Association between pulse pressure and acute kidney injury after transcatheter aortic valve implantation

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【Background】

Acute kidney injury (AKI), a complication after transcatheter aortic valve implantation (TAVI), has been found to be independently associated with short-term and long-term mortality. Arterial stiffness is reported to be a strong predictor of cardiovascular events and renal dysfunction. As arterial stiffness increases, a pulse wave is transmitted and reflected more rapidly, resulting in higher pulse pressure (PP). PP can be therefore used as an index of arterial stiffness. The association between AKI after TAVI and PP remains unclear.

【Aim】

To identify the predictors of AKI after TAVI and clarify the association between PP and AKI after TAVI.

【Methods】

Study subjects: Patients who underwent TAVI for aortic stenosis under general anaesthesia

Study duration: 1st Oct 2013 to 31st Aug 2017

Exclusion criteria: Patients in whom perioperative peripheral PP (pPP) was not measured, those with atrial fibrillation, those with severe aortic regurgitation, and those requiring cardiopulmonary bypass as a rescue device or reoperation because of bleeding complications

Measurements: Perioperative pPP at rest, obtained using oscillometry over the brachial artery, as an index of arterial stiffness
AKI was defined according to the Valve Academic Research Consortium (VARC)-2 criteria.

Statistical analysis: Univariate and multivariate logistic regression analyses for identifying the independent preoperative and intraoperative predictors of AKI.

【Results】

Table 1 Baseline characteristics

	All (n=74)	AKI (n=33)	Non-AKI (n=41)	P-value
STS score	5.97 [4.92-7.93]	6.53 [5.16-9.42]	5.69 [4.85-6.92]	0.111
Age, years	86 [83-89]	87 [84-89]	86 [82-88]	0.198
Male sex	24 (32.4)	11 (33.3)	13 (31.7)	0.882
Height, cm	148 [143-156]	146 [143-157]	148 [144-154]	0.636
Body weight, kg	47.6 [43.4-57.4]	50.0 [45.3-60.0]	47.1 [42.9-52.3]	0.164
Baseline serum creatinine, mg/dL	0.96 [0.74-1.09]	0.97 [0.77-1.13]	0.93 [0.73-1.07]	0.427
eGFR, mL/min/1.73m ²	50.9 [37.6-62.9]	50.3 [34.2-60.9]	51.2 [38.8-64.8]	0.350
NYHA classification III-IV	17 (24.3)	10 (30.3)	7 (17.9)	0.271
BNP, pg/mL	181[96-361]	201 [119-372]	170 [90-799]	0.589
pPP, mmHg	67 [53-78]	73 [67-86]	58 [50-72]	<0.001
Comorbidities				
Diabetes mellitus	21 (28.4)	11 (33.3)	10 (24.4)	0.396
Dyslipidemia	42 (56.8)	21 (63.6)	21 (51.2)	0.284
Hypertension	62 (83.8)	30 (90.9)	32 (78.0)	0.136
Old myocardial infraction	15 (20.3)	7 (21.2)	8 (19.5)	0.857
Chronic kidney disease	50 (67.6)	25 (75.8)	25 (61.0)	0.177
Congestive heart failure	34 (45.9)	14 (42.4)	20 (48.8)	0.585
COPD	8 (10.8)	3 (9.1)	5 (12.2)	0.669
Peripheral vascular disease	20 (27.0)	11 (33.3)	9 (22.0)	0.303
Echocardiographic findings				
Ejection fraction, %	62 [57.25-69]	62 [56-67]	62 [59-71]	0.465
Mean aortic valve gradient, mmHg	54 [44-64]	52 [44-62]	55 [44-65]	0.575
Aortic valve area, cm ² /m ²	0.47 [0.38-0.53]	0.47 [0.38-0.53]	0.47 [0.39-0.53]	0.974
Procedural parameters				
Transapical approach	27 (36.5)	19 (57.6)	8 (19.5)	<0.001
Contrast agent, mL	89 [65-111]	80 [63-113]	90 [71-110]	0.556
RBC transfusion needed	49 (66.2)	27 (81.8)	22 (53.7)	0.011

STS: Society of Thoracic Surgeons, eGFR: estimated glomerular filtration rate, NYHA: New York Heart Association, COPD: chronic obstructive pulmonary disease
Continuous variables are reported as median [25th-75th]. Category variables are reported as number. (%).

Table 2 Risk factors for AKI development after TAVI

Variables	Univariate analysis		Multivariate analysis	
	OR (95% CI)	P-value	OR (95% CI)	P-value
pPP, mmHg	1.06 (1.03-1.10)	<0.001	1.09 (1.04-1.13)	<0.001
Transapical approach	5.60 (1.99-15.8)	0.001	13.1 (3.34-50.9)	<0.001
RBC transfusion needed	3.89 (1.32-11.4)	0.014		

Table 3 Outcomes

	All (n=74)	AKI (n=33)	Non-AKI (n=41)	P-value
ICU stay, hours	50 [27-74]	62.5 [50-100]	27 [24-51]	<0.001
In-hospital mortality, n (%)	1 (1.4)	1 (3)	0 (0)	0.446
Hospital stay after TAVI, days	11 [8-14]	12 [11-15]	9 [7-11]	<0.001
6-month mortality, n (%)	2 (2.7)	2 (6.1)	0 (0)	0.212

ICU: intensive care unit

【Conclusion】

These results indicate that high pPP and the transapical approach can be predictors of AKI after TAVI. AKI was associated with longer length of stay in ICU and hospital after TAVI.

Fig. 1. Study flow diagram

Fig. 2. pPP ROC curve

Cut-off point of pPP: 67 mmHg
AUC: 0.743, 95% CI [0.629-0.857]
Sensitivity: 0.758, Specificity: 0.683