

Cardiac pacing therapy of ESC

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Pathophysiology and classification

- ▶ Bradyarrhythmias requiring cardiac pacing can be caused by a variety of aetiologies and the early identification of a potentially reversible cause is the first step towards treatment.
 - ▶ The main physiological effect of bradycardia is lower cardiac output.
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Table 3 – Causes of bradycardia.

INTRINSIC

Idiopathic (ageing) degeneration

Ischaemic heart disease

Infiltrative diseases: sarcoidosis, amyloidosis, haemochromatosis

Collagen vascular diseases: systemic lupus erythematosus, rheumatoid arthritis, scleroderma

Congenital diseases, including sinus node and AV node disease

Infective diseases: myocarditis, endocarditis, Chagas disease, diphtheria, Gram-negative sepsis, typhoid fever, Lyme disease

Rare genetic diseases: associated with a cardiomyopathy (laminopathies, myotonic dystrophy, desminopathies, mitochondrial disorders, Danon disease, Anderson-Fabry disease, PRKAG2 mutation) or not (primary conduction defect)

Surgical trauma: valve replacement (including percutaneous aortic replacement), heart transplantation

Intended or unintended AV block due to catheter ablation procedures

EXTRINSIC

Physical training (sports)

Vagal reflex: vasovagal, situational (micturition, defecation, swallow, gastrointestinal stimulation, cough, post-prandial, etc), carotid sinus syndrome

Idiopathic paroxysmal AV block

Drug effects

Cocaine abuse and other recreational drugs

Electrolyte imbalance: hypokalaemia, hyperkalaemia

Metabolic disorders: hypothyroidism, hypothermia, anorexia nervosa

Neurological disorders: increased intracranial pressure, central nervous system tumours

Obstructive sleep apnoea

AV = atrioventricular.

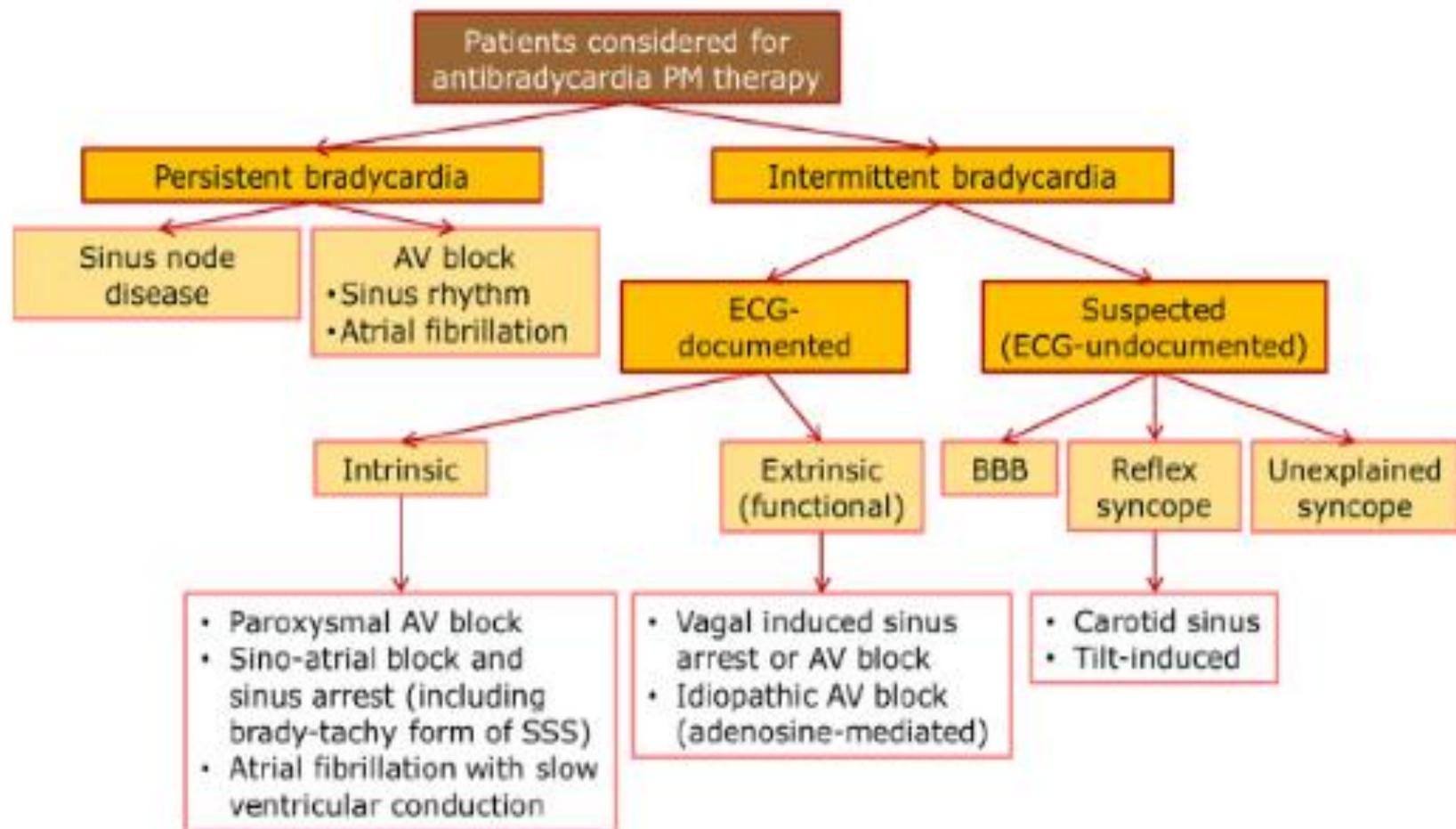


Fig. 2 – Classification of bradyarrhythmias based on the patient's clinical presentation.

Diagnosis

Table 4 – Typical symptoms of bradycardia (SB and AV block).

Persistent bradycardia	Intermittent bradycardia
Due to cerebral hypoperfusion	
<ul style="list-style-type: none">● Easy fatiguability● Irritability, lassitude, inability to concentrate● Apathy, forgetfulness, cognitive impairment● Dizziness, vertigo	<ul style="list-style-type: none">● Syncope, pre-syncope● Dizziness, vertigo● Light-headedness, blurred vision
Due to other mechanisms	
<ul style="list-style-type: none">● Shortness of breath, heart failure● Reduced exercise capacity (chronotropic incompetence)	<ul style="list-style-type: none">● Sudden dyspnoea and chest pain unrelated to exercise● Palpitation (irregular beats)

AV = atrioventricular; SB = sinus bradycardia.

Diagnosis

Table 5 – Diagnosing bradyarrhythmic syncope after the initial evaluation: most useful tests.

Prolonged electrocardiogram
monitoring strategy

Provocative (laboratory)
test strategy

Holter
External loop recorder
Remote at-home telemetry
Implantable loop recorder

Carotid sinus massage
Tilt table test
Electrophysiological study
Exercise test

Diagnosis

- ▶ Made from a standard ECG when persistent, and from a standard ECG or Holter ECG when intermittent.

Indications for pacing

- ▶ When a transient or reversible cause is excluded, the indication for cardiac pacing is determined by the severity of bradycardia, rather than its aetiology. **The clinical presentation** is more useful for selecting patients for permanent cardiac pacing therapy

Indication for pacing in patients with persistent bradycardia

Recommendations	Class ^a	Level ^b	Ref. ^c
1) Sinus node disease. Pacing is indicated when symptoms can clearly be attributed to bradycardia.	I	B	1, 6–9
2) Sinus node disease. Pacing may be indicated when symptoms are likely to be due to bradycardia, even if the evidence is not conclusive.	IIb	C	-
3) Sinus node disease. Pacing is not indicated in patients with SB which is asymptomatic or due to reversible causes.	III	C	-
4) Acquired AV block. Pacing is indicated in patients with third- or second-degree type 2 AV block irrespective of symptoms.	I	C	-
5) Acquired AV block. Pacing should be considered in patients with second-degree type 1 AV block which causes symptoms or is found to be located at intra- or infra-His levels at EPS.	IIa	C	-
6) Acquired AV block. Pacing is not indicated in patients with AV block which is due to reversible causes.	III	C	-

Indication for pacing in intermittent documented bradycardia

Recommendations	Class ^a	Level ^b	Ref. ^c
<p>1) Sinus node disease (including brady-tachy form). Pacing is indicated in patients affected by sinus node disease who have the documentation of symptomatic bradycardia due to sinus arrest or sinus-atrial block.</p>	I	B	1, 6-9
<p>2) Intermittent/paroxysmal AV block (including AF with slow ventricular conduction). Pacing is indicated in patients with intermittent/paroxysmal intrinsic third- or second-degree AV block.</p>	I	C	-
<p>3) Reflex asystolic syncope. Pacing should be considered in patients ≥ 40 years with recurrent, unpredictable reflex syncope and documented symptomatic pause/s due to sinus arrest or AV block or the combination of the two.</p>	IIa	B	5, 18, 19

<p>4) Asymptomatic pauses (sinus arrest or AV block). Pacing should be considered in patients with history of syncope and documentation of asymptomatic pauses >6 s due to sinus arrest, sinus-atrial block or AV block.</p>	IIa	C	-
<p>5) Pacing is not indicated in reversible causes of bradycardia.</p>	III	C	-

Indication for pacing for first-degree atrioventricular block

Recommendations	Class ^a	Level ^b
Permanent pacemaker implantation should be considered for patients with persistent symptoms similar to those of pacemaker syndrome and attributable to first-degree atrioventricular block (PR >0.3 s).	IIa	C

Indications for pacing therapy in paediatric patients and congenital heart disease

Recommendations	Class ^a	Level ^b	Ref. ^c
1) Congenital AV block. Pacing is indicated in high degree and complete AV block in symptomatic patients and in asymptomatic patients with any of the following risk conditions: ventricular dysfunction, prolonged QTc interval, complex ventricular ectopy, wide QRS escape rhythm, ventricular rate <50 b.p.m., ventricular pauses >three-fold the cycle length of the underlying rhythm.	I	C	-
2) Congenital AV block. Pacing may be considered in asymptomatic patients with high degree and complete AV block in absence of the above risk conditions.	IIb	C	-
3) Postoperative AV block in congenital heart disease. Permanent pacing is indicated for postoperative advanced second degree or complete AV block persisting >10 days.	I	B	137–141

4) Postoperative AV block in congenital heart disease. Permanent pacing should be considered for persistent, asymptomatic post-surgical bifascicular block (with or without PR prolongation) associated with transient, complete AV block.

5) Sinus node disease. Permanent pacing is indicated for symptomatic sinus node disease, including brady-tachy syndrome, when a correlation between symptoms and bradycardia is judged to be established.

6) Sinus node disease. Permanent pacing may be useful for asymptomatic resting heart rate <40 b.p.m. or ventricular pauses lasting >3 sec.

IIa	C	-
I	C	-
IIb	C	-

Summary

- ▶ Permanent pacing has become a standard part of the therapeutic armamentarium in the care of rhythm disturbances in pediatric and congenital heart disease (CHD) patients. Great care must be taken to evaluate the specific need for and expected benefit from pacemaker implantation. This requires an awareness of the potential complications of pacing as well an understanding of the available pacing hardware and features.
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