Effects of mitral annular calcification on the outcomes of transcatheter aortic valve implantation

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Background: Transcatheter aortic valve implantation (TAVI) has become the standard of care treatment in patients with severe aortic stenosis who carry intermediate or high risk for surgical aortic valve replacement. Mitral annular calcification (MAC) is frequently seen in patients with aortic stenosis and it is associated with increased cardiovascular morbidity and mortality. It is reported that MAC is an independent predictor of all cause mortality after TAVI.

Aim: The aim of this study is to both evaluate the relationship between mitral annular calcification and TAVI related complications and mortality; and to define the predictors of both all cause mortality and permanent pacemaker implantation after TAVI.

Methods: All of the patients who underwent TAVI procedure due to severe aortic stenosis between 01.01.2020 and 01.06.2020 in our University Hospital were screened and patients fullfilling including criterias were enrolled. Patients' baseline demographic datas, laboratory, echocardiography and TAVI procedure related parameters were recorded. Outcomes are identified as follows; association between mitral annular calcification and TAVI related complications, establishment of the predictors of all cause mortality and permanent pacemaker implantation, definition of the in-hospital and all cause mortality rates.

Results: A total of 245 patients including 98 males (40%) and 147 females (60%) were enrolled in the study. The mean age of the population was 76,3±8,3 years. The mean left ventricular ejection fraction was % 54,8±11,4; aortic valve area was 0,74±0,14 cm^2 and mean aortic transvalvular gradient was 47,0±14,3 mmHg. MAC was detected in 148 (% 60,4) patients (Table 1). In-hospital mortality was occurred in 14 (5,7%) cases. Permanent pacemaker implantation was performed in %17,8 (n=42) patients and all cause mortality was developed in 89 (36,3%) cases during the median 23,1 (11,6–44,3) months follow-up. Pericardial effusion (26,4% vs 12,4%; p=0,013) and contrast induced nephropathy (21,6% vs 7,2%; p=0,005) were developed more frequently in patients with MAC than without MAC (Table-2). Only the presence of MAC extending to left ventricular outflow tract was detected to be independent predictor of permanent pacemaker implantation requirement (HR: 3,32; p=0,002). All cause mortality predictors were established as; use of renin-angiotensin-aldosterone system blockers (HR: p=0,012), level of hemoglobin (HR: 0,79; p=0,006), severe mitral annular calcification (HR: 1,94; p=0,024) and atrial fibrillation development after TAVI (HR: 2,39; p=0,002). There was not any correlation between aortic valve area and MAC vloume (r=0,03; p=0,689), MAC Hounsfield Unit (r=–0,007; p=0,934) and MAC Agatston score (r=–0,08; p=0,290).

Discussion: MAC is associated with all cause mortality after TAVI and MAC extending to left ventricular outflow tract is an independent predictor of permanent pacemaker implantation requirement.

Tablo 1. Baseline characteristics

	MAC (+) (n=148)	MAC (-) (n=97)	p value
Gender, male,n, %	51 (% 34,5)	47 (% 48,5)	**0,029***
Age, years, mean ±sd	77,2 ± 7,70	75,15 ± 9,12	0,060
Body mass index	27,9 ± 5,1	27,5 ± 4,7	0,540
NYHA class	3 (3-4)	3 (2,5-4)	0,415
Comorbidities, n (%);			
- Hypertansion	115 (% 77,7)	71 (% 73,2)	0,420
- Diabetes	52 (% 35,1)	25 (% 25,8)	0,123
- COPD	35 (% 23,6)	20 (% 20,6)	0,578
- Coronary artery disease	60 (% 40,5)	47 (% 48,5)	0,222
- Chronic kidney disease	16 (% 10,8)	6 (% 6,2)	0,313
- Atrial fibrillation	25 (% 16,9)	18 (% 18,6)	0,738
- Stroke	16 (% 10,8)	6 (% 6,2)	0,313
- Heart failure	30 (% 20,3)	24 (% 24,8)	0,409
* HFrEF	10 (% 6,8)	15 (% 15,5)	--
* HFpEF	20 (% 13,5)	9 (% 9,3)	--
-Renal artery stenosis	45 (% 30,4)	17 (% 17,5)	**0,034***
Drugs:			
Beta blocker, n (%)	90 (% 60,8)	71 (% 73,2)	**0,046***
Statin	58 (% 39,2)	44 (% 45,4)	0,338
RAAS Blocker	74 (% 50)	52 (% 53,6)	0,581
MRA	8 (% 5,4)	5 (% 15,5)	**0,008***
Diuretics	69 (% 46,6)	50 (% 51,5)	0,451
Laboratory findings:	11,6 ± 1,6	12,3 ± 1,8	**0,002***
Hemoglobin, gr/dL	0,93 (0,72-1,18)	0,93 (0,75-1,11)	0,959
Creatinine, mg/dL	69,2 (50,1-82,3)	72,9 (57,2-85,2)	0,273
GFR, mL/dk/1,73 m^2	372 (144,5-1044)	372 (155-10,76)	0,915
BNP , pg/mL			
STS score	9,3 ± 3,6	8,6 ± 2,8	0,102
Logistic Euro score	30,8 (24,0-42,7)	28,8 (21,5-41,6)	0,270
Follow-up, months	20,7 (10,1-45,1)	26,1 (12,6-42,8)	0,105

Abbreviations: COPD: Chronic obstrucitve pulmonary disease; STS: Sociery for Thoracic Surgeons; RAAS: Rening angiotensin aldosterone system; MRA: Mineralocorticoid receptor antagonist; GFR: Glomerular filtration rate; BNP: B-type natriuretic peptide
*Statistically significant values

Table 2. Outcomes

	MAC (+) (n=148)	MAC (-) (n=97)	p value
Aoric regurgitation, n (%);			
- Mild	102 (% 68,9)	54 (% 55,7)	0,107
- Moderate	9 (% 6,1)	8 (% 8,2)	
Aortic valve gradient (peak), mmHg	17,9 ± 6,8	18,1 ± 6,4	0,858
Insertion site complications, n (%);	21 (% 14,2)	18 (% 18,6)	0,462
- Hematoma	10 (% 6,8)	9 (% 9,3)	
- Pseudoaneurysm	8 (% 5,4)	7 (% 7,2)	
- Arteriovenous fistula	2 (% 1,4)	0 (% 0)	
- Infection	1 (% 0,7)	2 (% 2,1)	
Retroperitoneal hematoma, n (%)	0 (% 0)	2 (% 2,1)	0,156
TAVI valve endocarditis, n (%)	0 (% 0)	2 (% 2,1)	0,156
Pacemaker implantation,n (%)	26 (% 17,8)	16 (% 17,8)	1,000
Stroke, n (%)	7 (% 4,7)	6 (% 6,2)	0,837
Pericardial effusion, n (%)	39 (% 26,4)	12 (% 12,4)	**0,013***
Contrast induced nephropathy, n, (%)	32 (% 21,6)	7 (% 7,2)	**0,005***
Post-TAVI atrial fibrillation, n (%)	17 (% 13,8)	11 (% 13,9)	1,000
Intraoperative complication, n (%)	17 (% 11,5)	8 (% 8,2)	0,546
Mortality, n (%)			
- In hospital mortality	11 (% 7,4)	3 (% 3,1)	0,173
- All cause mortality	64 (% 43,2)	25 (% 25,8)	**0,008***

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