

Incidence and Clinical Consequences of Conduction Disturbances After TAVR

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Nature of Financial Relationship

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Other Financial Benefit

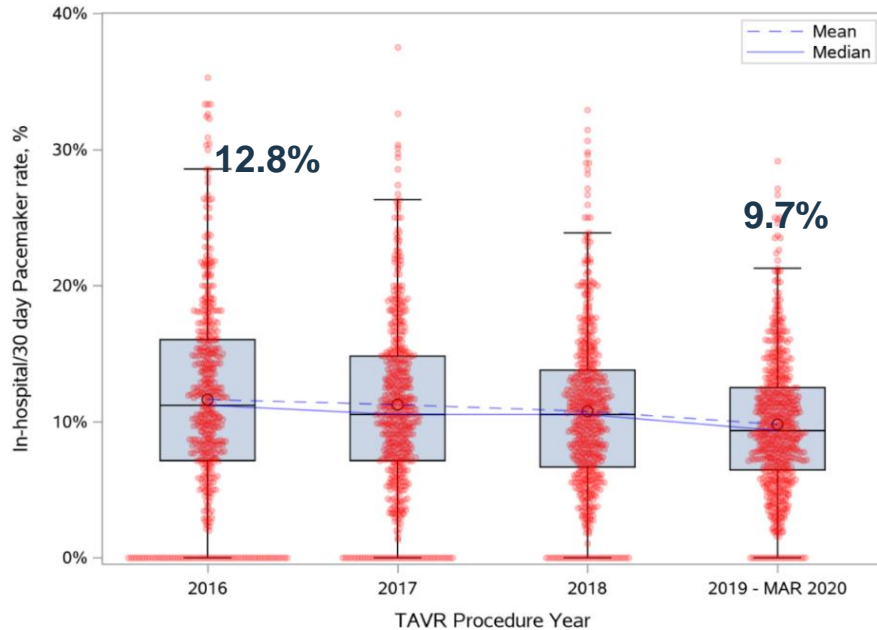
Ineligible Company

None
Medtronic, Edwards Lifesciences
ConKay Medical
None
None
None

All financial relationships have been mitigated.
Faculty disclosure information can be found on the app

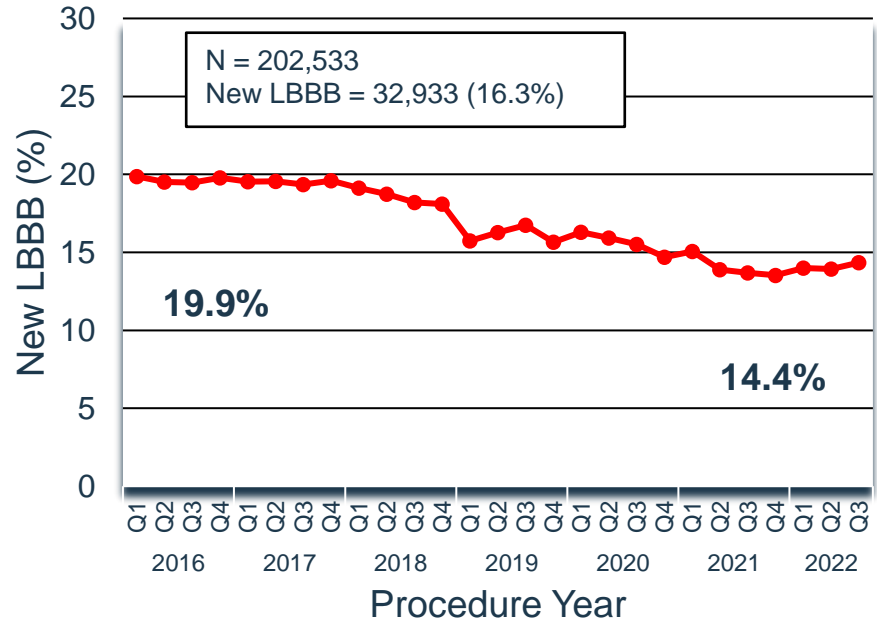
Incidence of Conduction System Abnormalities

Pacemaker implantation



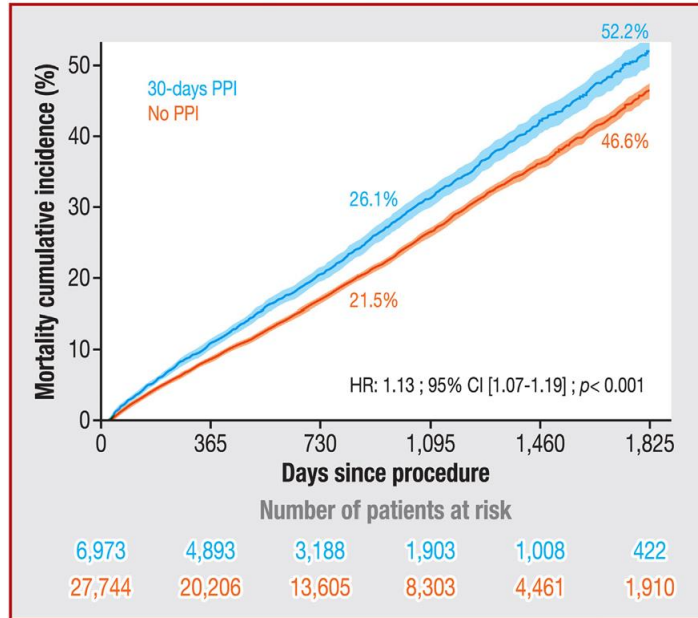
NOTE: Each red dot represents a Site.

LBBB

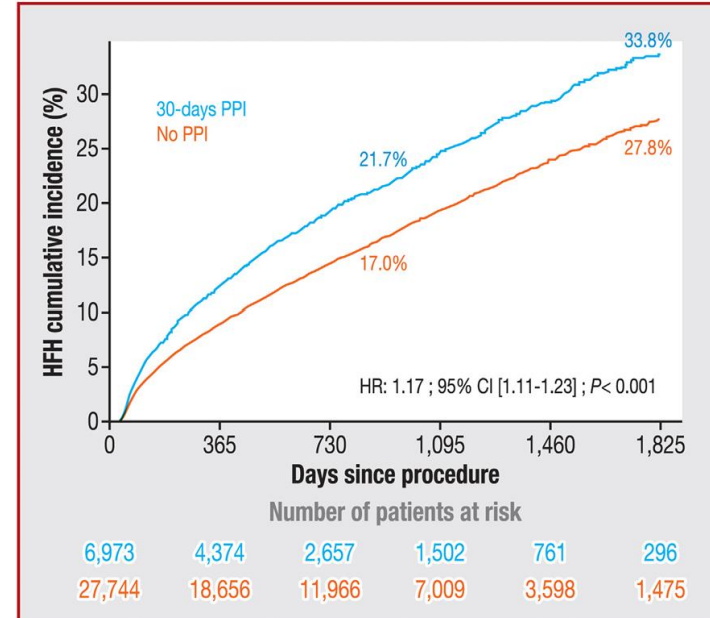


Adverse outcomes after permanent pacemaker – FRANCE-TAVI Registry

All-cause mortality



Heart Failure Hospitalization



Predictors of Conduction System Abnormalities

Clinical / Demographic

Sex
Age
Diabetes mellitus
Prior CAD/CABG

Anatomic

MS Length
Annular / LVOT area
Degree oversizing
Calcium burden
MAC

Permanent Pacemaker

Left Bundle Branch Block

Electrocardiographic

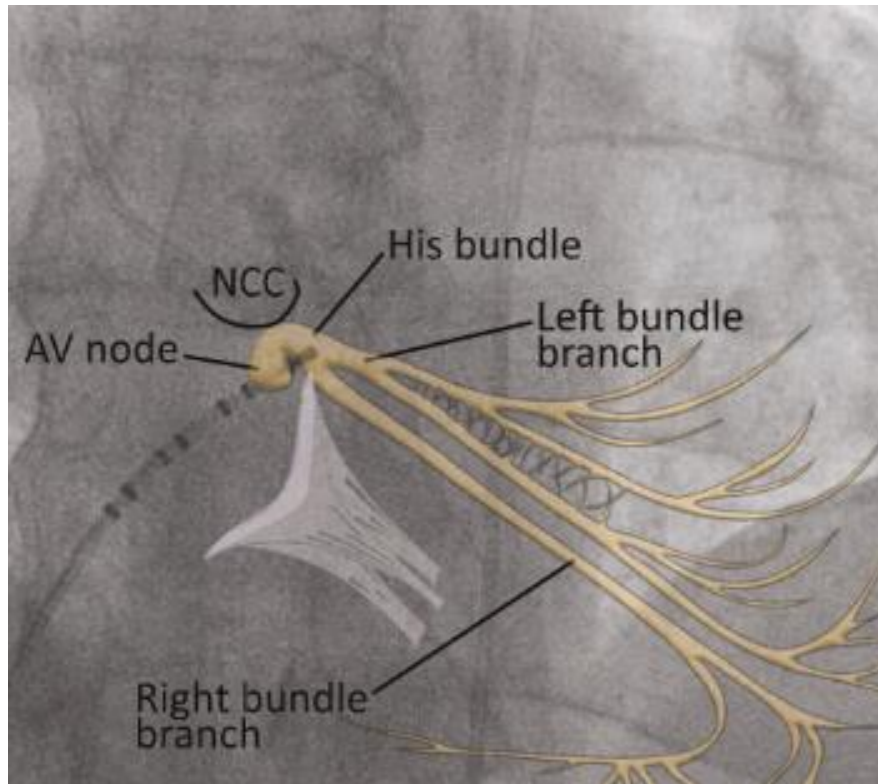
RBBB
LAFB/LBBB
1° AVB
Wide QRS

Procedural

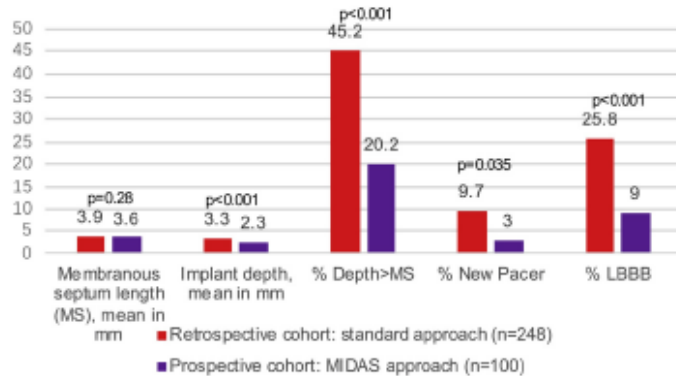
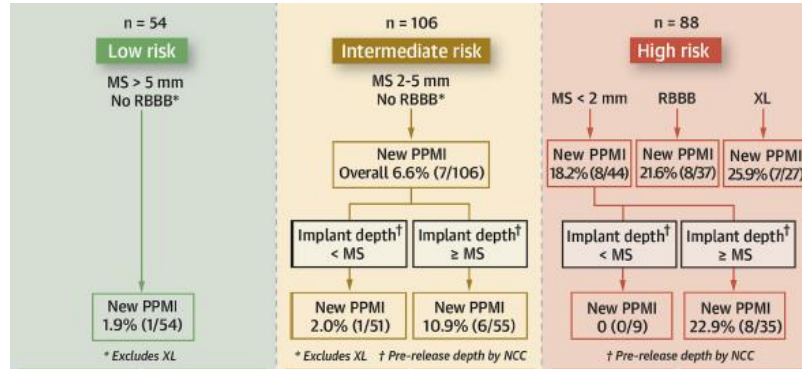
Valve selection
Depth of implant
Pre-dilation
Post-dilation
Intraprocedural AVB

Mechanism of conduction system disturbance

- **Conduction fibers originate below level of membranous septum**
 - Interaction w/ guidewire/valve/balloon/delivery system can lead to disturbance
- **Postmortem studies have demonstrated injury to be due to:**
 - Direct compression
 - Hemorrhage
 - Ischemia
 - Inflammation
- **Conduction system abnormalities exist along a continuum**
 - Strategies to minimize PPM also reduce likelihood of LBBB



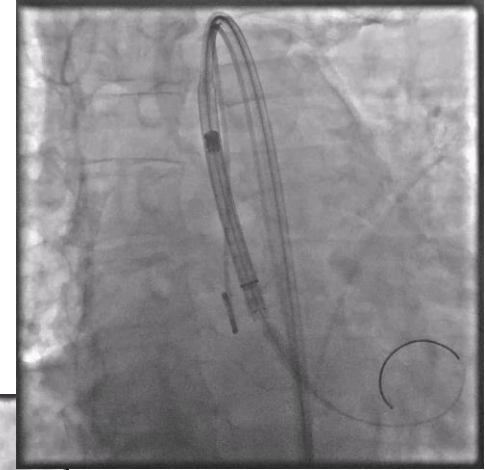
Depth of implantation matters!



Jilaihawi, H. et al. JACC Intv. 2019

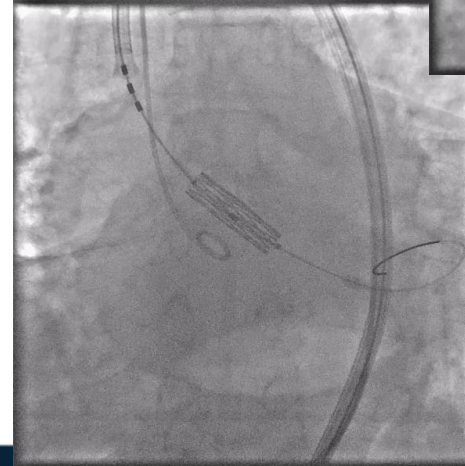
Cusp overlap technique:

- Isolate NCC and overlap LCC/RCC
- Aortogram in cusp overlap view and LAO view to ensure depth



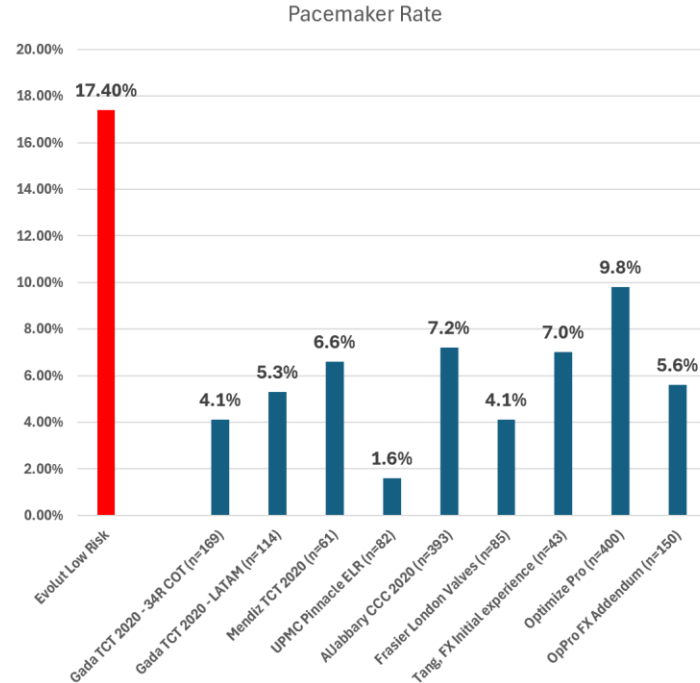
High deployment technique

- Line up at “lucent line”
- RAO/CAU angulation to remove parallax from valve
- Deploy



Pacemaker Rates with Contemporary Techniques

Evolut – Cusp Overlap Technique



S3 – High Deployment Technique

| Conventional Deployment Technique | High Deployment Technique | |
|---|---|--|
| | | |
| Implantation Depth | 3.2 ± 1.9 mm | 1.5 ± 1.6 mm |
| 30-day Permanent Pacemaker Implantation | 13.1% | 5.5% |
| New-onset Left Bundle Branch Block at Discharge | 12.2% | 5.3% |
| 1-year Aortic Regurgitation | 15.9% 2.7% | Mild (≥1+ – <2+) Moderate-to-severe (≥2+) 16.5% 1% |
| 1-year Hemodynamic Performance | 11.8 ± 4.9 mmHg 22.5 ± 9 mmHg 0.48 ± 0.13 | Mean gradient Peak gradient Doppler velocity index 13.1 ± 6.5 mmHg 25 ± 11.9 mmHg 0.47 ± 0.15 |

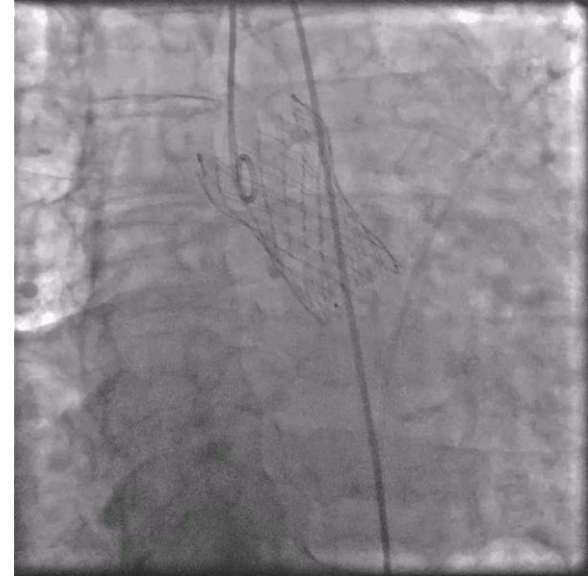
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OPTIMIZE PRO FX Addendum

- N=151 patients at 11 US sites from 9/2022-10/2023
- 3 key COT steps:
 - Initial deployment in cusp overlap projection
 - Begin deployment at mid-pigtail or higher
 - Assess depth in cusp overlap view at 80%
- Primary outcome: death/stroke at 30d: **2.7%**
- **Rate of PPM at 30d: 6.7%**
- **New LBBB: 26.4%**
- Factors influencing PPM rate:
 - Lunderquist: 5.9% vs 8.3%, p=0.56
 - Depth <6mm: 3.4% vs. 12.8%, p=0.04
 - Depth >MSL: 0.0% vs 10.5%, p=0.03
- 1 patient required second valve

The best way to avoid PPM is a precise, shallow implant

The Price of Shallow Implantation



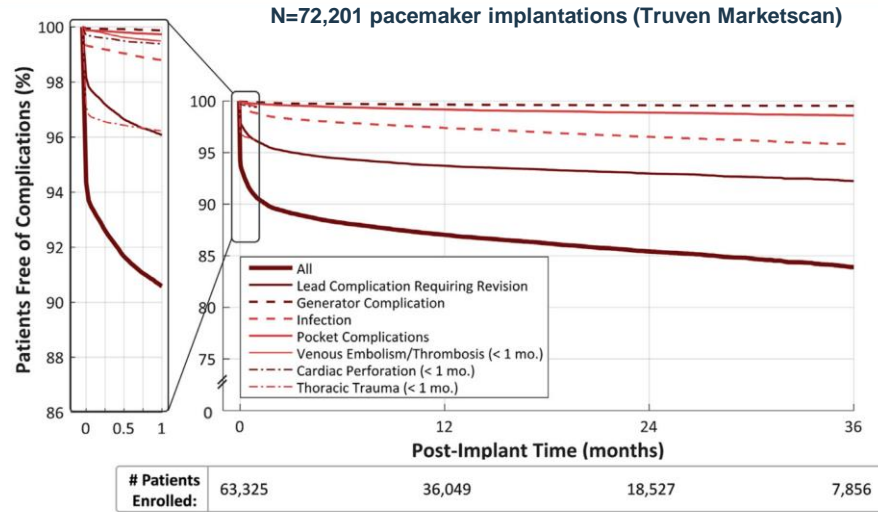
Short Term

- Less safety margin for valve movement during deployment
- Migration/Embolization

Long Term

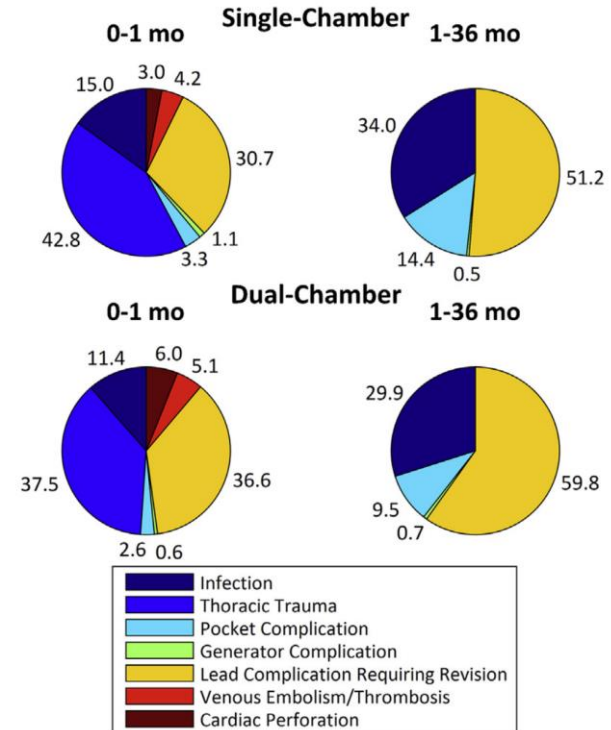
- Coronary Re-access
- Future ViV options

Transvenous pacemakers are not benign!



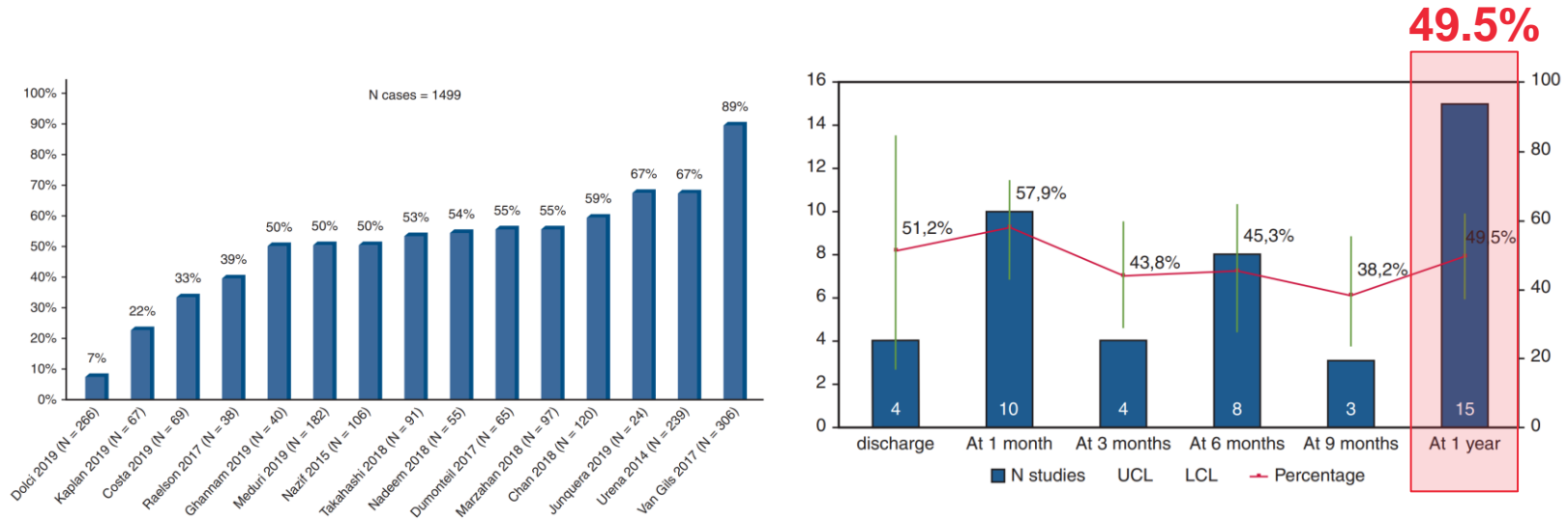
Risk of device complications:

- 9.1% at one month
- 15% by 3 years



Thoracic trauma = pneumo/hemothorax

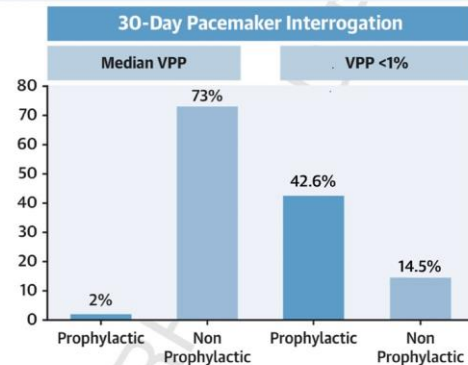
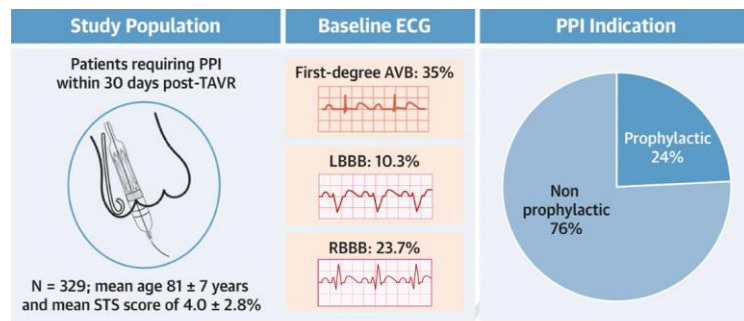
Pacemaker Dependency at 1 year



In this meta-analysis (23 studies, n=18,610 patients), up to 50% of patients not pacemaker dependent by 1 year.

PROMOTE Study – Prophylactic PPM

- “Prophylactic” PPM if:
 - Enlarged QRS w/ daily changes ($\geq 20\text{ms}$ \uparrow in PR or QRS for 2+ days)
 - QRS $> 150\text{ms}$ OR PR $> 240\text{ms}$
- Overall PPM rate 15.6%, 24% were for prophylactic indication
- Prophylactic PPMs had:
 - Median 2% VPP (c/w 73%)
 - 42.6% had VPP $< 1\%$ at 30d
 - No difference whether EPS performed prior
 - *But: 5% in this group were PPM dependent!*



- About one fourth of patients receiving PPI after TAVR had a prophylactic indication
- Despite similar clinical outcomes, prophylactic PPI patients exhibited a very low pacing burden at 30 days.
- These findings would not support prophylactic PPI following TAVR

Fischer Q, et al. JACC Clin Electrophysiol. 2025;■(■):■-■.

Summary

- Conduction system abnormalities are the most common complications following TAVR and are associated with higher morbidity, mortality, and cost
 - Techniques to limit PPM placement also will limit LBBB
- Overall rates are decreasing with time
 - Platform iterations (Evolut FX+, Navitor Vision)
 - Improved implantation technique (COT, HDT)
- Identifying patients requiring PPM over time remains challenging:
 - Shallower implant can reduce PPM but with downstream short/long-term consequences
 - PPM are not benign
 - There is still a need for effective algorithms to identify high-risk patients post-TAVR