of the model to compute average test accuracy, which contributes to the heterogeneity as well.

Disclosures

The authors have no conflicts of interest to declare.

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Prevalence and Outcomes of Tricuspid Valve Disease in Patients Undergoing Mitral Valve Surgery (from the Nationwide Inpatient Sample Database)

The prevalence and outcomes of mitral valve (MV) surgery with coexistent tricuspid valve disease (TVD) and concomitant tricuspid valve (TV) surgery remain understudied in large patient populations.[1] We sought to determine the prevalence of TVD and TV surgery in patients undergoing MV surgery and the associated patients' characteristics and outcomes.

We used the publicly available Nationwide Inpatient Sample (NIS) developed by the Healthcare Cost and Utilization Project for this retrospective study.[2] We identified the appropriate ICD-9 and ICD-10 codes for patients who underwent MV surgery between 2003 and 2017. Patients were then grouped based on the presence or absence of TVD and whether they underwent concomitant TV surgery. Age, race, admission type, comorbidities, and outcomes, including acute kidney injury (AKI), stroke, bleeding, and mortality, were compared in both cohorts using chi-square test for categorical variables, *t* test for continuous variables, and logistic regression for the predictors of in-hospital mortality. All statistical tests were performed using SPSS Statistics 24 (IBM Corp., Armonk, New York).

Of the 107,936 patients who underwent MV surgery, 18.01% had TVD (Table 1). These patients with coexistent TVD were more frequently women and from racial minorities. They were also older and had more comorbidities, including atrial fibrillation, hypertension, diabetes mellitus, liver disease, coagulopathy, renal failure, and pulmonary disease. Interestingly, despite more frequent comorbidities, patients with TVD were more commonly referred for elective admission. In terms of outcomes, although stroke and bleeding were less common, acute kidney injury and in-hospital mortality were significantly higher in patients with TVD. The length of stay, discharge needing care, and encounter cost were also higher in these patients (Table 1).

Of the 19,434 patients with TVD, 32.01% underwent concomitant TV surgery. Patients who did not undergo TV surgery were more frequently male, white, and referred for urgent admission. They also had more chronic lung disease. In terms of outcomes, patients who underwent concomitant surgery had higher AKI rates and in-hospital mortality but fewer strokes and bleeding. Also, they had a longer length of stay and higher encounter cost (Table 1). However, after adjusting for age, sex, and urgent admissions, TV surgery was not found to be independently associated with higher in-hospital mortality risk (odds ratio [OR] = 1.084, 95% confidence interval [CI] [0.958 to 1.227], p = .199), while urgent admission was a significant predictor (OR = 1.959, 95% CI [1.743 to 2.201], p <.001).

Previous studies have shown that TV disease is relatively common in patients with MV disease, particularly in patients with functional mitral regurgitation, and negatively impacts these patients' survival even after successful MV surgery.[1] However, concomitant TVD treatment is still insufficiently performed,[3] and addressing the TVD at the time of MV intervention has been suggested to improve patients' outcomes. Previous studies have shown conflicting results, with some showing worse procedural short-term outcomes while other more recent studies did not show increased morbidity and mortality.[4,5] In our analysis, only 32% of patients with TVD underwent TV surgery, suggesting a continuing under-treatment of these patients. In the short term, we found that additional TV surgery was associated with good outcomes and did not independently infer an increased risk of in-hospital mortality. Therefore, further studies to assess the long-term outcomes and survival of patients who undergo concomitant mitral and tricuspid valve interventions are needed.

This study has inherent limitations attuned to any retrospective study, though its primary goal was descriptive. The database itself has its known limitations, including the lack of physical examination data, specifics of the valvular dysfunction, imaging and procedural details, antithrombotic treatment, and long-term follow-up data. Besides, the reasons for not undergoing concomitant

Table 1
Patients' characteristics and outcomes

Variable	All patients who underwent MV surgery* (n = 107,936)			Patients who underwent MV surgery and had TVD† (n = 19,434)		
	No TVD† (n = 88,502)	TVD† (n = 19,434)	P-value§	No TV Surgery‡ (n = 13,213)	TV Surgery‡ (n = 6,221)	P-value§
Age (years), median (IQR)	62 (46-80)	65 (51-79)	<0.001	65 (61-69)	66 (62-70)	<0.001
Women	48941 (55.3%)	12107 (62.3%)	<0.001	7711 (58.4%)	3876 (62.3%)	<0.001
White	57956 (65.5%)	11904 (61.3%)	<0.001	8324 (63%)	3580 (57.5%)	0.006
Admission type			<0.001			<0.001
Elective admissions	55581 (62.8%)	12636 (65%)		8531 (64.6%)	4099 (65.9%)	
Urgent admissions	32696 (36.9%)	6761 (34.8%)		4649 (35.2%)	2112 (33.9%)	
Comorbidities						
Hypertension	44893 (50.7%)	10198 (52.5%)	<0.001	6899 (52.2%)	3299 (53%)	<0.001
Diabetes mellitus	16325 (18.4%)	3784 (19.2%)	<0.001	2491 (18.9%)	1293 (20.8%)	<0.001
Smoker	21100 (23.8%)	3965 (20.4%)	<0.001	2791 (21.1%)	1174 (18.9%)	0.077
Obesity¶	8533 (9.6%)	1901 (9.8%)	0.593	1316 (10%)	585 (9.4%)	0.025
Dyslipidemia#	31844 (36%)	6606 (34%)	<0.001	4607 (34.9%)	1999 (32.1%)	<0.001
Atrial fibrillation	44196 (49.9%)	12797 (65.8%)	<0.001	8530 (64.6%)	4267 (68.6%)	<0.001
Liver disease	1450 (1.6%)	446 (2.3%)	<0.001	270 (2%)	176 (2.8%)	<0.001
Coagulopathy	21057 (23.8%)	5517 (28.4%)	<0.001	3713 (28.1%)	1804 (29%)	0.149
Renal failure	11278 (12.7%)	3128 (16.1%)	<0.001	2058 (15.6%)	1070 (17.2%)	0.008
Chronic lung disease	17416 (19.7%)	4168 (21.4%)	<0.001	2950 (22.3%)	1248 (20.1%)	<0.001
Peripheral vascular Disorder	7534 (8.5%)	1653 (8.5%)	0.931	1201 (9.1%)	452 (7.3%)	0.068
Outcomes						
Length of stay (days), mean ± SD	13.2 ± 13.3	13.8 ± 12.4	<0.001	13.4 ± 11.8	14.7 ± 13.7	<0.001
Total charges ($), mean ± SD	208,292 ± 204,165	218,589 ± 198,124	<0.001	210,296 ± 185,424	236,224 ± 221,724	<0.001
Discharge needing care$	54055 (61.1%)	12998 (66.9%)	<0.001	8794 (66.6%)	4204 (67.6%)	0.141
Acute kidney injury	16905 (19.1%)	3944 (20.3%)	<0.001	2535 (19.2%)	1409 (22.6%)	<0.001
Stroke	3727 (4.2%)	502 (2.6%)	<0.001	348 (2.6%)	154 (2.5%)	<0.001
Bleeding	11813 (13.3%)	2035 (10.5%)	<0.001	1423 (10.8%)	612 (9.8%)	<0.001
Mortality	5150 (5.8%)	1225 (6.3%)	0.010	814 (6.2%)	411 (6.6%)	<0.001

* Mitral valve surgery. Defined using the following procedure codes: ICD9; 35.24, 35.23, 35.12, ICD10; 02RG0JZ, 02RG4JZ, 02RG07Z, 02RG08Z, 02RG47Z, 02RG48Z, 02RG4KZ, 027G04Z, 027G0DZ, 027G0ZZ, 02NG0ZZ, 02QG0ZZ, 02VG0ZZ, 02QG4ZZ.
† Tricuspid valve disease. Defined using the following diagnosis codes: ICD9; 397.0, 424.2, 746.1, ICD10; I070, I071, I072, I360, I361, I362, Q224.

TV surgery in our sample were not clear and require further evaluation. However, this study is the largest and most recent in the medical literature to assess patients who underwent MV surgery while having concomitant TVD.

In conclusion, this nationwide study showed that although about one-fifth of patients who undergo MV surgery also have TVD, only a portion of them undergo concomitant TV surgery.

Disclosure

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Meta-Analysis of Atrial Fibrillation in Patients With COVID-19

A number of published papers have investigated the relation between atrial fibrillation (AF) and clinical outcomes of patients with coronavirus disease 2019 (COVID-19). However, the conclusions