

# Relative Amplitude Index: A new tool for hemodynamic evaluation of periprosthetic regurgitation after transcatheter valve implantation



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INNSBRUCK

**N. BONAROS, A. HEINZ, M. DE CILLIA, F. PLANK, S. MÜLLER, T. BARTEL, G. FRIEDRICH, G. FEUCHTNER, T. SCHACHNER, M. GRIMM, L. MÜLLER**

**DEPARTMENTS OF CARDIAC SURGERY, CARDIOLOGY  
AND RADIOLOGY INNSBRUCK MEDICAL UNIVERSITY**

**Nothing to disclose rearding this presentation**

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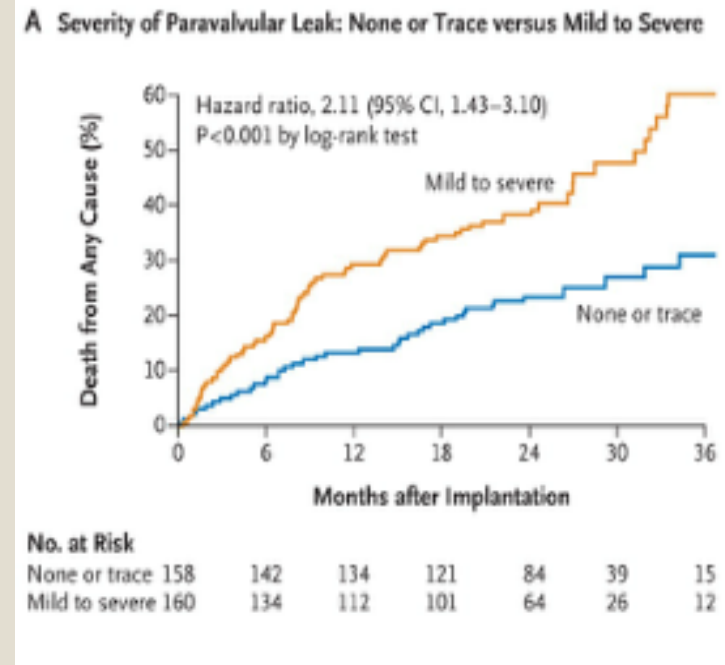
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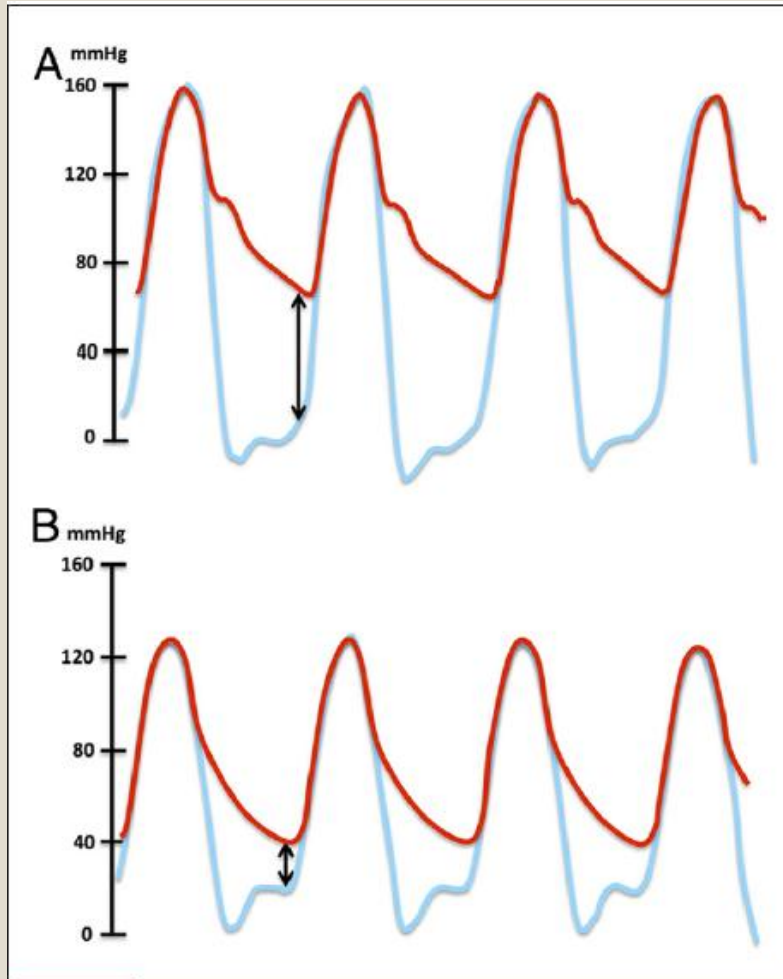
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# Post-TAVI periprosthetic regurgitation (PAR)

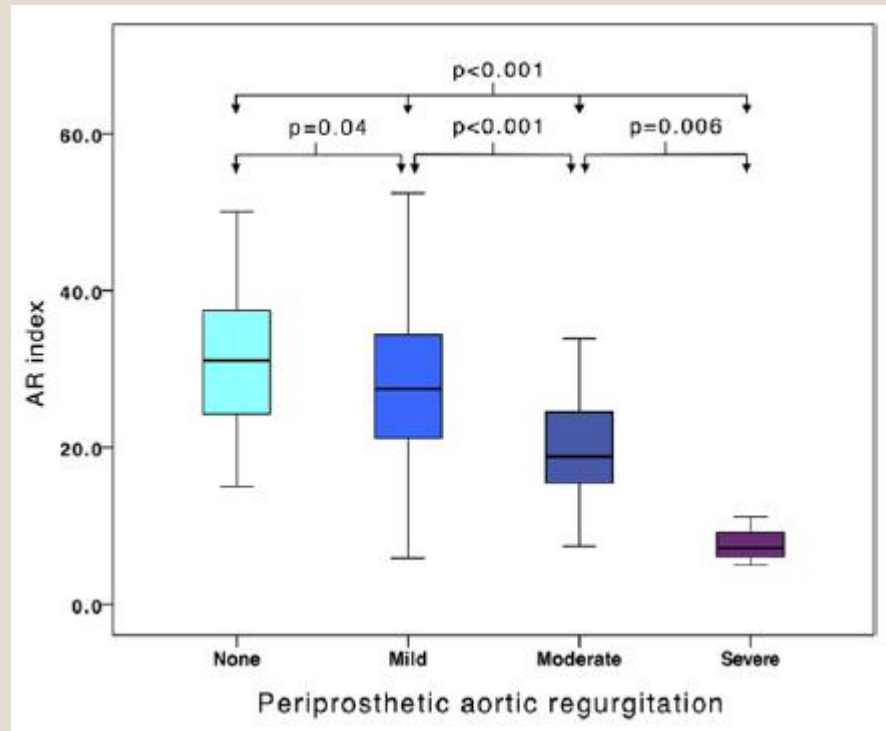
- Moderate/Severe: 7-25%  
Trivial/mild: <80%<sup>1</sup>
- PARTNER <sup>2</sup>:
  - Moderate/Severe: 7 % 1 y
  - PAR $\geq$ II: Impaired prognosis
  - Increased mortality at 1y after TAVI (HR: 2.11)



# Aortic Regurgitation index



$$\text{AR Index} = \{ (\text{DBP} - \text{LVEDP}) / \text{SBP} \} \times 100$$

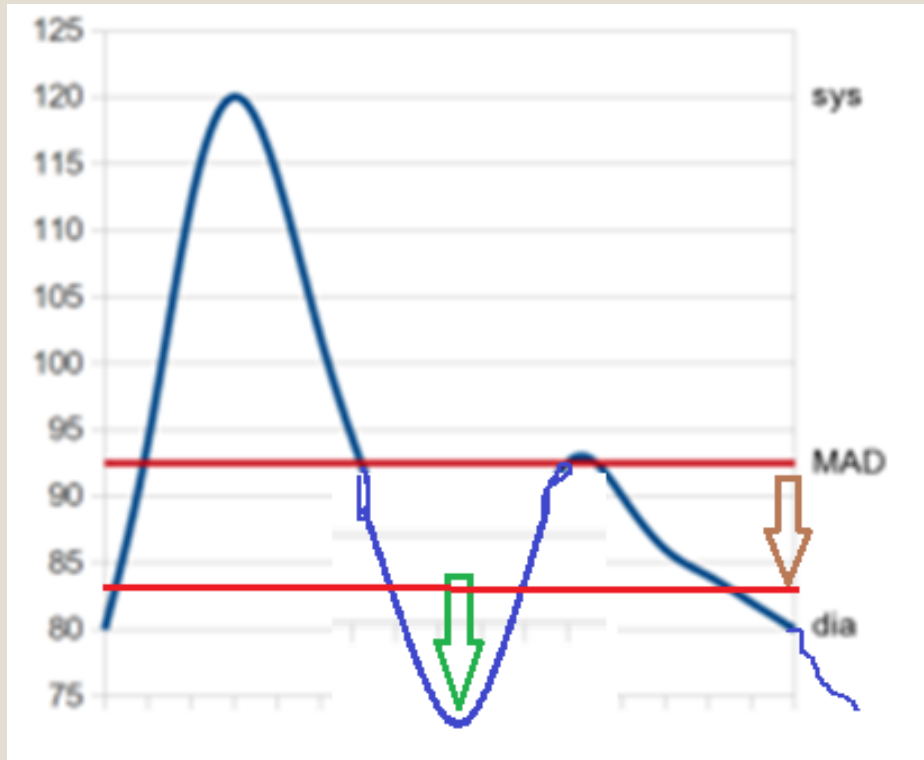


Sinning et al. JACC. 2012; 59(13): 1134-41

# Methods



- $$\text{RAI} = \left( \frac{\text{Post TAVI BP Amplitude}}{\text{Post TAVI sBP}} - \frac{\text{Pre TAVI BP Amplitude}}{\text{Pre TAVI sBP}} \right) \times 100\%$$



# Demographics (n=110)



|                     | n or median | Range or % |
|---------------------|-------------|------------|
| Log Euroscore I     | 25          | 4-75       |
| Euroscore II        | 10          | 2-40       |
| Age                 | 83          | 58-97      |
| Gender (M/F)        | 51/59       | 46/54 %    |
| Transfemoral        | 49          | 45%        |
| Transapical         | 48          | 44%        |
| Transaxillar        | 5           | 4%         |
| Transaortic         | 8           | 7%         |
| Balloon expdandable | 104         | 95%        |
| Self expandable     | 6           | 5%         |

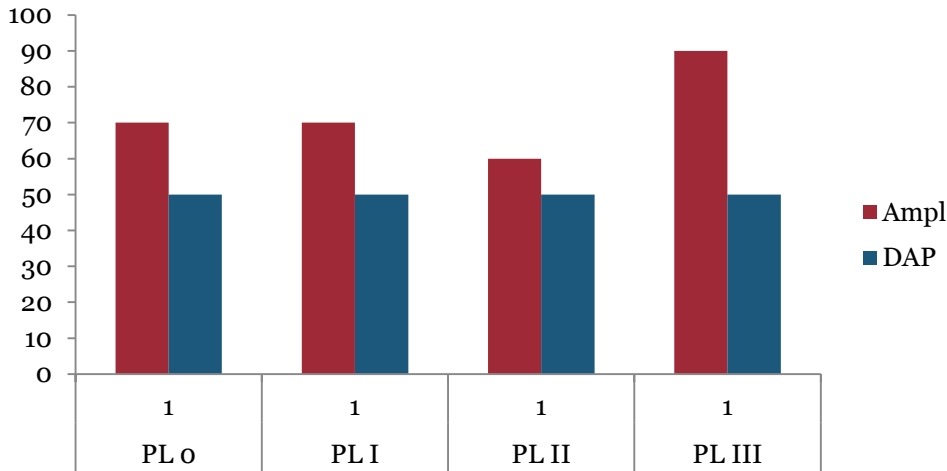
- Follow-up: Median (min-max)= 377(2-1721)d

# Perioperative results



|                              | <b>n=110 (%)</b> |
|------------------------------|------------------|
| 30-d Mortality               | 7 (6%)           |
| Periprosthetic regurgitation |                  |
| None/trace                   | 61 (56%)         |
| Mild                         | 38 (35%)         |
| Moderate                     | 10 (9%)          |
| Severe                       | 1 (1%)           |
| Device success               | 108 (98%)        |
| Respiratory failure          | 9 (8%)           |
| Stroke                       | 2 (2%)           |
| Follow-up Mortality          | 30 (27%)         |

# Correlation of blood pressure to PAR



Kruskal-Wallis Test

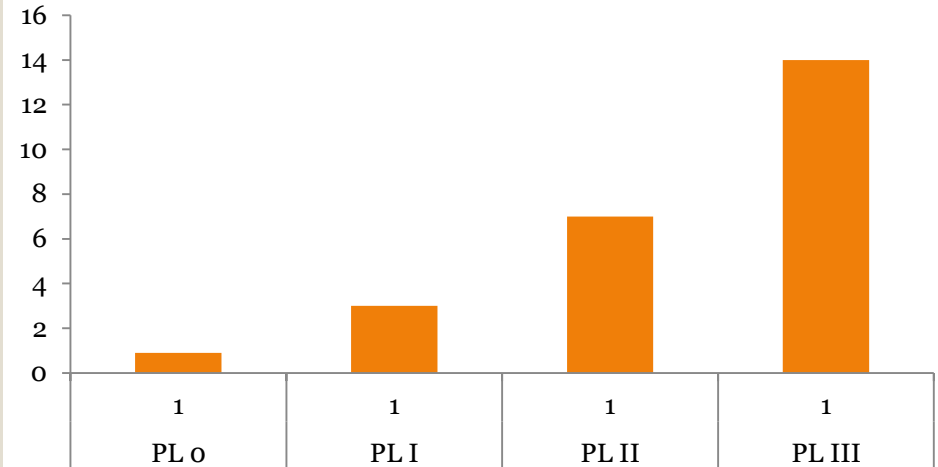
Amplitude  $p=0.148$

Diastolic Pressure  $p=0.278$

RAI  $p=0.011$

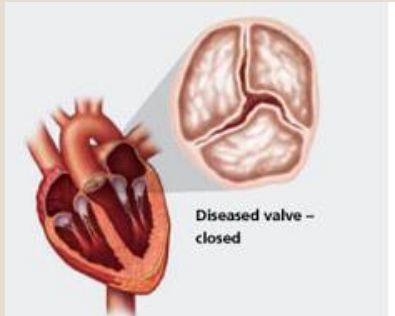
**Cut-off  
RAI  $\geq 14$**

**RAI > 14**

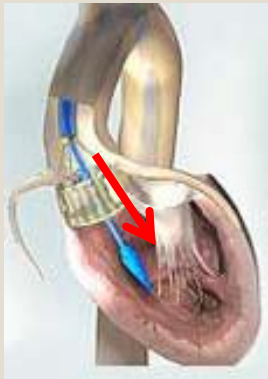




# Clinical example



**RAI=15.3**



**RAI=-3.7**



# Perioperative results stratified by RAI

|                   | RAI<14<br>(n=103) | RAI>14 (n=7) | p      |
|-------------------|-------------------|--------------|--------|
| 30-d Mortality    | 5 (4.9%)          | 2 (28.6%)    | 0.013  |
| Paravalvular leak |                   |              |        |
| No/Trace          | 59 (57.3%)        | 2 (28.6%)    | 0.067  |
| Mild              | 35 (34%)          | 3 (42.9%)    | 0.633  |
| Moderate          | 9 (8.7%)          | 1 (14.3%)    | 0.621  |
| Severe            | 0 (0%)            | 1 (14.3%)    | <0.001 |
| >Mild             | 9 (8.7%)          | 2 (28.6%)    | 0.05   |
| AKI stage 1       | 32 (31.1%)        | 3 (42.9%)    | 0.517  |
| AKI stage 2       | 15 (14.6%)        | 2 (28.6%)    | 0.321  |
| AKI stage 3       | 7 (6.8%)          | 5 (71.4%)    | 0.042  |
| AKI stage 4       | 18 (17.5%)        | 5 (71.4%)    | 0.001  |
| Device success    | 101(98.1%)        | 7(100%)      | 0.710  |

# Results in follow-up stratified byRAI



|   | RAI<14 (n=103) | RAI>14 (n=7) | P-Wert |
|---|----------------|--------------|--------|
| Mortality                                 | 25 (24.3%)     | 5 (71.4%)    | 0.007  |
| Rehospitalization (cardiac reasons)       | 15 (15.3%)     | 2 (40%)      | 0.147  |
| Structural valve degeneration/dysfunction | 8 (7.9%)       | 2 (28.6%)    | 0.068  |
| Stroke                                    | 5 (5.2%)       | 0 (0%)       | 0.601  |
| Myocardial infarction                     | 1 (1%)         | 0 (0%)       | 0.819  |
| AKI stage 3                               | 7 (7.3%)       | 0 (0%)       | 0.531  |
| AKI stage 4                               | 3 (3.1%)       | 1 (20%)      | 0.06   |
| Respiratory failure                       | 0 (0%)         | 1 (4.5%)     | 0.055  |

# Predictors for 30d-Mortality



|   | Dead (n= 30) | Alive (n= 80) | p       |
|---|--------------|---------------|---------|
| RAI $\geq 14$                           | 2 (29%)      | 5 (5%)        | 0.013   |
| PAR $\geq 2^\circ$                      | 2 (29%)      | 9 (9%)        | 0.05    |
| Perioperative renal replacement therapy | 7 (100%)     | 16 (16%)      | <0.0001 |
| Periop. respiratory failure             | 4 (57%)      | 5 (5%)        | <0.0001 |
| Pulmonary Hypertension                  | 6 (86%)      | 29 (28%)      | 0.002   |
| Non-previous CABG                       | 6 (86%)      | 79 (77%)      | <0.001  |
| Perioperative stroke                    | 0 (0%)       | 2 (2%)        | 0.073   |
| Transaxillary route                     | 0 (0%)       | 5 (5%)        | 0.715   |
| Selfexpandable valve                    | 0 (0%)       | 6 (6%)        | 0.668   |

# Predictors for Follow-up mortality



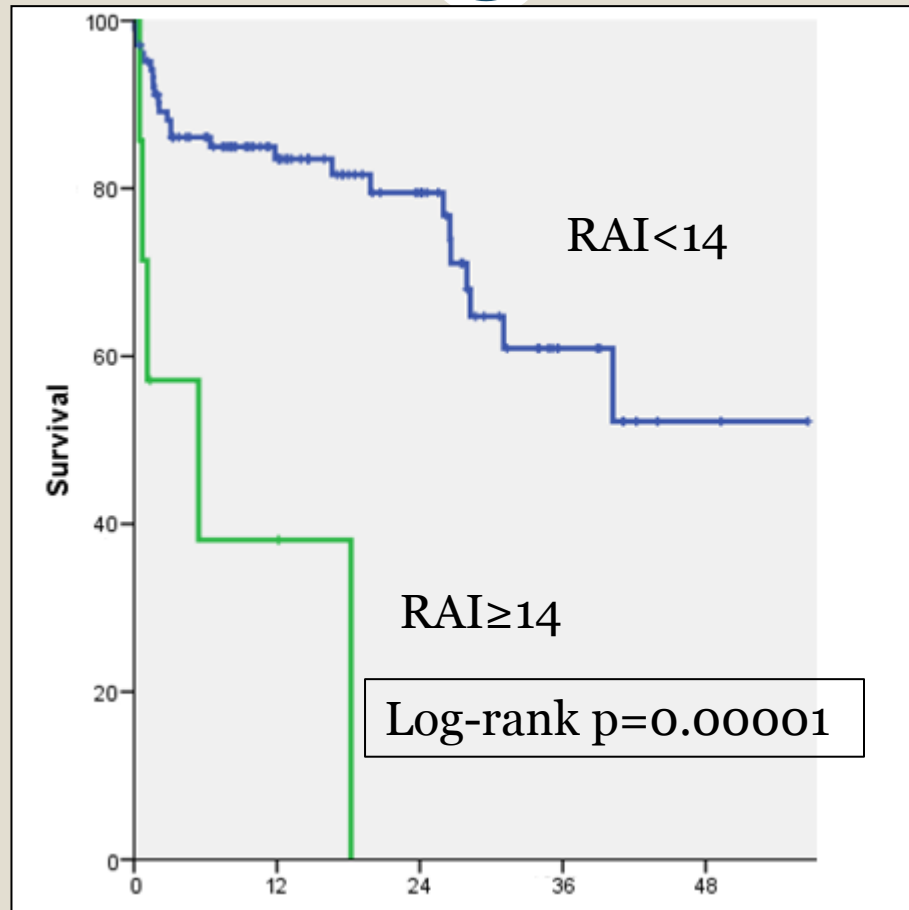
|                             | Dead (n= 30) | Alive (n= 80) | p       |
|-----------------------------|--------------|---------------|---------|
| RAI $\geq 14$               | 5 (17%)      | 2 (3%)        | 0.007   |
| PAR $\geq 2^\circ$          | 7 (23%)      | 4 (5%)        | 0.004   |
| Perioperative AKI req. HF   | 14 (47%)     | 9 (11%)       | <0.0001 |
| Periop. respiratory failure | 5 (17%)      | 4 (5%)        | 0.047   |
| Pulmonary Hypertension      | 16 (53%)     | 19 (24%)      | 0.003   |
| Non-previous CABG           | 25 (83%)     | 61 (75%)      | 0.605   |
| Perioperative stroke        | 2 (7%)       | 0 (0%)        | 0.02    |
| Transaxillary route         | 4 (13%)      | 1 (1%)        | 0.019   |
| Selfexpandable valve        | 4 (13%)      | 2 (3%)        | 0.046   |

# Independent predictors for Follow-up mortality



| Prädiktoren                             | Wald-Koeffizient | Hazard-Ratio | 95% CI       | P-Wert |
|---|------------------|--------------|--------------|--------|
| RAI>14                                  | 5.325            | 5.790        | 1.242-13.650 | 0.047  |
| PVL≥moderate                            | 7.091            | 7.646        | 1.711-34.172 | 0.008  |
| Perioperative renal replacement therapy | 6.933            | 5.753        | 1.564-21.161 | 0.008  |

# Survival (median Follow-up: 1J)



|       |     |    |    |   |   |          |
|-------|-----|----|----|---|---|----------|
| Pts   | 103 | 57 | 33 | 9 | 2 | RAI < 14 |
| @risk | 7   | 1  | 0  | 0 | 0 | RAI ≥ 14 |

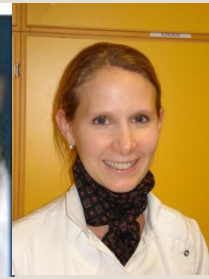
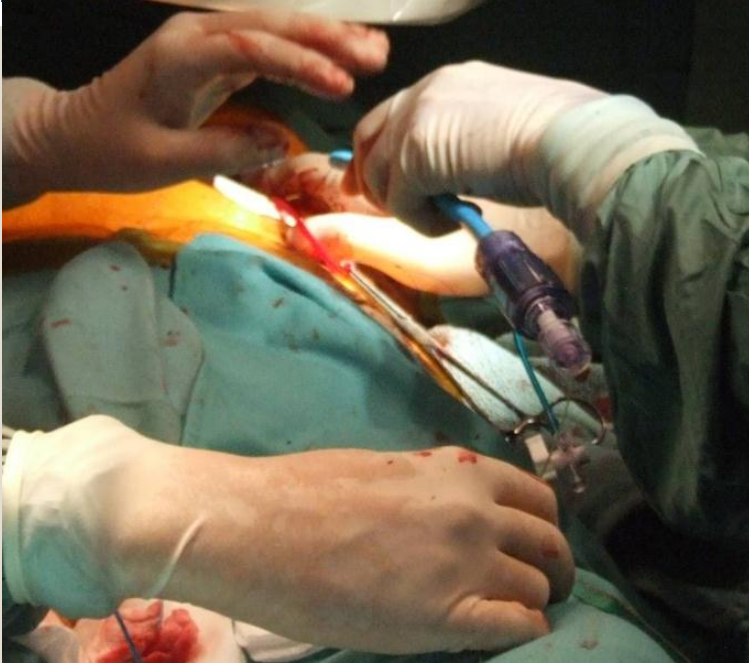
# Conclusions



- Relative Amplitude Index: easy to perform, reproducible and inexpensive means to predict the impact of PAR on hemodynamics
- RAI correlates to 30d- und follow-up-survival rates
- $RAI \geq 14$ : independent predictor for mortality in follow-up



# TAVI-Team Innsbruck



| Unplanned use of CBP         | 5 (5%)    |
|------------------------------|-----------|
| Aortic valve malposition     | 2 (2%)    |
| Valve in a valve deployment  | 3 (3%)    |
| Device success               | 108 (98%) |
| Early safety                 | 32 (71%)  |
| Clinical efficacy            | 101 (92%) |
| Cardiac tamponade            | 2 (2%)    |
| Major vascular complications | 5 (5%)    |
| Stroke                       | 2 (2%)    |
| Pacemaker implantation       | 4 (4%)    |
| AKI Stage 1                  | 35 (32%)  |
| AKI Stage 2                  | 17 (16%)  |
| AKI Stage 3                  | 9 (8%)    |
| AKI Stage 4                  | 23 (21%)  |