

When Is the Timing of the Pacemaker in Case of Abnormal Rhythm after Surgery or Intervention?



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Korean Heart Rhythm Society COI Disclosure

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to disclose concerning the presentation

Case

- M/79
- Persistent AF
- Symptomatic severe AS (bicuspid), dilatation of ascending aorta
 - s/p AVR, ascending aorta reduction plasty, Left Maze procedure
- POD #1, AF recurred → amiodarone loading
- POD #8, discharge
 - Warfarin
 - Amiodarone 200mg bid
 - Betaxolol 10mg 0.5T qd
 - Furosemide 40mg 0.5T qd, spironolactone 25mg qd
- POD #12, re-admission for syncope (x2) → D/C amiodarone and betaxolol

Holter (POD #13)

General

106760 QRS complexes
0 Paced beats (< 1%)
11 Ventricular beats (< 1%)
0 Supraventricular beats (< 1%)
0 BB beats (< 1%)
0 Junctional beats (< 1%)
0 Aberrant beats
100 % of total time in AF/AFL
< 1 % of total time classified as noise

Ventriculars (V, F, E, I)

11 Isolated
0 Couplets
0 Bigeminal cycles
0 Runs totaling 0 beats

Heart Rates

38 Minimum at 15:11:43 20-Jan
79 Average
130 Maximum at 18:29:17 20-Jan
11802 Beats in tachycardia (>100 bpm), 11% total
9730 Beats in bradycardia (<60 bpm), 9% total
16.1 Seconds Max R-R at 14:58:43 20-Jan

Supraventriculars (S, J, A)

0 Isolated
0 Couplets
0 Bigeminal cycles
0 Runs totaling 0 beats

ST Channel 1

4.4 mm at 12:35:45 20-Jan
-4.8 mm at 15:50:15 20-Jan

ST Channel 2

4.8 mm at 11:12:00 20-Jan
-4.8 mm at 12:27:15 20-Jan

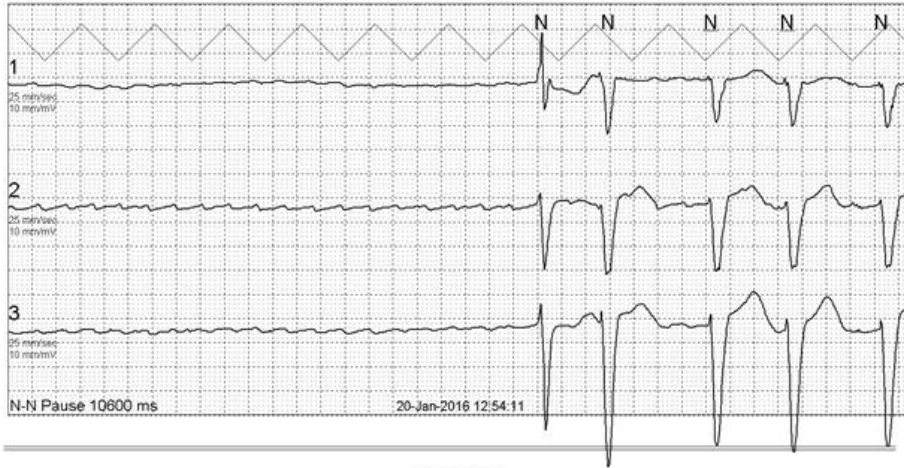
ST Channel 3

4.8 mm at 11:01:15 20-Jan
-4.6 mm at 12:30:15 20-Jan

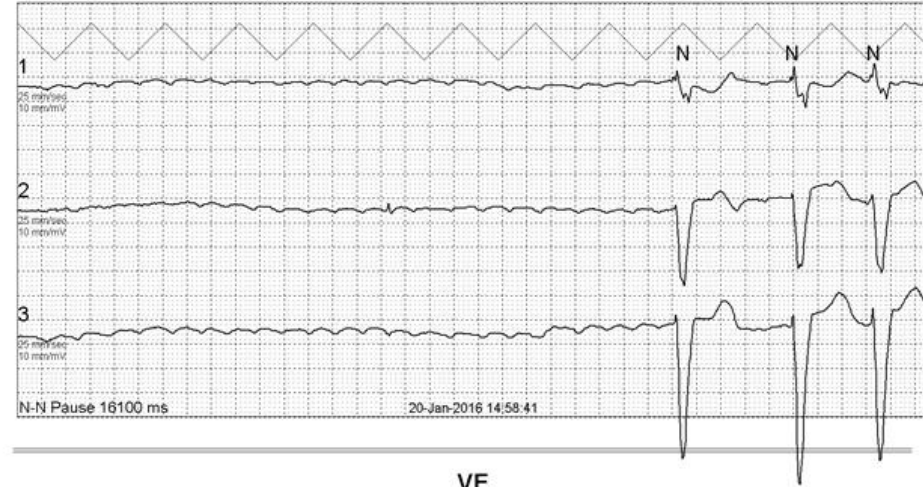
Interpretation

Holter (POD #13)

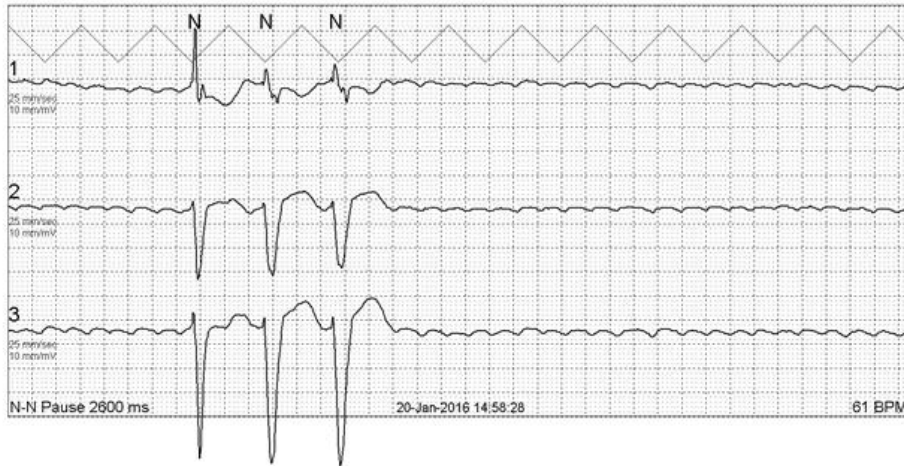
Pause 2



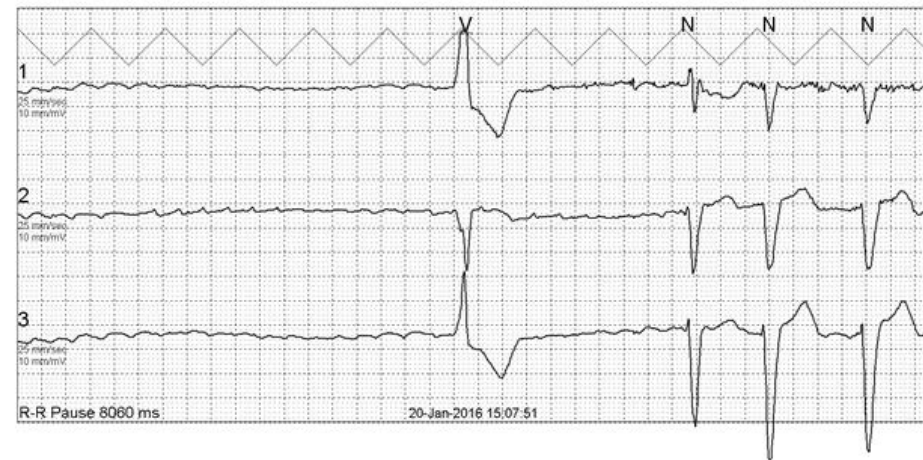
Pause 2



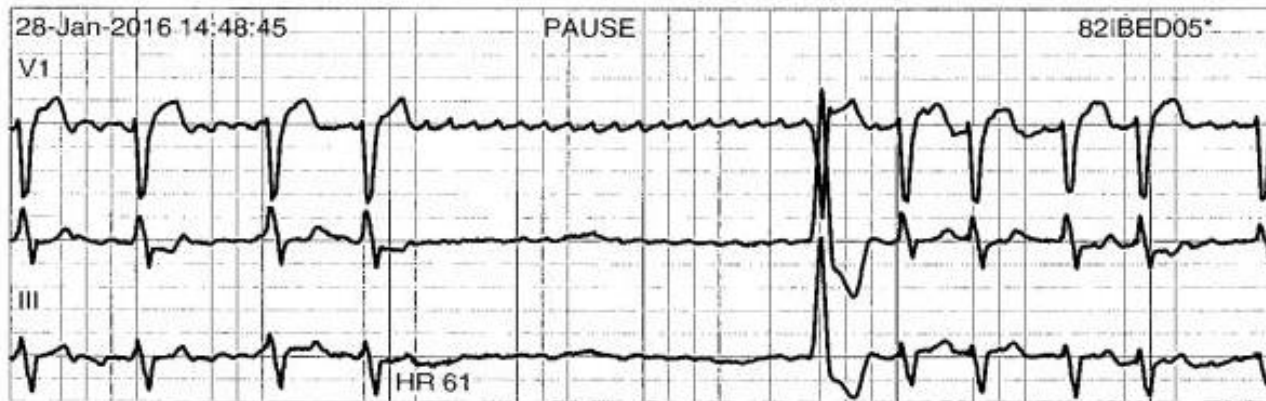
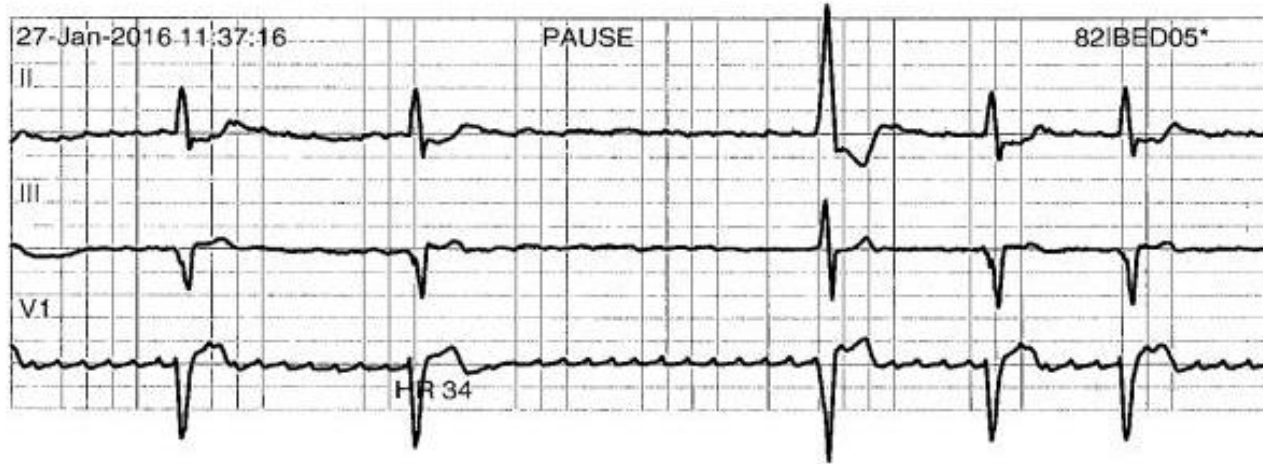
Pause 1



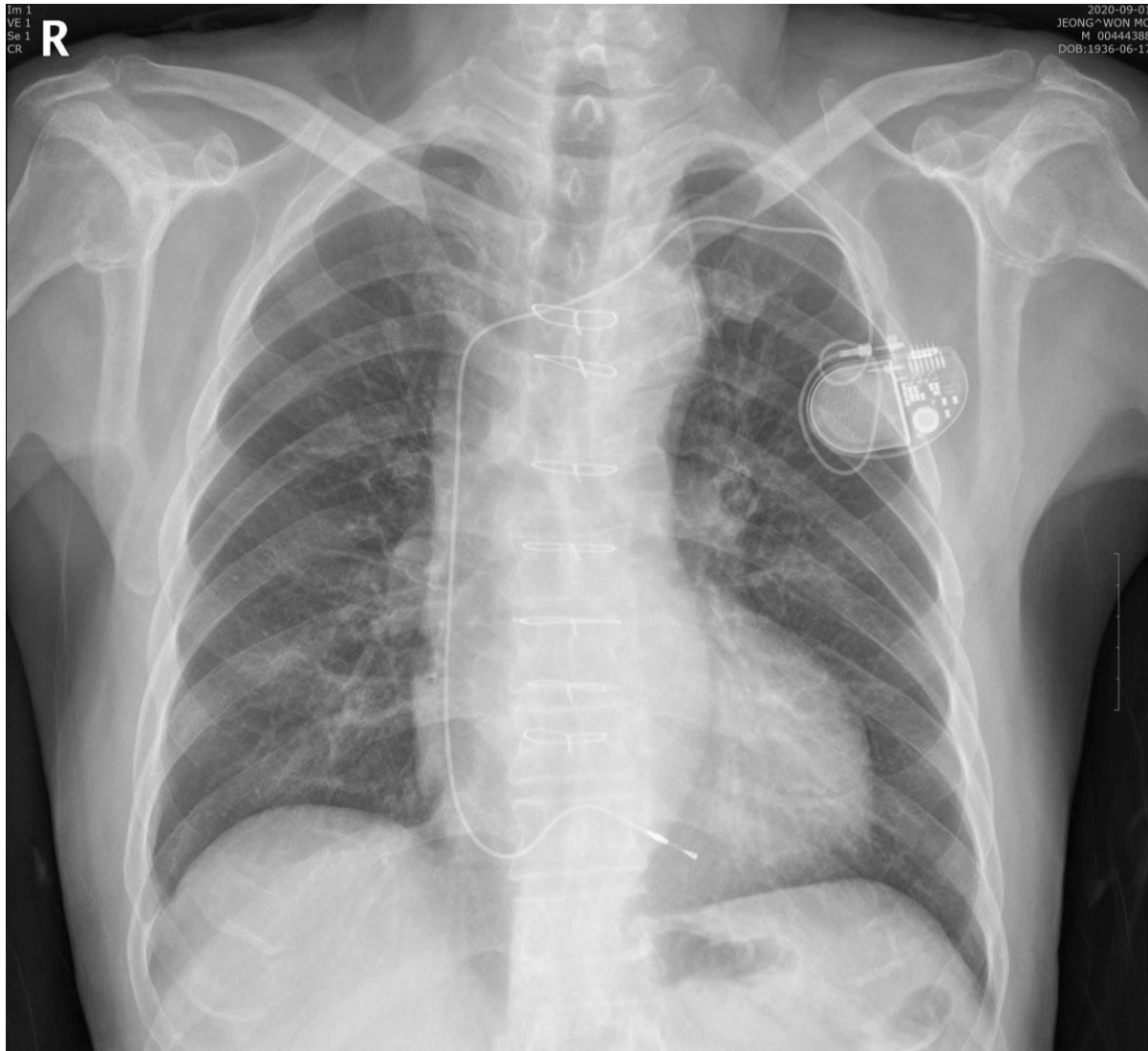
VE



POD #21-22 (amiodarone D/C #9~10)



POD #23 (amiodarone D/C #11)



FastPath™ Summary

Battery

Longevity: 11,7 yrs



Implant Date: 29 Jan 2016
 Voltage 3,04 V
 Magnet Rate 100,0 ppm
 Battery Current 9 uA
 Remaining Capacity to ERI >95%

Test Results 20 Aug 2019

A Automatic

	Capture	Sense	Lead Impedance
V	0,5V @ 0,4ms (Bi) 0,75V @ 0,4ms (Bi) 11 Dec 2018	7,0mV (Bi) A 9,0mV (Bi) 11 Dec 2018	540 Ω (Bi) A 550 Ω (Bi) 11 Dec 2018

Parameters

Mode VVI
 Base Rate 60 min⁻¹

Capture & Sense	V
AutoCapture	Off
Pulse Amplitude (Margin)	2,5 V (5.0:1)
Pulse Width	0,4 ms
AutoSense	Off
Sensitivity (Safety Margin)	2,0 mV (3.3:1)

Diagnostics Summary	Since 11 Dec 2018	Episodes Summary	Since 11 Dec 2018	Counts	EGMs
VP	52 %	High Ventricular Rate	0	0	
		Magnet Response	0	0	

No Alerts

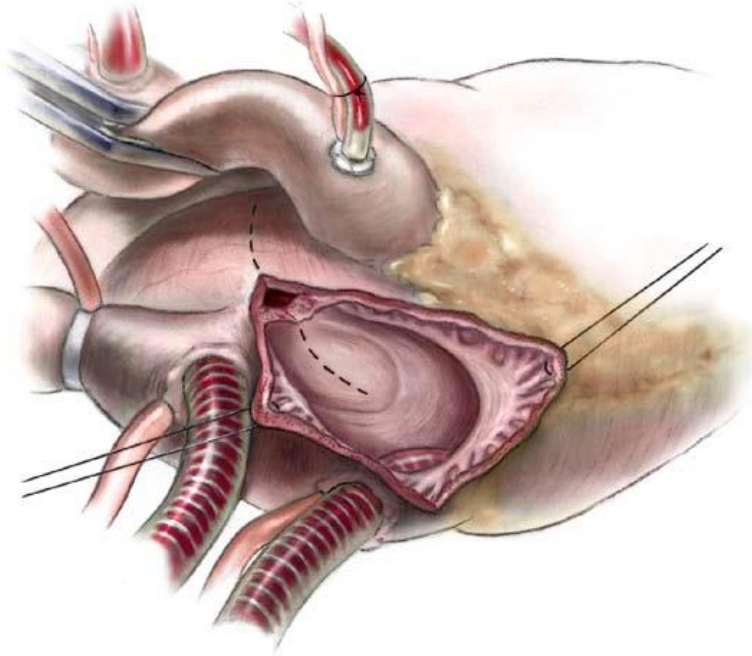
Postoperative bradycardia after cardiac surgery

- Pathophysiology
 - Trauma and inflammation
 - Hemodynamic stress
 - Ischemic injury
 - Perioperative drugs
 - Electrolyte disorders
- Risk factors for bradycardia after cardiac surgery
 - Type of cardiac surgery and the anatomical relationship to the conduction system.
 - Pre-existing conduction abnormalities
 - LBBB, RBBB, bifascicular, trifascicular, 2nd degree AV block
 - Longer cardiopulmonary bypass duration

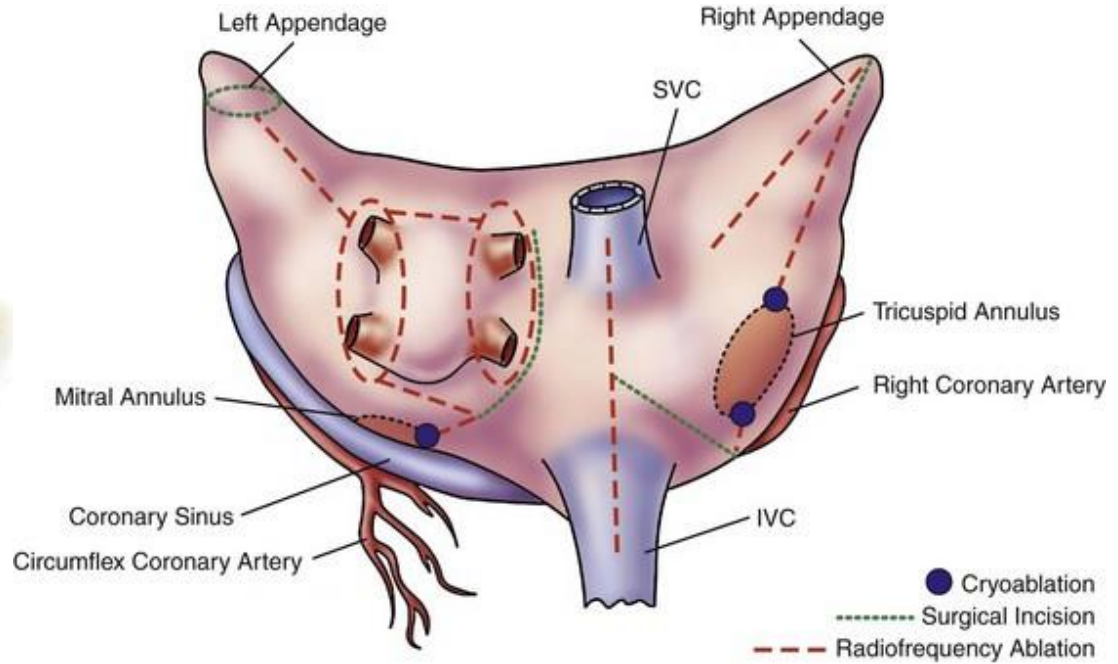
Postoperative bradycardia after cardiac surgery

- Indication for PM implantation for postoperative bradycardia: **same as indication for those without surgery**
 - AV block
 - Sinus node dysfunction
 - Slow AF
- Long-term PM dependency in patients with PM after cardiac surgery
 - Sinus node dysfunction: 30~40% remain PM dependent
 - AV block: 65~100% remain PM dependent
- Challenge with bradycardia after cardiac surgery
 - Hemodynamic instability with bradycardia
 - Prolonged hospital stay and delayed recovery

Sinus node dysfunction after cardiac surgery



Superior transseptal approach

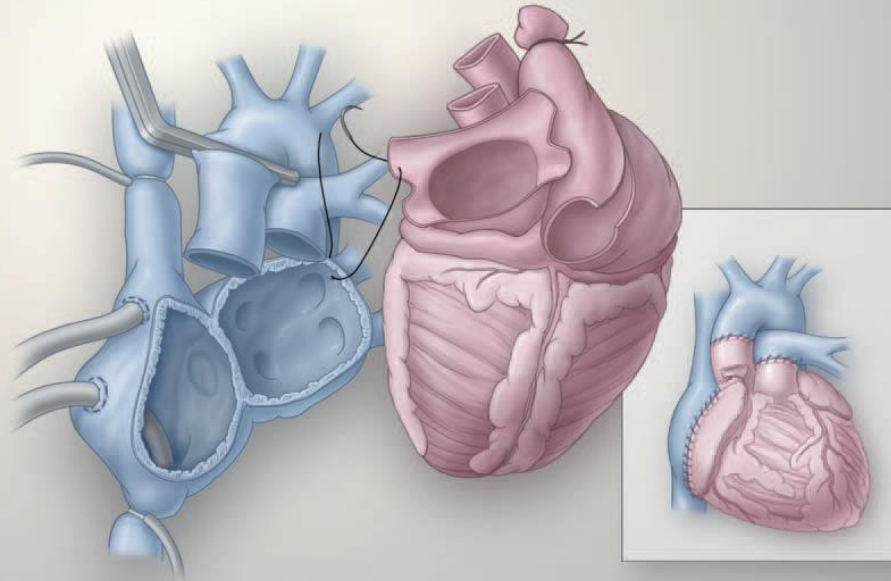


Cox Maze IV procedure

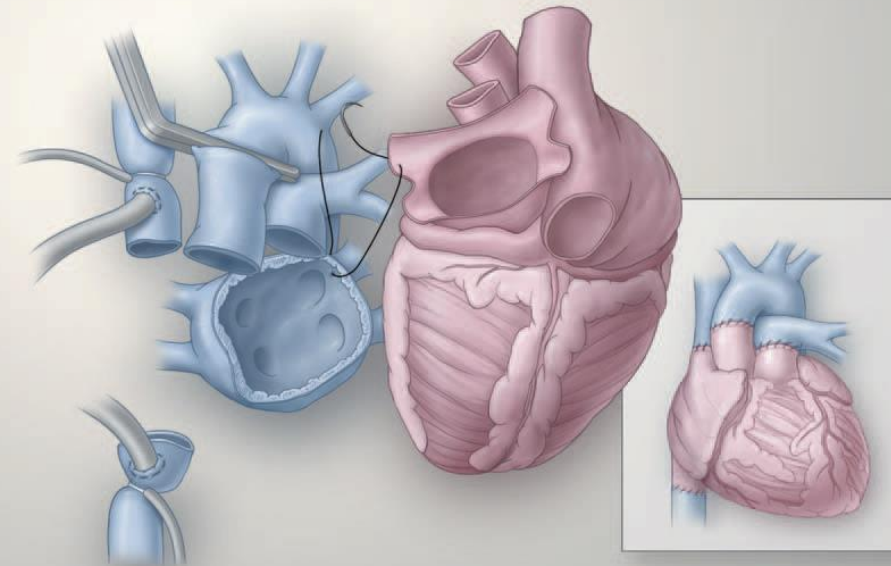
Sinus node dysfunction after heart TPL

Lesser SND with bicaval technique

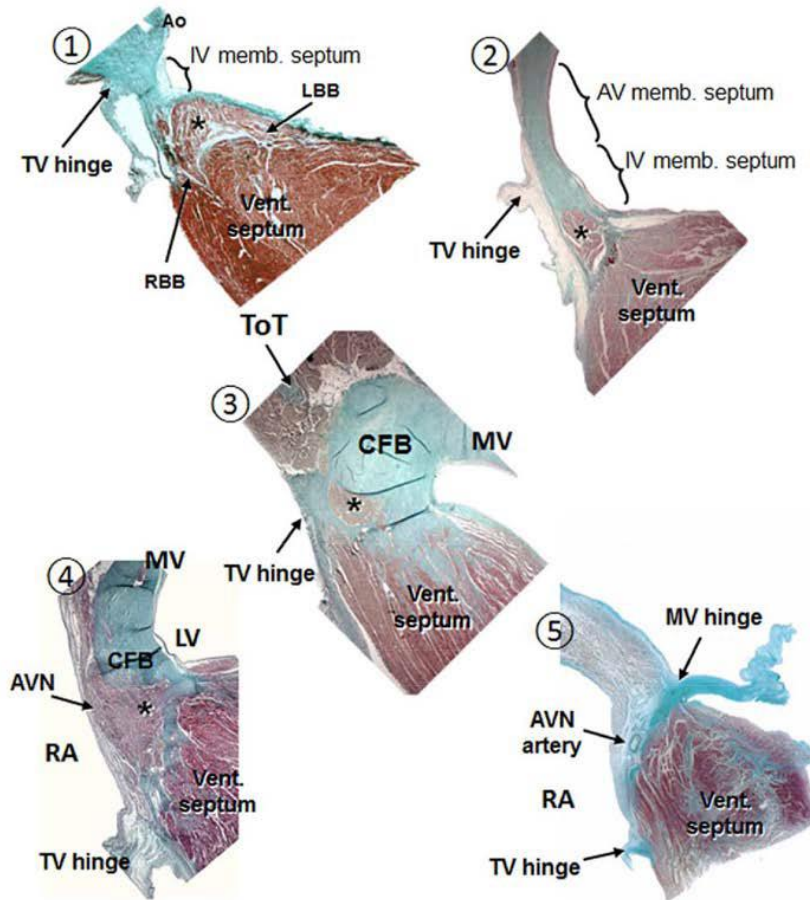
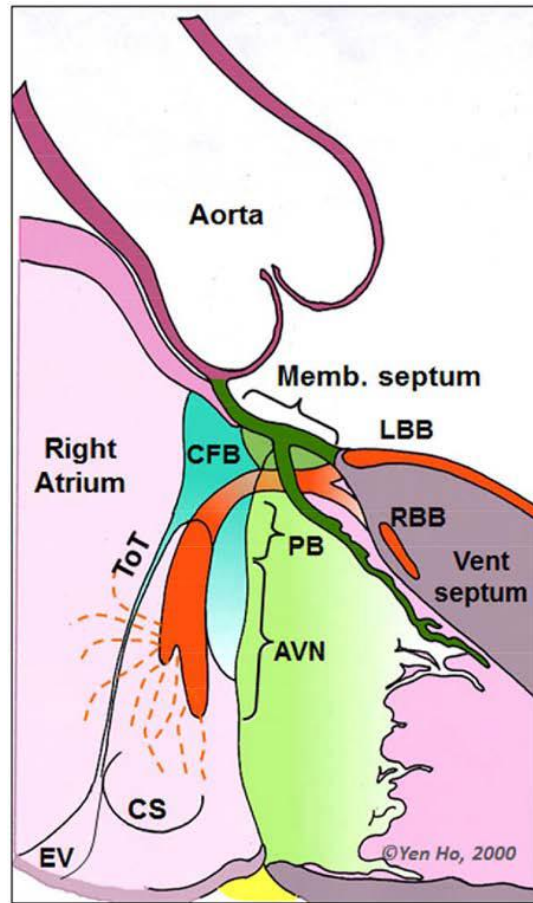
Biatrial heart TPL



Bicaval heart TPL



AV conduction disturbances after cardiac surgery



Aortic, mitral, or tricuspid valve surgery

CABG

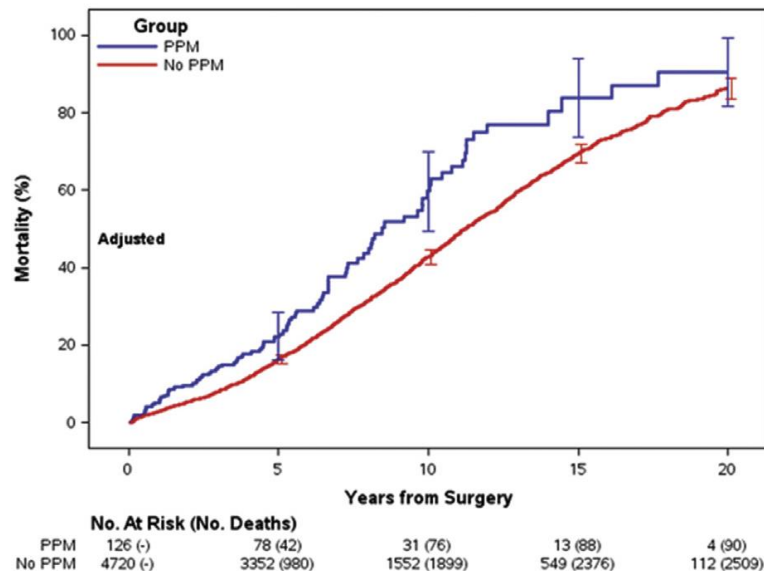
- PM implant after CABG: 0.4~2.0%
- Symptomatic bradycardia already present before surgery → **generally not resolve** with CABG
- New onset SND or advanced AV block after CABG → timing of pacemaker implant: **5 to 7 days after surgery** is reasonable

Valvular surgery

- Rates of PM implant after valve surgery
 - MV 3.5%
 - AV 5.1%
 - TV 12%
 - AV+MV 10%
 - MV+TV 16%
 - AV+MV+TV 25%

Valvular surgery

- PM after AV surgery: 3~8.5% (1.5% in AMC)
 - Injury to common bundle from edema, removal of calcium, or deeply placed sutures
 - **Most patients do not recover AV conduction: >90%**
 - Higher long-term mortality in patients with PM



Ann Thorac Surg 2017;104:1259–66
Interact Cardiovasc Thorac Surg. 2013 Apr;16(4):476-81.

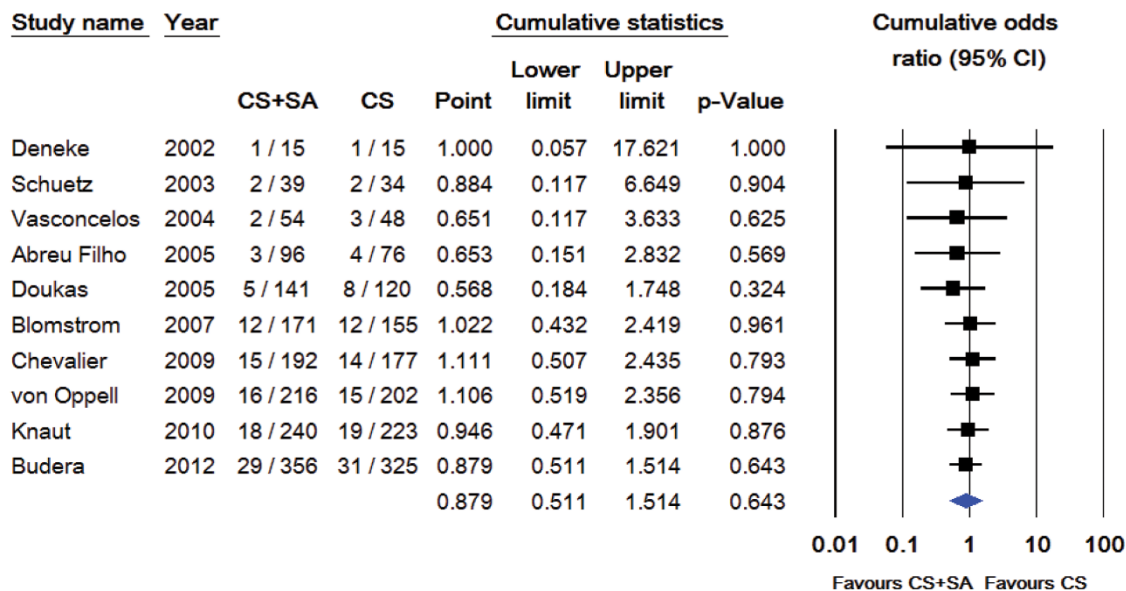
- New onset advanced AV block or SND after AV surgery
→ timing of pacemaker implant: **3 to 5 days after surgery** is reasonable

Valvular surgery

- PM after MV surgery: 1~9%
 - Probably d/t injury to AV nodal artery (running close to MV)
 - MVR > MV repair with incomplete annuloplasty band
- New onset AV block or SND after MV surgery → timing of pacemaker implant: **5 to 7 days after surgery** is reasonable
- PM after TV surgery
 - AV node is located between anterior and septal TV leaflets
 - Isolated TV surgery is rare
 - TVR: need for LV lead
 - TV repair: incidence of moderate to severe or severe TR is 42% after RV lead placement
- New onset AV block or SND after TV surgery → timing of pacemaker implant: **3 to 5 days after surgery** is reasonable

Surgery for AF

- **11%** of patients undergoing a Cox Maze IV procedure in addition to mitral valve surgery required postoperative PM implantation
- Whether surgery for AF is associated with an increased risk for postoperative PM is mixed
 - Significant evolution in the lesion set and surgical technique
 - Adding ablation for AF: increased likelihood of PM ?



RCTs comparing CS+SA vs. CS-only surgical treatment for AF

CS: cut and sew
SA: surgical ablation

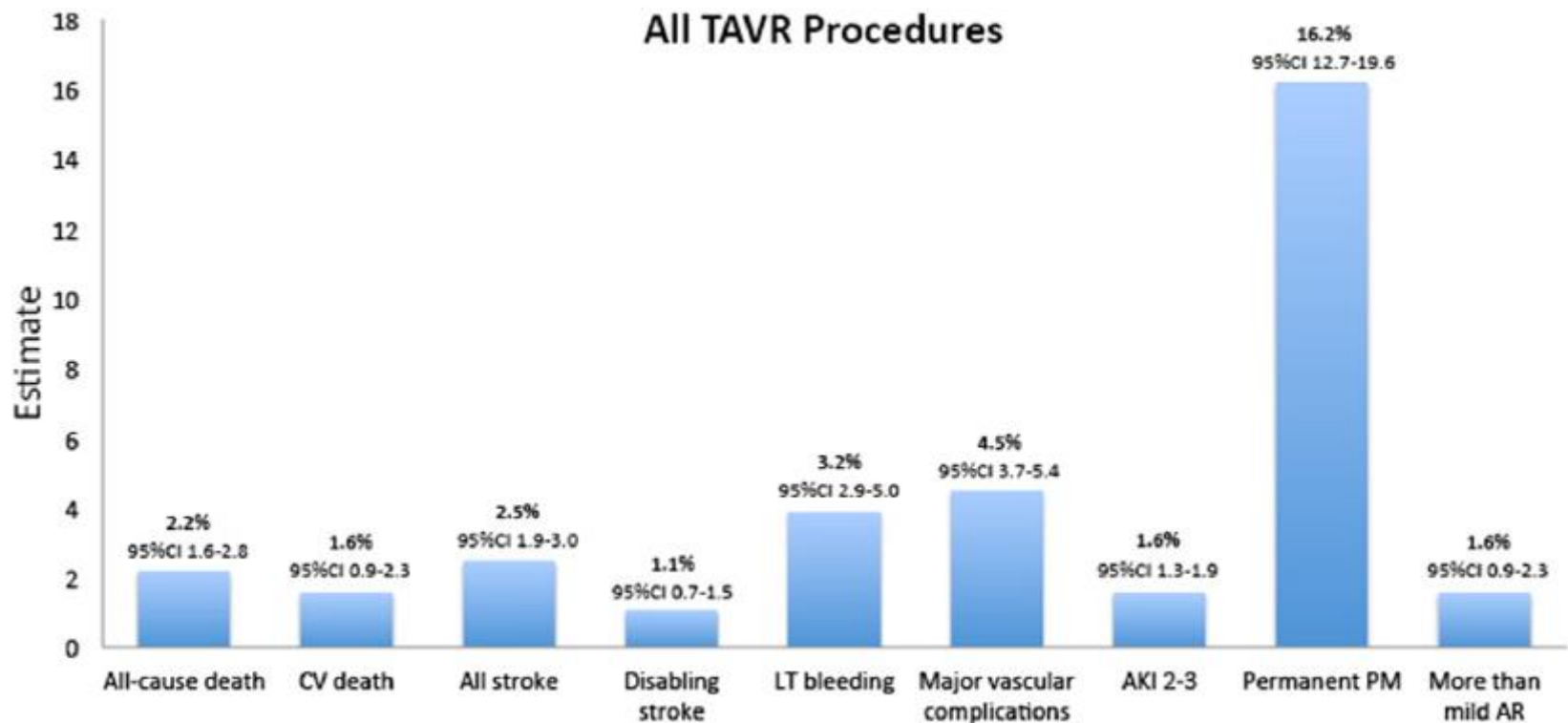
Heart 2014;100:722–730.

PM after Heart transplant, Surgical myectomy, and Alcohol septal ablation

- PM after Heart transplant
 - Biatrial anastomoses: 10~14% → Bicaval heart anastomoses: 2~4%
 - SND (~80%): careful evaluation for the presence of symptoms
- PM after surgical myectomy or alcohol septal ablation
 - 10% after alcohol septal ablation
 - 4.4% after surgical myectomy
 - 60% develop RBBB after alcohol septal ablation
 - 90% develop LBBB after surgical myectomy

Pacemaker after TAVR

- High grade AV block: 60~96% within 24 hours of TAVR, up to 30% \geq 48 hours after TAVR
- PM after Second-generation TAVR: 16.2% (12.7~19.6%)



PM after TAVR

- Conduction disturbances after TAVR
 - New LBBB occurs in 19-55%
 - New high-degree AV block in 10%
 - Up to half of new BBB and CAVB resolve before discharge
 - Only half of patients with a new PM after TAVR will be pacer dependent
- Predictors for PM
 - Baseline RBBB
 - Implantation of CoreValve (self-expandable) > SAPIEN 3 (balloon-expandable)
 - Depth of implantation
 - Oversizing/stretching of the aortic annulus/LVOT
 - 1st-degree AV block
- Timing of PM: 3-5days after TAVR?

Summary

- Bradycardia is common after cardiac surgery and often requires permanent pacemaker.
- Although some of the new-onset SND or AV block after cardiac surgery recover in the long term, it is important to implant a pacemaker at an appropriate timing for the patient recovery and shorter hospital stay.
- It is reasonable to implant PM 3-7 days after cardiac surgery in patients with bradycardia according to the individual situations.
 - Type of cardiac surgery or intervention
 - SND vs. AV block
 - Concomitant drug use

Thank You

Indications, Effectiveness, and Long-Term Dependency in Permanent Pacing After Cardiac Surgery

- 120 patients with PM implantation after cardiac surgery
- Dependency status evaluation
 - From charts and PM clinic records
 - Dependency: more than 1 occasion of continuous pacing when the pacing rate was ≤ 50 or of tracking when AV delay was ≥ 220
 - 51 dependent, 35 nondependent, 34 indeterminate
- Dependency status confirmation
 - 20 patients were monitored continuously
 - 7 dependent \rightarrow 7 dependent confirmed
 - 7 nondependent \rightarrow 5 nondependent, 1 dependent, 1 N/A
 - 6 indeterminate \rightarrow 3 dependent, 3 nondependent
 - 8 out of 19 ($\geq 40\%$) patients eventually became totally nondependent
- Complete AV block as the indication for pacing was the strongest predictor of future pacemaker dependency