



# SLEEP APNEA & ARRHYTHMIAS

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## AGENDA

- Introduction
- Sleep Apnea and Arrhythmias
- Clinical Implications

SLEEP APNEA AND ARRHYTHMIAS

## INTRODUCTION | Sleep-Related Rhythms

Sleep

Arousal

SN Arrhythmia

Bradycardia

Pauses

Low Grade AV Block

SLEEP APNEA AND ARRHYTHMIAS

## INTRODUCTION | Sleep-Related Rhythms

Sleep

Arousal

↑ Heart Rate

↑ Blood Pressure

↑ Cardiac Output

SLEEP APNEA AND ARRHYTHMIAS

## INTRODUCTION | Sleep Apnea

**Types (SDB)**

Epidemiology

**Obstructive Sleep Apnea/  
Hypopnea Syndrome**

**Central Sleep Apnea**

**Obesity Hypoventilation  
Syndrome**

**Cheyne-Stokes Respiration**

**Upper Airway Resistance  
Syndrome**

SLEEP APNEA AND ARRHYTHMIAS

## INTRODUCTION | Sleep Apnea

**Epidemiology**

Types (SDB)

**2-4% in adult population**

**Men Twice as Women**

**82% of affected men  
undiagnosed**

**93% of affected women  
undiagnosed**

**Associated with increased  
risk of CV morbidity**

SLEEP APNEA AND ARRHYTHMIAS

## OSA & ARRHYTHMIAS | Limitations

**Disease Related**

Methodology

Arrhythmia Related

Multiple Conditions

Inconsistent Definitions

Tracking Adherence to Treatment

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## OSA & ARRHYTHMIAS | Limitations

Disease Related

**Methodology**

Arrhythmia Related

Non-randomization

Self Reporting of Condition

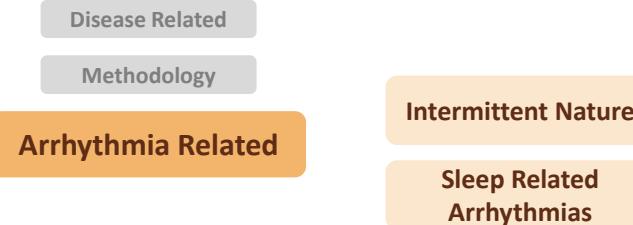
Self Reporting of Treatment

Comorbid Conditions

Short Period of Monitoring

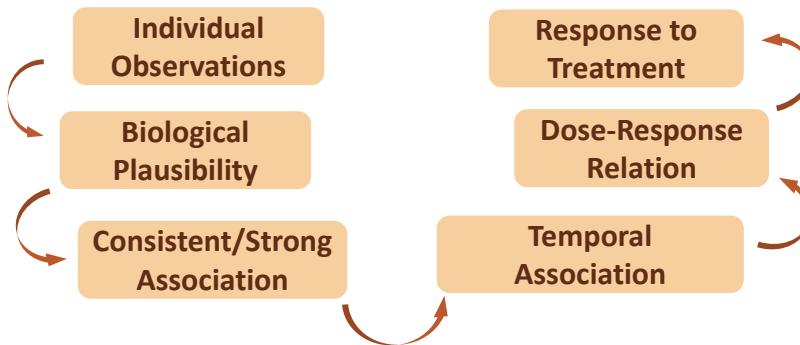
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## OSA & ARRHYTHMIAS | Limitations



SLEEP APNEA AND ARRHYTHMIAS

## OSA & ARRHYTHMIAS | Proving Causation



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## OSA & ARRHYTHMIAS | Observations

### Cardiac Arrhythmia and Conduction Disturbances During Sleep in 400 Patients With Sleep Apnea Syndrome

CHRISTIAN GUILLEMINAULT, MD, STUART J. CONNOLLY, MD, and  
ROGER A. WINKLE, MD

Cardiac Arrhythmia or Conduction Abnormality	Before Tracheostomy		After Tracheostomy	
	Awake	Asleep	Awake	Asleep
Sinus arrest 4 to 13 s	0	15	0	0
Second-degree atrioventricular block				
Mobitz type I	0	5	0	0
Mobitz type II	0	10	0	0
Ventricular tachycardia	0	8	0	0
Atrial flutter	0	2	0	0
Atrial fibrillation	0	8	0	0
Extreme sinus bradycardia	0	2	0	0
Frequent premature ventricular contractions (>2/min)	6	18*	4	4

Guilleminault et al. *Am J Cardiol.* 1983

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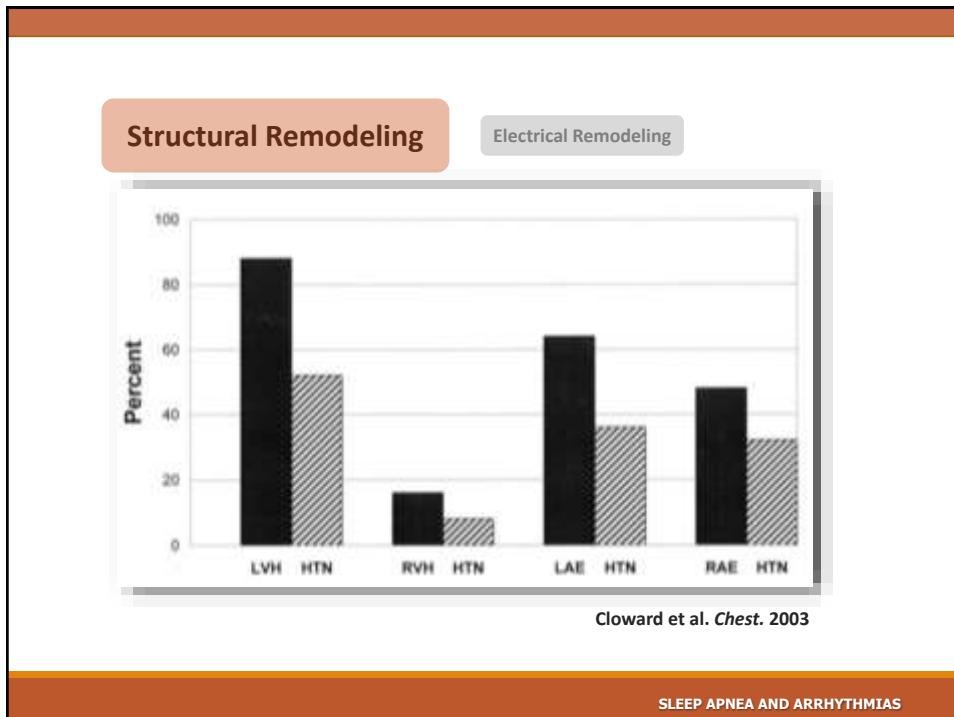
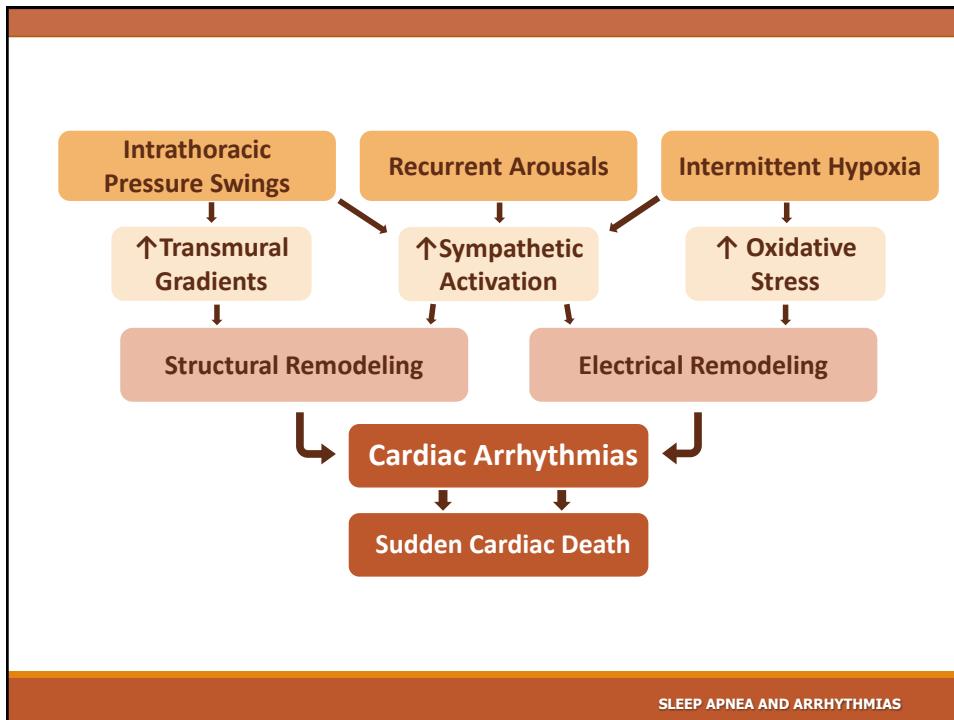
## OSA & ARRHYTHMIAS | Pathophysiology

Intrathoracic Pressure Swings

Recurrent Arousals

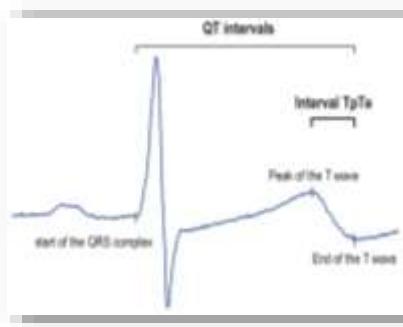
Intermittent Hypoxia

SLEEP APNEA AND ARRHYTHMIAS



## Electrical Remodeling

Structural Remodeling



The figure shows a portion of an ECG tracing. A vertical line marks the start of the QRS complex. The time interval from the start of the QRS to the peak of the T wave is labeled 'QT intervals'. The time interval from the end of the QRS complex to the end of the T wave is labeled 'Interval TpTe'. The peak of the T wave is also labeled 'Peak of the T wave'.

- 41 OSA patients on CPAP
- Divided to;
  - 21 patients stopped CPAP for 2 weeks
  - 20 patients continued therapy
- Measured;
  - QTc and Tp Te intervals
  - Tp Te/QT ratio

Camen et al. Eur J Appl Physiol. 2013

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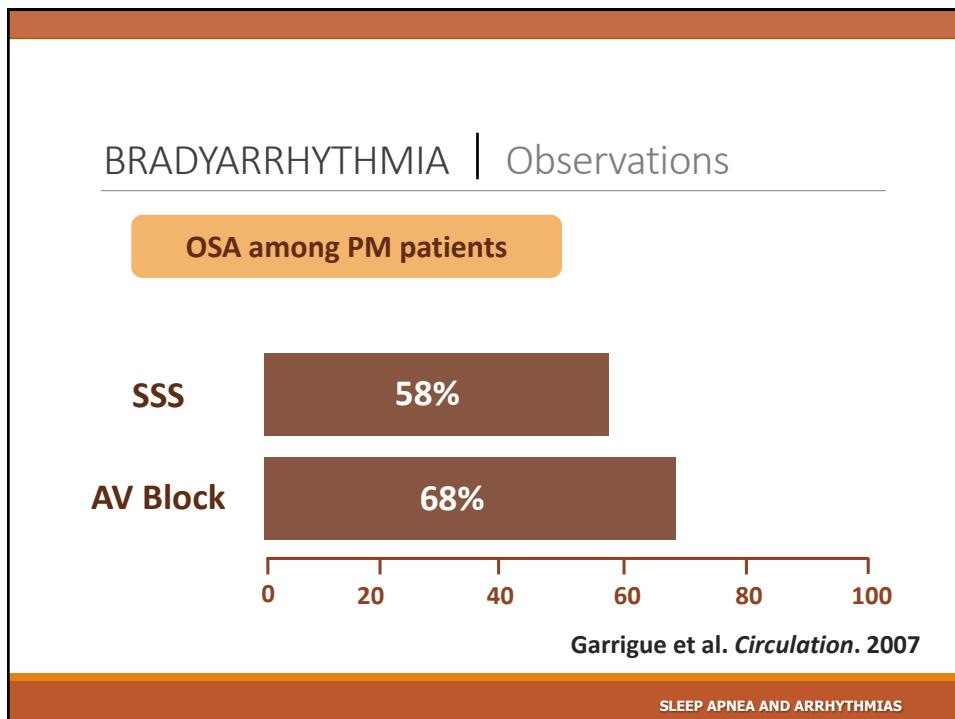
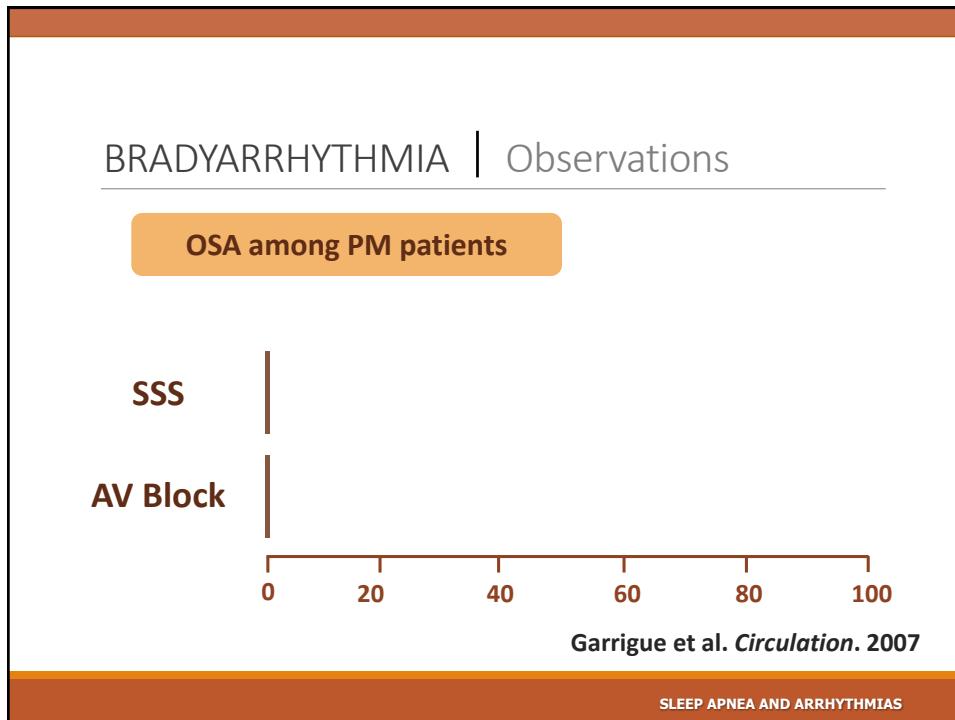
## OSA & ARRHYTHMIAS | Spectrum

**Bradyarrhythmias**

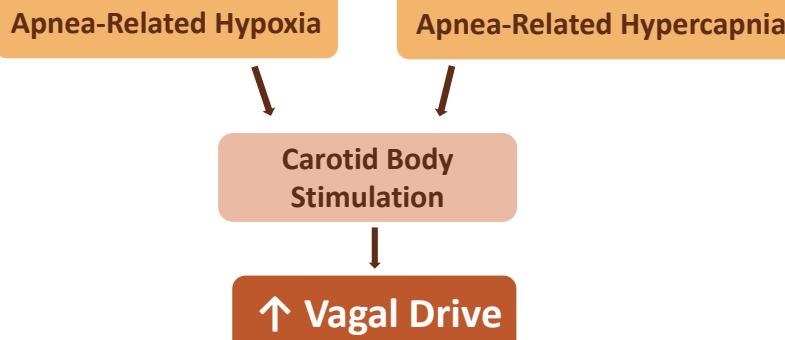
**Atrial Fibrillation**

**Sudden Cardiac Death**

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## BRADYARRHYTHMIA | Mechanisms



SLEEP APNEA AND ARRHYTHMIAS

## BRADYARRHYTHMIA | Association

Ref.	Design	Patients	Diagnostic method	Cardiac monitoring	Results
Bicker et al. <sup>84</sup>	Observational, prospective	128 undiagnosed OSAS	PSG	30-h Holter ECG	Second and third-degree AV blocks more often in 73% of OSAS patients than in controls (1-3° AV block in 47%, increased by CPAP)
Sivaprakash et al. <sup>85</sup>	Observational, prospective	23 moderate-severe OSAS	PSG	Implantable loop recorder	AV blocks in 73% of OSAS patients (1-3° AV block in 47%, increased by CPAP)
Gilmorewick et al. <sup>84</sup> Mohr <sup>86</sup>	Uncontrolled Uncontrolled	400 severe OSAS 13 undiagnosed OSAS	PSG PSG	30-h Holter ECG 30-h Holter ECG	AV blocks in 73% of OSAS patients (1-3° AV block in 47%, increased by CPAP) No significant difference in atrio-pause (1-5 s), AV blocks, intraventricular conduction delay, pauses and tachycardia, significantly different, increased and second degree AV blocks not significantly different and pauses (1-2 s) significantly different, reduced by CPAP
Mohr et al. <sup>81</sup>	Case-control	228 severe OSAS vs. 228 healthy	PSG	12-lead ECG during PSG	No significant difference in atrio-pause (1-5 s), AV blocks, intraventricular conduction delay, pauses and tachycardia, significantly different, increased and second degree AV blocks not significantly different and pauses (1-2 s) significantly different, reduced by CPAP
Ricote et al. <sup>87</sup>	Case-control	96 OSAS vs. 87 healthy	PSG	Holter ECG during PSG	No significant difference in atrio-pause (1-5 s), AV blocks, intraventricular conduction delay, pauses and tachycardia, significantly different, increased and second degree AV blocks not significantly different and pauses (1-2 s) significantly different, reduced by CPAP
Ajor et al. <sup>78</sup>	Nonrandomized, prospective	107 mild, 398 moderate, 783 severe OSAS; 44 healthy (11% CPAP therapy)	PSG	12-lead ECG during PSG	Significant increase in atrio-pause and second-degree AV blocks reduced in 82.5% (1-2 s) significantly different, reduced by CPAP
Hollings et al. <sup>88</sup>	Observational, prospective	45 undiagnosed OSAS	PSG	18-h Holter ECG (before and after 2-3 days of CPAP)	Significant increase in atrio-pause and second-degree AV blocks reduced in 82.5% (1-2 s) significantly different, reduced by CPAP
Kastner et al. <sup>89</sup>	Nonrandomized, prospective	16 OSAS with nocturnal heart block without electrophysiological abnormalities	PSG	30-h Holter ECG before and after CPAP/BIPAP	AV blocks and atrio-pause completely eliminated in 74%, reduced in 33% patients, unchanged in 13%
Bicker et al. <sup>84</sup>	Observational, prospective	17 undiagnosed OSAS patients with heart blocks	PSG	ECG before and after CPAP	Significantly decreased in heart blocks, completely abolished in 70.6%

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## BRADYARRHYTHMIA | Association

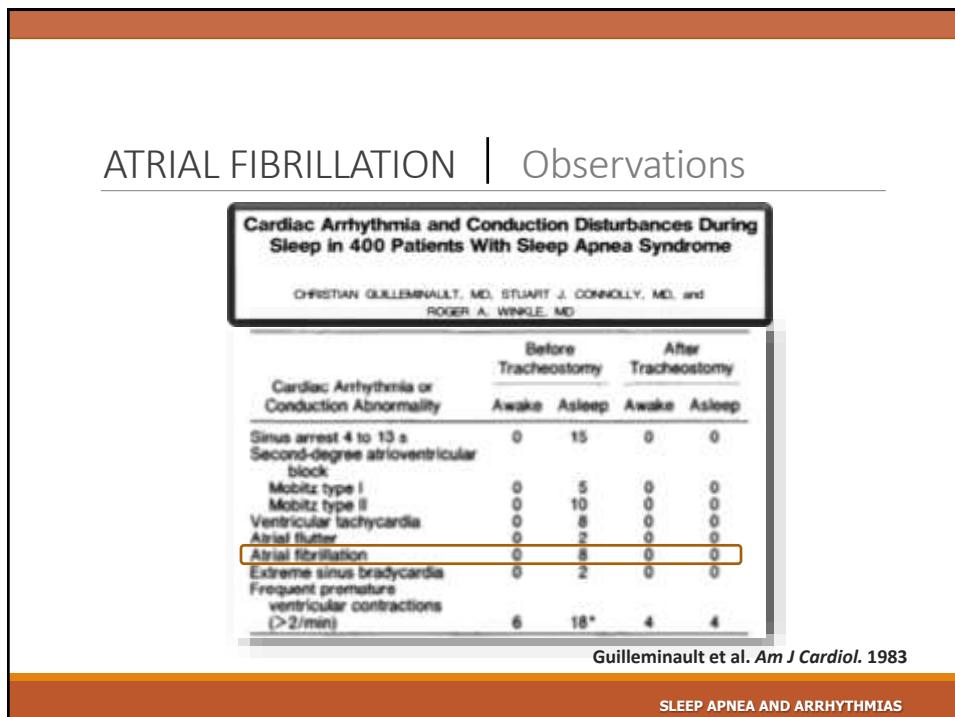
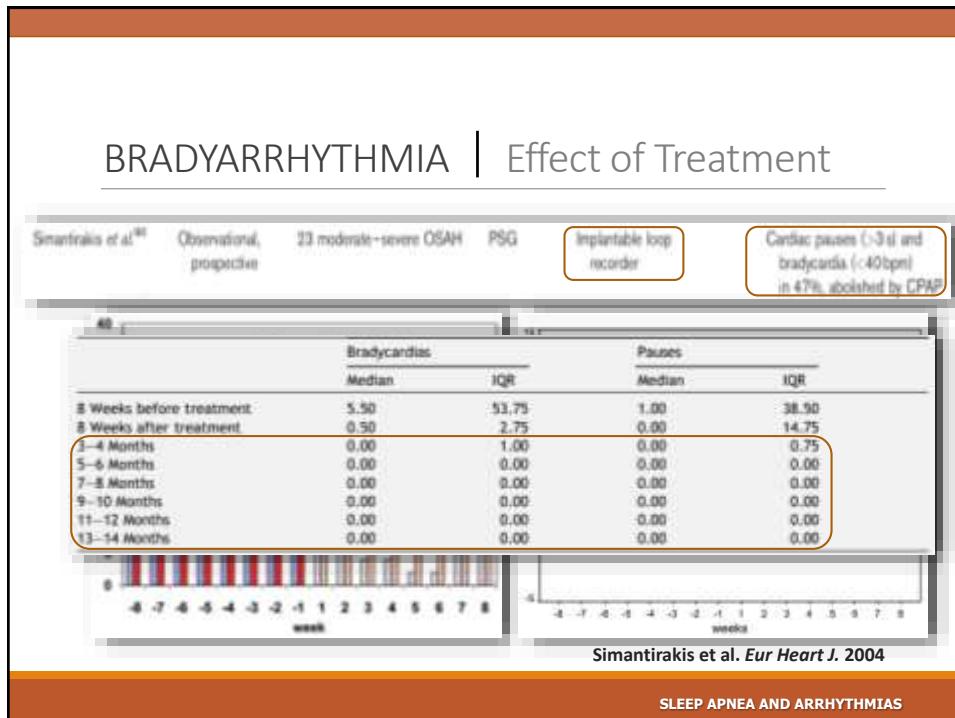
Guilleminault et al. <sup>91</sup>	Uncontrolled	400 severe OSAH	PSG	24-h Holter ECG	Sinus arrest in 10%; AV block in 7%
Mike <sup>92</sup>	Uncontrolled	73 unselected OSAH	PSG	24-h Holter ECG	Sinus bradycardia (<30 bpm) and pauses (>1.8 s) in 9%; first and second-degree AV block in 4%

### SLEEP APNEA AND ARRHYTHMIAS

## BRADYARRHYTHMIA | Effect of Treatment

Harrison et al. <sup>93</sup>	Observational, prospective	45 unselected OSAH	PSG	18 h Holter ECG before and after 2-3 days of CPAP	Sinus pauses and second-degree AV block resolved in 87.5%
Koehler et al. <sup>94</sup>	Nimodermized, prospective	16 OSAH with nocturnal heart block without electrophysiological abnormalities	PSG	24 h Holter ECG before and after CPAP/BPAP	AV blocks and sinus arrest completely eliminated in 56%; reduced in 31% patients, unchanged in 13%
Becker et al. <sup>95</sup>	Observational, prospective	17 unselected OSAH patients with heart block	PSG	ECG before and after CPAP	Significantly decrease of heart block, completely abolished in 70.6%

### SLEEP APNEA AND ARRHYTHMIAS



## ATRIAL FIBRILLATION | Mechanisms

Vagal Tone

Pro-inflammatory state

Co-Morbidities

↑ LA & LV masses

SLEEP APNEA AND ARRHYTHMIAS

## ATRIAL FIBRILLATION | Associations

Ref	Design	Outcome	Diagnostic method	Control matching	Results
Heisler et al. <sup>17</sup>	Cross-sectional	229 patients (100 AF, 129 healthy)	ECG	113 non-AF healthy (H)	Prominent day/night arrhythmic noise present in LAFM.
Aszkenasy et al. <sup>18</sup>	Retrospective	277 patients (184 AF)	ECG	104 healthy (H)	Nocturnal arrhythmia was more prevalent (odds ratio 1.6) in patients (OR = 1.62; 95% CI 0.4-5.8).
Heisler et al. <sup>19</sup>	Cross-sectional	46 patients with atrial fibrillation undergoing coronary angiography, 10 non-fibrillating patients, 40 healthy volunteers	ECG	10 healthy (H)	High night-to-day arrhythmic noise associated with atrial fibrillation.
Heisler et al. <sup>20</sup>	Cross-sectional	100 patients with atrial fibrillation, 100 healthy volunteers, 100 patients with SA nodal dysfunction, 100 healthy volunteers	ECG	100 healthy (H)	ECG arrhythmic noise was more prevalent in patients with atrial fibrillation.
Heisler et al. <sup>21</sup>	Cross-sectional	60 healthy volunteers, 60 patients with atrial fibrillation, 60 patients with SA nodal dysfunction	ECG	60 healthy (H)	Nocturnal arrhythmia was more prevalent in AF vs H.
Heisler et al. <sup>22</sup>	Cross-sectional	60 healthy volunteers, 60 patients with atrial fibrillation, 60 patients with SA nodal dysfunction	ECG	60 healthy (H)	Daytime arrhythmia was more prevalent in AF vs H.
Bergqvist et al. <sup>23</sup>	Cross-sectional	78 patients undergoing ECG check up, 30 healthy volunteers, 30 patients with atrial fibrillation, 30 patients with SA nodal dysfunction	ECG	78 healthy (H)	Greater arrhythmia at 10P in ECGAF group, reduced by CPAP.
Miles et al. <sup>24</sup>	Observational	100 patients undergoing ECG check up	ECG	70 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Miles et al. <sup>25</sup>	Observational	100 patients undergoing ECG check up	ECG	70 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Heisler et al. <sup>26</sup>	Cross-sectional	401 total, 268 patients, 133 healthy, 104 healthy (H)	ECG	1 from 100 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Jungblut et al. <sup>27</sup>	Observational	102 AF patients undergoing ECG monitoring, 100 healthy (H)	ECG	1 from 100 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Heisler et al. <sup>28</sup>	Observational	102 AF patients undergoing ECG monitoring, 100 healthy (H)	ECG	1 from 100 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Heisler et al. <sup>29</sup>	Observational	102 AF patients undergoing ECG monitoring, 100 healthy (H)	ECG	1 from 100 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Hip et al. <sup>30</sup>	Observational	102 AF patients undergoing ECG monitoring, 100 healthy (H)	ECG	1 from 100 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Heisler et al. <sup>31</sup>	Observational	102 AF patients undergoing ECG monitoring, 100 healthy (H)	ECG	1 from 100 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Hip et al. <sup>32</sup>	Observational	102 AF patients undergoing ECG monitoring, 100 healthy (H)	ECG	1 from 100 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Hip et al. <sup>33</sup>	Observational	102 AF patients undergoing ECG monitoring, 100 healthy (H)	ECG	1 from 100 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).
Hip et al. <sup>34</sup>	Observational	102 AF patients undergoing ECG monitoring, 100 healthy (H)	ECG	1 from 100 healthy (H)	Day & AF after CPAP (n=50, 50/50), AF in patients (75/75) was significantly more prevalent than healthy controls (25/25).

SLEEP APNEA AND ARRHYTHMIAS

## ATRIAL FIBRILLATION | Associations

Gilleman et al. <sup>91</sup>	Uncontrolled	400 severe OSAH	PSG	24h Holter ECG	Nocturnal paroxysm of AF = 9%
Gami et al. <sup>100</sup>	Case-control	3640 adults <65 years old without AF	PSG	12lead ECG in 4.7-year follow-up	Incident AF due to OSAH HR 3.20

### SLEEP APNEA AND ARRHYTHMIAS

## ATRIAL FIBRILLATION | Associations

Moss et al. <sup>102</sup>	Observational, prospective	121 undergo CABG surgery	PSG	12lead ECG in followup	Risk of AF after CABG due to OSAH RR 1.8
Minasian et al. <sup>103</sup>	Observational, prospective	61 AF patients (38% with severe OSAH)	PSG	12lead ECG in followup	AF in severe OSAH less likely related to antiarrhythmic drugs and vice versa

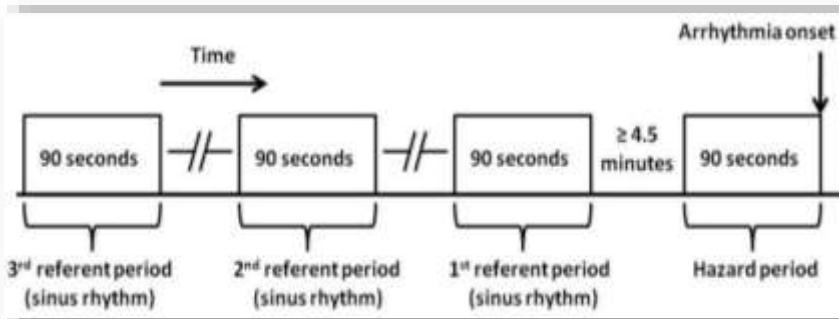
### SLEEP APNEA AND ARRHYTHMIAS

## ATRIAL FIBRILLATION | Associations

Jorgenson et al. <sup>177</sup>	Nonrandomized, prospective	324 AF patients undergone to radiofrequency ablation (41% OSAH)	PSG	12-lead ECG in follow-up	OSAH predicts AF recurrence OR 3.04
Bitter et al. <sup>198</sup>	Nonrandomized, prospective	76 AF patients undergone to cryoablation (11% OSAH)	PSG	7-day Holter ECG during 1-year follow-up	Moderate-severe OSAH predicts AF recurrence HR 3.25

## SLEEP APNEA AND ARRHYTHMIAS

## ATRIAL FIBRILLATION | Temporal Association



Monahan et al. *J Am Coll Cardiol.* 2009

## SLEEP APNEA AND ARRHYTHMIAS

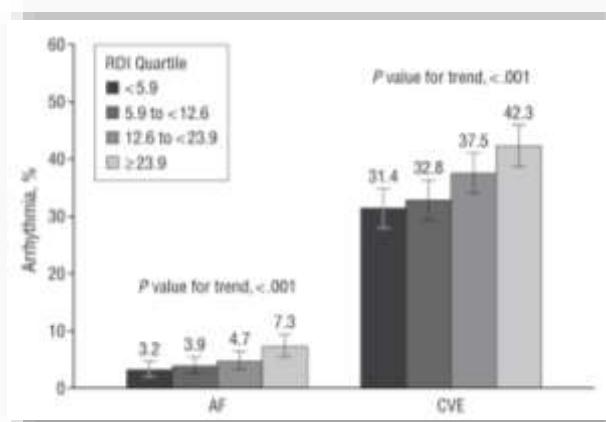
## ATRIAL FIBRILLATION | Temporal Association

	Number of arrhythmias included in each analysis	Odds Ratio (95% CI)
<b>Primary Overall Analysis</b>	62	17.5 (5.3–58.4)
<b>Sub-Analyses</b>		
By Arrhythmia type		
PAF	15	17.9 (2.2–144.2)
NSVT	47	17.4 (4.0–75.7)

Monahan et al. *J Am Coll Cardiol.* 2009

SLEEP APNEA AND ARRHYTHMIAS

## ATRIAL FIBRILLATION | Dose-Response



Mehra et al. *Arch Intern Med.* 2009

SLEEP APNEA AND ARRHYTHMIAS

## atrial fibrillation | Effect of Treatment

## ↓ Hypoxia-Related Vagal Activation

## **↓ Inflammation**

↓ LV Mass and LA size

#### SLEEP APNEA AND ARRHYTHMIAS

## atrial fibrillation | Effect of Treatment

## ↓ LV Mass and LA size

Neilan et al. / Am Heart Assoc. 2013

#### SLEEP APNEA AND ARRHYTHMIAS

## atrial fibrillation | Effect of Treatment

**↓ LV Mass and LA size**

LV mass, g	164 (34)	154 (26)	174 (36)	<b>0.005</b>
LV mass index, $\text{g}/\text{m}^2$	75 (14)	71 (11)	80 (14)	<b>0.0002</b>
RAEDV, mL	177 (44)	167 (37)	178 (51)	0.27
RVEDV index, $\text{mL}/\text{m}^2$	78 (19)	77 (16)	80 (21)	0.47
RVEDV, mL	67 (27)	66 (24)	66 (28)	0.97
RVESV index, $\text{mL}/\text{m}^2$	40 (11)	40 (11)	39 (12)	0.87
RVEF, %	51 (8)	50 (7)	51 (8)	0.24
Left atrial dimension, mm	44 (6)	41 (6)	46 (8)	<b>0.0003</b>

Neilan et al. *J Am Heart Assoc.* 2013

SLEEP APNEA AND ARRHYTHMIAS

## atrial fibrillation | Effect of Treatment

No.	Design	Patients	Diagnostic method	Outcome measure	Results
Watanabe et al. <sup>17</sup>	Cross-sectional	229 patients (100 healthy vs 129 healthy)	PSG	12-hour ECG monitoring	Pneumotachograph more sensitive to OSA than ECG monitoring. OSA defined as >10% apnea-hypopnea index (AHI) or >15% IMR <0.50. High AHI associated with increased risk of stroke.
Aszkenasy et al. <sup>18</sup>	Observational	277 patients (184 H)	PSG	12-hour ECG monitoring	PSG more sensitive than ECG monitoring to detect OSA.
Aszkenasy et al. <sup>19</sup>	Cross-sectional	46 patients with atrial fibrillation undergoing coronary angiography, 20 with atrial fibrillation and 26 without, 40 with normal ECG and 69 with abnormal ECG	PSG	12-hour ECG monitoring	Normal ECG and normal PSG were associated with low prevalence of OSA.
Neubauer et al. <sup>20</sup>	Observational	209 patients (100 healthy vs 109 with OSA)	PSG	12-hour ECG monitoring	Normal ECG and normal PSG were associated with low prevalence of OSA.
Huang et al. <sup>21</sup>	Observational	78 patients undergoing ECG check up, 42 with atrial fibrillation and 36 without, 30 with normal ECG and 48 with abnormal ECG	PSG	12-hour ECG monitoring	Greater prevalence of OSA in ECG abnormal group, indicated by ECG.
Miles et al. <sup>22</sup>	Observational	117 patients (60 with atrial fibrillation)	PSG	12-hour ECG monitoring	High AHI after CPAP (mean 10-12.64 vs 0.21) and in patients (75.88 vs 12.50) compared to those without atrial fibrillation.
Miles et al. <sup>23</sup>	Observational	117 patients (60 with atrial fibrillation)	PSG	12-hour ECG monitoring	Prevalence of OSA significantly different between CPAP and no CPAP.
Yao et al. <sup>24</sup>	Observational	461 total, 368 patients, 93 healthy, 10 healthy (14.6% of healthy)	PSG	12-hour ECG monitoring	High AHI after CPAP (mean 10-12.64 vs 0.21) and in patients (75.88 vs 12.50) compared to those without atrial fibrillation.
Demperscheid et al. <sup>25</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	(CPAP) patients with OSA had higher AHI and longer duration of OSA.
Oliver et al. <sup>26</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	AF patients with OSA had higher AHI and longer duration of OSA.
Oliver et al. <sup>27</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	AF patients with OSA had higher AHI and longer duration of OSA.
Yao et al. <sup>28</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	AF patients with OSA had higher AHI and longer duration of OSA.
Oliver et al. <sup>29</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	AF patients with OSA had higher AHI and longer duration of OSA.
Yao et al. <sup>30</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	AF patients with OSA had higher AHI and longer duration of OSA.
Yao et al. <sup>31</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	AF patients with OSA had higher AHI and longer duration of OSA.
Yao et al. <sup>32</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	AF patients with OSA had higher AHI and longer duration of OSA.
Yao et al. <sup>33</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	AF patients with OSA had higher AHI and longer duration of OSA.
Yao et al. <sup>34</sup>	Observational	102 AF patients undergoing ECG monitoring, 50 healthy	PSG	12-hour ECG monitoring	AF patients with OSA had higher AHI and longer duration of OSA.

SLEEP APNEA AND ARRHYTHMIAS

## atrial fibrillation | Effect of Treatment

Kanegiela et al.<sup>118</sup>Observational,  
prospective79 patients undergone DC shock  
for AF or atrial fibrillation  
(39 OSAH, 12 of whom treated  
with CPAP)

PSG

12-lead ECG in follow-up

Greater occurrence of AF in OSAH  
group, reduced by CPAP

### SLEEP APNEA AND ARRHYTHMIAS

## atrial fibrillation | Effect of Treatment

Jangraungpetch et al.<sup>117</sup>Nonrandomized,  
prospective334 AF patients undergo  
to radiofrequency ablation  
(41% OSAH)

PSG

12-lead ECG in follow-up

OSAH predicts AF recurrence  
OR 3.04Bitter et al.<sup>119</sup>Nonrandomized,  
prospective75 AF patients undergo  
to cardioablation (41% OSAH)

PSG

7-day Holter ECG during  
1-year follow-upModerate-severe OSAH predicts  
AF recurrence HR 1.20Pati et al.<sup>120</sup>Nonrandomized,  
prospective3000 AF patients undergo  
PVAI (840 OSAH, 315 of  
whom treated with CPAP)

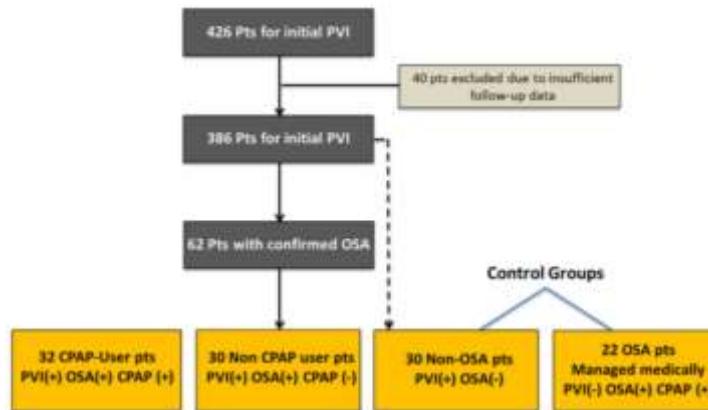
PSG

12-lead ECG in follow-up

AF recurrence in non-CPAP  
patients with pulmonary vein  
atrium trigger HR 8.81

### SLEEP APNEA AND ARRHYTHMIAS

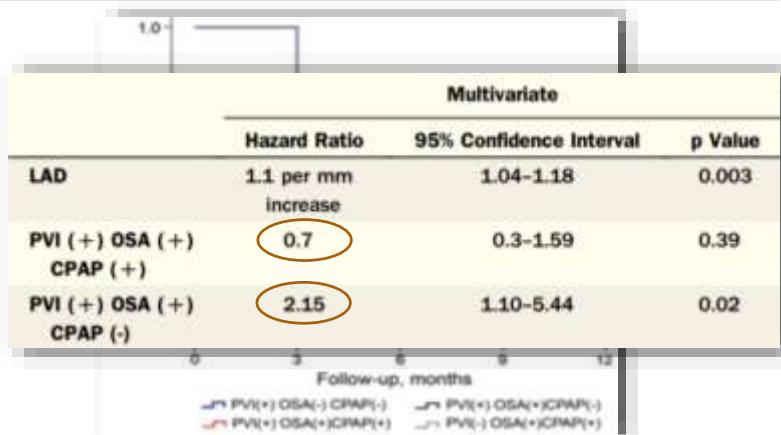
## ATRIAL FIBRILLATION | Effect of Treatment



Fein et al. J AM Coll Cardiol. 2013

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## ATRIAL FIBRILLATION | Effect of Treatment



Fein et al. J AM Coll Cardiol. 2013

SLEEP APNEA AND ARRHYTHMIAS

## SCD | Mechanisms

### Apneic Spells

High Vagal Tone

Hypertension

↑ Sympathetic Activation

Pro-inflammatory State

Pro-coagulant State

SLEEP APNEA AND ARRHYTHMIAS

## SCD | Mechanisms

### High Vagal Tone

Hypertension

Apneic Spells

Sinus Arrest

High Grade AV Block

SLEEP APNEA AND ARRHYTHMIAS

## SCD | Mechanisms

Apneic Spells

High Vagal Tone

Hypertension

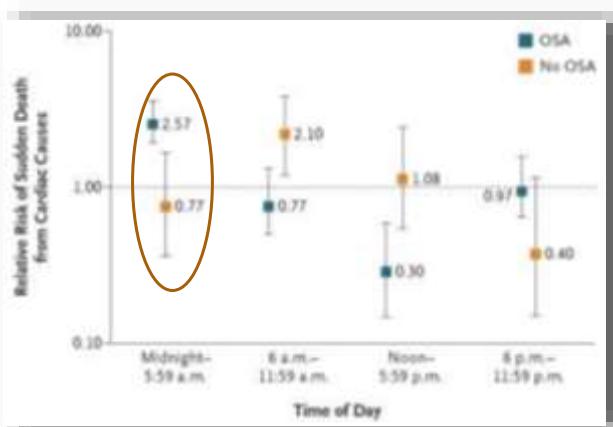
Concentric  
Hypertrophy

Myocardial Ischemia

Fibrosis & Wall  
Stress

SLEEP APNEA AND ARRHYTHMIAS

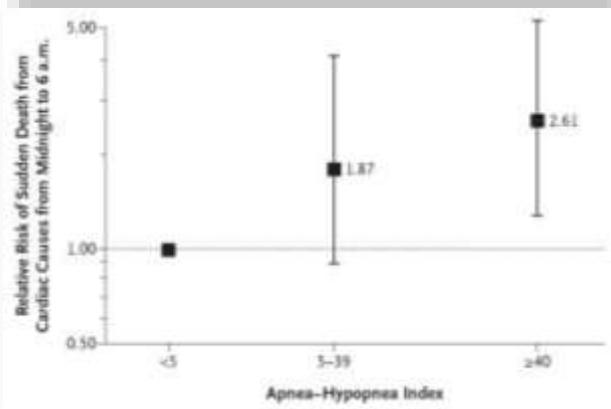
## SCD | Associations



Gami et al. N Eng J Med. 2005

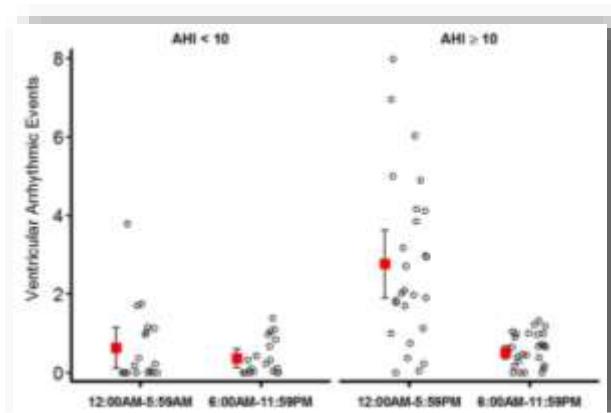
SLEEP APNEA AND ARRHYTHMIAS

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Gami et al. *N Eng J Med.* 2005

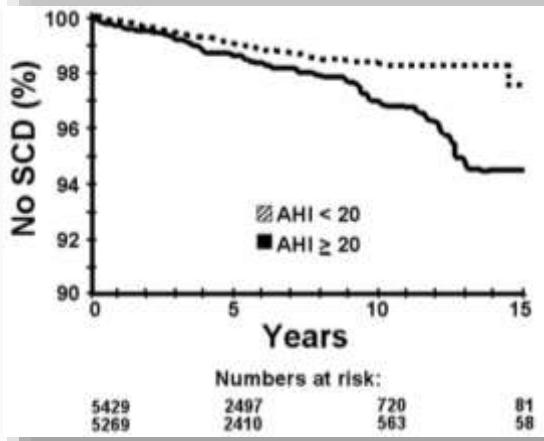
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## SCD | Temporal Association

Zeidan-Shwiri et al. *Heart Rhythm.* 2011

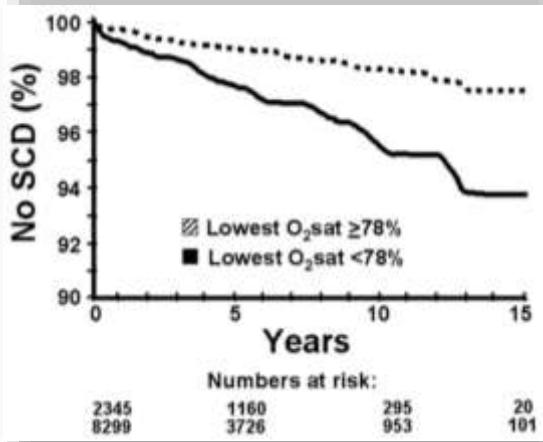
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## SCD | Dose-Response Relation

Gami et al. *J Am Coll Cardiol.* 2013

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## SCD | Effect of Treatment



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## CLINICAL IMPLICATIONS | Screening

## ► STOP Questionnaire

- Snoring
- Tiredness
- Observed you stop breathing
- Blood Pressure

## ► BANG

- BMI >35
- Age >50
- Neck circumference >40 cm (>15.7")
- Gender male

High risk: Yes to >3 items → Refer for sleep testing

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## CLINICAL IMPLICATIONS | SCD & Brady

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
Sleep apnoea syndrome should be considered in the differential diagnosis of bradyarrhythmias.	IIa	B
The presence of sleep apnoea and reduced oxygen saturation may be considered as a risk factor for SCD in subjects with sleep disordered breathing.	IIb	C

SLEEP APNEA AND ARRHYTHMIAS

## CLINICAL IMPLICATIONS | Atrial Fibrillation

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
Correction of hypoxaemia and acidosis should be considered as initial management for patients who develop AF during an acute pulmonary illness or exacerbation of chronic pulmonary disease.	IIa	C
Interrogation for clinical signs of obstructive sleep apnoea should be considered in all AF patients.	IIa	B
Obstructive sleep apnoea treatment should be optimized to reduce AF recurrences and improve AF treatment results.	IIa	B

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