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Contemporary Results of Transcatheter Aortic Valve Implantation in Patients with a Low Ejection Fraction: Retrospective Analysis of a Single Center Experience

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Abstract

Background: Reduced ejection fraction may increase the complications after transcatheter aortic valve implantation (TAVI). We investigated the impact of low flow (LF) and low gradient (LG) on long term mortality after TAVI in addition to other predictors.

Methods: We included retrospectively 450 patients with EF <40%, whom underwent TAVI in central hospital Bad Berka, Germany between 2012 and 2018. Patients were divided in to 4 groups according to the aortic mean pressure gradient and stroke volume. All demographic parameters and clinical outcomes were compared among the groups. Binary logistic regression was used to identify the predictors of 1-year mortality.

Results: Overall 1-year mortality was 16.3%, the 30-days mortality was 11.9%, 8.6%, 14.3% and 5%, and the 1-year mortality was 19.9%, 13.7%, 24.5% and 6.7% in LFLG, LFHG, NFLG and NFHG respectively. Univariable predictors for 12-month mortality were: age, male gender, diabetes mellitus, dementia, peripheral vascular disease, atrial fibrillation, ejection fraction <25%, TAPSE <16 mm, pulmonary hypertension and LG. Multivariable analysis showed that pulmonary hypertension (OR 3.4; 95% CI: 1,7-6.7, p value 0.0001), diabetes (OR 3; 95% CI: 1.5-5.8, p value 0.001) and dementia (OR 28; 95% CI: 5.6-144, p value 0.0001) remained as independent predictors. Significant improvement in NYHA class was shown in 81.7%, 83.4%, 93.5% and 80%, in LFLG, LFHG, NFLG and NFHG respectively.

Conclusions: TAVI improved the quality of life in all subgroups. LG has an impact on the 1-year mortality. Diabetes, dementia and pulmonary hypertension are independent predictors of 1-year mortality.

Keywords: Transcatheter aortic valve implantation; Transfemoral; Ejection fraction; Low flow; Low gradient

Abbreviations: AS: Aortic Stenosis; AVA: Aortic Valve Area; IQRs: Interquartile Ranges; LF: Low Flow; LG: Low Gradient; LVEF: Left Ventricular Ejection Fraction; MAPSE: Mitral Annular Plane Systolic Excursion (MAPSE and TAPSE); SAVR: Surgical Aortic Valve Replacement; SVi: Stroke Volume Indexed for Body Surface Area; TAPSE: Tricuspid Annular Plane Systolic Excursion

Introduction

Today, transcatheter aortic valve implantation (TAVI) is becoming a standard of care for the treatment of severe symptomatic aortic valve stenosis in intermediate and high-surgical risk patients. Along with advanced age and NYHA class, depressed Ejection fraction and low flow/low gradient aortic stenosis (LF/LG AS) appears to be a poor prognostic factor in patients undergoing surgical aortic valve replacement (SAVR). The intraoperative mortality is inversely proportional to EF and transvalvular aortic gradient. However, SAVR was associated with better survival as compared to medical treatment [1,2]. Here arises the role of TAVI as a safe alternative therapy not only with declined mortality but also with symptoms relief and improvement of quality of life in this specific cohort of patients [3-6].

In the context of TAVR, prior studies showed contradictory results about the predictors of mortality and worse outcomes. Some studies proposed LF as an independent predictor of increased mortality [7,8], while others found that LG not LF or low LVEF is an independent predictor of mortality [9,10]. According to the mean pressure gradient (mPG) and the indexed stroke volume (SVi), patients with AS could be categorized in four group: 1: normal flow high gradient (NFHG), 2: low flow high gradient (LFHG), 3: low flow low gradient (LFLG) and 4: normal flow low gradient (NFLG). In most of the previous studies, LFLG patients had the worst prognosis [7-10]. The indication of intervention in LG-NF aortic stenosis is not addressed in the current guidelines [11,12] and accordingly the outcome after TAVI in this subgroup is not well studied. This study compared the long-term outcomes after TAVI among these four subgroups in patients with

reduced LVEF <40% and tried to identify the possible predictors of long-term mortality.

Methods

Four hundred and fifty patients from September 2012 and September 2018 with severe AS, depressed ejection fraction [EF] <40% and low flow (LF) AS were included in this retrospective observational single center study (central hospital Bad Berka in Germany) with a volume of around 340 TAVI yearly. Patients were divided in to 4 groups according to the aortic mean pressure gradient (low gradient ; with Pmean <40 mm Hg and high gradient [HG]: Pmean >40 mm Hg) and stroke volume (low flow; with stroke volume index ≤ 35 mL/m^2 and normal flow with stroke volume index >35 mL/m^2), see Figure 1. All demographic parameters and clinical outcomes were subsequently compared among the four groups. Cox proportional hazards were used to identify predictors of 1-year mortality.

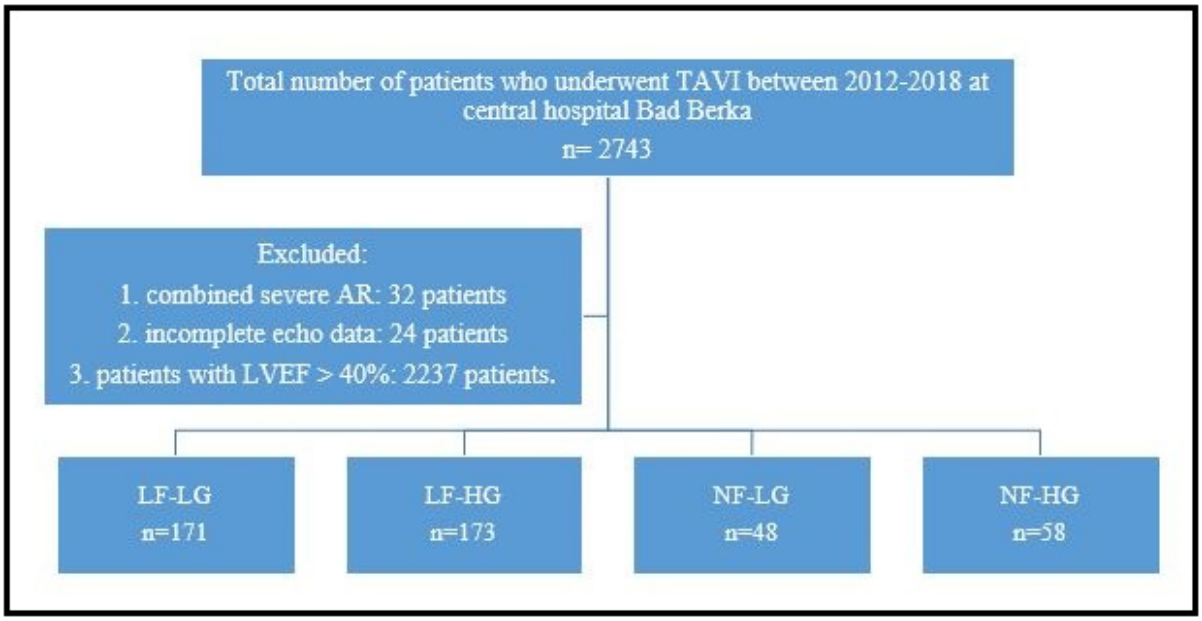

Figure 1: Flow chart for inclusion in the study.

Patients were differentiated based on SVi (stroke volume/body surface area) into LF <35 ml/m^2 and NF ≥ 35 ml/m^2. Patients were considered to have HG severe AS if the mean transvalvular gradient was ≥ 40 mmHg and LG if it was <40 mmHg. LF-HG: low flow and high gradient; LF-LG: low flow, low gradient; NF-HG: normal flow and high gradient and NF-LG: normal flow and low gradient.

A dedicated team of cardiac surgeons, cardiologists, and anesthesiologists discussed and reached consensus that TAVI was in the best interest of the patient. STS and EuroSCORES were calculated in all patients using the online calculators (http://riskcalc.sts.org/STS WebRiskCalc273/de.aspx and http://www.euroscore.org/). For the suitability for TAVI, several diagnostic modalities were performed: transesophageal echocardiography, multislice computed tomography (MSCT), and angiography. All patients underwent an echocardiographic evaluation of the aortic annulus, the aortic valve mean gradient (Bernolli equation), aortic valve area (AVA by continuity equation)), and the LVEF (by simpsons rule), using commercially available ultrasound systems (Philips). LVEF was estimated according to Simpson's rule. Stroke volume was measured by pulsed wave Doppler in the LV outflow tract and was indexed for body surface area (SVi). All patients underwent a preprocedural coronary angiography and significant CAD was treated interventionally prior to TAVI.

Procedure technical steps and device preparation whether the Boston scientific valve (Symetis accurate), Edwards SAPIEN (Edwards Lifesciences, Irvine, CA) or Evolut (Medtronic) were performed in a hybrid surgical suite. The patients received general anesthesia. Transfemoral vascular access was obtained percutaneously under angiographic control and use of two "pre-closing" devices (10F Prostar XL and 6F Proglide, Abbott Vascular, Abbott Park, IL). Arterial and venous guide wires were placed into one groin before the procedure for potential emergency femoral cannulation. Patients were routinely extubated immediately after the procedure.

Our end points were the all-cause mortality at 30-days and at 1-year, futility, rehospitalization due to cardiac cause, stroke, vascular complication and acute renal injury.

Statistics

Continuous variables were presented as means standard deviation or medians and interquartile ranges (IQRs). Comparisons of continuous variables between groups were performed with the two-sample Student t-test. Categorical variables were expressed as frequency percentages and compared using the chi-square or Fisher's exact test. A univariable and a multivariable Cox proportional hazard analysis were used to identify predictors of mortality in the study group. Variables with a p value <0.1 in the univariable analysis were calculated into the multivariable Cox regression analysis to allow for the determination of independent predictors for survival. A two-sided p value <0.05 was considered to be significant. All data were analyzed

with SPSS software (version 23 for Windows; SPSS Inc. Chicago. IL). All patients assigned a written informed consent for the procedure. This study is not funded through any companies or research institutes.

Results

Our demographic baseline variables of our 450 patients as shown in Table 1 were as follows: 296 men and 154 women with a mean age of 79.4 ± 5.2 years. The low flow low gradient (LFLG) group entailed 171, the low flow high gradient (LFHG) group entailed 173 patients, the low gradient normal flow (NFLG) group entailed 48 patients and the high gradient normal flow (NFHG) group entailed 58 patients.

As regard preoperative characteristics, relative difference was located between the four groups concerning the rate of stroke and pacemaker implantation (higher in both LG groups), previous cardiac operation and pulmonary hypertension (higher in both LF groups), pacemaker implantation (lower in the LG groups) and with higher EuroScore II in the NFLG group.

	LFLG n=171	LFHG n=173	NFLG n=48	NFHG n=58	p Value
Age years	79.3 ± 5.7	78.20 ± 5.3	79.8 ± 5.9	79.5 ± 5.2	0.18
Male n (%)	122 (70.9%)	106 (61.3%)	32 (65.3%)	36 (62.1%)	0.5
BMI kg/m²	28.9 ± 5.7	28.8 ± 4.8	27.6 ± 4.8	29.3 ± 7.1	0.3
COPD n (%)	47 (26.7%)	41 (23.7%)	13 (26.5%)	13 (22.4%)	0.8
DM n (%)	90 (51.7%)	72 (41.6%)	26 (53.5%)	20 (34.5%)	0.6
CRF >II n (%)	84 (47.7%)	74 (42.3%)	28 (57.1%)	35 (58.3%)	0.009
NYHA III-IV n (%)	131 (76%)	137 (79%)	39 (80%)	48 (82%)	0.09
CAD n (%)	101 (57.4%)	87 (50.9%)	29 (59.2%)	32 (35.2%)	0.5
PM n (%)	53 (30.1%)	14 (10.9%)	17 (34.3%)	12 (20%)	0.000 1
PVD n (%)	101 (57.4%)	87 (50.9%)	29 (59.2%)	32 (55.2%)	0.5
CAS n (%)	15 (8.7%)	24 (13.9%)	3 (6.1%)	1 (1.7%)	0.03
Stroke n (%)	20 (11.4%)	9 (5.2%)	6 (12.2%)	0	0.01
Dementia n (%)	6 (3.6%)	6 (3.5%)	2 (4.1%)	0	0.3
Re do n (%)	33 (18.8%)	23 (13.3%)	14 (3.1%)	3 (5.2%)	0.005
PH n (%)	68 (38.6%)	74 (42.3%)	13 (26.5%)	15 (25%)	0.04
LBBB n (%)	38 (21.6%)	18 (10.3%)	9 (10.9%)	12 (20%)	0.017
GFR [ml/min/m²]	52 ± 12.5	53 ± 11.4	51 ± 12.2	53 ± 13.1	0.6
Hb [mmol/] (preoperative)	7.4 ± 1.0	7.3 ± 0.9	7.5 ± 1.0	7.7 ± 0.8	0.7
proBNP	4258 ± 7654	6139 ± 9582	5088 ± 6649	4003 ± 7585	0.1
Log EuroScore	30 ± 26	32 ± 29	41 ± 28	36 ± 15	0.2
EuroScore II	7.4 ± 10	9.7 ± 13	22.3 ± 16	9.8 ± 10	0.001
STS	7.2 ± 8.3	6.6 ± 8	6.1 ± 5.2	11.5 ± 5.4	0.4

Note: Values are in mean ± SD or n (%). BMI: body mass index; BNP: brain natriuretic peptide; CAD: coronary artery disease; CAS: carotid artery stenosis; COPD: chronic obstructive pulmonary disease; CRF: chronic renal failure; DM: diabetes mellitus; EuroSCORE: European System for Cardiac Operative Risk Evaluation; GFR: glomerular filtration rate; Hb: hemoglobin; LBBB: left bundle branch block; LF-HG: low flow and high gradient; LF-LG: low flow and low gradient; LVEF: left ventricular ejection fraction; MR: mitral regurgitation; NF-HG: normal flow and high gradient; NF-LG: normal flow and low gradient; PCI: percutaneous coronary intervention; PH: pulmonary hypertension; PVD: peripheral vascular disease; STS: Society of Thoracic Surgeons

Table 1: Demonstrates all relevant demographic data.

Higher LV mass index in the form of eccentric hypertrophy was observed more in both NF groups, the lowest LV mass was observed in LFLG group. Global LV ejection fraction was higher in both groups with high gradient. Longitudinal systolic function of both ventricles assessed with mitral and tricuspid annular plane systolic excursion (MAPSE and TAPSE) were better in NFHG group than other groups, where the MAPSE was severely reduced <7 mm and mean TAPSE was around 16 mm. Table 2 demonstrates all relevant preoperative echocardiographic data.

	LFLG n=171	LFHG n=173	NFLG n=48	NFHG n=58	p Value
LVEF %	29.9 ± 12.7	32.5 ± 12.5	28.6 ± 11.8	35.4 ± 10.5	0.0006
SV/BSA ml/m²	22.1 ± 8.8	23.4 ± 9.8	41.9 ± 10	41 ± 9.8	0.001
Mean PG AV mmHg	22.3 ± 8.9	49.9 ± 12.3	24.8 ± 6.2	52.9 ± 12.6	0.001
Max. PG AV mmHg	38.7 ± 14	74 ± 16.9	40.2 ± 6.9	80 ± 17	0.0001
Velocity less index	0.28 ± 0.1	0.19 ± 0.05	0.23 ± 0.04	0.23 ± 0.06	0.001
AVA/BSA cm²/m²	0.3 ± 0.03	0.29 ± 0.06	0.4 ± 0.04	0.35 ± 0.08	0.1
LVEDD mm	50.3 ± 18	52.4 ± 11	54..6 ± 5.6	54.1 ± 7.7	0.6
LVEDD/BSA mm/m²	25.1 ± 10.8	26.7 ± 6.6	29.5 ± 3.8	28.2 ± 3.6	0.03
SWT mm	11.6 ± 4	13 ± 3.6	13.8 ± 2.7	14.3 ± 2.8	0.0001
SWT/BSA mm/m²	5.8 ± 2.5	6.3 ± 2.7	7.3 ± 1.8	7.2 ± 2.7	0.002
PWT mm	10 ± 4.9	10.3 ± 5.2	11.4 ± 3.5	13.7 ± 2.2	0.0001
PWT/BSA mm/m²	4.7 ± 2.8	4.8 ± 3.1	5.4 ± 1.9	6.9 ± 2.4	0.001
LV mass g	204 ± 43	242 ± 29	288 ± 37	329 ± 28	0.005

LV mass/BSA g/m²	104 ± 19	125 ± 18	153 ± 14	168 ± 21	0.004
MAPSE mm	6.7 ± 1.8	6.6 ± 1.8	6.6 ± 1.8	7.7 ± 1.8	0.002
TAPSE mm	16.1 ± 4.9	16.2 ± 6.3	16.4 ± 5.7	20 ± 3.6	0.001
RVSP mmHg	37 ± 17.3	40 ± 16.6	38 ± 11.9	37 ± 14.2	0.2

Note: Results in mean ± SD. AVA: aortic valve area index; LV: left ventricle; LVEF: left ventricular ejection fraction; MAPSE: mitral annular plane systolic excursion; PG: pressure gradient; PWT: posterior wall thickness; RVSP: right ventricular systolic pressure; SV: stroke volume index; SWT: septal wall thickness; TAPSE: tricuspid annular plane systolic excursion, other abbreviations as in table 1.

Table 2: Demonstrates all relevant preoperative echocardiographic data.

There was no significant difference between groups concerning device size and type, operative time, volume of contrast solution, newly developed arrhythmias and need for post-dilatation. The mean gradient across the aortic valve reduced significantly in all groups at discharge and 1 year follow up.

Significant improvement in NYHA class was shown in all groups, 81.7%, 83.4%, 93.5% and 80%, in LFLG, LFHG, NFLG and NFHG respectively. The length of index hospital stay was not significantly different between the four group. However, hospital readmissions due to cardiac cause were higher in both groups with LG: LFLG 13.1% and NFLG 20.4% in comparison with patients with high HG: LFHG and NFHG were 4% and 6.7%, respectively.

Incidence of AVB III was higher in LFHG group (23.4%) *vs* 9.1%, 0% and 11.7% in the other groups. Postoperative pericardial effusion was observed more frequently in the both groups with low gradient 7.5% and 10.2% vs in both with high gradient, 2.3% and 0%. There was no significant difference between groups concerning vascular complications and postoperative strokes, see Table 3.

	LFLG n=171	LFHG n=173	NFLG n=48	NFHG n=58	p Value
Futility	32 (18.3%)	29 (16.6%)	3 (6.5%)	12 (20%)	0.2
12-m Mortality	35 (19.9%)	24 (13.7%)	12 (24.5%)	4 (6.7%)	0.02
Pericardial eff.	13 (7,5%)	4 (2.3%)	5 (10.2)	0	0.01
Vascular com.	13 (5.7%)	6 (3.4%)	3 (6.1%)	3 (5%)	0.3
AVB	16 (9.1%)	41 (23.4%)	0	7 (11.7)	0.0001
Readmission	23 (13.1%)	7 (4%)	10 (20.4%)	4 (6.7%)	0.001
Stroke	11 (6.3%)	7 (4%)	3 (6.1%)	1 (1.7%)	0.2
Hospital stay [D]	17.3 ± 15	17 ± 11	17 ± 12	15 ± 7	0.2
Delirium	30 (17.4%)	13 (7.6%)	6 (13%)	11 (18.3%)	0.032
Transfusion	43 (26.4%)	26 (15.9%)	19 (39.6%)	3 (5.2%)	0.0001
Hb [mmol/l]	6.2 ± 0.9	6.3 ± 0.9	6.3 ± 0.7	6.3 ± 0.6	0.4
GFR [ml/min/m²]	50 ± 12.9	52 ± 13.1	46 ± 19	55 ± 9.9	0.1

Note: Results in mean ± SD or n (%). AVB: atrioventricular block; D: days; M: mortality; other abbreviations as in table 1

Table 3: Differences between the groups as regard clinical end points.

Our results concerning survival showed that: overall 1-year mortality in all patients was 16.3%, the 30-days mortality was 11.9%, 8.6%, 14.3% and 5%, and the 1-year mortality was 19.9%, 13.7%, 24.5% and 6.7% in LFLG, LFHG, NFLG and NFHG respectively, see Figure 2. Univariable predictors for 12-month mortality were: age, male gender, diabetes mellitus, dementia, peripheral vascular disease, atrial fibrillation, ejection fraction <25%, TAPSE <16 mm, pulmonary hypertension and aortic mean pressure gradient. Multivariable analysis showed that pulmonary hypertension (OR 3.4; 95% CI: 1,7-6.7, p value 0.0001), diabetes (OR 3; 95% CI: 1.5-5.8, p value 0.001) and dementia (OR 28; 95% CI: 5.6-144, p value 0.0001) remained as independent predictors, see Table 4.

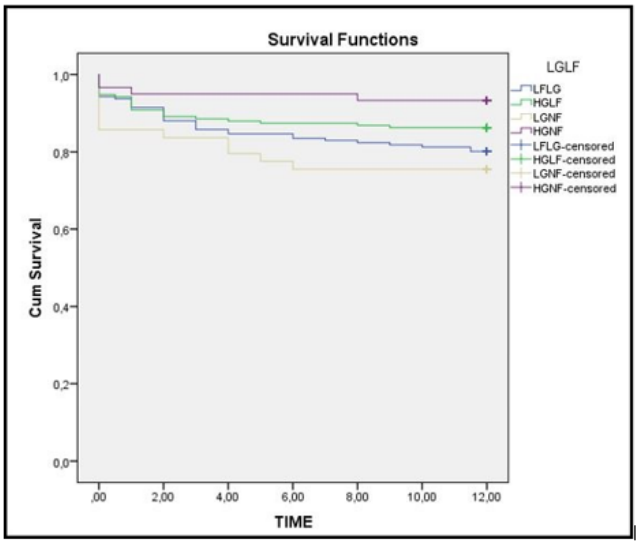

Figure 2: Kaplan-Meier Curves for the 4 Groups of Patients Separated According to Flow and Gradient Levels.

LF-HG: low flow and high gradient; LF-LG: low flow and low gradient; NF-HG: normal flow and high gradient; NF-LG: normal flow and low gradient.

	Univariate analysis				Multivariate analysis			
		95% Confidence Interval		p Value		95% Confidence Interval		p Value
		Lower	Upper			Lower	Upper	
Age	1,817	1,113	2,967	0.019	1,454	746	2,833	0.2
Male	1,911	1,085	3,365	0.026	1,383	687	2,786	0.3

NYHA III-IV	1,245	587	2,640	0.7				
Obesity	622	360	1,076	0.09				
COPD	739	408	1,339	0.3				
Diabetes	2,299	1,390	3,803	0.001	3,029	1,558	5,891	0.001
CRF	1.1	0.7	1.8	0.6				
CAD	1,011	619	1,653	0.7				
Stroke	1,502	656	3,442	0.3				
Dementia	7,155	2,409	21,247	0.001	28,499	5,613	1,44,706	0.0001
CAS	940	402	2,195	1				
Re do	1,174	619	2,226	0.6				
PVD	4,593	2,478	8,513	0.0001				
Tumor	2,266	1,194	4,301	0.01				
EuroScore II	1,446	314	6,661	1				
AF	2,518	1,523	4,163	0.0001	1,913	961	3,807	0.065
LVEF <25%	2,920	1,757	4,852	0.001	2,007	983	4,100	0.056
MAPSE	2,119	996	4,508	0.056				
TAPSE	2,536	1,506	4,269	0.001	1,424	745	2,722	0.2
MR III-IV	3,1	0.94	11,2	0.059				
TR III-IV	3,552	0.977	12,913	0.06				
Low flow	1,161	691	1,950	0.6				
Low grad.	1,768	1,150	2,721	0.01	1,047	509	2,155	0.9
PH	2,783	1,614	4,797	0.002	3,423	1,738	6,743	0.0001

Note: MR: mitral regurgitation; OR: odds ratio; TR: tricuspid regurgitation; other abbreviations as in table 1.

Table 4: Predictors of all-cause mortality.

Discussion

Out of this study we could conclude that : 1) diabetes mellitus, dementia and pulmonary hypertension were independent predictors of all-cause 1-year mortality following TAVI in patients with low EF, 2) patients with LG either with or without LF had worse outcomes following TAVR compared with those with HG; and 3) patients with NF had higher LV mass comparing to patients with LF and patients with NFHG had better both global and longitudinal systolic function of both ventricles.

Our overall 1-year mortality was 16.3%, which is comparatively higher than what reported by Abramowitz et al as 13.6% [9]. This could be explained throughout the different study design, larger cohort volume and longer conduction time over 10 years. One-year mortality was 19.9%, 13.7%, 24.5% and 6.7%, in LFLG, LFHG, NFLG and NFHG respectively. LG predicted 1-year mortality in the univariate analysis with OR 1.76, CI 95%: 1.15-2.7, this result is in line with the results of Abramowitz and Amabile et al. [3]. The similarity of our results to his could be due to the relative high similarity of our cohort risk characteristics and profile through our nearly similar STS and Euroscore values. Ben-Dor et al. confirmed the fact that patients with low EF with low gradients are more prone to worse outcomes compared with patients with high gradients [13-17]. In this study, LF was not a predictor of mortality neither in univariate nor in multivariate analysis. On the contrary, Le Ven et al as well as Gotzmann etal and the analysis of Herrmann stated that LF is an independent predictor of mortality after TAVI [3,7,8]. This variation is a merely statistical difference, which could be interpreted through the study population size. Our study defined dementia as a strong independent predictor of mortality in multivariate (OR 28; 95% CI: 5.6-144, p value 0.0001). Despite being recorded only in 3.1% of study patients. This fact aroused the clinical importance of assessing the preoperative mental status of TAVI patients and its prognostic value.

Our high mortality in patients with LFLG coincides with the results of Le Ven et al, Abramowitz et al and Herrmann et al, but opposes to these studies regarding the high mortality in patients with NFLG patients. This could be explained with high EuroScore II in this group 12.3% and the associated comorbidities especially diabetes (53.5%) and chronic renal failure with GFR < 30 ml/min/m² (57.1%). Diabetes was an independent predictor of mortality not only in our study, but also in the study conducted by Abramowitz et al who identified diabetes and CRF as independent predictors of mortality after TAVI [9]. Moreover, NFLG group had the lowest LVEF (mean LVEF 28.3%), high LV mass 153 ± 14 g/m² and the mean MAPSE was 6.6 mm. It's worth noting that MAPSE; as a parameter; was the main core in one of our previous studies, which defined MAPSE <7 mm as a cut of point and correlated it to higher mortality and hospital readmissions due to cardiac causes after TAVI [13]. Turakhia et al. showed that high LV mass index was associated with higher mortality [14]. The current European guidelines [12] recommended in patient with NFLG a critical reevaluation of the diagnosis and there is no clear recommendation for intervention. This recommendation was based on old studies which showed a good prognosis of this group of patients [15,16]. In contrast to the present study, patients in these studies had good global and (longitudinal systolic function mean LVEF 71% and mean MAPSE 15 mm *vs* 28.6% and 6.6 mm). Interestingly, reduced MAPSE was an independent predictor of survival in one of these studies [15].

In our study, special attention was given to preoperative echocardiographic data addressing valvular and ventricular dimensions and contractility. Eccentric hypertrophy with higher LV mass index and large cavity size was observed in both NF groups. MAPSE and TAPSE were better in NFHG group (mean MAPSE 7.7 mm and mean TAPSE 20 mm) than other groups, where the MAPSE were severely reduced <7 mm and mean TAPSE was around 16 mm. We believed that this contributed to the good prognosis among this group of patients.

Some studies concluded that moderate to severe mitral regurgitation is a predictor of mortality after TAVI [9], on the other hand, in our study, neither moderate to severe mitral regurgitation nor tricuspid regurgitation were predictors of mortality. Pulmonary hypertension predicted the 1-year mortality in both univariate and multivariate analysis (OR 3.4; 95% CI: 1,7-6.7, p value 0.0001), which should be included in TAVI risk scores. In the study of Amabile et al. atrial fibrillation and low ejection fraction were associated with higher mortality in multivariate analysis [10]. In our study, both predicted mortality in univariate analysis but failed to predict mortality in multivariate analysis.

The higher NYHA class in our study is explained pathologically through the consequently dilated ventricular dimensions and depressed global and longitudinal systolic function in this subset of patients. TAVI improved the quality of life assessed by NYHA status in all subgroups regardless the flow and gradient status. It's worth mentioning the role played by the PARTNER Trial which proved that TAVI is superior to medical therapy in survival, quality of life, and increase in the LVEF [8]. Even after TAVI the hospital readmissions due to cardiac causes were more frequent in the two groups with LG, which may implicate an advanced myocardial disease in this subset of patients.

Limitations

Finally, the limitations of our study are: first being a retrospective observational study, and there may have residual confounders that we did not account for. Second: focusing only on TAVI patients with low EF adds on the other hand a criticizing point which is the absence of comparable control group with normal EF. Moreover, our study was not a randomized trial and consequently it could be considered a non-powerful study and cannot be hypothesis productive. We believe that there is a necessity of more prospective studies.

Conclusion

TAVI for AS with reduced LVEF improved the quality of life assessed by NYHA status in all subgroups regardless the flow and gradient status. LG has an impact on the 1-year mortality and increases the rate of hospital readmissions due to cardiac causes. The indication of TAVI in NFLG AS should be critically reevaluated because of high 1-year mortality. Diabetes, dementia and pulmonary hypertension are independent predictors of 1-year mortality after TAVI.

Conflicts of Interest

There are no conflicts of interest for the present study.

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