



# Mid-Term Outcome after Aortic Valve Replacement in Tertiary hospital

Sira Laohathai MD<sup>1\*</sup>

Montien Ngodngamtaweesuk MD<sup>2</sup>

Piya Samankatiwat MD<sup>2</sup>

<sup>1</sup> CardioThoracic surgery unit, Department of surgery, Faculty of Medicine Vajira hospital, Navamindradhiraj University, Bangkok, Thailand

<sup>2</sup> CardioThoracic surgery unit, Department of Surgery, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

\* Corresponding author, e-mail address : sira\_l@hotmail.com

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## Abstract

**Background:** Surgical aortic valve replacement (SAVR) is a standard procedure for symptomatic aortic valve disease, however, there was a limited data about this procedure in Thailand especially in terms of long-term outcomes. This study aims to present mid-term results after aortic valve replacement as a single institution.

**Methods:** A retrospective cohort study was conducted. All 112 consecutive patients who underwent isolated SAVR at Ramathibodi hospital between 2010 – 2015 were enrolled in this study. Patient characteristics, operative procedures, perioperative complications and postoperative outcomes were retrospectively reviewed from medical recording system. The endpoints were overall survival at 30 days, 1 years and 5 years, peri-operative and valve-related complications.

**Results:** There was 112 patients. Seventy-eight (69%) patients were male. Median age was 66 (IQR 14-87). Median follow-up period was 36 months (IQR 24-60). The most common pre-operative clinical symptoms were congestive heart failure followed by myocardial infarction and angina pectoris. The majority of pathology was degenerative aortic stenosis. Median of Euroscore was 1.5% (0.5-7%). Thirty-day, one-year and three-year survival of isolated SAVR was 98, 96 and 96 % respectively. There were 4.4 % of the patients who required a permanent pacemaker and stroke rate was 1.8%. In subgroup analysis, there was no difference in overall survival between age < 60 and more than 60 years old. (P=0.67)

**Conclusion:** An isolate aortic valve replacement is a safe procedure with a low post-operative complication and also demonstrate a good long-term outcome.

**Keywords:** aortic valve replacement, cardiac surgery



# ผลของการผ่าตัดระยะกลางในผู้ป่วยที่ได้รับการเปลี่ยนลิ้นหัวใจบริเวณเอออร์ติก

ศิริระ เลาทัย พบ.<sup>1\*</sup>

มณฑิธร งดงามทวิสุข พบ.<sup>2</sup>

ปิยะ สมานคตวิวัฒน์ พบ.<sup>2</sup>

<sup>1</sup> หน่วยศัลยศาสตร์ทรวงอก ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์วชิรพยาบาล มหาวิทยาลัยนวมินทราธิราช กรุงเทพมหานคร ประเทศไทย

<sup>2</sup> หน่วยศัลยศาสตร์ทรวงอก ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล กรุงเทพมหานคร ประเทศไทย

\* ผู้ติดต่อ, อีเมล: sira\_l@hotmail.com

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## บทคัดย่อ

**บทนำ:** การผ่าตัดเปลี่ยนลิ้นหัวใจบริเวณเอออร์ติกเป็นการผ่าตัดที่ได้มาตรฐานสำหรับผู้ป่วยที่มีอาการและมีรอยโรคบริเวณลิ้นหัวใจบริเวณเอออร์ติก การศึกษาชนิดนี้เป็นการศึกษาเพื่อศึกษาอัตราการรอดชีวิต และ ภาวะแทรกซ้อนของผู้ป่วยที่ได้รับการผ่าตัดเปลี่ยนลิ้นหัวใจบริเวณ เอออร์ติกในโรงพยาบาลรามาธิบดี

**แนวทางวิจัย การศึกษาย้อนหลังเชิงพรรณนา:** ตั้งแต่ปี 2553-2558 มีผู้ป่วยรับการผ่าตัดเปลี่ยนลิ้นหัวใจบริเวณเอออร์ติก 112 คน ในโรงพยาบาลรามาธิบดี โดยการศึกษาเป็นการเก็บรวบรวมโดยใช้ข้อมูลเวชระเบียนในโรงพยาบาลรามาธิบดี

**ผลของงานวิจัย:** มีผู้ป่วยเพศชายจำนวนทั้งหมด 78 คน และ อายุเฉลี่ยที่ 65.5 ปี อาการนำของผู้ป่วยมาด้วยหัวใจล้มเหลวและ หัวใจขาดเลือดเฉียบพลัน และ เจ็บหน้าอก พยาธิสภาพที่พบบ่อยที่พบ คือโรคลิ้นหัวใจบริเวณเอออร์ติกตีบ โดยอัตราการรอดชีวิตที่ 30 วัน, 1 ปี และ 3 ปี อยู่ที่ร้อยละ 98, 96 และ 96 ตามลำดับ โดยอัตราภาวะแทรกซ้อนที่ต้องใส่เครื่องกระตุ้นหัวใจอยู่ที่ร้อยละ 4.4 และ สมองขาดเลือด 1.8 และ จากการศึกษาเฉพาะกลุ่มไม่พบความแตกต่างทางนัยสถิติของอัตราการรอดชีวิต ระหว่างผู้ป่วยที่มีอายุมาก และ อายุน้อย

**สรุป:** การผ่าตัดเปลี่ยนลิ้นหัวใจบริเวณเอออร์ติกเป็นการผ่าตัดที่ได้มาตรฐาน และ ปลอดภัย โดยมีภาวะแทรกซ้อนต่ำ และมีอัตราการรอดชีวิตที่ดี

**คำสำคัญ:** ผ่าตัดเปลี่ยนลิ้นหัวใจบริเวณเอออร์ติก, ผ่าตัดหัวใจ

## Introduction

Natural history of aortic valve stenosis, most of patients develop a symptom starting from either angina or syncope to congestive heart failure. Once, if these lesions are left untreated, it could become lethal, with a median survival of less than 2 years in those with heart failure symptoms<sup>1-5</sup>. Medical therapy is not effective for the long-term management of aortic valve disease. Surgical aortic valve replacement remains the standard of operation in patients with an acceptable risk profile.

In 2016, 15,085 cardiovascular thoracic surgery cases had been performed in Thailand with 4,608 cases of valvular surgery. An isolated aortic valve replacement (AVR) is the most common primary valve procedure in Thailand. In Ramathibodi hospital, we are tertiary-care center which had been operated cardiac surgery more than 20 year. In recent year, we had been annually performed 400 surgical cardiac cases per years. The objective of this study was to demonstrate in-hospital outcomes and long-term survival of patients undergoing surgical AVR as a single institution.

## Methods

This study was a retrospective cohort from consecutive patients who underwent elective surgical AVR in Ramathibodi hospital, Bangkok, Thailand between February 2010 and December 2015. Indications for AVR were a patient who has a symptomatic and severe aortic valve disease either aortic valve stenosis, regurgitation or mixed type<sup>6</sup>. Preoperative coronary angiography was routinely performed in patients whose age over 45 years or any suspicious of myocardial ischemia such as abnormalities of regional wall motion or history of chest pain and one or more cardiovascular risk factors<sup>7</sup>. All patients did not have any significant

stenosis of coronary artery disease. After being discharged home, each patient was continuously followed up every 1 to 3 months at the cardiovascular surgical clinic. Patients whom could not be obtained medical records or received emergency operation were excluded from this study. The Kaplan-Meier was used for survival analysis. Institutional review board of research ethic committee has been approved with protocol number of ID 01-60-48.

## Definition of terms and outcomes

Elderly is a patient whom age over than 70 years old<sup>8</sup>

Severe aortic valve stenosis was defined as aortic valve area less than 1.0 cm<sup>2</sup> and mean gradient above 40 mmHg by echocardiography<sup>6</sup>.

Severe aortic regurgitation is divided into 3 categories; Firstly, the qualitative aspect is abnormal or flail or large coaptation defect for valve morphology, large central color flow or dense continuous wave of regurgitant jet, holodiastolic flow reversal in descending aorta (end-diastolic velocity more than 20 cm/s). Secondly, semiquantitative category is vena contracta width more than 6 mm and pressure half-time less than 200 milliseconds. Lastly, quantitative one is an effective regurgitant orifice area 30 mm<sup>2</sup> or higher and regurgitant volume at least 60 ml/beat<sup>6</sup>.

Dyslipidemia is defined as elevated total or low-density lipoprotein (LDL) cholesterol levels, or low levels of high-density lipoprotein (HDL) cholesterol. End staged renal disease is defined as a presence of renal function with estimated glomerular filtration rate (GFR) <15 ml/min. Peripheral arterial disease means patients who have the ankle-brachial index (ABI) less than 0.9. For pre-operative risk score, the logistic EuroSCORE was calculated by using the online calculator (<http://www.EuroSCORE.org/calc.html>)<sup>9</sup>.

Major adverse cardiovascular and cerebral events (MACE) is all-cause mortality; thrombotic vascular events, acute myocardial infarction and stroke. In the immediate post-surgical period acute myocardial infarction is defined as creatinine kinase MB levels higher 80 U/L.

Post-discharge acute myocardial infarction is defined by two out of three of the following symptoms: acute chest pain, signs of a new acute myocardial infarction on the electrocardiogram or elevation of relevant biomarkers. Stroke is stated as neurological deficits lasting for more than 24 hours.<sup>10</sup>

### Surgical procedure

All surgical procedures were performed by cardiothoracic surgical staff at Ramathibodi hospital. SAVR were performed by using cardiopulmonary bypass under mild systemic hypothermia (30 to 34°C). Myocardial protection was achieved using various solution such as blood or crystalloid or colloid cardioplegia. For incision, there were several approaches using either a standard median sternotomy or partial median sternotomy or right anterior thoracotomy approach. Type of incision and myocardial protection was selected by each surgeon. The operating surgeons also selected the type of valve prosthesis according to patient's age, underlying disease and by their preferences.

### Post-operative anticoagulant therapy

In case of mechanical valve, all patients received warfarin within 24 hours after surgery. Anticoagulation effect of warfarin was monitored by INR level. The acceptable level of INR was 1.8-2.5 for aortic valve replacement surgery. On the other hand, all patients with bioprosthetic valve were received both aspirin and warfarin within 24 hours postoperatively. All patients will be continued warfarin for 3 months with INR level at 1.8-2.5. However, aspirin is continuously taken lifelong.

### Statistical analysis

For categorical variables, Chi-square tests, Fisher's exact test were used as appropriate. Data with no normal distribution were analyzed by Wilcoxon's rank-sum test. Log rank test were analyzed to demonstrated overall survival graph. Continuous variables are presented as mean  $\pm$  standard deviation (SD) unless otherwise noted . P-values <0,05 were considered statistically significant. All statistical analyses were performed using STATA statistical software v.14,0 (Texas, USA).

### Results

There were 112 patients who underwent AVR at Ramathibodi hospital between 2010 and 2015. Median age at surgery was 65.5 years. The majority of gender was male, 69%. Common symptoms were congestive heart failure followed by angina, myocardial infarction and stroke in 86.6%, 8.9%, 2.7% and 1.8%, respectively. The most common etiology of aortic valve disease was degenerative disease. Bicuspid aortic valve was found in 23.2 percent of cases. Left ventricular ejection fraction was 57%. Mean average of EuroSCORE II was 1.5%  $\pm$  0.5%. All baseline characteristics was shown in Table 1.

Cardiopulmonary bypass time and aortic clamp time was 118.5 and 84.9 min, respectively. Minimally invasive approach either through hemi-sternotomy or anterior thoracotomy in 26.7 per cent of the patients. Only two patients (1.8%) required insertion of an intra-aortic balloon pump intra-operatively (Table 2).

During postoperative period, 2 (1.8%) cases required re-operation for the control of bleeding. Cardiac arrhythmia was the most common complication in 26.8 per cent. Permanent stroke was observed in 1.8% of patients. 30-day hospital mortality was 1.8%. Causes of death in two cases were intra-operative massive bleeding and intracranial hemorrhage in the other case (Table 3). Regarding mid-term outcomes in median follow-up period

of 36 months, there were two patient's dead within 6 months after the operation due to sepsis and the other from unknown cause (figure 1).

In subgroup analysis, there were 45 (40%) patients who age over than 70 years old. there was no different in overall survival between young and elderly group. (log rank test 18.2; P=0.67)

**Table 1:**

Basic characteristics data was shown in Table 1.

Demographics	Mean (N = 112)
Age, mean (SD)	65.5 (12.4)
Male, n (%)	78 (69%)
smoker, n (%)	43 (38%)
Body weight, mean (SD)	63.2 (18)
Height, mean (SD)	156.6 (18)
NYHA, n (%)	
1	30 (26.6%)
2	56 (50%)
3	25 (20.5%)
4	1 (0.9%)
Underlying disease, n (%)	
Stroke	10 (8.9%)
Diabetes mellitus	25 (22%)
Hypertension	77 (68.7%)
End stage renal disease	9 (6%)
Atrial fibrillation	10 (8.9%)
Clinical presentation, n (%)	
Congestive heart failure	97 (86.6%)
Myocardial infarction	3 (2.7%)
Angina pectoris	10 (8.9%)
Stroke	2 (1.8%)
Bicuspid aortic valve, n (%)	26 (23.2%)
Etiology, n (%)	
Degenerative valve	84 (75%)
Rheumatic heart disease	6 (5.3%)
Infective endocarditis	7 (6.3%)
Prolapse	14 (12.5%)
other	1 (0.9%)
Ejection fraction, mean (SD)	57% (16)
Euroscore, mean (range)	1.5% (0.5%-7%)
Echo pre-op data for aortic stenosis	
- Aortic valve area, mean (SD)	0.74 (0.26)
- Mean gradient, mean (SD)	59.15 (20.7)

NYHA, New York Heart Association

**Table 2:**

Operative parameter was shown in Table 2

Operative detail	Mean (N = 112)
CPB time, mean (SD)	121 (28.4)
Aortic clamp time, mean (SD)	86.6 (23)
Implant type, n (%)	
Mechanical valve	70 (62.5%)
Bioprosthesis valve	36 (32.2%)
Sutureless valve	6 (5.3%)
IABP (Post-operative), n (%)	2 (1.8%)
Mini-AVR, n (%)	30 (26.7%)

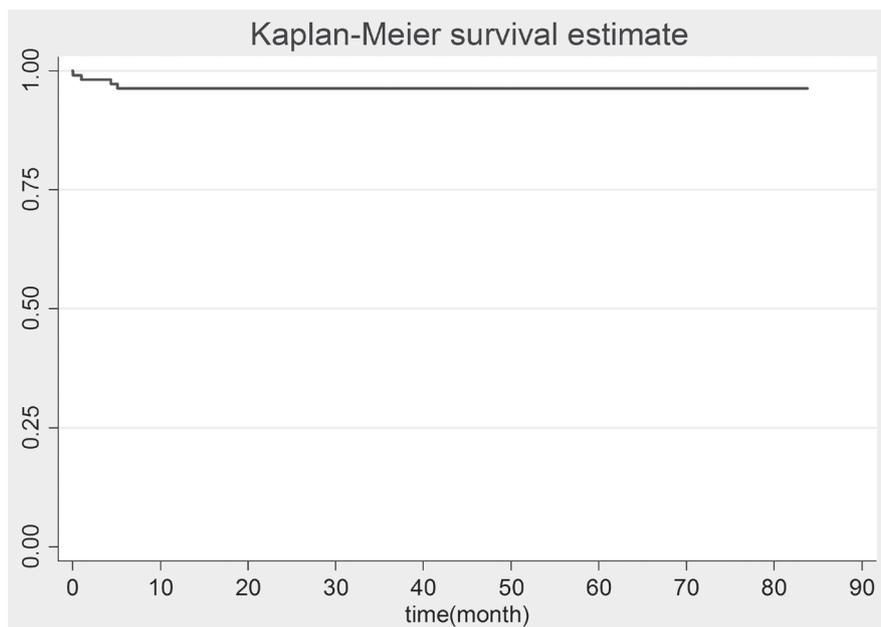
CPB, cardiopulmonary bypass; IABP, intra-aortic balloon pump, AVR, aortic valve replacement

**Table 3:**

Post-operative event was shown in Table 3.

Post-operative event	Mean (N = 112)
Reoperation for control bleeding, n (%)	2 (1.8%)
Post-operative arrhythmia, n (%)	30 (26.8%)
CVA (permanent), n (%)	2 (1.8%)
Heart block (need permanent pacemaker), n (%)	5 (4.4%)
30-day hospital mortality, n (%)	2 (1.8%)

CVA, cerebrovascular event



**Figure 1:** Mid-term outcome of over survival after patients received aortic valve replacement (Figure 1.)

## Discussion

In the current era with modern technology, a number of surgical aortic valve replacement cases have been decreasing and replaced by percutaneous approach. Leon et al and Makkar et al have published benefits of percutaneous valve replacement over medical therapy in inoperable high-risk patients<sup>11-12</sup>. In 2015, Micheal et al also reported their results that percutaneous valve implantation could be performed as an alternative to surgery in high surgical risk cohort<sup>13</sup>.

However, there are two important findings emerged from this contemporary study. Firstly, the short- and long-term prognosis in patients undergoing SAVR at our institution were excellent compared to the expected survival in symptomatic patients with aortic valve disease which is in the range of 2 to 3 years and also comparable with other national countries base study result<sup>14-16</sup>. Secondly, the rate of postoperative complications of SAVR in our study was also acceptable. Only 1.7 per cent developed stroke and also 4.46 percent required permanent pacemaker. Comparing with the percutaneous valve series reported by Micheal et al demonstrated that twenty percent of patients requiring implantation of permanent pacemaker and three percent with stroke<sup>13</sup>.

In this study, there are many limitations such as short follow-up time, retrospective nature and completeness of data collection.

## Conclusion

In conclusion, long term survival after aortic valve surgery is excellent according to our result. We believe that surgical aortic valve replacement remains the gold standard of treatment in low and intermediate risk operable symptomatic aortic valve disease. However, the decision making should be based on the multidisciplinary team, including cardiologist, cardiac surgeon, anesthesiologist and also the patients, discussion. Further study

in large-scale multicenter cohorts may improve the outcomes by helping in establishment of best practice for the patients.

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## Conflict of interest

none

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none

## References

1. Davies SW, Gershlick AH, Balcon R. Progression of valvar aortic stenosis: a long-term retrospective study. *Eur Heart J* 1991;12(1):10-4.
2. Horstkotte D, Loogen F. The natural history of aortic valve stenosis. *Eur Heart J* 1988;9 Suppl E:57-64.
3. Lung B, Baron G, Butchart EG, Delahaye F, Gohlke-Barwolf C, Levang OW, et al. A prospective survey of patients with valvular heart disease in Europe: The Euro Heart Survey on Valvular Heart Disease. *Eur Heart J* 2003;24(13):1231-43.
4. Nkomo VT, Gardin JM, Skelton TN, Gottdiener JS, Scott CG, Enriquez-Sarano M. Burden of valvular heart diseases: a population-based study. *Lancet*. 2006;368(9540):1005-11.
5. Ross J, Jr., Braunwald E. Aortic stenosis. *Circulation*. 1968;38(1 Suppl):61-7.
6. Baumgartner H. The 2017 ESC/EACTS guidelines on the management of valvular heart disease : What is new and what has changed compared to the 2012 guidelines? *Wien Klin Wochenschr*. 2018;130(5-6):168-71.
7. Windecker S, Kolh P, Alfonso F, Collet JP, Cremer J, Falk V, et al. [2014 ESC/EACTS Guidelines on myocardial revascularization]. *Kardiol Pol*. 2014;72(12):1253-379.

8. Ashikhmina EA, Schaff HV, Dearani JA, Sundt TM, 3rd, Suri RM, Park SJ, et al. Aortic valve replacement in the elderly: determinants of late outcome. *Circulation* 2011;124(9):1070-8.
9. Nashef SA, Roques F, Sharples LD, Nilsson J, Smith C, Goldstone AR, et al. EuroSCORE II. *Eur J Cardiothorac Surg* 2012;41(4):734-44; discussion 44-5.
10. Smilowitz NR, Gupta N, Ramakrishna H, Guo Y, Berger JS, Bangalore S. Perioperative Major Adverse Cardiovascular and Cerebrovascular Events Associated With Noncardiac Surgery. *JAMA Cardiol* 2017;2(2):181-7.
11. Leon MB, Smith CR, Mack M, Miller DC, Moses JW, Svensson LG, et al. Transcatheter aortic-valve implantation for aortic stenosis in patients who cannot undergo surgery. *N Engl J Med* 2010;363(17):1597-607.
12. Makkar RR, Fontana GP, Jilaihawi H, Kapadia S, Pichard AD, Douglas PS, et al. Transcatheter aortic-valve replacement for inoperable severe aortic stenosis. *N Engl J Med* 2012;366(18):1696-704.
13. Mack MJ, Leon MB, Smith CR, Miller DC, Moses JW, Tuzcu EM, et al. 5-year outcomes of transcatheter aortic valve replacement or surgical aortic valve replacement for high surgical risk patients with aortic stenosis (PARTNER 1): a randomised controlled trial. *Lancet* 2015;385(9986):2477-84.
14. Astor BC, Kaczmarek RG, Hefflin B, Daley WR. Mortality after aortic valve replacement: results from a nationally representative database. *Ann Thorac Surg* 2000;70(6):1939-45.
15. Clark RE. The STS Cardiac Surgery National Database: an update. *Ann Thorac Surg*. 1995;59(6):1376-80; discussion 80-1.
16. Kvidal P, Bergstrom R, Malm T, Stahle E. Long-term follow-up of morbidity and mortality after aortic valve replacement with a mechanical valve prosthesis. *Eur Heart J* 2000;21(13):1099-111.