

Incidence and Outcome of Conduction Disturbance

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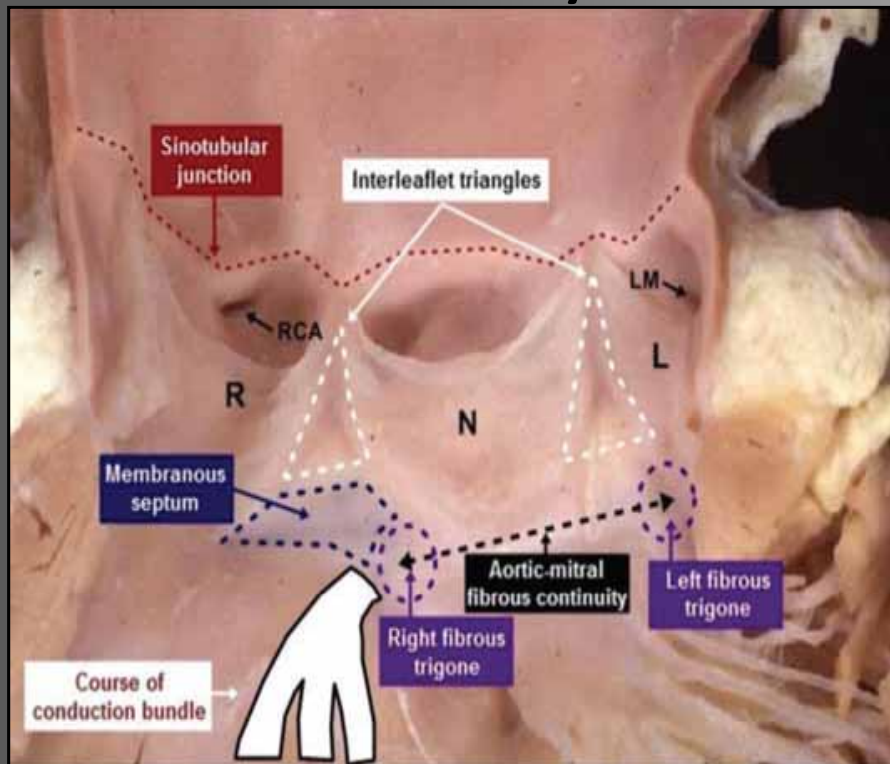
TAVI Summit 2013, Seoul, August 8th

Conduction Disturbances after TAVR

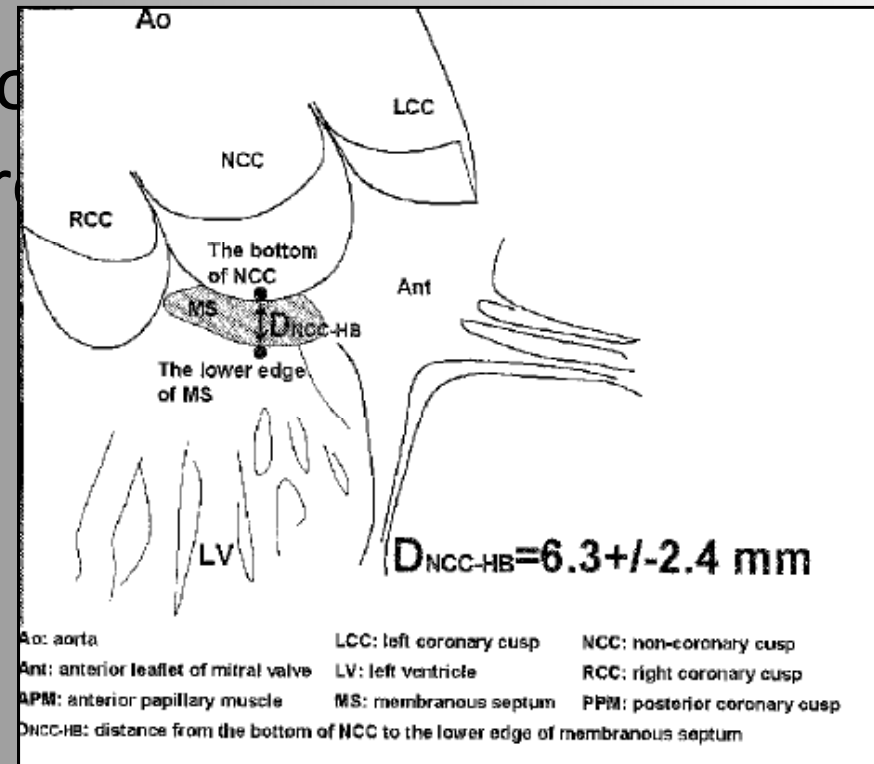
- Anatomical Considerations
- Conduction Disturbances and Pacemaker Implantation
 - Driving Factors
 - Patient Impact
- Conclusions

Anatomical Considerations

- Conduction abnormalities are not atypical following AVR due to the anatomical proximity of the aortic valve to the conduction system



Modified from Tawara.



Igawa et. al, Jap Circ 2009

Preexisting Conduction Disturbances

- Degenerative Aortic Stenosis (AS) is associated with electrical conduction abnormalities because calcification in and around the aortic valve can progress and extend to involve the electrical conduction system of the heart
- Rates of conduction abnormalities are high in patient with AS
 - Atrial Fibrillation 32%
 - Hemiblock 23%
 - LBBB 17%
 - RBBB 17%

Preexisting Conduction Disturbances

- As a result, multivariate logistic regression analysis of predictors for permanent pacemaker implantation post-transfemoral CoreValve implantation include many baseline conduction abnormalities.
 - ✓ > 75 years old
 - ✓ pre-operative atrial fibrillation, right bundle branch block (RBBB), or left bundle branch block (LBBB)
 - ✓ pre-operative ventricular rate < 65 b.p.m
 - ✓ pulmonary hypertension
 - ✓ septal wall thickness

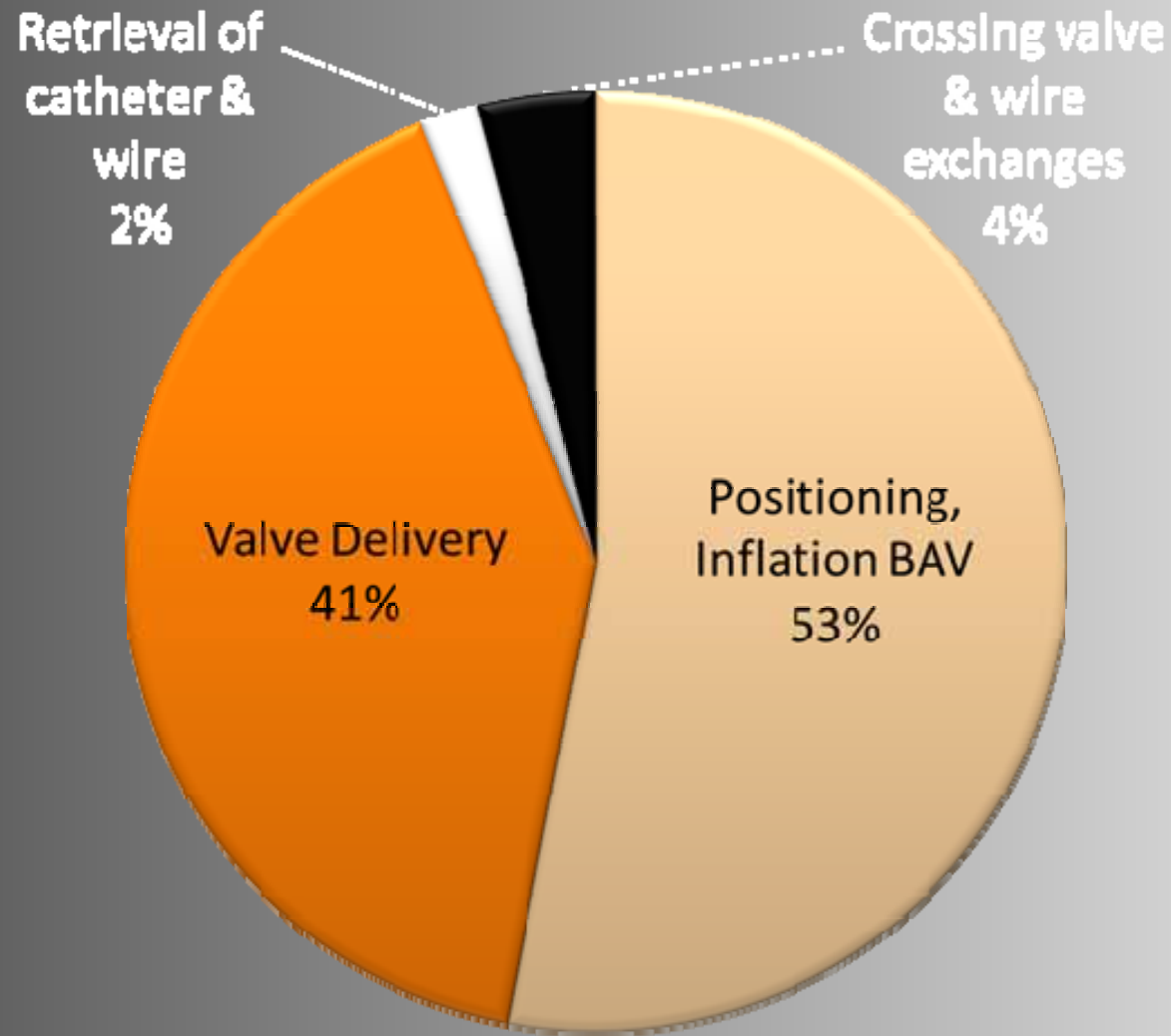
Conduction Disturbances after TAVR

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Driving Factors of Conduction Disturbances and Pacemaker Implantation

✓ Pre-implant BAV

Contribution of TAVR Procedure to Formation of New Conduction Disturbances



Pre-implant BAV during TAVR

- Patients developing new conduction disturbances during BAV had a significantly higher balloon/annulus ratio (1.10 ± 0.10 vs. 1.03 ± 0.11 , $P=0.030$)¹
 - Maintaining a balloon/annulus ratio near 1 during BAV may reduce the incidence of new conduction disturbances and need for pacemaker implantation during TAVR¹.
- The most common type of new conduction disturbances due to BAV is LBBB¹
- 34.1% of new conduction disturbances that develop during TAVR resolve before patient discharge¹
- 2%¹ to 16%² of new pacemaker implantation in TAVR may be due to conduction disturbances caused during BAV

1. Nuis R. *Eur Heart J*. 2011;32(16):2067-2074. (N= 65)

2. Grube E. *JACC Cardiovasc Interv* 2011;4(7):751-757. (N=60)

Driving Factors of Conduction Disturbances and Pacemaker Implantation

- ✓ Pre-implant BAV
- ✓ Implant Depth

Implant Depth Impacts Conduction Disturbances

- A lower (ventricular) position of the Edwards valve relative to the hinge point of the anterior mitral leaflet was associated with a higher incidence of new LBBB (35% vs. 0%, $P = .029$).

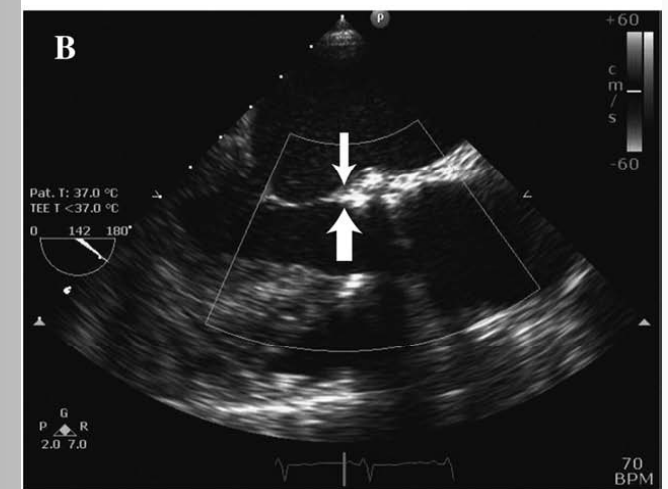
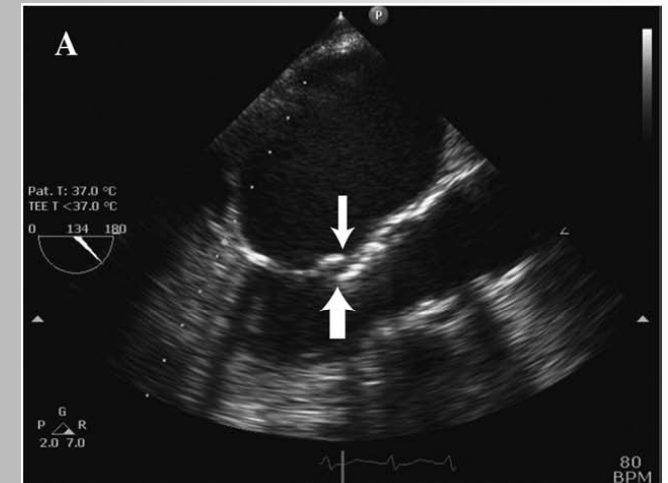
Implanted Above

→ 0% of patients developed LBBB

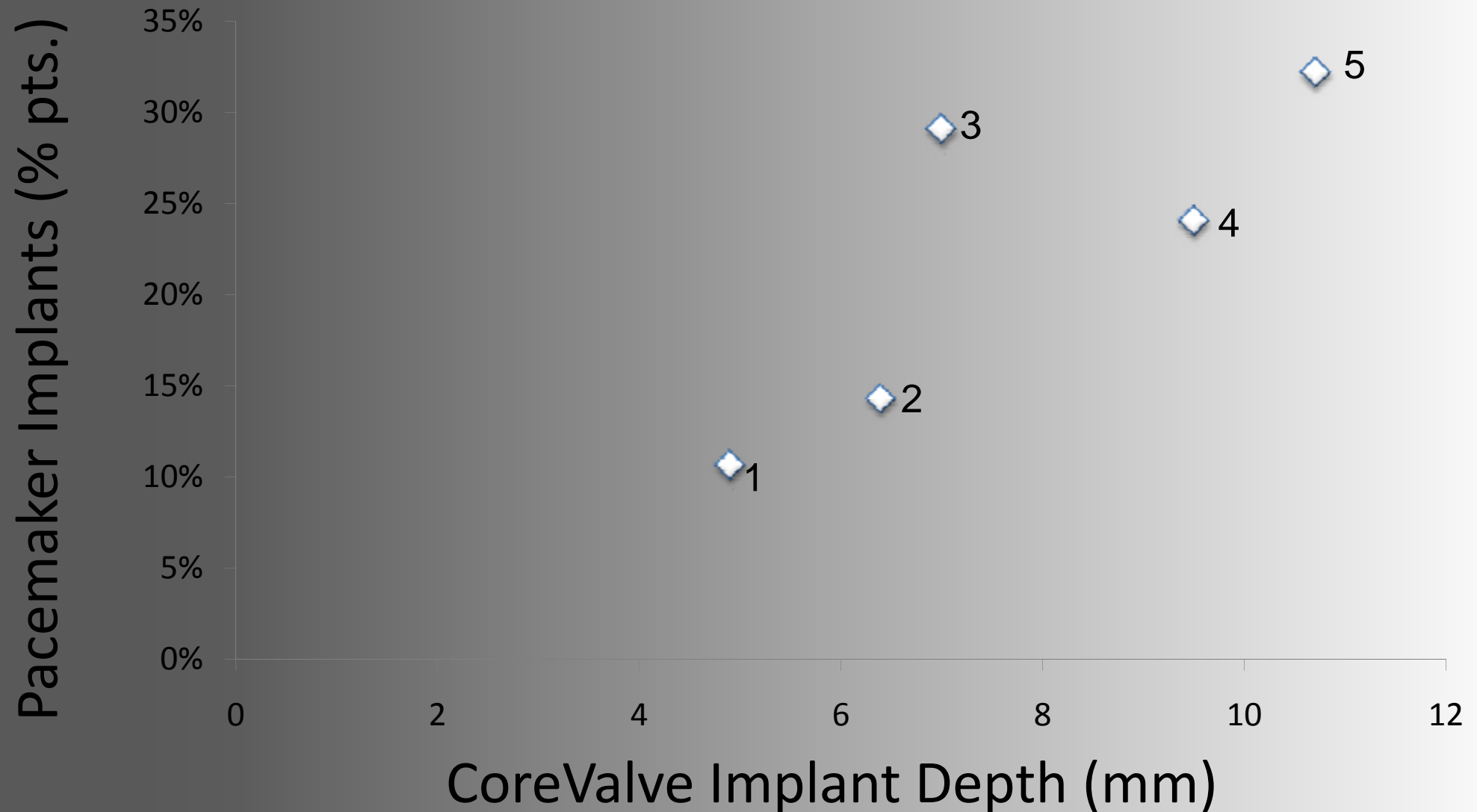
Hinge Point of the Anterior Mitral Valve

Implanted Below

→ 35% of patients developed LBBB



Relationship between Implant Depth and Pacemaker Implantation



¹Tchetche, et al. EuroIntervention 2012 (N=134); ²Munoz-Garcia, et. al. JACC CV 2012 (N=195); ³Chorianopoulos et. al. JIC 2012 (N=70);
⁴De Carlo, et. al. AHJ 2012 (N=275); ⁵Calvi, et. al. JICE 2011 (N=181).

CoreValve Procedural Outcomes at Target Implant Depth

- 134 CoreValve patients treated at 2 experienced centers
- All implants performed using the AccuTrak delivery system and a 4-6 mm target implant depth
- Appropriately sized balloon used for pre-implant BAV

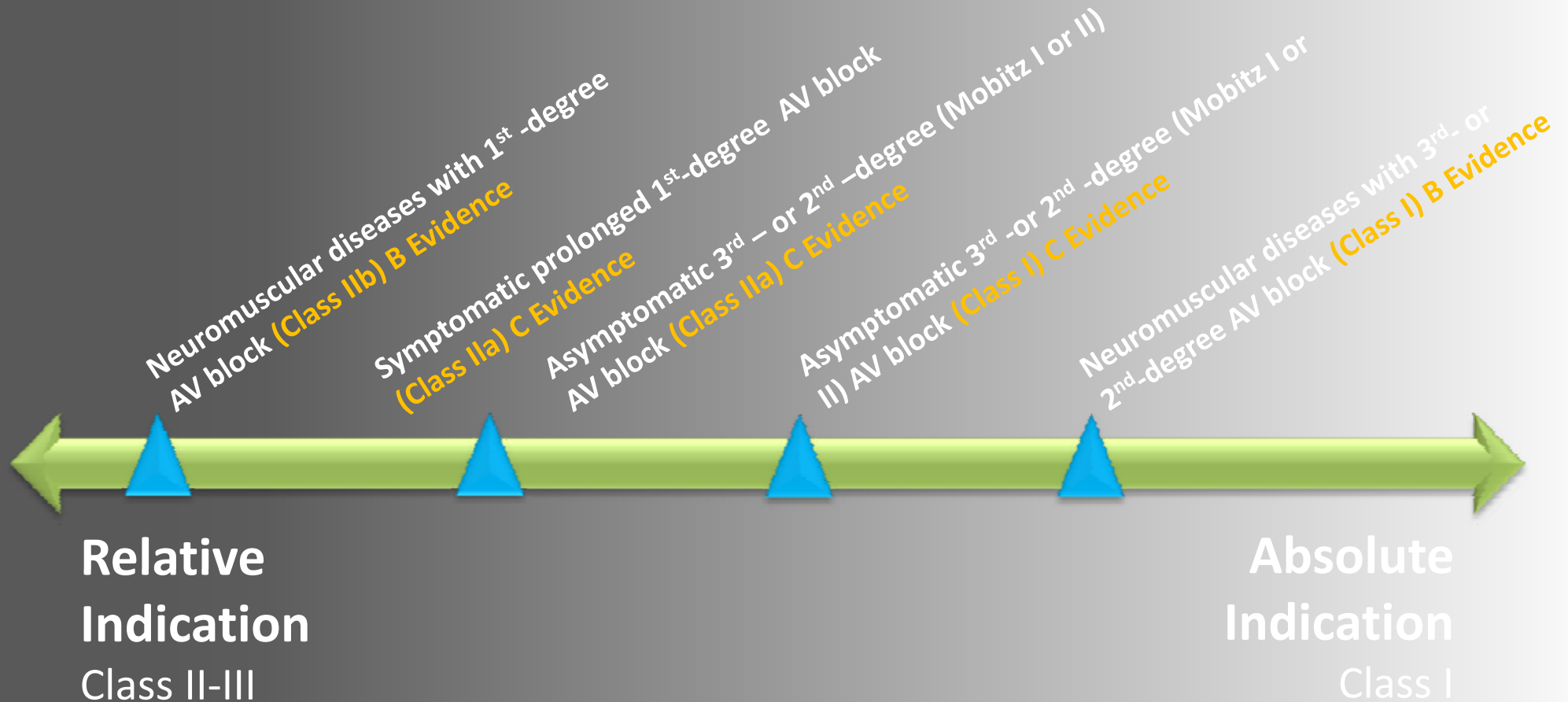
| N=134 | Patients (%) |
|--------------------------------|---------------------|
| Procedural Success | 133 (99.2) |
| BAV | 129 (98.5) |
| Balloon-Annulus Ratio | 0.95 ± 0.09 |
| Depth of Implant | 4.9 ± 2 |
| PVL > 2/4 | 0 (0) |
| Central leak | 0 (0) |
| New LBBB | 18 (13.4) |
| New Transient or Sustained AVB | 17 (12.7) |
| New Pacemaker Implantation | 12* (10.6) |

*12 of 113 patients without baseline pacemaker.
Tchetche, et al; EuroIntervention 2012; e-publication.

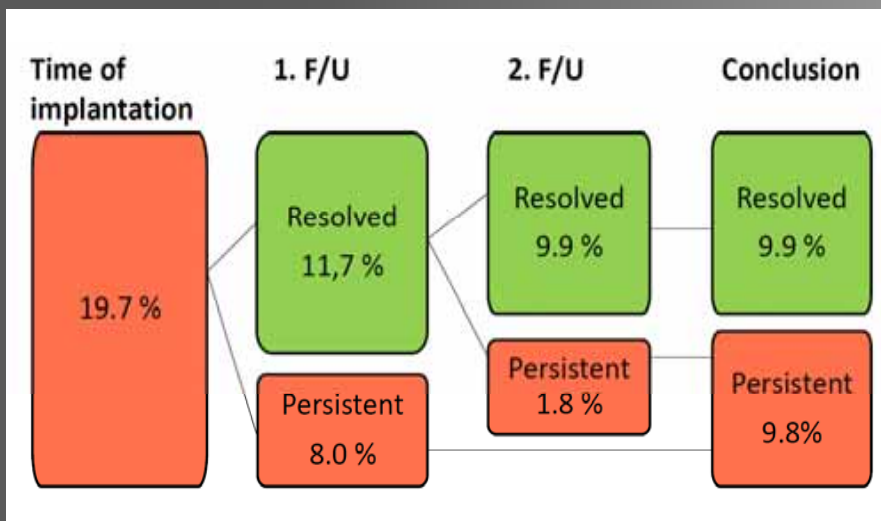
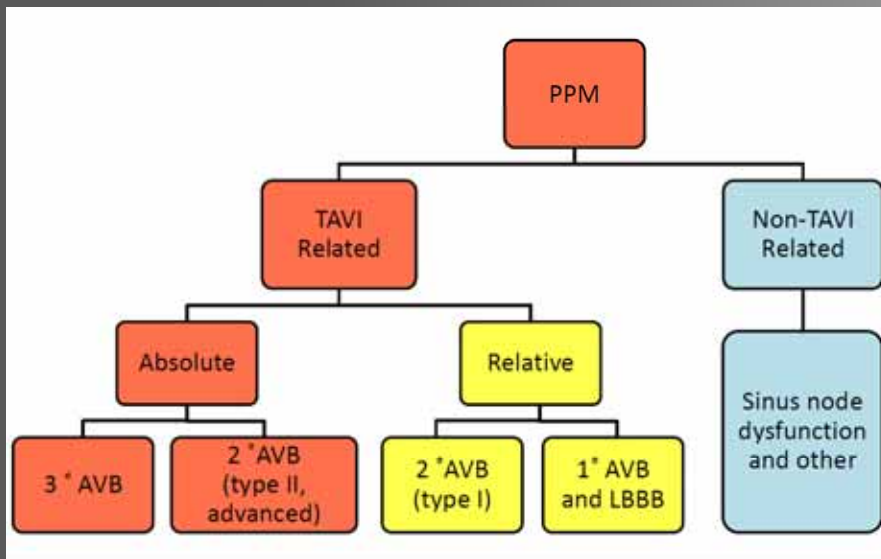
Driving Factors of Conduction Disturbances and Pacemaker Implantation

- ✓ Pre-implant BAV
- ✓ Implant Depth
- ✓ Variations in Application of Pacemaker Indications

Application of PPM Guidelines is Variable



Absolute vs. Relative Pacemaker Indications



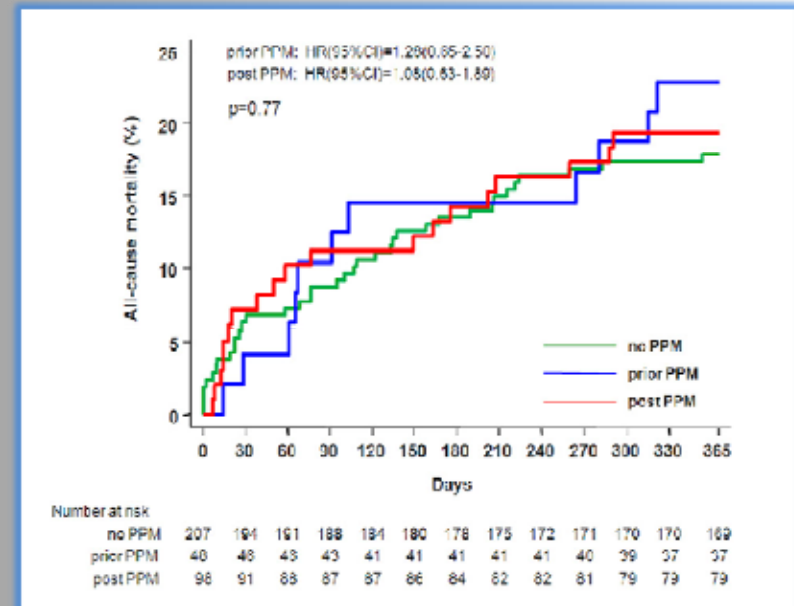
- 258 CoreValve patients from Nov 2007 to Feb 2012 (Copenhagen, Denmark)
- 9% with preexisting pacemaker
- 19.7% of patients had an absolute pacemaker indication (3° and 2° AVB-type II)
- 3% of patients had a relative pacemaker indication (2° AVB-type I, 1° AVB & LBBB)
- Patients with an absolute pacemaker indication: after periprocedural period only 9.8% of TAVI patients had an absolute pacemaker indication
 - 9.9% of conduction disturbances resolved

Conduction Disturbances after TAVR

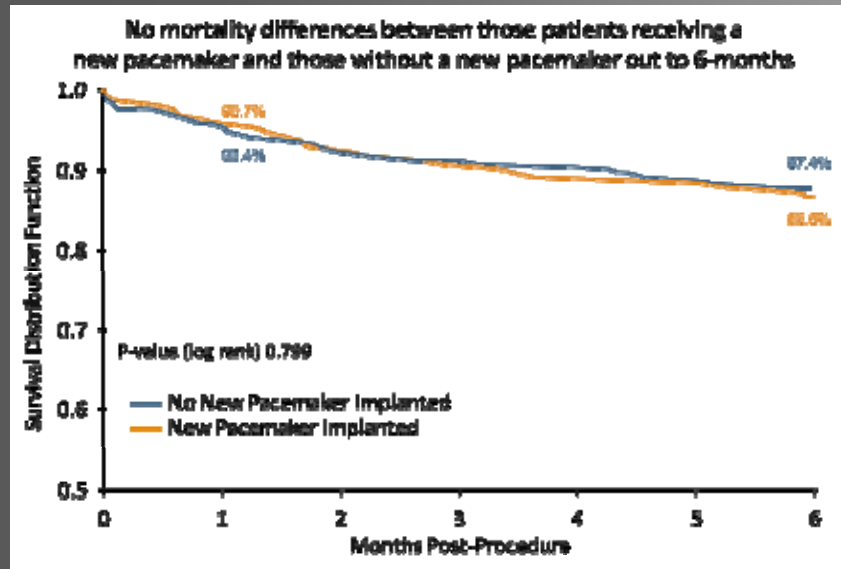
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Pacemaker Implantation Post-TAVR Not Associated With Increased Mortality

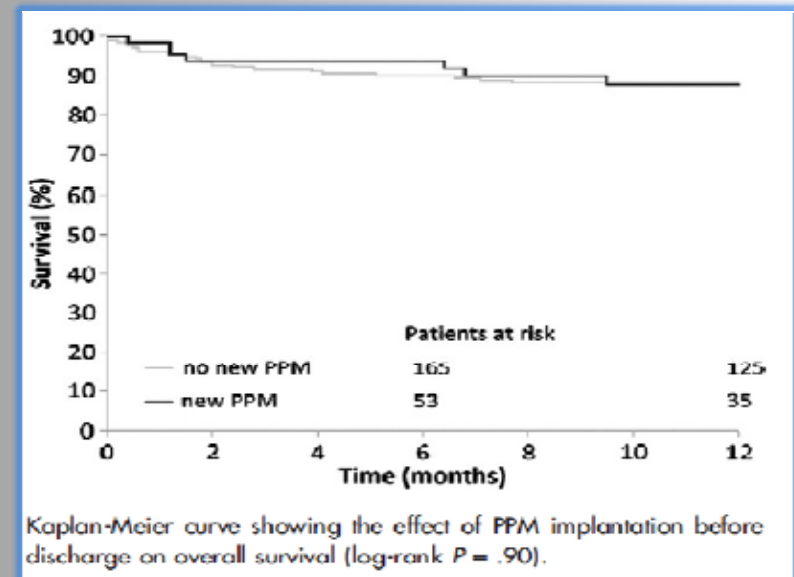
Three large studies demonstrate no association between pacemaker implantation and mortality



Buellesfeld, et. al. JACC 2012, (N=353; 319 CoreValve)

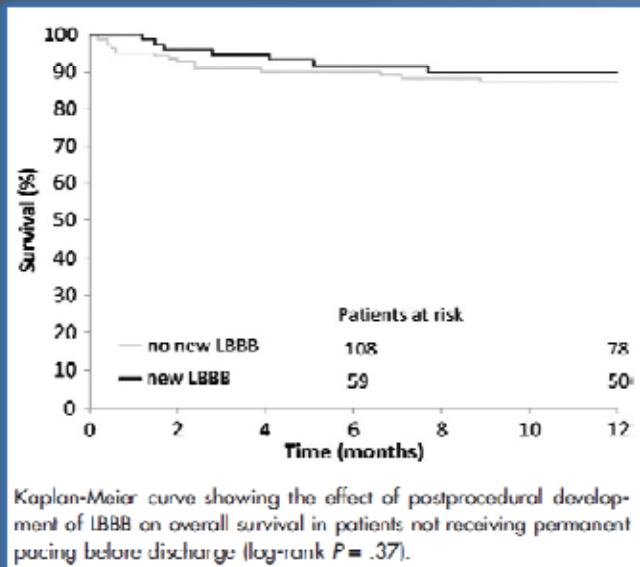


Bauernschmitt, et. al. EuroPCR 2012, (N=996 CoreValve)

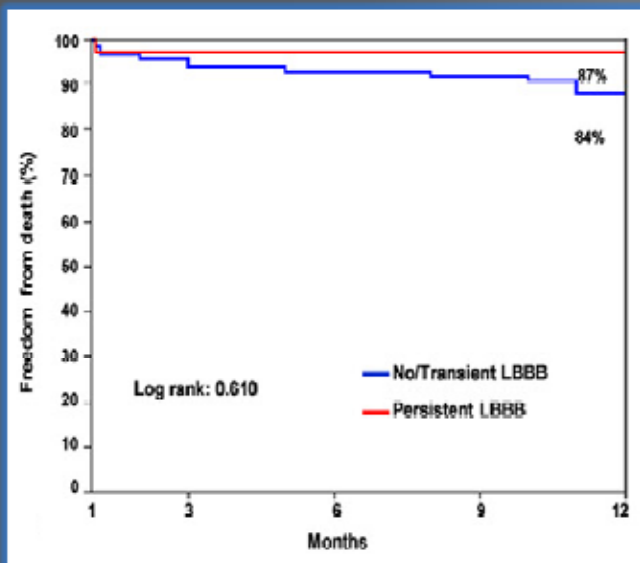


De Carlo, et. al. AHJ 2012, (N=275 CoreValve)

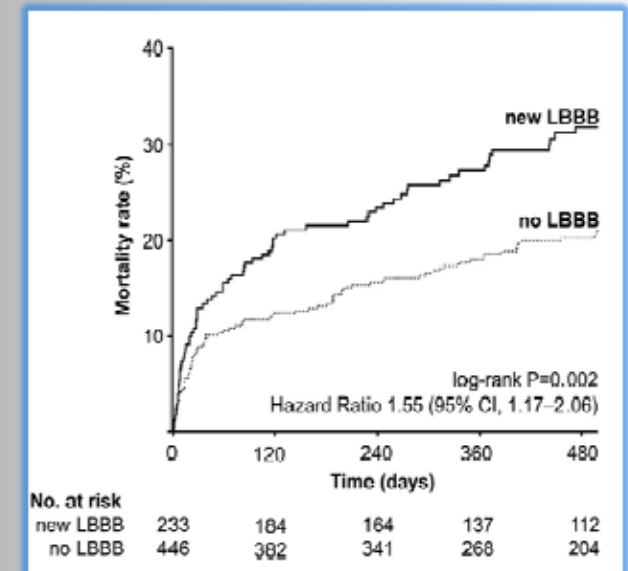
Current Research is Inconclusive Regarding Mortality Impact of LBBB Post –TAVR



LBBB Post-TAVR
NO Mortality Impact
 De Carlo, et. al. AHJ 2012
 (N=275; CoreValve)



LBBB Post-TAVR
NO Mortality Impact
 Urena, et. al. JACC 2012
 (N=202; Edwards)



LBBB Post-TAVR
Mortality Impact
 Patients not receiving permanent
 pacemaker before discharge.
 Houthuizen, et. al. Circulation 2012, (N=679; 387 CoreValve)

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Conclusions

- Conduction abnormalities are not atypical following AVR and TAVR due to the anatomical proximity of the aortic valve to the conduction system
 - Rates of conduction abnormalities are high in patient with AS
- Pre-existing conduction disturbances predict post-TAVR pacemaker implantation
- Post-TAVR pacemaker implantation is not associated with an increase in mortality
 - The mortality affect of LBBB is not known today
- Best practice in BAV sizing, depth of implant, and application of pacemaker implant guidelines can result in low rates of post-TAVR conduction disturbances