Sleep-Related Cardiac Arrhythmias

Good evening.

Today we will explore **sleep-related cardiac arrhythmias** — abnormal heart rhythms that occur or are influenced by sleep.

This topic is critical because sleep is not only a neurological state — it is also a period of major cardiovascular regulation.

Definition

Cardiac arrhythmia

Sleep-related cardiac arrhythmias refer to:

Abnormal heart rhythms occurring during sleep

Changes in heart rate or rhythm linked to sleep stages or sleep disorders

These may be:

- Benign and physiological
- Or clinically significant and dangerous

Normal Cardiac Changes During Sleep

During normal sleep:

- Heart rate slows
- Blood pressure decreases
- Parasympathetic (vagal) tone increases

This is most prominent in:

NREM sleep.

During:

Rapid Eye Movement Sleep

- Heart rate becomes variable
- Sympathetic activity increases
- Irregularity is more common

Types of Arrhythmias Seen During Sleep

1. Bradyarrhythmias

- Sinus bradycardia
- Sinus pauses
- AV block

These are often:

- Normal during deep sleep
- Due to increased vagal tone

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2. Tachyarrhythmias

- Atrial fibrillation
- Supraventricular tachycardia
- Ventricular arrhythmias

These may be triggered by:

- Sympathetic surges
- Hypoxia
- Arousals

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3. Ectopic Beats

- Premature atrial contractions (PACs)
- Premature ventricular contractions (PVCs)

Common and often benign unless frequent.

Sleep Stages and Arrhythmia Risk

NREM Sleep

- Dominated by parasympathetic activity
- Bradycardia more common
- Stable rhythm

REM Sleep

- Autonomic instability
- Sudden sympathetic bursts
- Increased risk of tachyarrhythmias

Role of Autonomic Nervous System

The balance between:

- Sympathetic (fight-or-flight)
- Parasympathetic (rest-and-digest)

shifts throughout sleep.

Arrhythmias often occur when this balance becomes unstable.

Sleep Apnea and Arrhythmias (High Yield)

Obstructive Sleep Apnea

This is the most important clinical association.

During apnea events:

- Oxygen drops
- CO_2 rises
- Intrathoracic pressure changes
- Sympathetic activity surges

This leads to:

- Bradycardia during apnea
- Tachycardia upon arousal

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Common Arrhythmias in OSA

- Atrial fibrillation
- Sinus pauses
- Ventricular ectopy

OSA is a major risk factor for recurrent arrhythmias.

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Mechanisms Linking Sleep and Arrhythmias

Key mechanisms include:

- Hypoxia
- Hypercapnia
- Autonomic fluctuations
- Mechanical stress on the heart
- Inflammation

These factors create electrical instability in cardiac tissue.

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Clinical Presentation

Patients may report:

- Palpitations at night
- Sudden awakenings
- Shortness of breath
- Chest discomfort

Some arrhythmias are asymptomatic and detected only during monitoring.

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Sudden Cardiac Events During Sleep

Certain arrhythmias can lead to:

- Sudden cardiac arrest
- Nocturnal death

Risk increases in patients with:

- Structural heart disease
- Severe sleep apnea

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Diagnosis

Evaluation includes:

Polysomnography (PSG)

- Identifies sleep stage and events
- Correlates arrhythmias with sleep phases

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ECG Monitoring

- Continuous rhythm monitoring
- Detection of arrhythmias

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Holter Monitor

- 24–48 hour cardiac monitoring
- Captures nocturnal events

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When to Be Concerned

Red flags:

- Frequent pauses (>3 seconds)
- Sustained tachyarrhythmias
- Symptoms (syncope, chest pain)
- Associated hypoxemia

These require further evaluation.

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Treatment

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Treat Underlying Sleep Disorders

For OSA:

- CPAP therapy is first-line
- Continuous Positive Airway Pressure

This reduces:

- Hypoxia
- Sympathetic surges
- Arrhythmia burden

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Cardiac Management

- Antiarrhythmic medications
- Pacemaker (for severe bradycardia)
- Ablation (for certain tachyarrhythmias)

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Lifestyle Modifications

- Weight management
- Reduce alcohol intake
- Improve sleep quality

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Prognosis

Benign arrhythmias:

- Common and often harmless

Pathologic arrhythmias:

- Require treatment
- May increase cardiovascular risk

Proper management of sleep disorders significantly improves outcomes.

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Key Exam Concepts

- Bradycardia during sleep can be normal
- REM sleep increases arrhythmia variability
- OSA is strongly linked to atrial fibrillation
- CPAP reduces arrhythmia risk

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Summary

Sleep-related cardiac arrhythmias arise from:

- Changes in autonomic balance
- Oxygen fluctuations
- Sleep stage transitions

They range from:

Benign physiological changes

to

Serious cardiac conditions

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Final Message

Sleep is a dynamic state affecting the heart profoundly.

Understanding the interaction between sleep and cardiac rhythm is essential for:

- Accurate diagnosis
- Effective treatment
- Prevention of serious complications

Sleep and cardiovascular health are deeply connected.

Recognizing this connection saves lives.