

## Incidence of Bacterial Endocarditis after Heart Valves Replacement Surgery in Mashhad (from 2012 to 2016)

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### ABSTRACT

**Introduction:** Bacterial endocarditis is one of the high mortality complications after the valve surgery. Despite the medical advancements, the mortality rate of Bacterial Endocarditis has not been decreased. We designed this study to determine the epidemiology of Bacterial Endocarditis following surgery.

**Materials and Methods:** This is retrospective study from 2012 to 2016 in Mashhad University of Medical Science. Patients with history of Cardiac Surgery with Implantation of Prosthetic valve. The diagnostic method of bacterial endocarditis was based on the Duke's criteria, Transthoracic echocardiography, and culture lab.

**Results:** Among 2802 patients with cardiac valve surgery, 9 patients had developed Bacterial endocarditis. The common infectious valve was mitral (58.4%) and prosthetic valves were mostly used in general (77%). There was no relationship between gender ( $p=0.47$ ), marital status ( $p=0.68$ ), and type of surgery ( $p=0.29$ ) and Bacterial endocarditis. But there was a significant relationship between the type of valve surgery and Bacterial endocarditis ( $p=0.01$ ). Also, 3 patients with Bacterial endocarditis had a history of smoking and drugs. Three patients also died and were excluded.

**Conclusion:** Bacterial endocarditis differ according to the different studies and our results were compatible with previous studies. Our study confirmed that the utilization rate of the prosthetic valve was higher than the homograft valve. The use of antibiotics should be evaluated prior to performing a culture test which could affect the test results and consequences of the study.

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### Introduction

Bacterial Endocarditis (BE) is a rare disease with the annual incidence of about 3-10 per

100,000 of population (1) and have up to 10 % in-hospital mortality (2).

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Inflammation of the endocardium is caused by bacteria that have entered the bloodstream. The strain of bacteria causing the inflammation, varies depending on the predisposing factors, such as congenital heart defects, heart valve diseases, heart valve prosthesis inflammation, and intravenous drug abuse.

Regardless of the noticeable improvement in the healthcare system, management of BE remains a big challenge. The reason behind that is the high degree of resistance to antibiotics and also an increasing number of old patients with accompanying comorbidities (3).

Risk factors can be divided into two major groups; those related to the host such as chronic kidney disease, cancer, Cardiac valvular abnormalities, diabetes, human immunodeficiency virus (HIV), and old age. The other category is the risk factors which are related to the procedure (3).

Almost half of the patients with acute BE require cardiac surgery (1). At surgery, the infected tissue is completely removed and then reconstruction of the valve can be done via replacement or repair. Different types of valves are used, including biological valve, mechanical valve, autograph, and homograft (4).

The 2014 American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommended a biological valve in patients with 65 years of age or older, while a mechanical valve is preferred in patients under 65 years of age, but the guidelines do not provide any specific surgical strategy for bacterial endocarditis surgery (5).

Some of the previous studies have found no remarkable difference in survival while comparing the patients with biological valves and mechanical valves. On the contrary, some other studies have reported that mechanical valves have more survival rate comparing to biological valves (4, 6, 7).

Therefore, the purpose of this retrospective study is to investigate the prognosis of patients with bacterial endocarditis who had undergone valvular surgery with biological and mechanical valves in means of understanding the optimal surgical approach in patients with bacterial endocarditis.

## Methods and Material

### Patients

The retrospective study consisted of all patients who had undergone surgery with any type of prosthetic valves including mechanical, Bio-prosthesis, and homograft between October 2012 and October 2016 at Imam Reza hospital and Ghaem hospital of Mashhad university of medical sciences. The patients who had definite Bacterial endocarditis base on the Duke criteria were selected (4, 7). The exclusion criteria included: 1-incomplete medical record, 2-lost in the follow-up, and 3-endocarditis was related to reketsia, fungi or inflammatory diseases this study was approved by the ethics committee of the Mashhad University of Medical Sciences. All patients were operated by the same surgical strategy.

### Equipment

The modified Duke criteria were used to validate the diagnosis of definite or possible IE, and also transthoracic echocardiography and culture lab were used in this study.

### Statistical analysis

Statistical analysis was performed via the statistical package for social sciences (SPSS, Chicago, ill.), version 20.0 for mac. P values of less than 0.05 were considered as statistically significant. Continuous quantitative data are presented as mean  $\pm$  standard deviation and categorical data are presented as percentages.

## Results

2802 patients who underwent surgery with any type of prosthetic valve surgery were recruited in this study. The *mean age* of the *patients* was  $47.85 \pm 17.71$  (1-91) years and 1497 (53.4) of patients were female. In total, 9 (0.3) patients mean aged  $49.78 \pm 18.64$  (19-72) years were identified as definite BE patients. Age differences between BE patient and overall patients was not significant ( $p=0.7$ ) (table 1). Between these 9 patients, 6 (0.2) cases were male and 3 (0.1) cases were female. There was not any significant relationship between sex and Bacterial Endocarditis ( $P=0.47$ ) (table 2). One patient among 9 endocarditis cases was smoker and 2 of them had an opium

addition. All patients underwent Transthoracic Echocardiography (TTE) which only three of them had positive cultures confirming their diagnosis. Four type of valve were used in this study (Table 3). The most common types of valvular surgery, respectively, included: mitral valve (58.3%), aortic valve (26.7), tricuspid valve (10.1), and pulmonary valve (4.6).

The pulmonary valve was involved in 0.8% of surgeries which had the most percentage. Chi-square test showed remarkable association between type of valve surgery and endocarditis ( $P < 0.05$ ). Heart valve surgery was performed via repair 356 (12.7 %) or replacement 2446 (87.3 %) of the valve. There were two types of artificial valves, Prosthetic valves (82.5%) and Homograft valves (4.6%). 2312 patients underwent prosthetic valve surgery in which 7 of them led to BE. Also, there was not any

significant relationship between type of the procedure and BE ( $P=0.06$ ). BE incident occurred in the two different hospitals.

### Discussion

In this study, we evaluated 2802 patients who had undergone any type of valve surgery between October 2012 and October 2018. In total, 9 patients (0.3%) were diagnosed with Bacterial Endocarditis post-operatively. According to our results, was significantly more common following the pulmonary valve surgery. BE still remains as a deadly complication after cardiac surgery. Diagnosis of Bacterial Endocarditis has become more challenging because of both improvement in the examination facilities and the increasing resistance to the antibiotics which has led to the present cases with atypical features.

**Table 1.** Age differences between patients with BE patients and overa.

	Overall	IE patients	P value*
Mean, y	47.85 ± 17.71	49.78 ± 18.64	0.7

\*Independent Samples Test

**Table 2.** Comparison sex in patients with and without BE.

		Endocarditis		Overall	P value *
		Negative	Positive		
				2802	
Sex	Male, n (%)	1299 (99.5)	6 (0.5)	1305	0.47
	Female, n (%)	1494 (99.8)	3 (0.2)	1497	

\*Chi-Square test

**Table 3.** Comparison type of valve surgery in patients with and without BE.

		Endocarditis		Overall	P value *
		Negative	Positive		
Type of valve	Mitral, n (%)	1630 (99.6)	6 (0.36)	1636 (58.3)	0.01
	Aortic, n (%)	749 (99.8)	1 (0.13)	750 (26.7)	
	Tricuspid, n (%)	284 (99.6)	1 (0.35)	285 (10.1)	
	Pulmonary, n (%)	129 (99.2)	1 (0.8)	130 (4.6)	

\*Chi-Square test

**Table 4.** Comparison type of procedure in patients with and without BE.

		Endocarditis		Overall	P value *
		Negative	Positive		
Type of valve	Prosthetic, n (%)	2305 (82.2)	7 (0.3)	2312 (82.5)	0.06
	Homograft, n (%)	129 (4.6)	2 (1.5)	131 (4.6)	
	Repair, n (%)	359 (12.8)	0	359 (12.8)	

\*Chi-Square test

Based on the time of the disease acquirement, this disease is classified into two types, early and late PVE. The early PVE is acquired within one year of the surgery, while the late PVE is acquired after one year post surgery. All of our patients were in the late PVE category (8). Previous literature in developed countries have reported 45 to 60 years old as the average age of endocarditis which most frequently had occurred after the age of 50 (9). In this study, patients were aged 19–68 years, with a median age of 55 years. Nunes et al (10). from Brazil and Al-Tawfiq et al (11). from Saudi Arabia have reported the median age of 45 and 59 years, respectively. Moreover, studies from India and Tunisia also showed lower median age of 27 and 34 years, respectively (12, 13). In general, it should be considered that the mean age of BE is younger in countries with lower socioeconomic status. Several studies have shown that men are more affected by BE than woman. However, a recent study in Iran revealed an opposite result in which women had greater risk for Bacterial Endocarditis than man(14). We also found that women had a higher risk of BE than men; Although, the difference was not significant and a study with a larger statistical population of EB patients is recommended. Our study confirmed that the utilization rate of the prosthetic valve was higher than the homograft valve (82.5%). So, normally most of BE cases (7 from 9 patients) had a history of prosthetic valve surgery which is related to a greater number of this kind of valve surgery. In addition, it seems that biological valves were associated with increased risk of BE compared to prosthetic valves. In this study, incidence of BE following valve surgery was 0.3% and the highest relative frequency of endocarditis was related to the

pulmonary valve. The most common valve affected in the studied patients with BE was mitral valve (66.6%). The results are similar to previous literature which reported studies. The most common susceptible valve was the mitral valve, followed by the aorta and then the tricuspid and pulmonary valve; but a similar study in Iran indicated that aortic valve is most commonly affected. Moreover, Faraji et al. demonstrated that the most affected valve were mitral valve (40%) and then aortic valve (34%)(15). Postoperative follow up is an important factor to determine the actual BE frequency. Fedeli et al. also mentioned that the mortality rate of patients increased within 2 years of follow-up (16). The limitation of this study is that the follow-up of patients did not last more than one year, so our result might be susceptible to change within a long time span.

### Conclusion

We presented the results of surgery in bacterial endocarditis after initial proper antibiotics that have same results with previous studies. Use of antibiotics should be evaluated prior to performing culture test which could affect the test results and consequences of study. Our study confirmed that the utilization rate of the prosthetic valve was higher than the homograft valve.

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