Nationwide cohort study of mitral valve repair versus replacement for infective endocarditis

Hsiu-An Lee, MD,[a] Yu-Ting Cheng, MD,[a] Victor Chien-Chia Wu, MD,[b] An-Hsun Chou, MD, PhD,[c] Pao-Hsien Chu, MD,[b] Feng-Chun Tsai, MD,[a] and Shao-Wei Chen, MD[a,d]

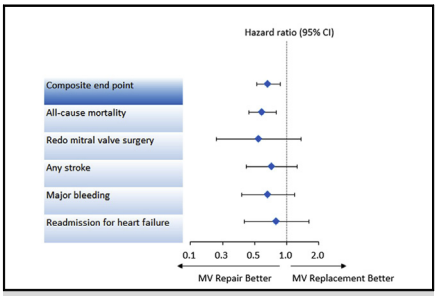
ABSTRACT

Objectives: The feasibility and long-term outcomes of mitral valve (MV) repair in patients with infective endocarditis (IE) remain unclear.

Methods: Using Taiwan's National Health Insurance Research Database, we identified 1999 patients who underwent MV surgery for IE during 2000 to 2013. The patients were more likely to have undergone valve replacement (1575 patients; 78.8%) than valve repair (424 patients; 21.2%). After 1:1 propensity score matching, 352 patients in each group were included for analysis. Perioperative outcomes and late composite end points, comprising all-cause mortality, MV reoperation, any stroke, major bleeding, and readmission for heart failure, were compared.

Results: Patients who received MV repair had fewer perioperative complications, lower in-hospital mortality rates (6.3% vs 10.8%; $P = .031$), and lower risks of late mortality (hazard ratio [HR], 0.59; 95% confidence interval [CI], 0.44-0.80), and composite end point (HR, 0.67; 95% CI, 0.52-0.87) during a mean follow-up of 4.8 years. Subgroup analysis revealed a trend in which the beneficial effect of MV repair was not apparent when surgeries were performed in hospitals within the lowest volume quartile (P for interaction $= .091$). In patients who underwent surgery during active IE, MV repair was also related to a lower rate of late mortality (HR, 0.64; 95% CI, 0.48-0.85).

Conclusions: Mitral repair for IE has better perioperative and late outcomes than mitral replacement. Mitral repair performed by an experienced team is recommended for IE patients instead of MV replacement whenever possible, even with an active infection status. (J Thorac Cardiovasc Surg 2018;■:1-11)



Mitral valve repair results in lower rates of late mortality and composite end point.

Central Message

Mitral repair for infective endocarditis has better perioperative and late outcomes than mitral replacement, and is recommended whenever possible, even for patients with an active infection status.

Perspective

The feasibility and long-term outcomes of mitral repair for infective endocarditis remain unclear. This nationwide population-based propensity score-matching study showed better perioperative and late outcomes after mitral repair than valve replacement, even in patients with active endocarditis. In low-volume centers, the repair rate was significantly lower and the beneficial effect of repair was less apparent.

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ADULT

The incidence of infective endocarditis (IE)-related hospitalization in Taiwan is approximately 6.43 episodes per 100,000 people annually.[1] Despite improvements in diagnosis and management, in-hospital mortality of IE

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From the [a]Division of Thoracic and Cardiovascular Surgery, Department of Surgery, Departments of [b]Cardiology, and [c]Anesthesiology, Chang Gung Memorial Hospital, Linkou Medical Center, and [d]Graduate Institute of Clinical Medical Sciences, College of Medicine, Chang Gung University, Taoyuan City, Taiwan.

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Address for reprints: Shao-Wei Chen, MD, Division of Thoracic and Cardiovascular Surgery, Department of Surgery, Chang Gung Memorial Hospital, Linkou Medical Center, Chang Gung University, No 5 Fuxing St, Gueishan District, Taoyuan City 33305, Taiwan (E-mail: josephchen0314@gmail.com).

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Abbreviations and Acronyms

ASMD = absolute standardized mean difference
CI = confidence interval
HR = hazard ratio
ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification
IE = infective endocarditis
MV = mitral valve
NHI = National Health Insurance
NHIRD = National Health Insurance Research Database

remains between 20% and 30%.[2,3] Although many patients are treated successfully with antibiotics, numerous patients still require surgery because of persistent sepsis, severe valvular destruction with heart failure, or repeated embolic complications.

If mitral valve (MV) surgery is indicated, valve repair is recommended over valve replacement whenever possible.[4] The feasibility and durability of repair in degenerative mitral regurgitation caused by leaflet prolapse or chordal rupture have been well established,[5-8] but the reparability and long-term outcomes of repair in IE remain questionable. Several studies have reported improved outcome after MV repair compared with MV replacement,[8-11] but others have not reported significant differences.[12,13] However, these were all retrospective studies with an inherent selection bias. Furthermore, long-term follow-up was limited. Therefore, we conducted this study to evaluate the perioperative and late outcomes of MV repair and replacement in patients with IE by using a nationwide population-based cohort study design with propensity score matched analysis to minimize confounding factors.

METHODS

Data Source

Taiwan's National Health Insurance (NHI) program is a universal compulsory health insurance system providing comprehensive medical care coverage to 99% of the country's 23.74 million people. Derived from the NHI program, the National Health Insurance Research Database (NHIRD) contains data that accurately represent Taiwan's population, with only minimal omitted data and a small participation bias.

The NHI program has a consistent data encryption process, allowing continuous tracking of all claims of each individual within the program. Moreover, because of the mandatory enrollment and affordability of the NHI program, even people who emigrate to other countries retain their NHI identities and return to Taiwan for medical treatment, especially those who have undergone major surgeries. Thus, nearly complete long-term follow-up of all patients is possible.

All data in the NHIRD are deidentified and anonymized to protect privacy; thus, this study was exempt from a full review by the Ethics Institutional Review Board of Chang Gung Memorial Hospital. Other relevant details have been described in previous publications.[14-16]

Study Population

A total of 15,111 patients who received MV surgery between January 1, 2000 and December 31, 2013 were identified using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) procedure codes (35.12, 35.23, and 35.24) and Taiwan NHI procedure codes (68015, 68016, 68017, and 68018), which are used for reimbursement claims (Figure 1). Of these patients, 2025 (13.4%) had a history of IE or a principal diagnosis of IE during the index hospitalization. ICD-9-CM diagnosis codes (421.0, 421.1, and 421.9) were used to identify the diagnosis of IE. Patients were excluded if they were aged younger than 18 years or had received previous valve surgery.

During the study period, 1999 adult patients underwent first-time MV surgery because of IE. Types of MV surgery were distinguished using ICD-9-CM procedure codes (35.12 for MV repair; 35.23 and 35.24 for MV replacement). Patients were more likely to undergo valve replacement (1575 patients; 78.8%) than repair (424 patients; 21.2%) in our study population. Longitudinal data for MV repair and replacement revealed an increase in the proportion of valve repair from 2000 to 2013 (P for trend = .047; Figure 1, *B*). To minimize potential selection bias, we calculated a propensity score from selected variables (Table 1) and matched each patient in the MV repair group with each patient in the MV replacement group. Finally, 352 patients from each group were identified and were eligible for analysis (Figure 1, *A*).

Baseline Characteristics and Outcomes

The examined demographic characteristics are listed in Table 1. Active IE was defined as a new diagnosis of IE during the index hospitalization (Table E3). Hospital level and the hospital's total volume of valve surgery and MV repair within the study period were also examined according to NHIRD claims data. Other surgical details were identified using Taiwan NHI procedure codes.

The examined outcomes during the index hospitalization are listed in Table 2. The primary outcome during follow-up was a composite of all-cause mortality, redo MV surgery, any stroke, major bleeding, and readmission for heart failure.

Death records and records of withdrawal from the NHI program were used to identify mortality. This method has been validated in previous studies.[17,18] The date on which a patient was admitted for MV surgery was defined as the index hospitalization. The patients were followed from their index hospitalization to December 31, 2013 or date of death, with a >99% completeness of follow-up.

Statistical Analysis

Before comparing outcomes between the MV repair and MV replacement groups, we performed propensity score matching to minimize the selection bias caused by an imbalanced distribution of baseline characteristics. The propensity score was calculated on the basis of clinical and surgical characteristics (Table 1 lists all variables, except for follow-up years), including date of the index hospitalization, which might be related to the probability of receiving MV repair. Although the number of patients was considerably greater in the MV replacement group, we adopted a 1:1 matching ratio to ensure higher precision and lower bias of treatment effects.[19] Greedy nearest neighbor matching was performed in which the caliper width was set as 0.2 of the SD of the logit of the propensity score.[20] An absolute standardized mean difference (ASMD) of <0.1 after propensity score matching was considered to indicate an adequate balance of the distribution of covariates.[21]

Data regarding clinical and surgical characteristics are presented as frequency and proportion for categorical variables or as mean ± SD for continuous variables. We compared the perioperative and in-hospital outcomes between the MV repair and MV replacement groups using a McNemar test for categorical parameters (eg, in-hospital mortality) or a paired sample t test for continuous parameters (eg, volume of transfusion).