Physiologic Pacing

New Innovations with Improved Outcomes

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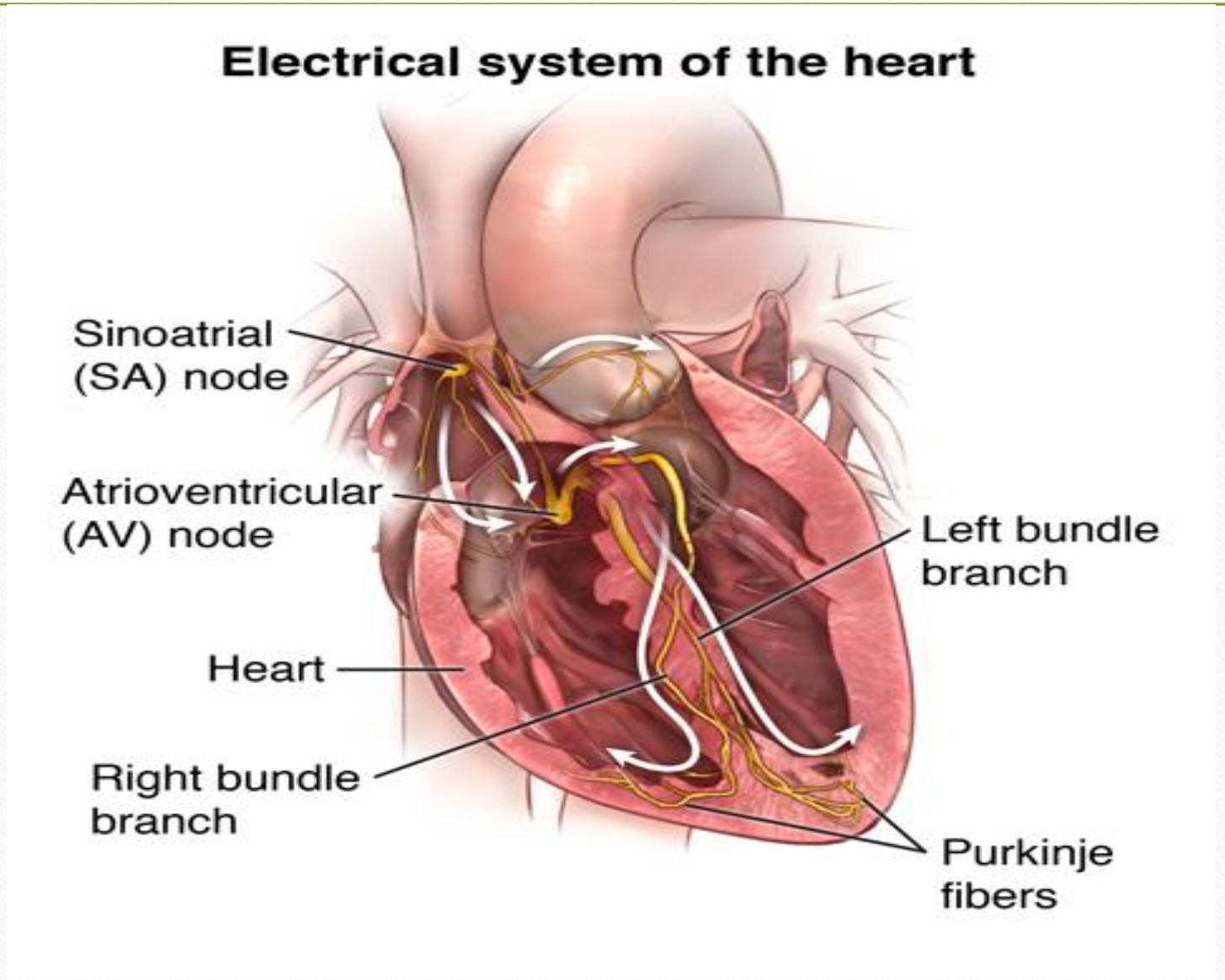
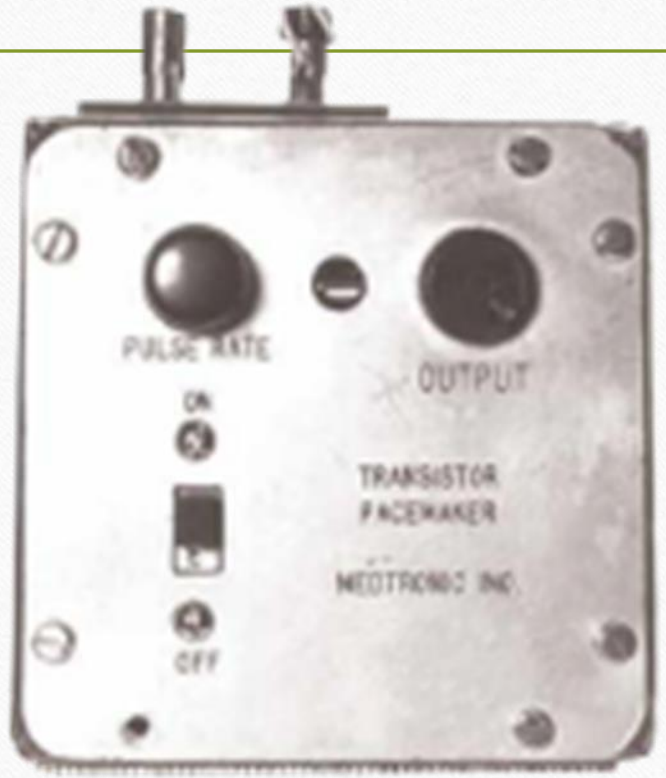

Electrical system of the heart
Sinoatrial (SA) node
Atrioventricular (AV) node
Heart
Right bundle branch
Left bundle branch
Purkinje fibers

History and Evolution of Pacing

- 1958 External pacemaker



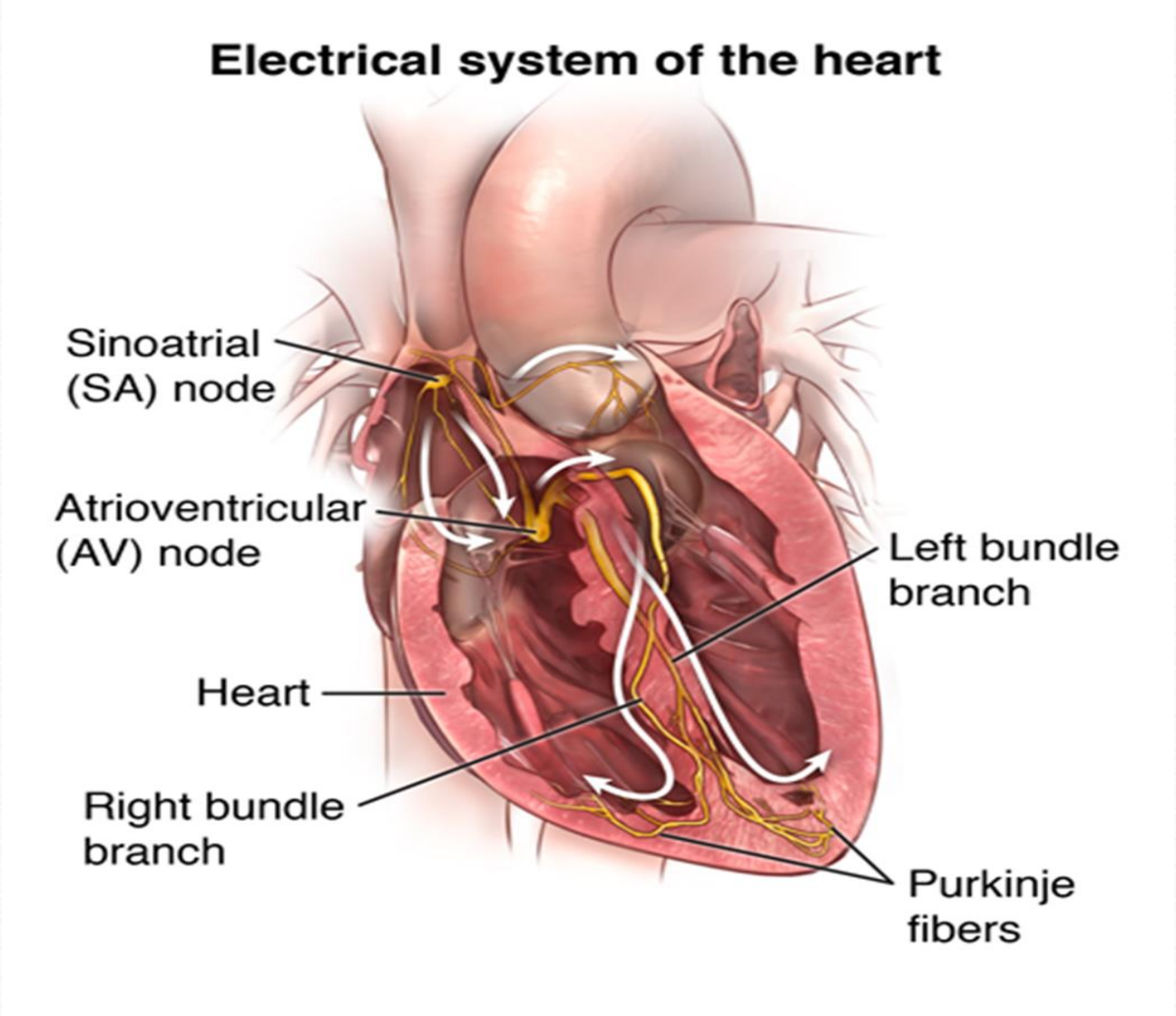
Evolving from MORE pacing to MINIMAL pacing to OPTIMIZED pacing

- 1960 Single chamber pacemaker (RV lead only)
- 1989 Dual chamber pacemaker
- 2016 Leadless pacemaker
- 2020 AV Leadless pacemaker

- 2024 Optimized placement of ventricular and atrial leads

Class I
Indications for Dual Chamber Pacemaker

- Symptomatic bradycardia
- Sinus node dysfunction with pauses, symptoms and chronotropic incompetence
- AV block (third degree and advanced second degree)
- Carotid sinus hypersensitivity with syncope
- Post cardiac transplant for symptomatic bradycardia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Why Move Beyond Right Ventricular Pacing?

Drawbacks of RV Pacing

Right ventricular pacing causes abnormal ventricular activation leading to dyssynchrony and increased heart failure risk.

Clinical Consequences

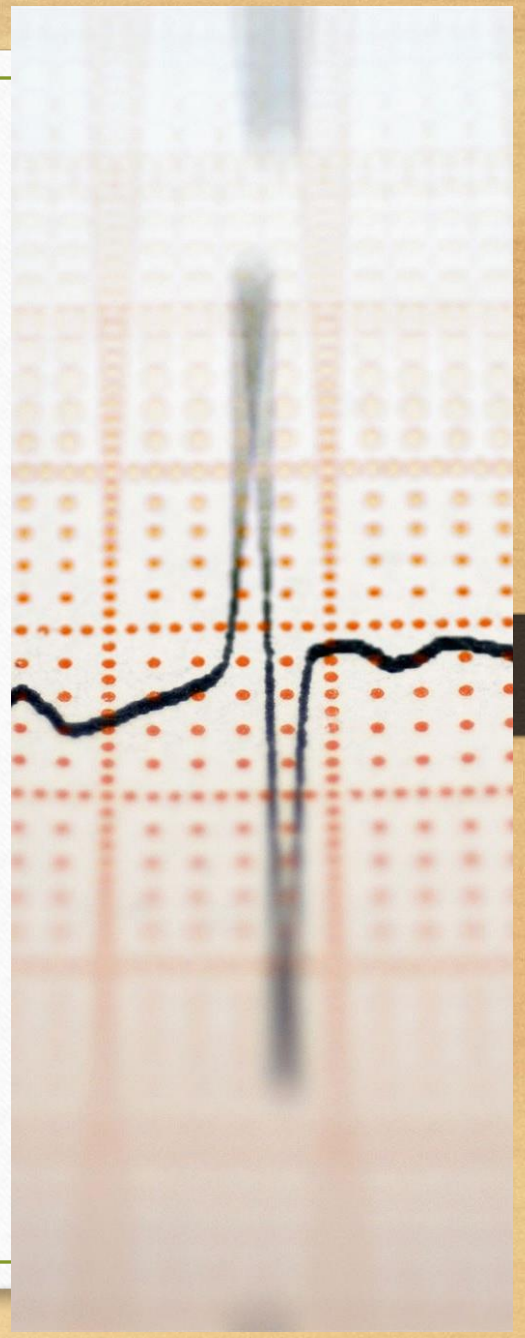
High RV pacing burden increases hospitalization rates for heart failure and atrial fibrillation, worsening cardiac performance.

Benefits of Physiologic Pacing

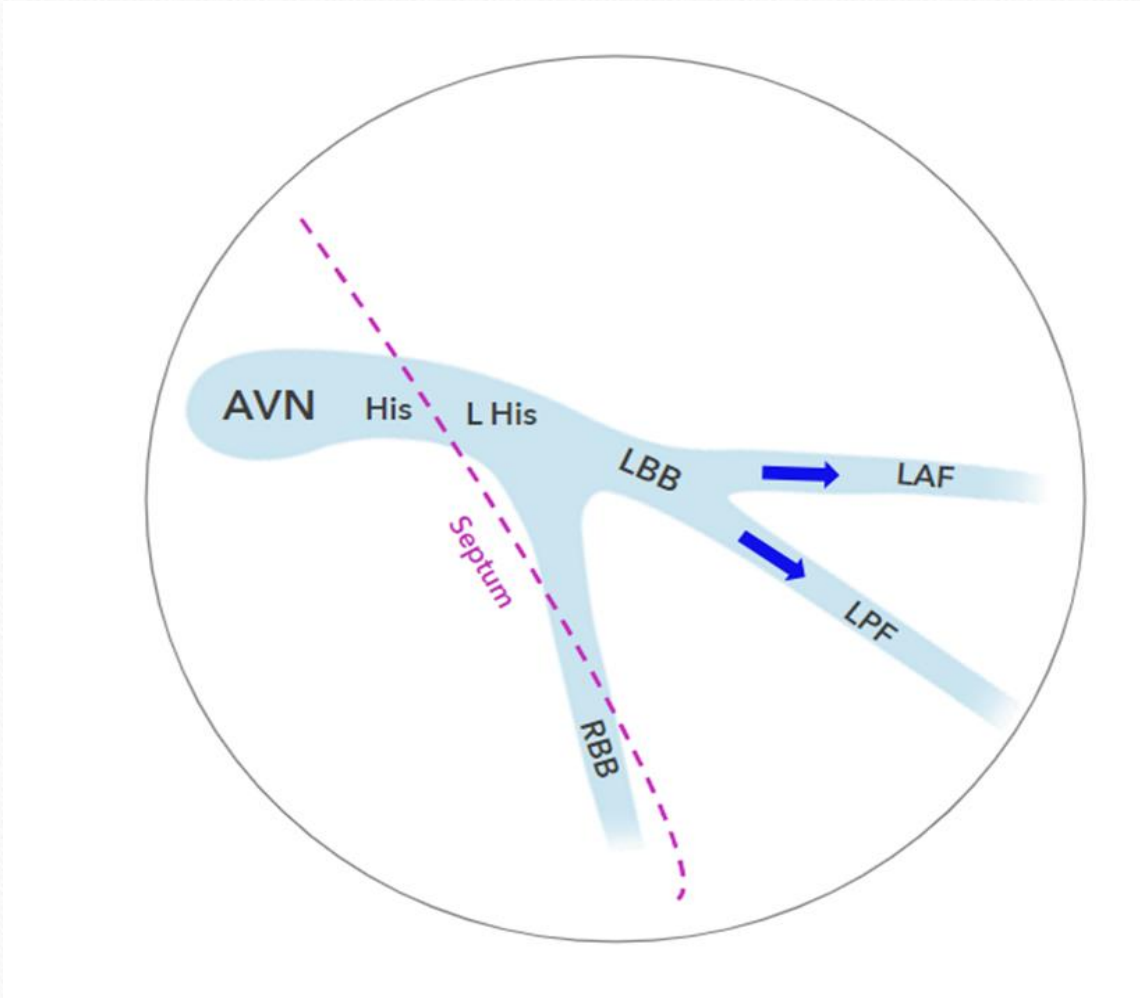
Physiologic HIS or Left bundle pacing improves outcomes by maintaining natural ventricular activation and reducing adverse cardiac events.

Guideline Recommendations

Current guidelines advise physiologic pacing for patients requiring extensive ventricular pacing to preserve heart function.



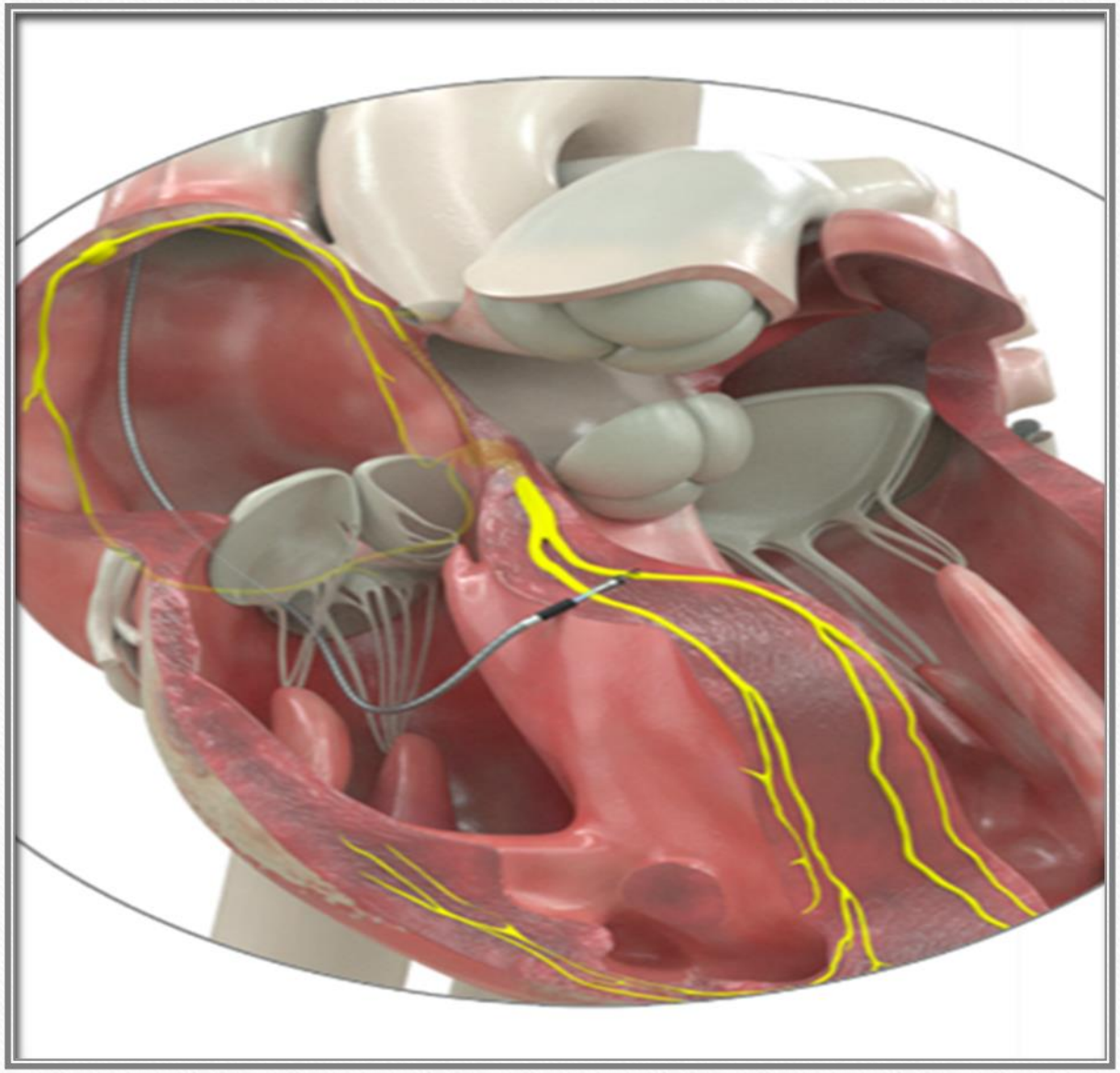
Left Bundle Branch Area Pacing



Optimized Pacing

Left Bundle Branch Area Pacing

(LBBAP)



Evidence Supporting Physiologic Pacing

Clinical Trial Evidence

BLOCK-HF trial showed biventricular pacing reduces heart failure events compared to RV pacing.

Improved Cardiac Function

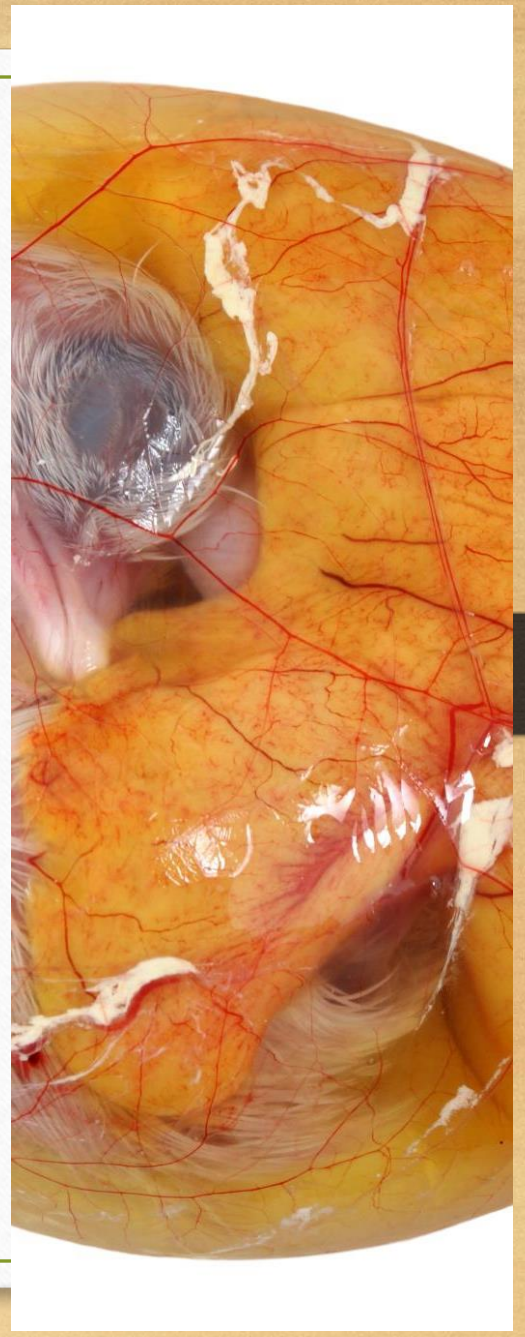
His-SYNC and HOPE-HF studies confirmed His-bundle pacing improves left ventricular ejection fraction and reduces dyssynchrony.

LBBAP Advantages

LBBAP registries show stable pacing thresholds, high success, and outcomes comparable to CRT.

Guideline Recommendations

Major societies recommend conduction system pacing to prevent pacing-induced cardiomyopathy in high-risk patients.



Patient Selection

Identifying Candidates for Referral

Referral Criteria Overview

Primary care and general cardiologists can identify patients with AV block needing high ventricular pacing for referral to advanced therapies.

Heart Failure and Pacing

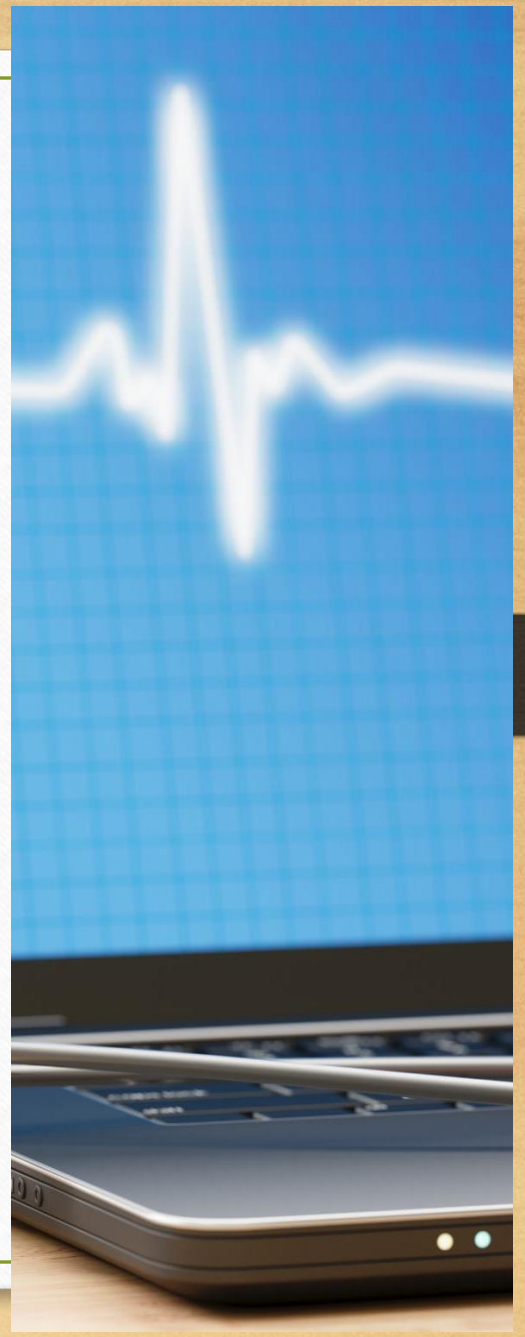
Patients with heart failure or reduced ejection fraction should be considered for physiologic pacing to improve outcomes.

Young Patients and Long-term Care

Young patients facing long-term pacing risk cardiomyopathy and benefit from conduction system pacing strategies.

Monitoring Post-Pacemaker Symptoms

Primary care providers and cardiologists should monitor for heart failure symptoms due to RV pacing-induced dyssynchrony and refer promptly.

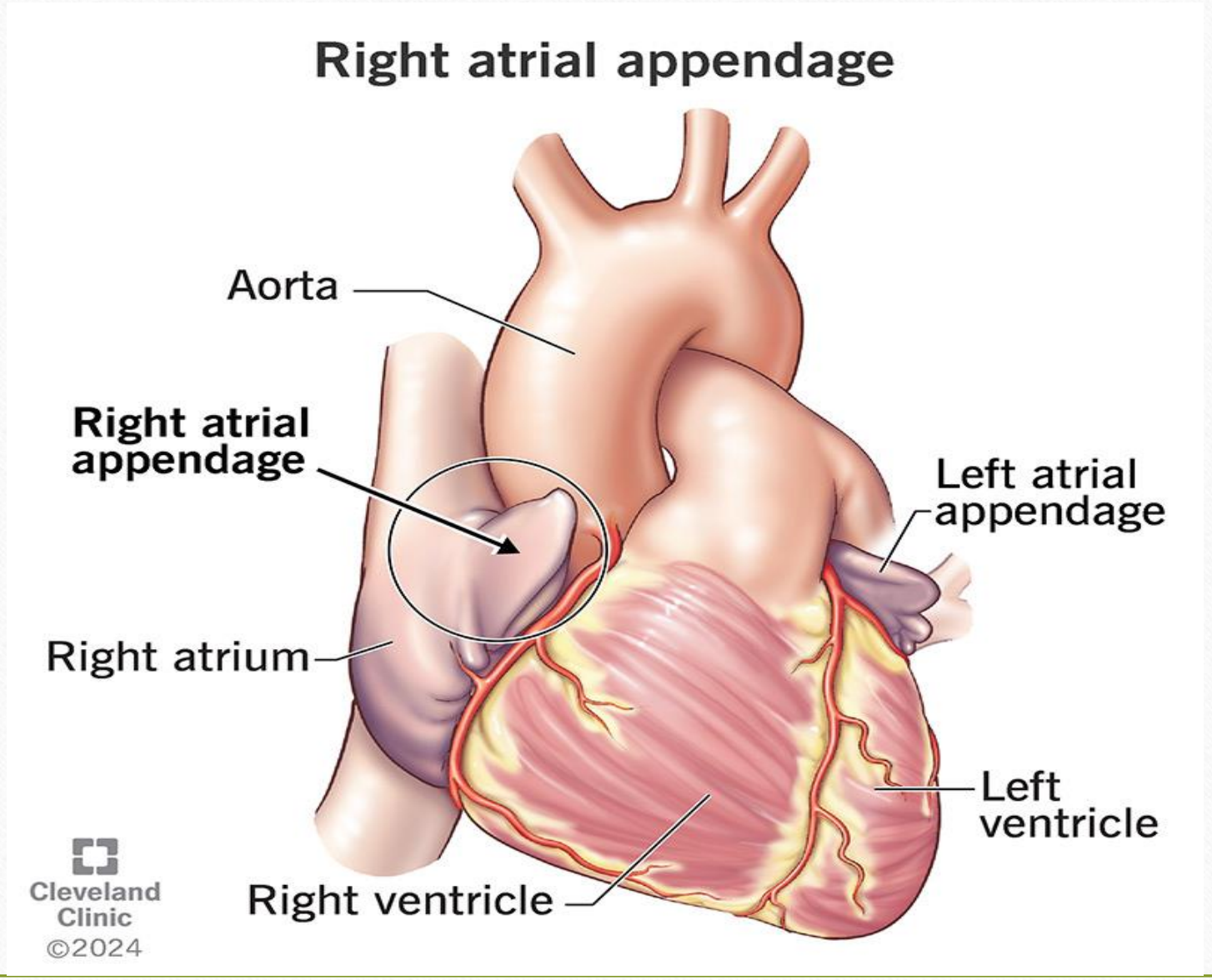


More Data Anticipated

- Left vs Left Trial (LvL): International trial comparing LBBAP versus Biventricular pacing for heart failure patients requiring cardiac resynchronization therapy (CRT). Began in 2024—completion 2029. Endpoints mortality and heart failure hopsitalization

- Protect HF: Physiologic versus RV Pacing outcome trial for bradycardia treatment. British randomized trial for RV versus physiologic pacing for all bradycardia indications. Enrolling 2600 patients. Began enrollment 2024—completion 2029. Endpoints mortality and heart failure morbidity

Anything New with the Atrial Lead?


Right atrial appendage
Aorta
Right atrial appendage
Left atrial appendage
Right atrium
Left ventricle
Right ventricle
Cleveland Clinic
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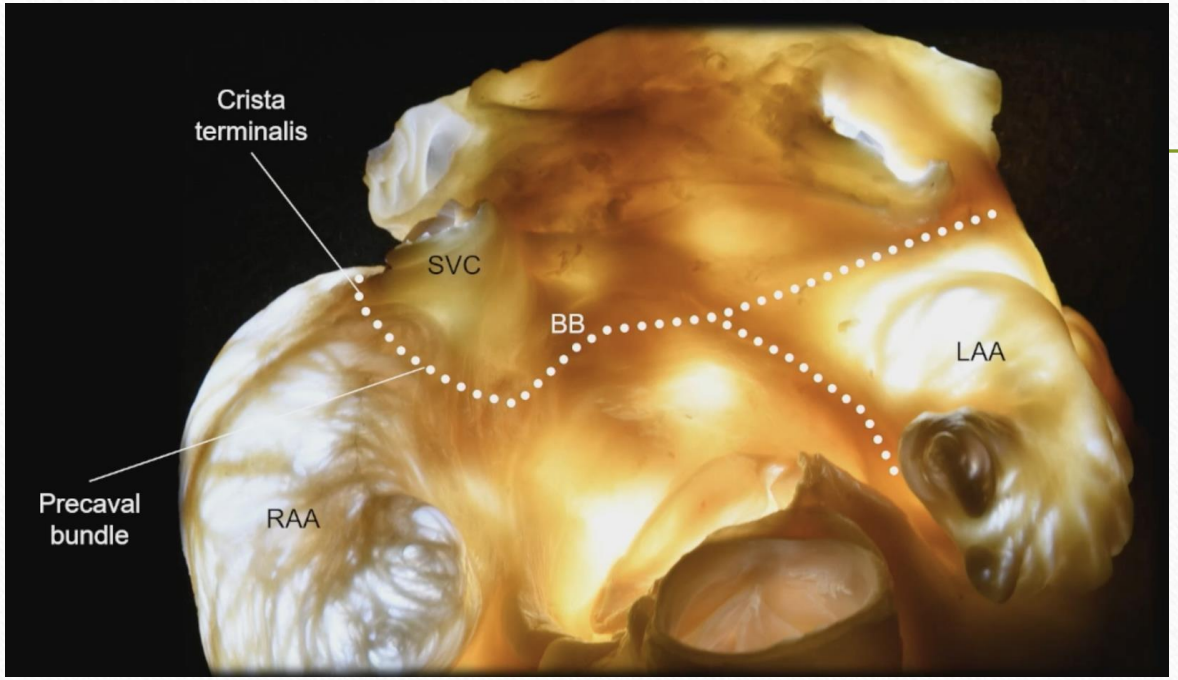
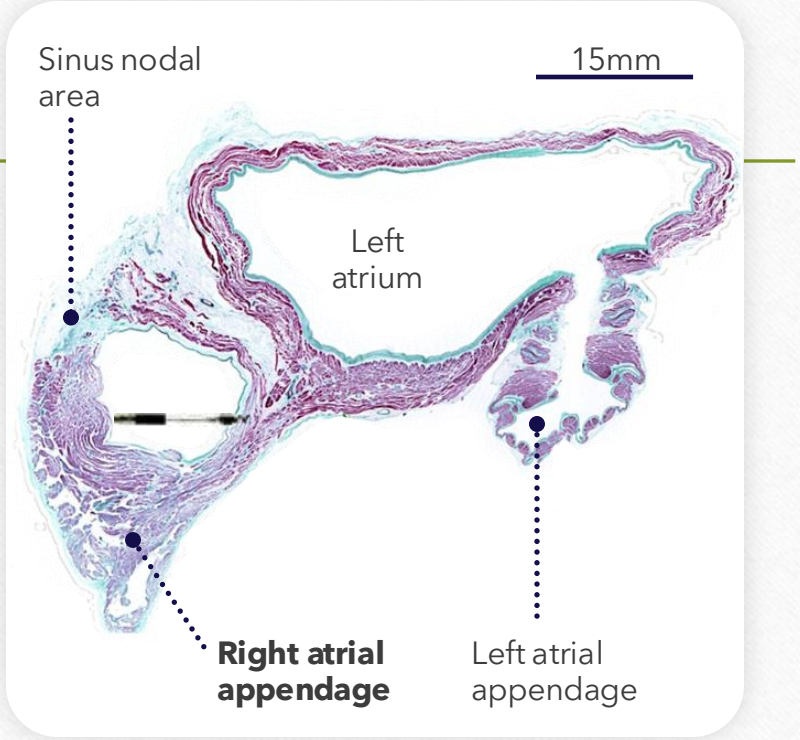
Negative affects of right atrial appendage pacing

- Increased LV volumes with high RA appendage pacing
- Delayed AV with RA appendage pacing times may increase mitral regurgitation
- Increased risk of heart failure readmissions due to diastolic filling problems (diastolic heart failure)
- Right atrial appendage is only 0.39mm thickness compared to interatrial septum >3mm thick


Bachmann's bundle
Sinoatrial node
Atrioventricular node
His bundle
Left posterior bundle
Purkinje fibers
Right bundle

Bachman's Bundle





Bachman Bundle Studies abound

Accelerated Bachmann bundle area pacing for atrial resynchronization in patients with non-obstructive hypertrophic cardiomyopathy and heart failure with preserved ejection fraction: (A randomized crossover trial**FOCUS ISSUE: BACHMANN'S BUNDLE**Volume 22, Issue 11P2757-2765November 2025 HeartRhythm)—reduce HFPEF

International Bachman Bundle interest… More to come

- **Prospective Cohort Study of Bachmann Bundle Versus Right Atrial Appendage Pacing: Impact on Atrial Cardiomyopathy Evaluated by Echocardiographic Parameters and Clinical Outcome (BRAVE)**
- **ClinicalTrials.gov ID** NCT07360067
- **Sponsor** Samsung Medical Center
- **Information provided by** Samsung Medical Center (Responsible Party)

Cardiac Resynchronization Therapy (CRT)

Principle of CRT

CRT uses biventricular pacing to restore coordinated contraction in patients with electrical dyssynchrony and heart failure.

Indications for CRT

Indicated for symptomatic heart failure, low ejection fraction, and wide QRS complex, especially LBBB morphology ≥150 ms.

Clinical Benefits

CRT reduces mortality and hospitalizations while improving quality of life in heart failure patients with dyssynchrony.

Role in Treatment

CRT remains essential alongside newer pacing techniques for patients with advanced dyssynchrony and structural heart disease.


PPS2025
ON-DEMAND
9th Annual International
Physiology of Pacing Symposium


HRX
HRX LIVE 2026
September 18-20
Atlanta, GA
Registration Open

Technology Abounds

More to come…

Keep your right amygdala alive!

Curiosity reigns


9.00