



## Short Term Quality of Life Following Transcatheter Aortic Valve Replacement

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### Abstract

**Background:** Transcatheter aortic valve replacement (TAVR) is the recommended therapy for patients with severe calcific aortic stenosis (AS) who are not suitable candidates for surgery. The aim of this study is to evaluate the quality of life (QOL) for patients with severe AS with extreme and high surgical risk following TAVR with the Core Valve Medtronic prosthesis.

**Methods:** An analysis of patients who underwent TAVR with the Medtronic self-expanding Core Valve system (Medtronic, Inc.) at the University of Miami hospital was conducted between April 2011, and March 2014. Demographic and clinical data were obtained from inpatient and outpatient clinical records. QOL assessment was realized with the SF-12 Health-Survey. The questionnaire was administered at baseline, 6 months and 1 year after TAVR. Missing values were treated with median based imputation.

**Results:** A total of 71 patients underwent TAVR therapy. Of these, 63 patients successfully completed or partially completed the SF-12 questionnaire at 6 months follow up. Mean age was  $85.0 \pm 8.2$  years and 65% were male. Eight patients (11.3%) died during follow up. After 6 months, a significant improvement in both scores (PCS 37.0;  $p < 0.001$  and MCS 52.5  $p < 0.001$ ) was observed.

**Conclusions:** The main finding of this study is that TAVR in patients with severe AS is followed by early improvements in quality of life. The results show a marked improvement in functional status and a significant improvement in quality of life in both physical and mental components.

### Introduction

Transcatheter Aortic Valve Replacement (TAVR) has emerged as an alternative treatment modality for patients with severe aortic stenosis (AS) who are at high or extreme risk for surgical aortic valve replacement (SAVR) [1]. Previous studies have shown that TAVR results in substantial reductions in symptoms and mortality [2-5]. Despite these health benefits, the assessment of quality of life (QOL) remains critical in these patients who often express quality of life over quantity of life [6]. The aim of this study is to evaluate the changes in quality of life in elderly patients with severe AS who underwent TAVR.

### Methods and Patient selection

From April 2011 until March 2014, 71 consecutive patients were

referred to the University of Miami Hospital for evaluation of TAVR. All patients eligible for the procedure had to be considered at high or extreme risk for SAVR if 2 cardiac surgeons and 1 interventional cardiologist at the clinical site estimated high ( $\geq 15\%$  and  $\leq 50\%$ ) or extreme ( $\geq 50\%$ ) risk for mortality or irreversible morbidity at 30 days with SAVR. Inclusion criteria were as follows: severe symptomatic aortic stenosis defined as an aortic valve area  $0.8 \text{ cm}^2$  or aortic valve index  $0.5 \text{ cm}^2/\text{m}^2$  and either a mean aortic valve gradient  $> 40 \text{ mm Hg}$  or a peak aortic valve velocity  $> 4.0 \text{ m/s}$  at rest or with a dobutamine stress if the left ventricular ejection fraction was  $< 50\%$ .

Principal exclusion criteria were an active gastrointestinal hemorrhage within the prior 3 months, a major stroke within the prior 6 months, or a life expectancy  $< 1$  year. All patients underwent TAVR via an iliofemoral, transaortic or subclavian approach, using the Medtronic self-expanding Core Valve system (Medtronic, Inc.). All patients gave their informed written consent after receiving complete information about risk and benefits of the study and procedure.

### Quality of Life assessment

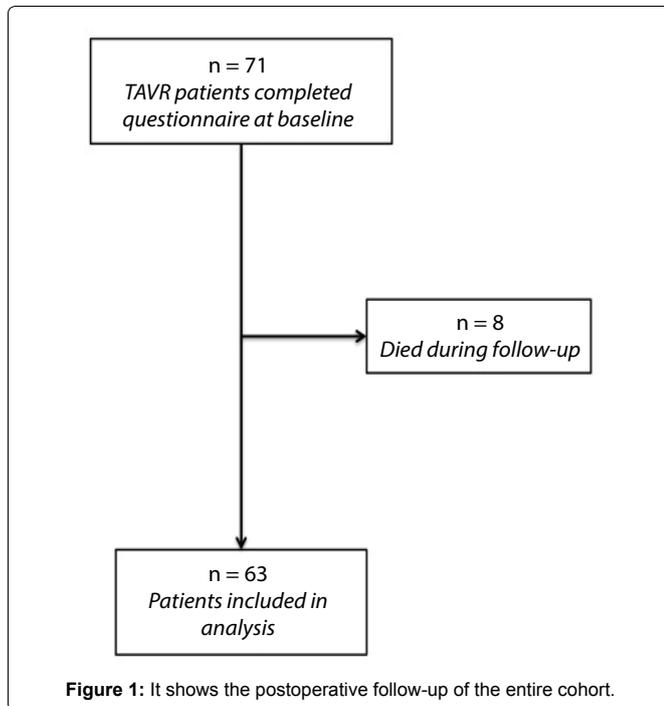
QOL was prospectively assessed using the SF-12 Health-Survey at baseline, 6 months and 1 year follow-up [7,8]. The SF-12 questionnaire consists of 12 questions, which measure functioning in 8 multi-item domains of daily life, such as: physical functioning, role limitation to physical health problems, bodily pain, general health, vitality as a measure of energy and fatigue, social functioning, role limitations due to emotional problems, and mental health related to psychological distress and psychological well-being. The Mental Component Summary (MCS) and the Physical Component Summary (PCS) are the 2 meta-scores of the SF-12, which combines the 8 domains and represent overall physical and mental functioning [8]. Higher SF-12 scores indicate better QOL, positive changes in SF-12 scores indicate improvement in QOL, and a negative change indicates deterioration. The scoring system and the interpretation of results of SF-12 has been explained elsewhere [8]. The questionnaires were administered by dedicated research staff to the participating patients during their screening for the TAVR procedure at the outpatient clinic and at their scheduled 6-months and 1-year clinical visit. After explaining the method and the purpose, the patients were then asked to complete the questionnaire.

### Statistical Analysis

Continuous variables were presented as mean + standard

**Table 2:** Clinical outcomes within 30 days.

	n = 63
30-d mortality, n (%)	1 (2)
MI, n (%)	0 (0)
Stroke, n (%)	2 (3)
Vascular complications, n (%)	3 (5)
AKI, n (%)	4 (6)
Atrioventricular block grade III, n (%)	7 (11)
LBBB, n (%)	10 (16)
PPM, n (%)	17 (27)
NYHA, mean SD	1.3 ± 0.5
Hospital stay (days)	
Mean ± SD	6.4 ± 2.3

**Figure 1:** It shows the postoperative follow-up of the entire cohort.**Table 1:** Baseline patient characteristics.

	n = 63
Male, n (%)	41 (65)
Age, years ± SD	85.0 ± 8.2
Diabetes, n (%)	21 (33)
STS, % ± SD	7.2 ± 3.2
Euroscore, % ± SD	15.1 ± 11.0
Hypertension, n (%)	55 (87)
Chronic kidney disease, n (%) (GFR < 60 ml/min/1.73m <sup>2</sup> )	24 (38)
COPD, n (%)	22 (35)
Peripheral artery disease, n (%)	26 (44)
Prior MI, n (%)	8 (13)
Prior CVA, n (%)	5 (8)
Prior CABG, n (%)	18 (29)
Prior PCI, n (%)	20 (32)
Pacemaker, n (%)	12 (19)
NYHA class, n (%)	
I	0 (0)
II	31 (49)
III	29 (46)
IV	2 (3)
Missing	1 (2)
Angina, n (%)	10 (16)
MMSE, score ± SD	27 3
Frailty measures, n (%)	
Albumin < 3.5 g/dL	17 (27)
Wheelchair bound	11 (18)
5-m gait speed > 6 s	42 (67)
Grip strength > 16 kg	42 (67)

deviations and compared with the use of the paired t-test or the Wilcoxon signed-rank test, as appropriate. Categorical variables were presented as counts and percentages and compared with the use of McNemar's test. A two-sided P-value of less than 0.05 was considered of statistical significance. Missing values were handled using multiple imputation. All data were processed using the Statistical Package for Social Sciences, version 15 (SPSS, Chicago, IL, USA).

## Results

In this cohort 71 (100%) of the patients successfully underwent

TAVR. In total 63 out of the 71 (89%) patients (67% male, median age 85 years) fully or partially completed SF-12 both at baseline and 6 months follow-up. The 30-day mortality was 2% and 8 (11.3%) patients had died at 6 months follow-up. In the all cohort, 1 patient died for cardiovascular causes, 2 for respiratory failure, 1 for aspiration pneumonia, 2 for sepsis and 2 for cancer. The remaining 6 patients were not able or willing to return to follow-up. For these 6 patients, multiple imputation was used for the missing data. Patients with missing SF-12 data at 6 months tended to be sicker than those is the analytic cohort, with more lung disease and higher STS mortality scores and euroscore (Figure 1) shows the postoperative follow-up of the entire cohort. Of the total of 63 analyzed, 51 patients underwent TAVR via iliofemoral approach, 7 via transaortic approach and 4 via subclavian approach. Baseline characteristics of the patients are summarized in (Table 1).

## Clinical outcomes

There was a significant difference in mean gradient (49.1 ± 11.1 to 10.0 ± 4.5 mmHg;  $p < 0.001$ ) one day after TAVR compared to baseline. Echocardiographic parameters 6 months after TAVR showed a significant difference in mean gradient (49.1 ± 11.1 to 8.4 ± 6.4 mmHg;  $p < 0.001$ ) and aortic valve area (0.60 ± 0.17 to 1.65 ± 0.45 cm<sup>2</sup>;  $p < 0.001$ ) compared to baseline. The left ventricular ejection fraction increased after 6 months, but this change did not achieve statistical significance (61 ± 11 to 63 ± 8  $p=0.4741$ ) Seventeen (27%) of the patients required a new PPM within 30 days after TAVR. The reason for PPM was a new onset complete heart block in 7 (11%) of the patients. Ten patients (16%) developed a new left bundle branch block within one month after the procedure. Two patients (3%) suffered from a non-fatal stroke and remained event-free during the 6 month follow up. NYHA class improved from 2.5 ± 0.6 to 1.3 ± 0.5 after 1 month and from 2.5 ± 0.6 to 1.2 ± 0.5 ( $P < 0.001$ ) after 6 months when compared to baseline. The average post-procedural length of stay was 6.4 ± 2.3 days. Other clinical outcomes of the studied patients are reported in (Table 2).

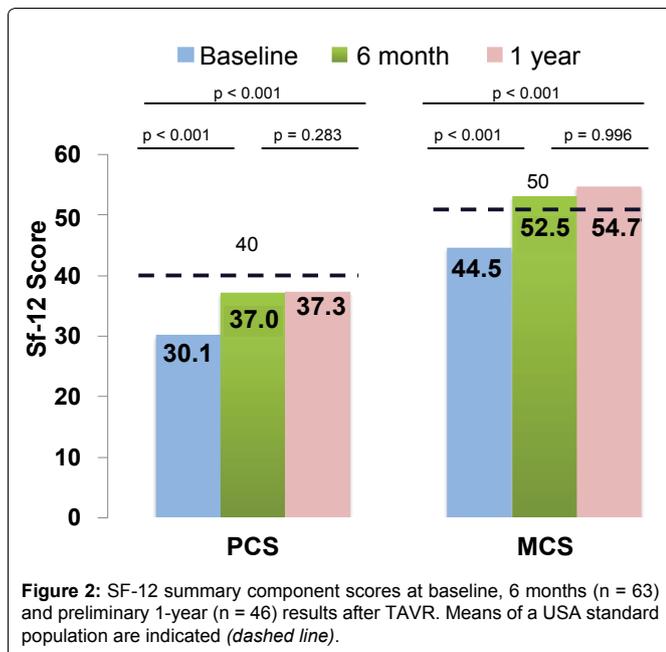
## Quality of Life

Mean pre-procedural SF-12 scores showed an impairment of perceived quality of life compared with general U.S. population > 75 years, both for physical (baseline-PCS 30.1 vs 40.0) and mental scores (baseline-MCS 44.5 vs. 50.0) [9]. Summary scores of quality of life at both baseline and at follow-up are schematized in (Figure 2). Mean pre-procedural PCS and MSC of SF-12 showed a significant improvement after 6 months of follow-up (30.1 vs 37.0,  $p < 0.001$ ; 44.5 vs 52.5,  $p < 0.001$ ).

Forty-six (65%) of the patients completed 1 year follow up by the time of inclusion. Preliminary results are schematized in (Figure 2).

## Discussion

The main finding of this single center observational study is that the quality of life in both physical and mental component significantly improved 6 months after TAVR in patients with severe aortic stenosis with excessive surgical risk. Pre-procedural SF-12 scores of this cohort showed impairment in quality of life compared with the general USA



population over the age of 75 years, both for mental and physical scores. Higher MCS score at 6-month follow up might be related to the relative absence of cognitive disorders in our population.

The present study adds additional evidence regarding QOL following TAVR and the results are consistent with previous published studies on this topic [10-17]. Correspondingly to an improved in QOL, an improvement in functional class and echocardiographic parameters was achieved. Eight (11.3%) patients did not reach 6 months survival threshold, this is comparable with previous published literature on QOL and TAVR [10-12,18].

QOL changes after TAVR have to be assessed to guide clinical decision-making and in particular in this patient population. In this population, clinicians are often challenged with a heterogeneous group of individuals in terms of life expectancy, presence of comorbidities, and degree of disability. Also, these patients may have different expectation of treatment than younger or less sick patients; quality of life may outweigh quantity of life after treatment. The current population showed a high frequency of comorbidities in patients selected for TAVR (Table 1). The presence of multiple comorbidities could limit QOL improvements despite an effective restoration of AS by valve replacement. Arnold *et al.* found that patients with poorer baseline health status assessed by the KCCQ tended to have more comorbidities, higher estimated mortality risk, and worse mobility [19]. Thus, confirming the importance of using QOL changes in clinical practice to guide decision making. To further emphasize this, a larger study is needed to identify predictors of either worsening or improvement of QOL that may help stratify patients for treatment when QOL is the main treatment goal.

The SF-36 has been used widely in cardiac patients, and has been used in studies investigating changes in QOL in patients older than 80 years after surgical aortic valve replacement (SAVR) [20]. Although it does not contain disease specific questions, it is a validated measurement of overall physical and mental health status. However, the SF-36 contains 36 items and therefore places a considerable burden on both patients and investigators [21]. In this study the widely accepted QOL assessment instrument, the SF-12, was used because of it is easy to understand, short and high feasible [8]. All these factors reduce the respondent burden and improve the response rate. Previous studies assessing the QOL following TAVR using the SF-12 showed similar results [11,13-15], thus confirming the results of the present study.

### Study limitations

The small sample size of study population and the single-site data

collection are limitations of the present study. Because of the small cohort we were not able to identify predictors for patient selection regarding the worsening or improvement of QOL. The single-site data collection potentially limits the generalizability of the present study.

Another limitation of the present study is missing data due to drop-out or incomplete questionnaires. These missing patients tended to be sicker and had a higher risk for morbidity and mortality. Therefore, we may have overestimated the results. We attempted to address this limitation by performing a multiple imputation of the missing data. The reported results encompass a follow-up period of only 6 months. The 6 months period might have been too short to establish whether the QOL keeps improving, worsens or reaches a plateau. The extrapolations from our own data suggest that after one year, there might be a greater improvement in the mental score and physical score, however these changes are not significant. Hence, further inclusion of patients and longer follow up is needed to observe the longer-term dynamics of QOL after TAVR.

### Conclusion

The main finding of this study is that TAVR in patients with severe AS is followed by early improvements in quality of life. The results show a marked improvement in functional status and a significant improvement in quality of life in both physical and mental components. The question whether this effect will last in the longer term remains to be determined.

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