

Mitral Valve Repair is Underused in Patients with Hypertrophic Obstructive Cardiomyopathy

Christina M. Vassileva, MD, Theresa Boley, MSN, Stephen Markwell, MA, Stephen Hazelrigg, MD

Division of Cardiothoracic Surgery, Southern Illinois University School of Medicine, Springfield, Illinois, USA



Dr. Vassileva

ABSTRACT

Background: The optimal surgical approach for patients with hypertrophic obstructive cardiomyopathy (HOCM) with concomitant mitral valve (MV) regurgitation has remained controversial. The purpose of this study was to use the largest all-payer database in the United States to examine the strategy most commonly used for the correction of mitral valve pathology in the setting of HOCM.

Methods: The Nationwide Inpatient Sample (NIS) database was searched from 2005 to 2008 to identify patients with a diagnosis of HOCM (ICD-9-CM code 425.1) who underwent MV repair (ICD-9-CM code 35.12) or replacement (ICD-9-CM codes 35.23 and 35.24). HOCM patients who underwent MV repair and those who underwent MV replacement were compared with respect to baseline characteristics, repair rates, hospital mortality, and length of stay (LOS).

Results: MV repair was performed in 17.2% of cases (219/1255). Repair rates did not show a significantly increasing trend over time ($P = .1419$). The median LOS was significantly longer for replacement than for repair (11 days versus 7 days, $P = .0001$). The mortality rate for patients who underwent repair was 0.00%, compared with 11.18% for those who underwent replacement ($P < .05$).

Conclusions: The majority of patients with a HOCM diagnosis underwent MV replacement for the correction of MV pathology. Referral to centers with special expertise in treating patients with HOCM may positively affect the operative outcomes of this patient subset.

INTRODUCTION

Hypertrophic obstructive cardiomyopathy (HOCM) is an autosomal dominant disease characterized by severe left ventricular hypertrophy, with the basal interventricular septum

being the most prominently involved. HOCM is associated with left ventricular outflow tract obstruction and sudden death, usually secondary to ventricular fibrillation [Braunwald 2009]. Concomitant mitral valve (MV) regurgitation is frequent in patients with HOCM and can occur by a variety of mechanisms, the most common of which are systolic anterior motion of the MV and concomitant degenerative MV disease [Yu 2000]. The optimal surgical approach for patients with HOCM with concomitant MV regurgitation has remained controversial [Wan 2009]. The purpose of this study was to use the largest all-payer database in the United States to investigate the strategy most commonly used for the correction of MV pathology in the setting of HOCM.

MATERIALS AND METHODS

Database

The Nationwide Inpatient Sample (NIS) is a stratified probability sample that includes data from approximately 20% of hospital admissions in the United States. Sampling bias in the NIS is minimized by stratifying by geographic region, urban versus rural location, teaching status, and hospital bed size. In other words, hospitals are divided into homogeneous subgroups with respect to these characteristics. Furthermore, the NIS has a process in place that ensures that hospitals within each of the different stratified subgroups in the overall sample have an equal probability of being chosen for the selected 20% sample. The database contains deidentified patient data that include up to 15 procedure codes and 15 diagnostic codes according to the International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9-CM).

Sample Selection

The NIS database from 2005 to 2008 was searched to identify patients with a diagnosis of HOCM (ICD-9-CM code 425.1) who underwent MV repair (ICD-9-CM code 35.12) or replacement (ICD-9-CM codes 35.23 and 35.24). HOCM patients who underwent MV repair and those who underwent MV replacement were compared with respect to baseline characteristics, repair rates, hospital mortality, and length of stay (LOS). Data are reported as number of admissions after appropriate weighting.

Received May 11, 2011; accepted June 29, 2011.

Correspondence: Christina Vassileva, MD, Division of Cardiothoracic Surgery, Southern Illinois University School of Medicine, 701 N First St, Rm D319, Springfield, IL 62794-9638, USA; 1-217-545-8875; fax: 1-217-545-7053 (e-mail: cvassileva@siu-med.edu).

Assessment of Patient Comorbidities

Initially, we compared patients who underwent MV repair and MV replacement with respect to individual comorbidities, including congestive heart failure, diabetes, cerebrovascular disease, peripheral vascular disease, and renal disease. However, because the sample size of the population of interest was small, and given that the data use agreement with the NIS which precludes reporting any statistics based on cell counts of 10 or fewer patients, we were unable to report many of the individual comorbidities. This problem is a reflection of the fact that few patients had the comorbidities in question. Therefore, we used the Charlson comorbidity index, which takes into account the presence and severity of comorbid conditions by means of a weighting scheme [Charlson 1987]. This index has been further adapted and validated for use with administrative databases [Deyo 1982]. It includes information on congestive heart failure, diabetes, peripheral vascular disease, cerebrovascular disease, hypertension, renal and pulmonary disease, among others. Moreover, it has been used extensively in previous published studies to control for baseline comorbidities. These studies included investigations of coronary revascularization and valve replacement [Birkmeyer 2002; Varghese 2010]. We also report the presence of congestive heart failure in the 2 groups separately for comparison, because it constituted the major comorbidity and was present in a significant number of patients. Patients with congestive heart failure were identified by ICD-9-CM codes 428 to 428.9.

Statistical Methods

Descriptive statistics, including frequencies, percentages, means, medians, and interquartile ranges, are presented. Group comparisons were carried out with chi-square tests of independence, independent-groups *t* tests, and median tests. Cochran-Armitage tests were used to test for trends across the years. Results were considered statistically significant for *P* values <.05. All analyses were performed with SAS version 9.2 (SAS Institute, Cary, NC, USA), which allows weighting to reflect the stratified sampling scheme used in the NIS. The study was approved by the Institutional Review Board.

RESULTS

During the time period of 2005 to 2008, there were 75,994 admissions with an HOCM diagnosis. The NIS database does not include patient-identifiable information. Consequently, we do not know what proportion of these admissions represent repeat admissions of the same patients. Of these 75,994 patients, 1255 (1.7%) underwent MV repair or replacement, and these patients constituted the study population.

The baseline characteristics of the repair and replacement groups are presented in Table 1. The mean age was 62.7 years. Of the total patient population, 63.1% were female, and 84.2% were white. The majority (69.3%) of the patients presented electively. The mean Charlson comorbidity index was 0.96. There were no differences between the patients who underwent MV repair and those who underwent MV replacement with respect to mean age, sex, race, Charlson

comorbidity index, congestive heart failure, hospital teaching status, and admission status.

MV repair was performed in 17.2% (219/1255) of the

Table 1: Comparison of Patients with Hypertrophic Obstructive Cardiomyopathy Who Underwent Mitral Valve (MV) Repair or Replacement

	Overall (n = 1255)	MV Repair (n = 219)	MV Replacement (n = 1036)	<i>P</i>
Age, y*	62.7, 64 (54 - 72)	60.0, 60 (50-72)	63.3, 65 (55- 73)	.1432
Female sex	63.1%	63.9%	62.9%	.8982
White race	84.2%	†	†	.3221
Elective admission	69.3%	†	†	.2768
Charlson index*	0.96, 1 (0-1)	0.78, 1 (0-1)	1.00, 1 (0-2)	.1657
Congestive heart failure	34.4%	37.8%	33.6%	.6087
Hospital teaching status	69.2%	75.9%	67.8%	.2692
hospital volume > 40 MV cases/y	77.1%	79.9%	76.6%	.6358

*Data are presented as the mean, median (interquartile range).

†In accordance with the Nationwide Inpatient Sample (NIS) data use agreement, actual percentages cannot be reported.

patients. Furthermore, repair rates did not show an increasing trend over time (*P* = .1419) (Figure 1). The majority of the patients (77.1%) presented for surgery to hospitals with an annual volume of at least 40 MV cases per year, and there was no difference between the patients who underwent repair and those who underwent replacement (*P* = .6358).

Hospital mortality and LOS comparisons are presented in Figure 2. The mortality rate for the patients who underwent repair was 0.00%, compared with 11.18% for those who

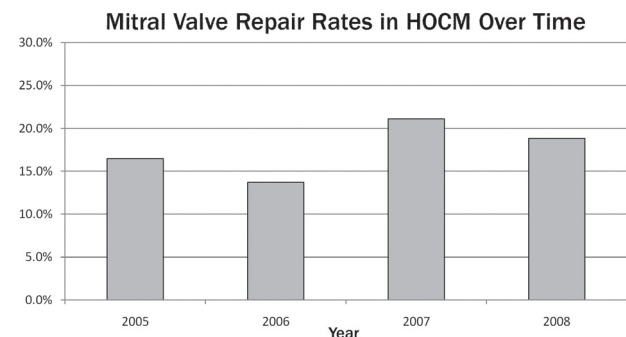


Figure 1: Yearly mitral valve repair rates in hypertrophic obstructive cardiomyopathy patients (HOCM) presenting for mitral valve surgery.

underwent MV replacement ($P < .05$). Similarly, the median LOS was significantly longer for MV replacement patients than for patients who underwent MV repair (11 days versus 7 days, $P = .0001$).

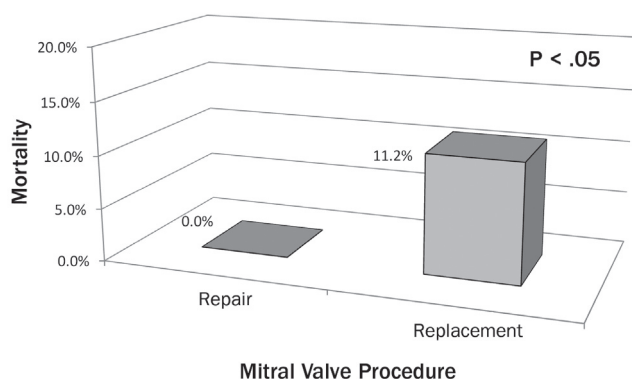


Figure 2. A, Hospital mortality in hypertrophic obstructive cardiomyopathy (HOCM) patients by type of mitral valve procedure.

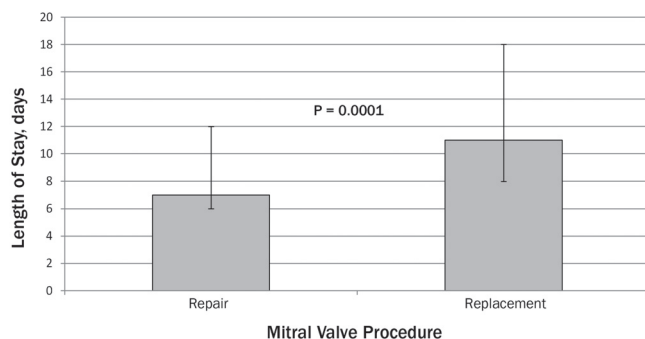


Figure 2. B, Length of stay of HOCM patients according to type of mitral valve procedure; data are presented as the median and interquartile range.

DISCUSSION

We undertook this investigation to examine procedure selection for MV intervention in patients with HOCM. Using the largest all-payer database in the US, we found that MV repair is used in a minority of patients with HOCM who present for MV surgery. The superiority of MV repair is well established [Galloway 1989]. In our patient subset, we observed a dramatic difference in mortality between patients who underwent MV repair, compared with those who underwent replacement. This finding was intriguing in light of the similarities in age, admission status, and comorbidities between the 2 groups. Furthermore, the mortality rate for MV replacement in our HOCM patient subset was considerably higher than the mortality rate for MV replacement in general [Galloway 1989].

There has been an increasing trend of MV repair as the procedure of choice for the correction of MV disease; however, this trend was not observed in the patients with a HOCM diagnosis, the majority of whom underwent MV replacement. The added complexity of the patients and the anatomic features of the pathology are likely contributory factors to this finding. Whereas referral to centers with a high volume of MV surgeries (>40 cases/year) does not seem to be linked to higher repair rates in our study population, referral to centers with special expertise in treating patients with HOCM may positively affect the operative outcomes of this patient subset.

Our study has several limitations. The NIS is an administrative database, the purpose of which is to gather data for billing purposes. There are significant limitations to the use of administrative databases, including erroneous coding and the lack of certain important clinical variables, among others [Shahian 2007]. The Healthcare Cost and Utilization Project (HCUP) quality control measures, however, should minimize these possibilities [AHRQ 2010]. This problem is not unique to administrative databases, however. Significant variation in data abstraction can exist with the definitions included in the Society of Thoracic Surgeons database, which has been used extensively for research purposes [Brown 2010]. The NIS database does not provide follow-up data, a feature that limits our ability to comment on long-term survival following MV repair versus replacement and/or the durability of MV repair, including reoperation rates. Despite these drawbacks, the NIS is the largest all-payer database in the United States and is used for the analysis of trends in healthcare use, access, charges, quality, and outcomes for both research and policy making [HCUP 2010]. Furthermore, some of its limitations are offset by large patient volumes, hard clinical end points, and the opportunity to explore real-world community data.

REFERENCES

- [AHRQ] Agency for Healthcare Research and Quality. 2010. HCUP quality control procedures. Available at: <http://www.hcup-us.ahrq.gov/db/quality.jsp>. Accessed October 2010.
- Birkmeyer JD, Siewers AE, Finlayson EV, et al. 2002. Hospital volume and surgical mortality in the United States. *N Engl J Med* 346:1128-37.
- Braunwald E. 2009. Hypertrophic cardiomyopathy: the early years. *J Cardiovasc Transl Res* 2:341-8.
- Brown ML, Lenocho JR, Schaff HV. 2010. Variability in data: the Society of Thoracic Surgeons national adult cardiac surgery database. *J Thorac Cardiovasc Surg* 140:267-73.
- Charlson ME, Pompei P, Ales KL, MacKenzie CR. 1987. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 40:373-83.
- Deyo RA, Cherkin DC, Ciol MA. 1992. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *J Clin Epidemiol* 45:613-9.
- Galloway AC, Colvin SB, Baumann FG, et al. 1989. A comparison of mitral valve reconstruction with mitral valve replacement: intermediate-term results. *Ann Thorac Surg* 47:655-62.

HCUP|HCUP Databases. 2010. Healthcare Cost and Utilization Project (HCUP). Available at: <http://www.hcup-us.ahrq.gov/nisoverview.jsp>. Accessed October 2010.

Shahian DM, Silverstein T, Lovett AF, Wolf RE, Normand SL. 2007. Comparison of clinical and administrative data sources for hospital coronary artery bypass graft surgery report cards. *Circulation* 115:1518-27.

Varghese JJ, Koneru S, Scaife SL, Zahnd WE, Francis ML. 2010. Mortality after coronary artery revascularization of patients with rheumatoid arthritis. *J Thorac Cardiovasc Surg* 140:91-6.

Wan CK, Dearani JA, Sundt TM 3rd, Ommen SR, Schaff HV. 2009. What is the best surgical treatment for obstructive hypertrophic cardiomyopathy and degenerative mitral regurgitation? *Ann Thorac Surg* 88:727-31.

Yu EH, Omran AS, Wigle ED, Williams WG, Siu SC, Rakowski H. 2000. Mitral regurgitation in hypertrophic obstructive cardiomyopathy: relationship to obstruction and relief with myectomy. *J Am Coll Cardiol* 36:2219-25.