital and Sentara Heart Hospital were used to identify initial/potential admissions for active cases of IE using appropriate IE-related ICD9 codes, from Spring of 2007 to August 13, 2015. Only adult cases (age 18+) were reviewed. Each admission that met Modified Duke Criteria for definite IE was classified into NVE and PVE and marked for further analysis. All cases were analyzed independently for risk factor, causative organisms, 30 day mortality, and use of surgical intervention on the valve. The clinical and microbiological features between NVE and PVE were compared to determine if any statistically significant differences existed between the two groups.

Results

Table 1. Demographics and comparison between native and prosthetic valve endocarditis

Demographics	Prosthetic (59)	Native (261)	Total (320)	Odds Ratio	P-value
Age (mean)	56 ± 14	56 ± 13			
Male:Female	35:24=1.49	158:103=1.53		1.05	0.86
Risk Factor					
Hemodialysis	11 (19%)	75 (28.7%)	86	0.57	0.12
Hx of IVDU	7 (12.1%)	25 (9.6%)	32	1.27	0.6
Other ICD	7 (12.1%)	31 (11.9%)	38	1	0.99
Valvular	2 (3.4%)	33 (12.7%)	35	0.25	0.057
Hx of IE	19 (32.8%)	25 (9.6%)	44	4.48	**< 0.0001**
Poor Dentition	4 (6.9%)	24 (9.2%)	28	0.72	0.55
Dental procedure	9 (15.3%)	9 (3.4%)	18	4.88	0.0043
Valvular Involvement					
Mitral	18 (30.5%)	108 (41.4%)	126	0.62	0.13
Aortic	34 (57.6%)	75 (28.7%)	107	3.8	**< 0.0001**
Tricuspid	0	29 (11.1%)	29	0.067	0.057
Multi-valve	3 (5%)	42 (16.1%)	45	0.28	**0.038**
Unknown	4 (6.8%)	7 (2.7%)	11	2.64	0.13
Organisms					
VG Strep	9 (15.5%)	47 (18%)	56	0.82	0.62
S. pneumoniae	0 (0)	7 (2.7%)	7	0.29	0.39
Other Strep	0 (0)	16 (6.1%)	16	0.13	0.15
Enterococcus	10 (17.2%)	30 (11.5%)	40	1.57	0.26
S. Aureus (MS)	10 (17.2%)	45 (17.2%)	55	0.98	0.96
S. Aureus (MR)	7 (12.1%)	52 (19.9%)	59	0.54	0.15
Coag-neg Staph	7 (12.1%)	31 (11.9%)	38	1	0.99
Fungal	2 (3.4%)	5 (1.9%)	7	1.8	0.49
Multi-bacterial	1 (1.7%)	5 (1.9%)	6	0.88	0.91
Culture negative	6 (10.2%)	15 (5.7%)	21	1.86	0.22
Outcomes					
Valve Surgery	16 (27.6%)	73 (27.9%)	89	0.96	0.9
30-day Mortality	18 (31.0%)	51 (19.5%)	69	1.81	0.067

Discussion

NVE was understandably the most common type of endocarditis, and accounted for 71.9% of all IE admissions in our study. Our findings are similar to three other studies, by Romano *et al*, Castonguayet *et al*, and Luk *et al,* that found NVE rates of 73%, 72% and 78% in their studies, respectively. We found 16.3% of our IE population to have PVE. The male to female ratio between the NVE and PVE cases were around 1.5:1, which concurs with current literature reporting that IE is still more common in males than females.

PVE cases had a significantly higher chance of having a history of IE ($p < 0.0001$). This is an expected finding, as valve replacement can be a part of the management of IE. PVE was also significantly more likely to be associated with a dental procedure performed in the preceding 6 months of IE admission compared to NVE ($p = 0.0043$). This implies that patients with prosthetic valves, who are currently covered under the 2007 AHA guidelines to receive IE prophylaxis prior to certain procedures, are still at a higher risk of developing PVE. It may be prudent to reconsider adding a post-procedure dose of antibiotic, which was recommended in past guidelines instead of only providing a single pre-procedure dose, to extend the protection of this high risk population with prosthetic valves. Lastly, we found no statistically significant difference in most other risk factors, such as hemodialysis, intravenous drug use, poor dentition and so on, between NVE and PVE in this study.

The mitral valve continues to be the most commonly affected valve in NVE at 41.3%. However, IE involving the aortic valve was significantly more likely to be associated with PVE ($p < 0.0001$) in this study. A large proportion of the general population has aortic valve diseases, such as aortic stenosis or congenital bicuspid aortic valves. These patients often deteriorate at an earlier age, requiring them to have valve replacement surgery as treatment. With the development of transcatheter aortic valve replacement (TAVR), more people with damaged aortic valves are opting in for this minimally invasive procedure, creating an expanding population with prosthetic aortic valves.

Conclusions (cont'd)

Our study also found a greater likelihood of PVE being caused by other bacteria that are not staphylococcal, streptococcal or enterococcal species. These bacteria were found to be common organisms such as Klebsiella, Enterobacter, Proteus, in addition to two cases caused by Pseudomonas Aeruginosa. This is likely explained by the fact that a prosthesis of any kind promotes general bacterial colonization and is an ideal environment for biofilm formation.

PVE showed a higher likelihood of 30 day mortality than NVE that is of near significance ($p = 0.067$) amongst the two cohorts in this study. This finding is likely multifactorial. One reason could be the higher incidence of recurrence and more severe disease, as suggested by our findings that PVE cases are more likely to be associated with a history of IE. The higher mortality seen in our PVE cohort could also be due to the multiple comorbidities in patients with prosthetic heart valves overall, as well as being due to general bacterial colonization on a prosthetic valve by less virulent organisms. Our finding could become significant if we extended the review. Furthermore, this finding supports two other studies that also found worse outcomes and mortality in PVE than NVE, reported by Grunenfelder et al and Romano et al.

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