



Perioperative predictors of early mortality following transcatheter aortic valve implantation

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BACKGROUNDS

Transcatheter aortic valve implantation (TAVI) has become the gold standard treatment for high surgical risk patients with aortic stenosis (AS), and its indications are expanding. On the other hand, early mortality has also been experienced. We retrospectively investigated perioperative predictors of early mortality within 1 year after TAVI.

METHODS

From March 2013 to December 2021, 233 patients underwent TAVI at our institution. Four patients of procedural failure and one patient of cancer death were excluded from the analysis. Mortality within 1 year after TAVI was defined as early mortality. Predictors of early mortality were evaluated using clinical variables including patient and procedural characteristics.

TAVI in Oita University Hospital

- ✓ General anesthesia
- ✓ Evaluation by transesophageal echo cardiography
- ✓ No hesitation to take an alternative approach or use ECMO

Results

Early mortality 5.3% (n =12) (There was no death within 30 days)

Cause of death: pneumonia 4 cases (33%); heart failure 4 cases (33%); myocardial infarction 1 case (8%); ARDS 1 case (8%), DIC 1 case (8%), unknown 1 case (8%)

On univariate analysis, prior cardiac surgery (p = 0.012), larger left ventricular end-diastolic diameter (p = 0.026), low flow low gradient AS (p = 0.034), preoperative mitral regurgitation (p = 0.005), preoperative tricuspid regurgitation (p = 0.011), emergent use of extracorporeal membrane oxygenation (ECMO) during TAVI (p < 0.0001) were associated with early mortality, although age, comorbidity, frailty scale, prophylactic use of ECMO was not associated. Multivariate analysis revealed emergent use of ECMO was an independent predictor of early mortality following TAVI (odds ratio 9.66; 95% confidence interval 1.339 – 69.776, p = 0.024).

Baseline characteristics

Variable	Overall population (n = 228)	Survivors (n = 216)	Dead (n = 12)	P value
Age, years	85 (82–88)	85 (82–88)	85 (83–89)	0.302
Male	77 (34%)	73 (34%)	4 (33%)	0.974
BMI, kg/m ²	22.6 ± 3.6	22.6 ± 3.5	22.0 ± 4.3	0.541
Clinical Frailty Scale	4.0 (3.0–5.0)	4.0 (3.0–4.5)	4.5 (3.0–5.0)	0.326
MMSE	25 (22–28)	25 (22–28)	22 (18–26)	0.140
Hypertension	167 (73%)	159 (74%)	8 (67%)	0.577
Diabetes	73 (32%)	6 (31%)	5 (41%)	0.462
Dyslipidemia	114 (50%)	108 (50%)	6 (50%)	1.000
Current smoker	51 (22%)	48 (22%)	3 (25%)	0.822
Prior cardiac surgery	16 (7%)	13 (6%)	3 (25%)	0.012
Atrial fibrillation	39 (17%)	36 (17%)	3 (25%)	0.456
Prior stroke	20 (9%)	18 (8%)	2 (17%)	0.321
NYHA class III or IV	84 (37%)	78 (36%)	6 (50%)	0.332
Acute heart failure	19 (8%)	18 (8%)	1 (8%)	1.000
NT-proBNP, pg/mL	1740 (738–3644)	1656 (737–3292)	5571 (2683–8754)	0.233
eGFR, mL/min/1.73m ²	49.3 (38.3–61.1)	50.5 (39.0–61.6)	38.1 (28.1–42.4)	0.204
STS score	6.3 (4.1–9.0)	6.2 (4.1–8.7)	8.2 (7.7–15.1)	0.721
LVEF, %	63 (56–70)	64 (57–70)	54 (46–65)	0.744
LV end-diastolic diameter, mm	42.8 ± 7.4	42.6 ± 7.3	47.5 ± 8.6	0.026
LV end-systolic diameter, mm	28.0 (23.0–33.0)	27.1 (23.0–32.2)	32.0 (27.5–35.9)	0.442
Mean pressure gradient, mmHg	46.9 (38.6–56.9)	47.1 (39.7–58.0)	38.6 (34.4–45.3)	0.136
Low flow low gradient AS	30 (13%)	26 (14%)	4 (33%)	0.034
Aortic regurgitation 3+ or 4+	8 (4%)	8 (4%)	0 (0%)	0.497
Mitral regurgitation 3+ or 4+	14 (6%)	11 (5%)	3 (25%)	0.005
Tricuspid regurgitation 3+ or 4+	8 (4%)	6 (3%)	2 (17%)	0.011
Annulus area, mm ²	413 (370–463)	410 (369–459)	432 (407–515)	0.163
Annulus perimeter, mm	73.1 ± 6.7	72.9 ± 6.7	75.6 ± 5.7	0.179

Procedural characteristics

Variable	Overall population (n = 228)	Survivors (n = 216)	Dead (n = 12)	P value
Trans-femoral approach	189 (83%)	179 (83%)	10 (83%)	0.967
Alternative approach				
Trans-apical	22 (10%)	20 (9%)	2 (17%)	0.401
Trans-subclavian	11 (5%)	11 (5%)	0 (0%)	0.423
Direct-aorta	2 (1%)	2 (1%)	0 (0%)	0.738
Trans-abdominal	3 (1%)	3 (1%)	0 (0%)	0.681
Edwards SAPIEN Valve	164 (72%)	153 (71%)	11 (91%)	0.118
Medtronic Corevalve	64 (28%)	63 (29%)	1 (8%)	0.118
Post dilation	62 (27%)	56 (26%)	6 (50%)	0.068
Concomitant PCI	25 (11%)	24 (11%)	1 (9%)	0.822
Emergent PCI	2 (1%)	2 (1%)	0 (0%)	0.738
ECMO				
Prophylactic ECMO	24 (11%)	22 (10%)	2 (17%)	0.476
Emergent ECMO	7 (3%)	4 (2%)	3 (25%)	<0.0001
Perivalvular leak ≥ 2+	12 (5%)	11 (5%)	1 (8%)	0.625
Postoperative AV block	25 (11%)	25 (12%)	0 (0%)	0.212

Multivariate analysis for predictors of early mortality following TAVI

Variable	p Value	Odds ratio	95% CI
Previous cardiac surgery	0.495	2.098	0.250–17.619
LV end-diastolic diameter	0.288	1.048	0.962–1.142
Low flow low gradient AS	0.499	1.805	0.325–10.015
Mitral regurgitation 3+ or 4+	0.414	2.196	0.333–14.478
Tricuspid regurgitation 3+ or 4+	0.161	4.560	0.547-38.010
Emergent ECMO	0.024	9.666	1.339–69.776

CONCLUSIONS

Emergent use of ECMO was an independent predictor of early mortality within 1 year after TAVI. Because intraoperative hemodynamic disruption directly affects patient prognosis, ECMO should be used prophylactically without hesitation in high-risk patients.