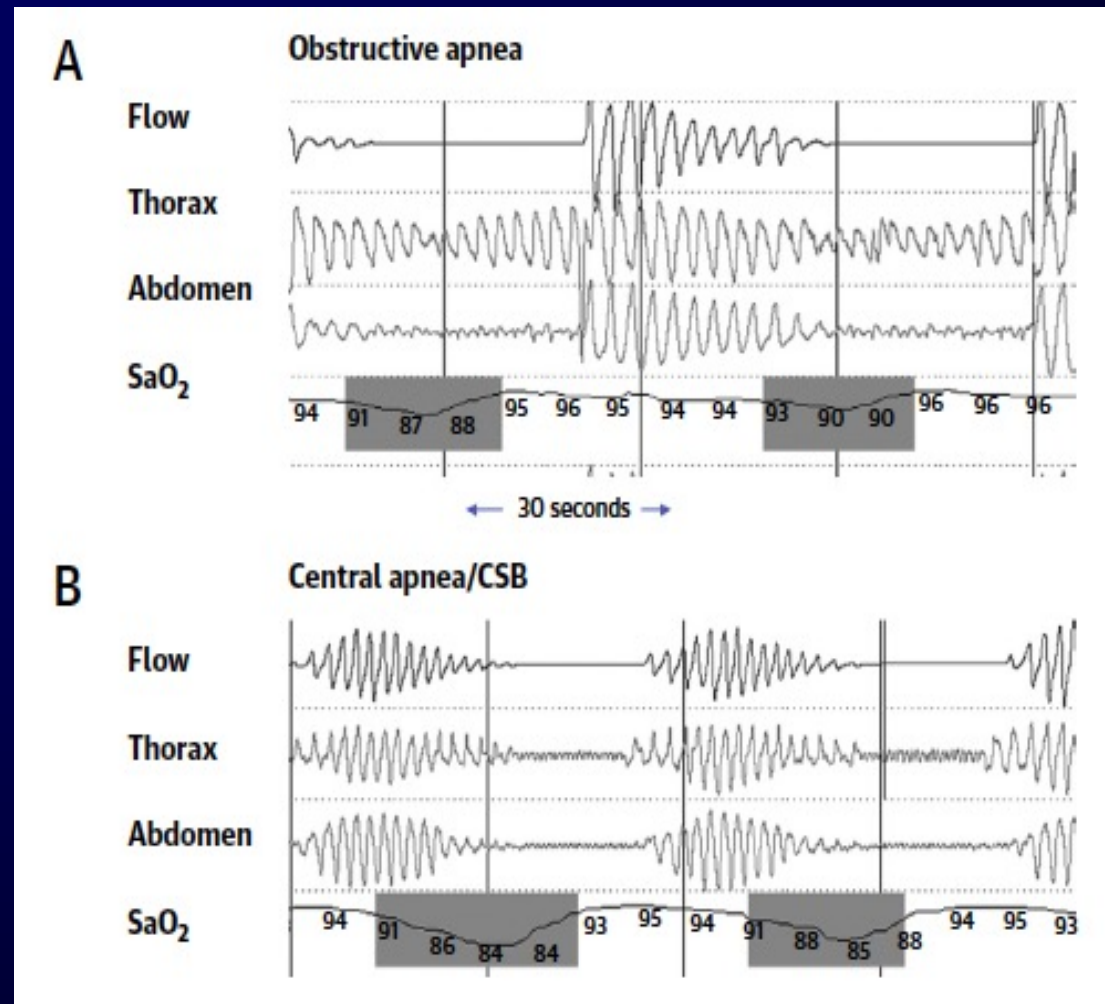


CUORE
E APNEE
OSTRUTTIVE
DEL SONNO

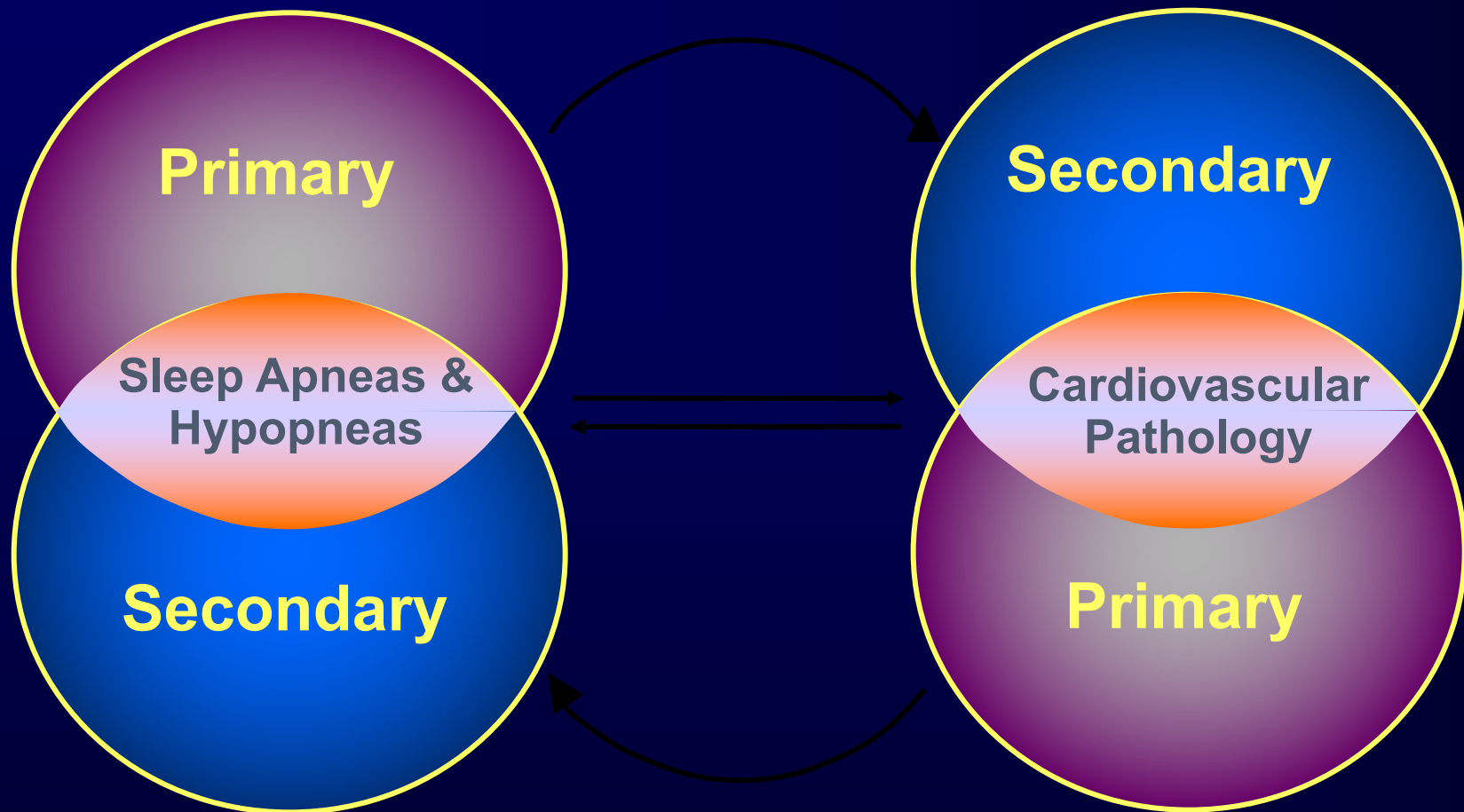
MAURIZIO BARONI

OSAS

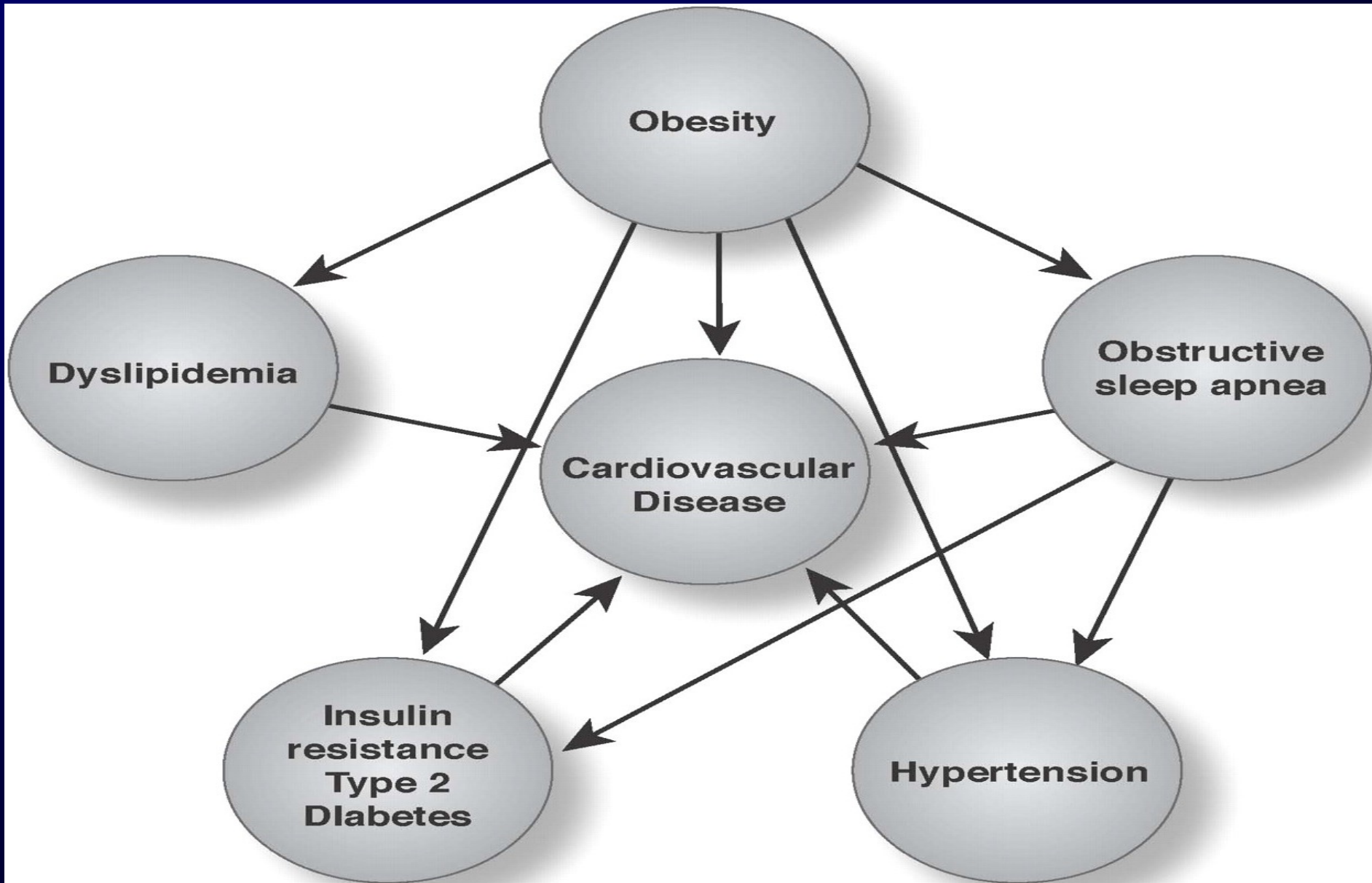
La sindrome dell'apnea ostruttiva del sonno è caratterizzata da episodi ricorrenti di ostruzione completa (**apnea**) o incompleta (**ipopnea**) delle vie respiratorie superiori durante il sonno, con conseguenti disturbi del sonno e presenza di sonnolenza durante il giorno.



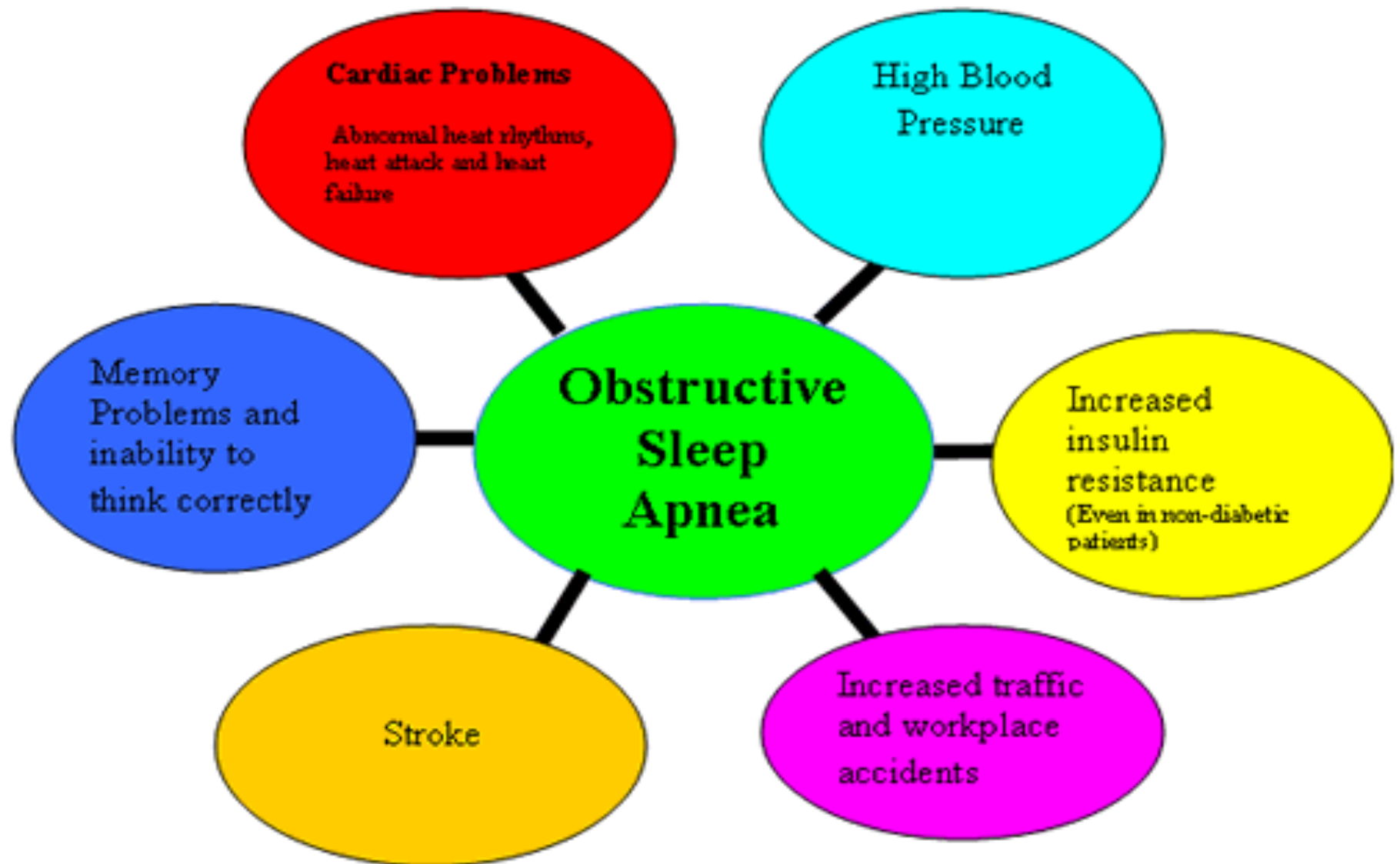
Interaction Between Sleep and Heart Pathology



FATTORI DI RISCHIO

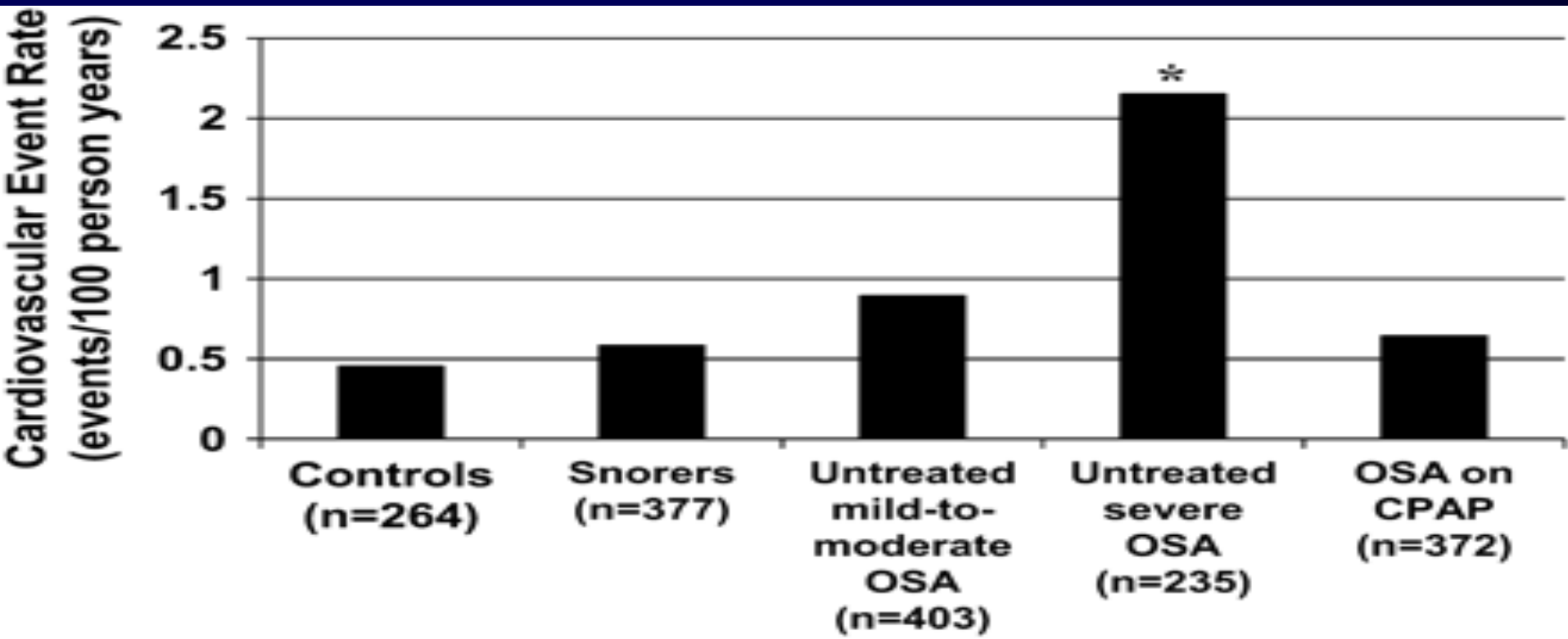


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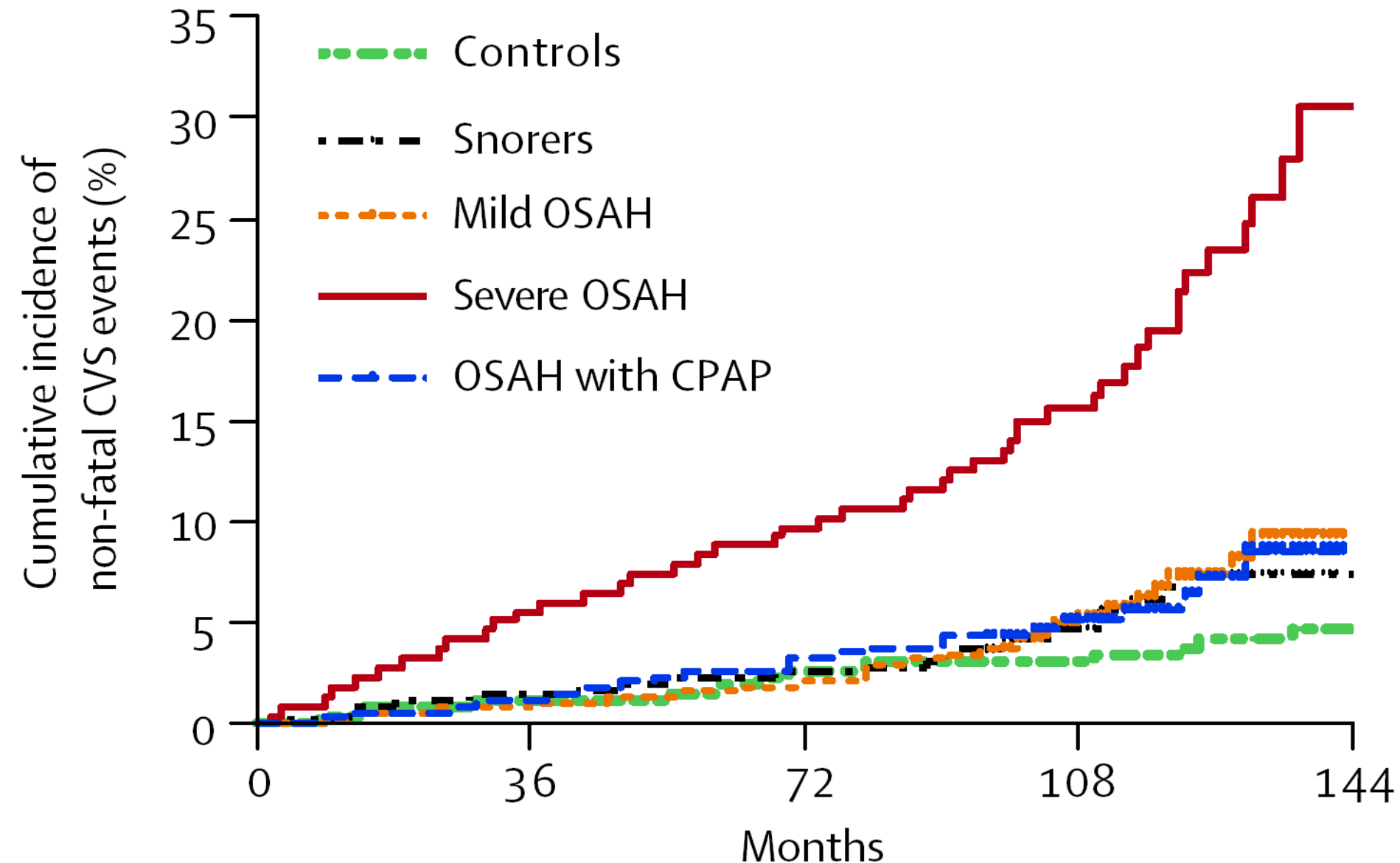


OSA and Cardiovascular disease

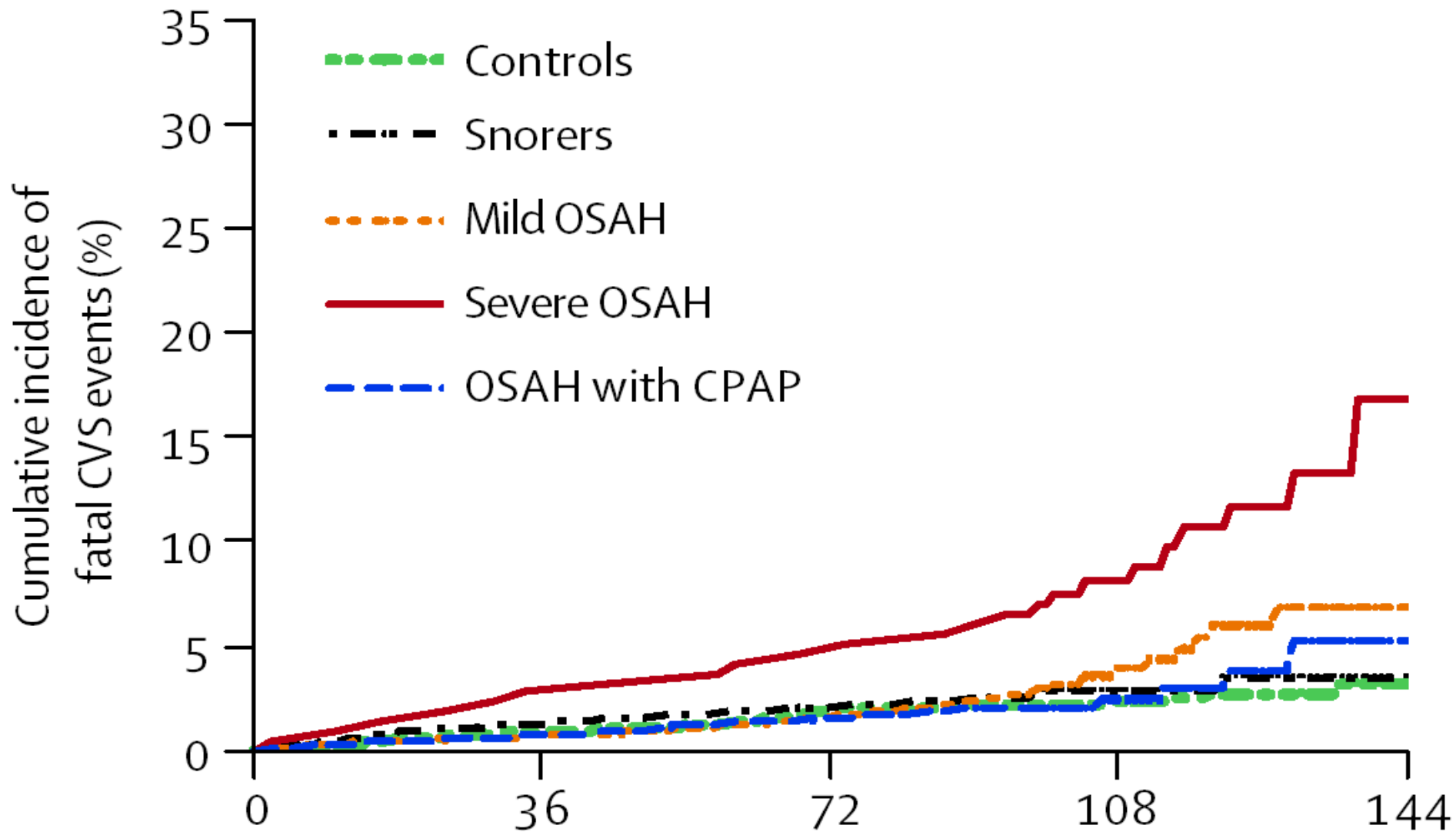
- There is a clear association between OSA and cardiovascular disease
- Higher incidence of adverse cardiovascular events in untreated patients with OSA



Non-Fatal Cardiovascular Events



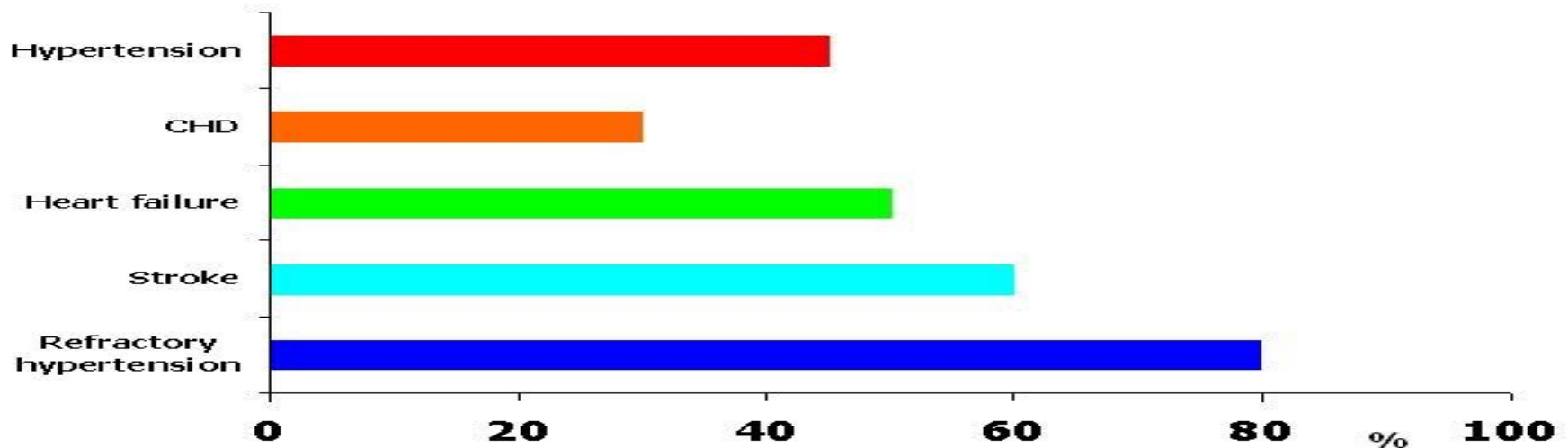
Fatal Cardiovascular Events



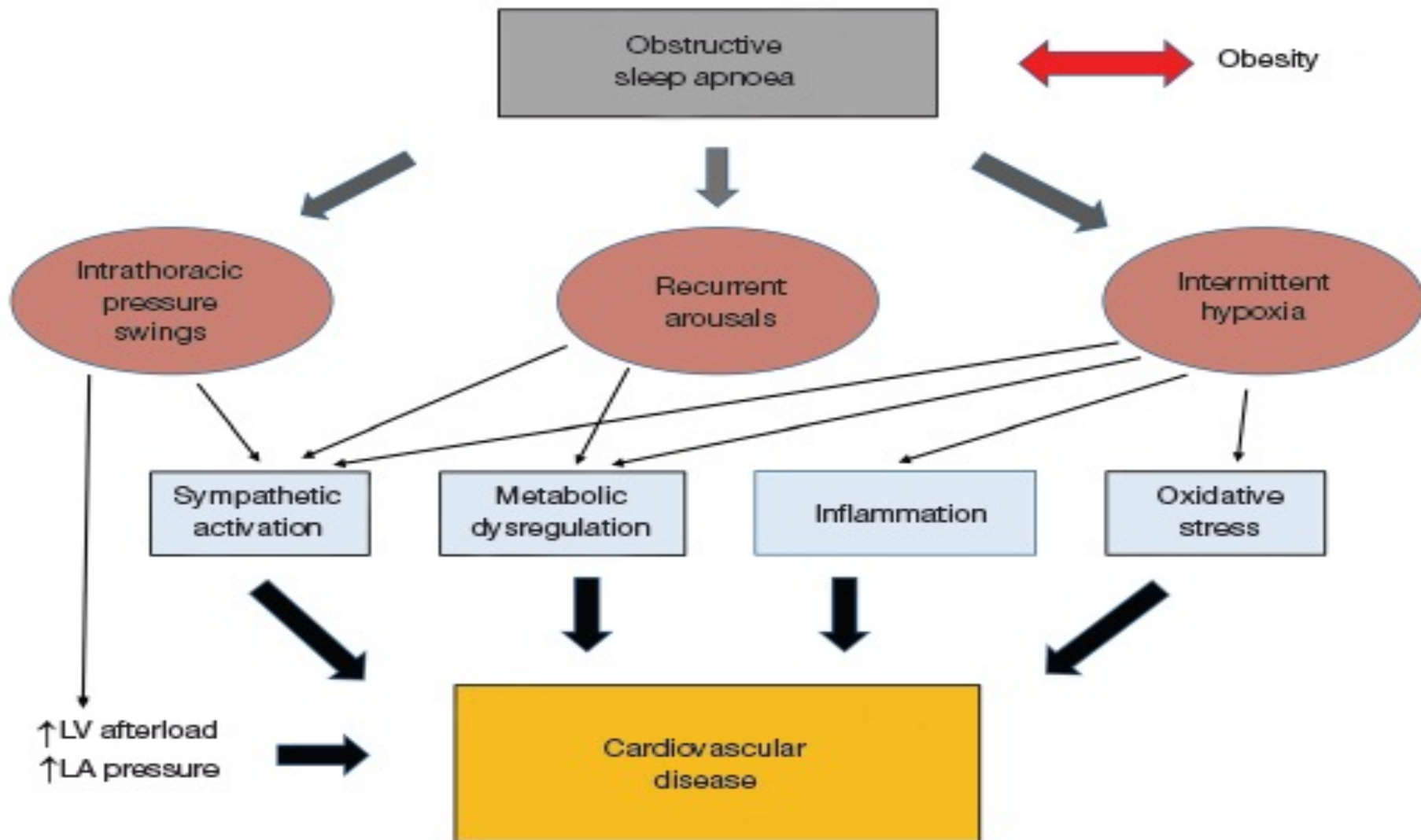
OSA and Cardiovascular Disease

- OSA is present in at least 10-25% of patients 30-60 years
- Prevalence increases with obesity and aging- both risk factors for heart failure
- OSA is a cause of hypertension and a risk factor for CAD the most common causes of heart failure
- OSA is present in up to 60% of patients with heart failure

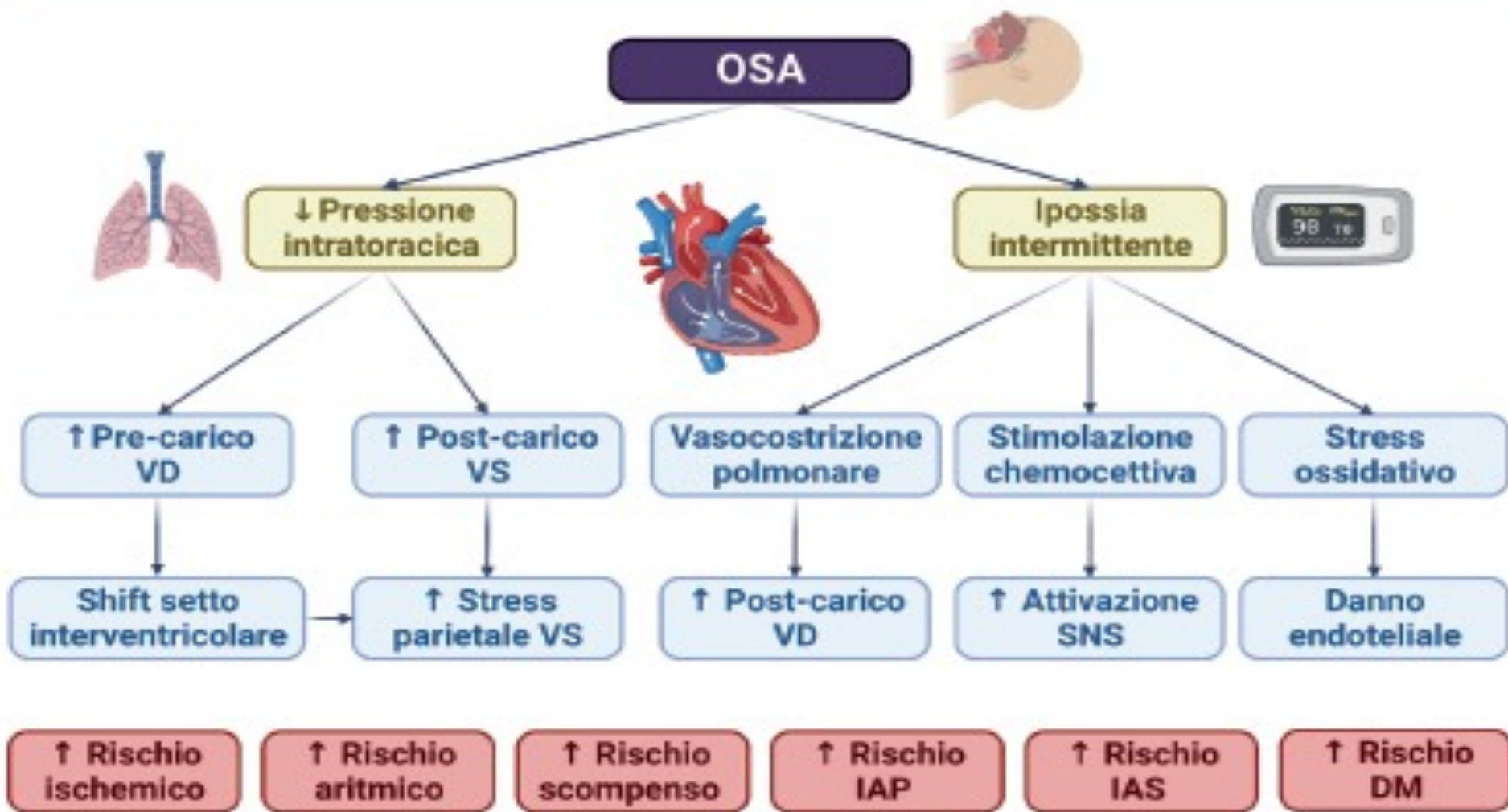
Sleep apnoea prevalence in CV diseases



FISIOPATOLOGIA



MECCANISMI FISIOPATOLOGICI COMPLICANZE CARDIOVASCOLARI



CARDIOVASCULAR CONSEQUENCES OF OBSTRUCTIVE SLEEP APNEA

- Hypertension
- Atherosclerosis
- Coronary artery disease
- Heart failure
- Arrhythmias
- Pulmonary hypertension
- Stroke
- Sudden death
- Glucose intolerance

IDENTIFIABLE CAUSES OF HYPERTENSION

- **Sleep apnea**
- Drug-induced or related causes
- Chronic kidney disease
- Primary aldosteronism
- Renovascular disease
- Chronic steroid therapy and Cushing's syndrome
- Pheochromocytoma
- Coarctation of the aorta
- Thyroid or parathyroid disease

OSA AND HYPERTENSION

Up to 50-60% of patients with sleep apnea may have hypertension .

Prevalence of OSAHS is greater in hypertensive patients than in general population.

Hypertension in patients with sleep apnea is often resistant to antihypertensive therapy.

OSA patients are more likely to be nocturnal “non-dippers”

Treatment of OSA reduces blood pressure

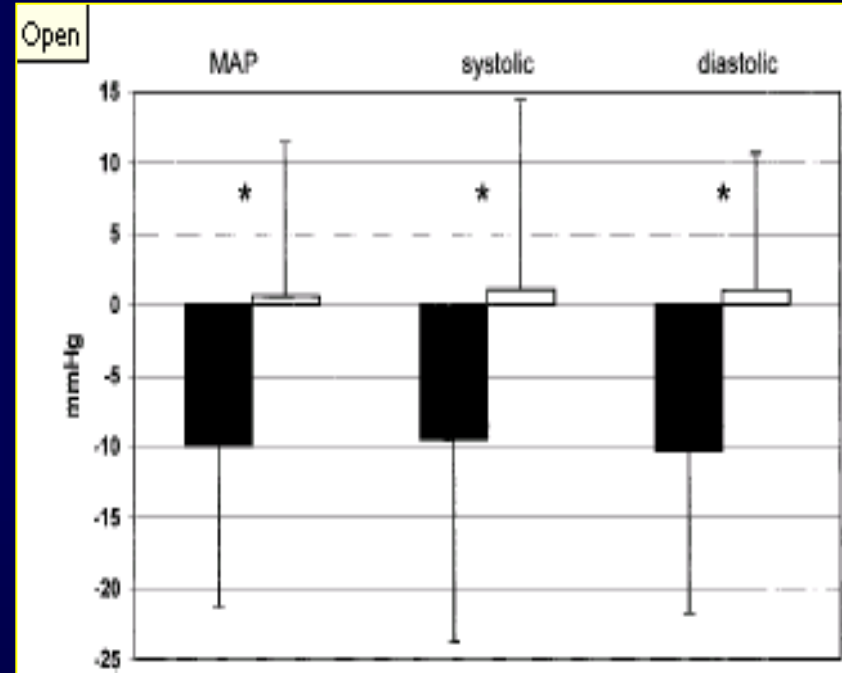


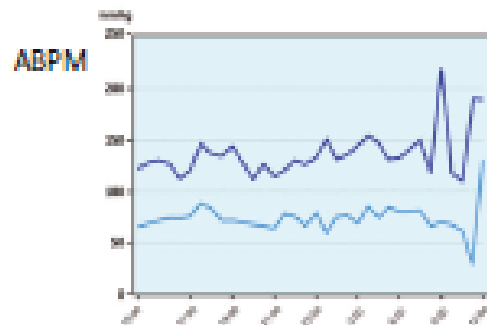
Figure 2. Changes in blood pressure with effective (closed bars) and subtherapeutic (open bars) nCPAP. *Significant difference. MAP indicates mean arterial blood pressure; systolic, systolic blood pressure; and diastolic, diastolic blood pressure. MAP, $P=0.01$; systolic blood pressure, $P=0.04$; diastolic blood pressure, $P<0.005$.

IPERTENSIONE ARTERIOSA

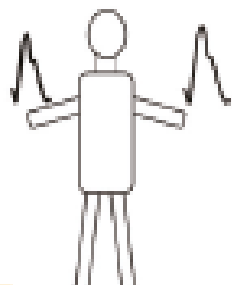
OSA-related Hypertension

Characteristics and Cardiovascular Damage of OSA-related Hypertension

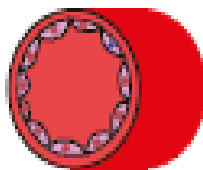
Resistant hypertension
Nocturnal hypertension (non-dipper)
Early morning hypertension
Increased BP variability



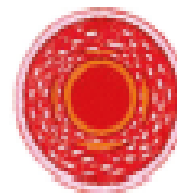
Inter-arm BP difference



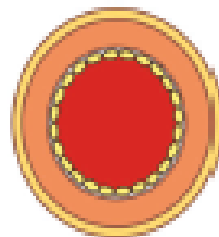
Endothelial dysfunction



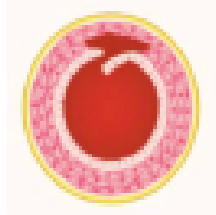
Increased arterial stiffness



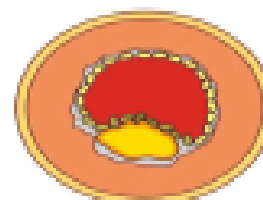
Aortic dilatation



Aortic dissection



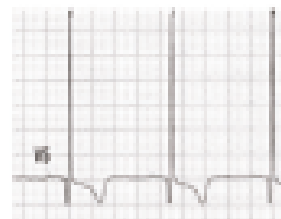
Aortic aneurysm



Atrial fibrillation



Left ventricular hypertrophy



Treatment strategies

CPAP untreated OSA

Beta-blocker

Diuretics

CCB

CPAP treated OSA

ARB

or

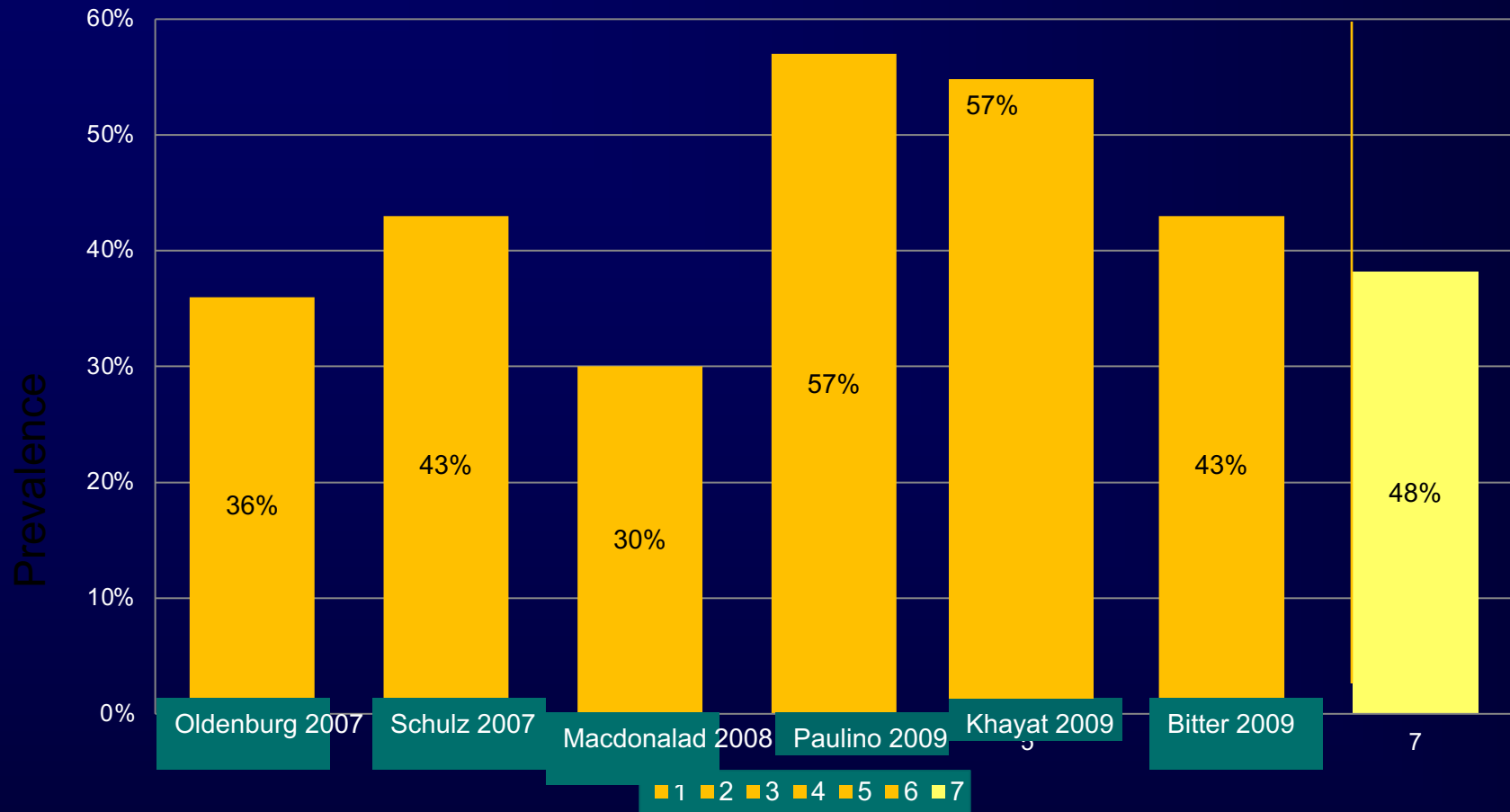


ARB in combination
with other drug classes

Potentially effective
medications

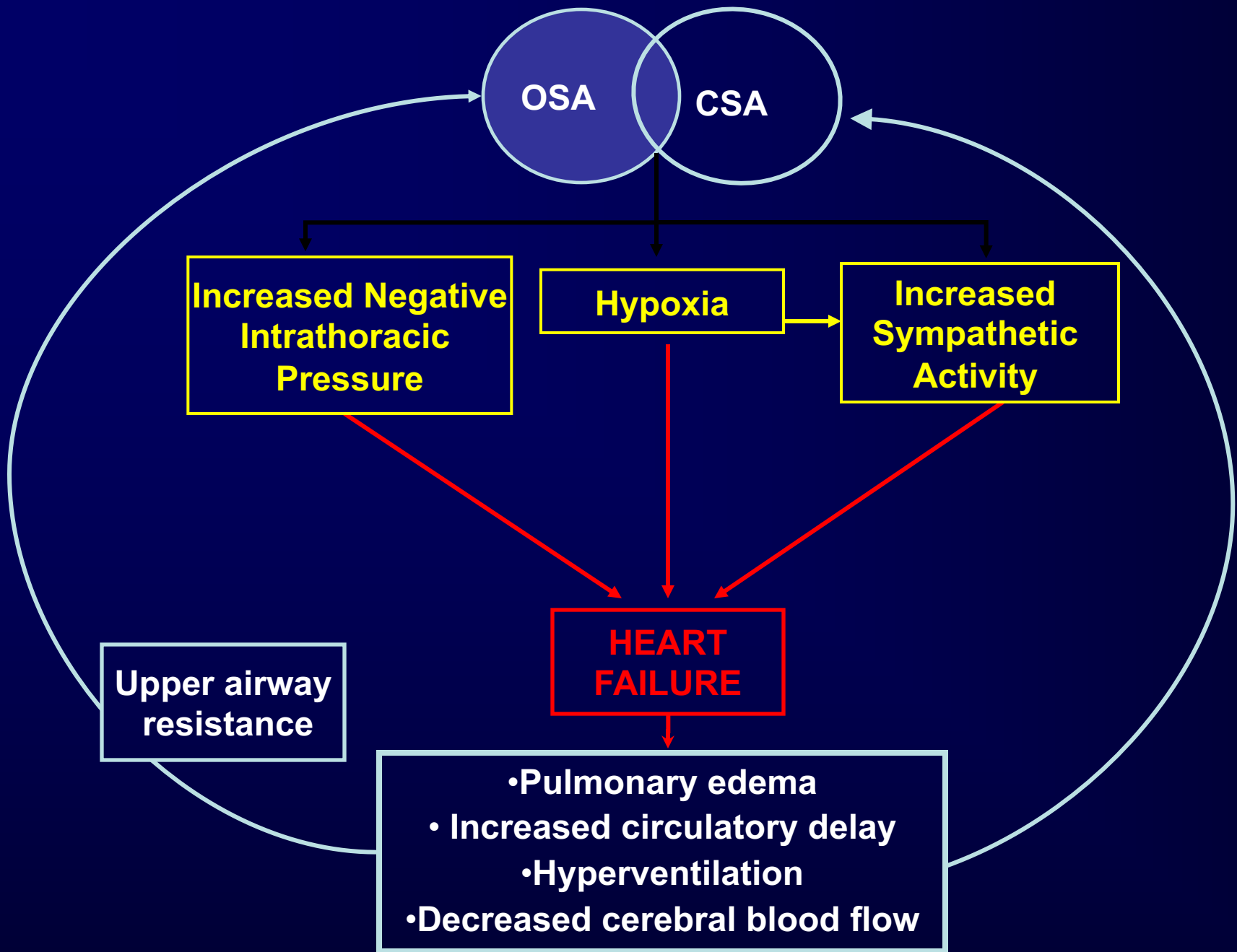
SGLT2i, ARNI,
GIP/GLP-1 RA

PREVALENCE OF OSA IN STABLE OUTPATIENTS WITH HEART FAILURE

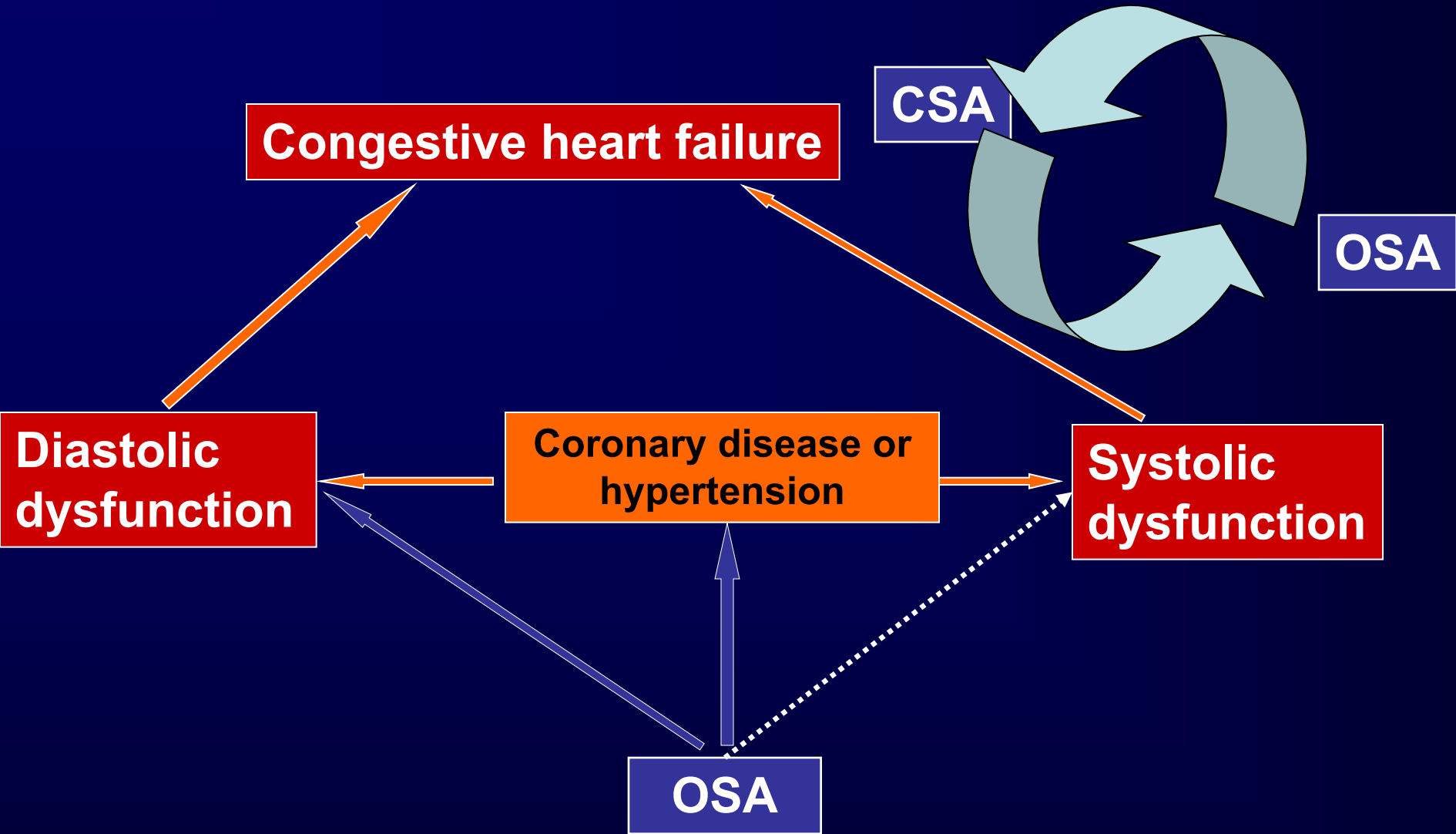


OSA AND HEART FAILURE

- Most direct mechanism in which OSA can induced LV dysfunction is by raising BP.
- Also:
 - Increased sympathetic outflow
 - Increased LV afterload acutely and chronically
 - Hypoxia induced increase of RV afterload
 - Increased risk of myocardial infarction



OSA and Heart Failure



PULMONARY HYPERTENSION

- 16% - 42% of patients with OSA have PH
- PH in OSA patients is associated with:
 - Obesity
 - Poor lung function
 - Degree and duration of hypoxemia
 - Hypercapnea
 - Not associated with age, gender or OSA severity
- Typically mean PAP is only mildly elevated unless there is underlying lung or heart disease.

PULMONARY HYPERTENSION

Hypoxemia-induced pulmonary vasoconstriction leads to vascular remodeling

Large negative intrathoracic pressures generated during obstructive apneas increase LV transmural pressure causing greater myocardial oxygen demand, reduced CO, and increased wedge pressure.

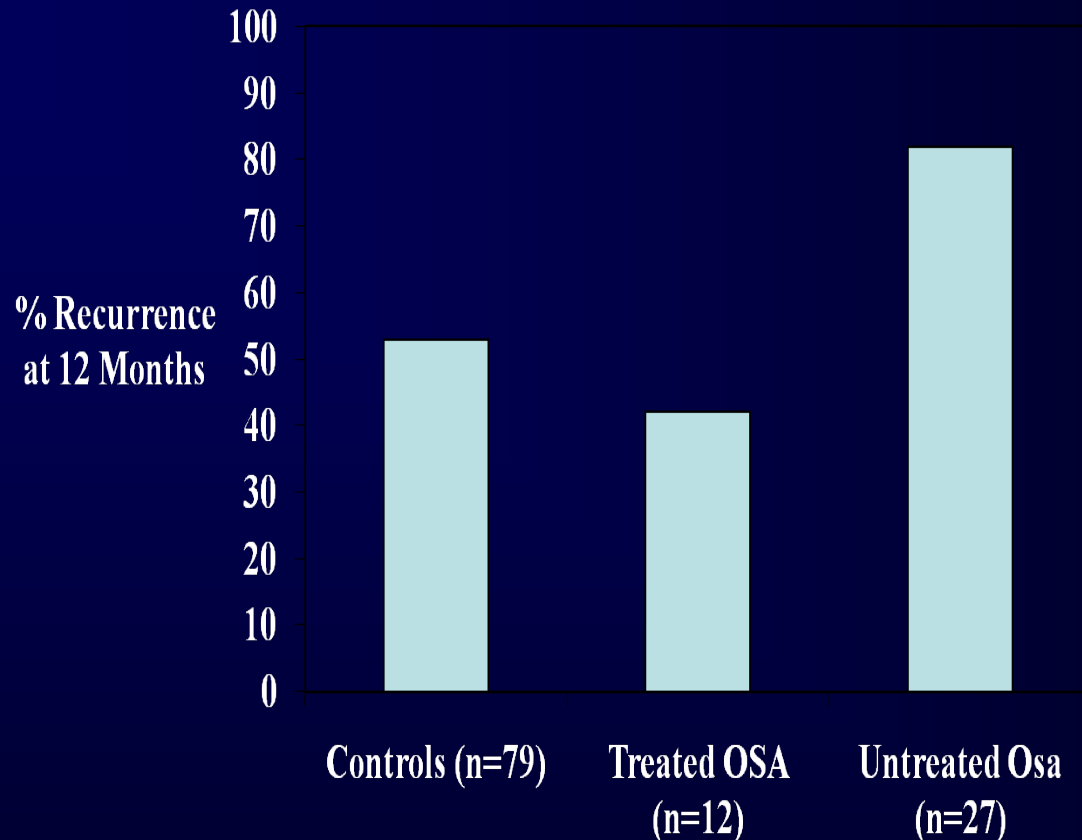
OSA AND ABNORMAL HEART RHYTHMS: ATRIAL FIBRILLATION

Four times increased risk
of AF in pts with OSA
(AHI>30)

Onset of >75% of
persistent Afib episodes
in pts with OSA occur at
night (8pm-8am)

A fib recurrence after
cardioversion twice as
high in untreated OSA

Nocturnal hypoxemia
influences the onset of A
fib



ARITMIE E APNEE OSTRUTTIVE

FIGURE 4 The Complex and Dynamic Substrate for Arrhythmia Induced by Sleep Apnea

- Negative intrathoracic pressure changes
- Cyclical desaturation/reoxygenation
- Sympatho-vagal activation

Acute (transient) electrophysiological changes

Atrium

- Refractoriness ↓
- Conduction velocity ↓
- Triggers ↑

Ventricle

- QT dispersion ↑
- Triggers ↑

Chronic (progressive) cardiac remodeling

Atrium

- Atrial dilatation
- Fibrosis/ connexin remodeling
- Conduction disturbances

Ventricle

- Hypertrophy
- Heart failure

+ Cardiovascular Risk Factors



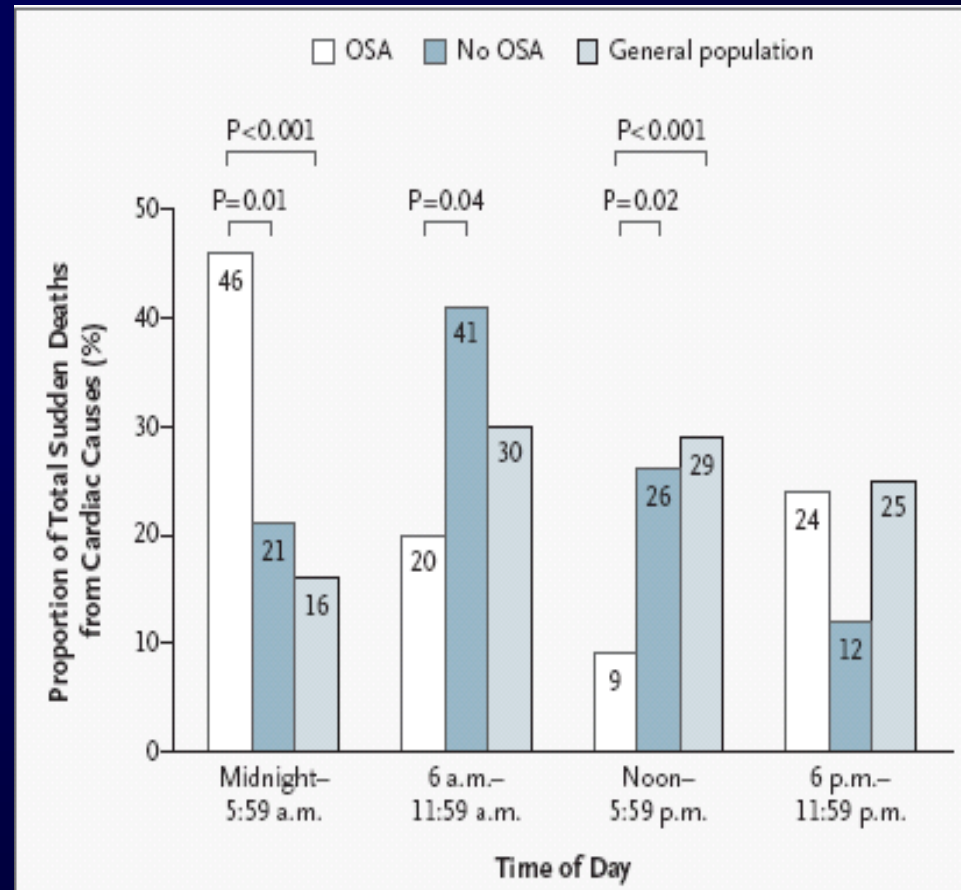
ARRHYTHMIAS

- Nocturnal arrhythmias have been shown to occur in up to 50% of OSA patients.
 - Nonsustained ventricular tachycardia
 - Sinus arrest
 - Second degree AV block
 - Frequent PVC's

SUDDEN DEATH

In >50% of persons with OSA sudden death from cardiac causes occurred from 12 midnight to 6 AM/ highest risk of cardiac sudden death in general population occurred from 6 AM to 12 noon

Severity of OBA correlated with rate of sudden cardiac death

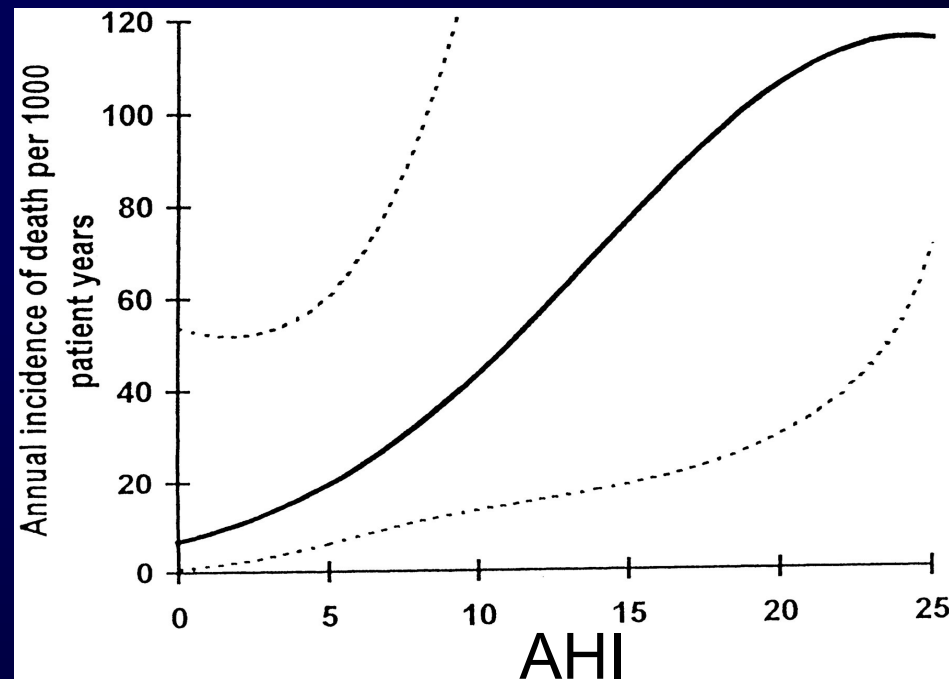


OSA AND HEART ATTACKS:

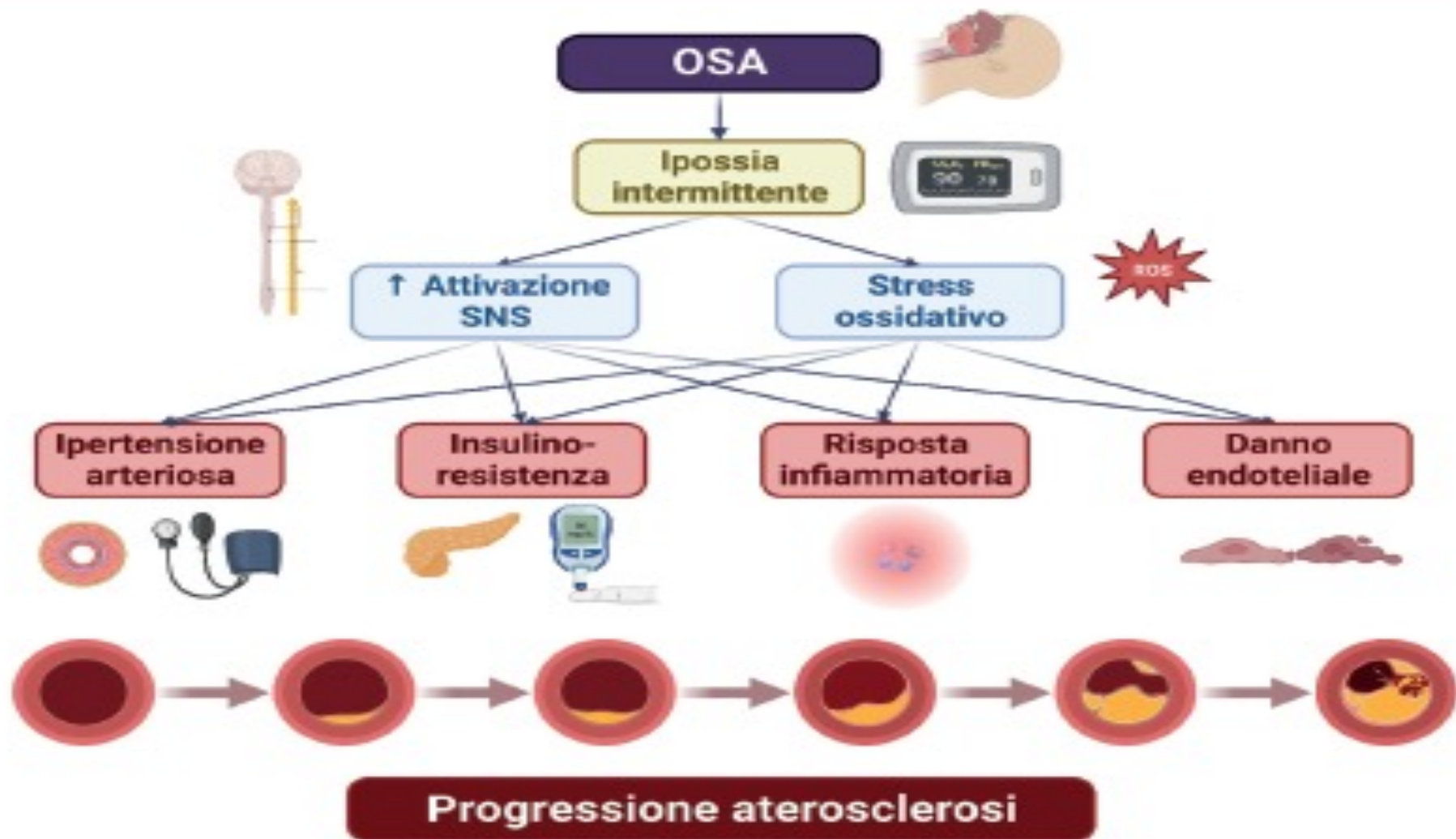
- Multiple nightly stresses on the heart:
 - Repetitive fluctuations in oxygen levels,
 - Increased blood pressure surges and
 - High sympathetic nervous system tone

SLEEP APNEA AND CORONARY ARTERY DISEASE

- >30% of patients with CAD have sleep apnea
- OSA is associated with an increased risk of cardiovascular mortality in patients with CAD with a dose-response relationship



PROGRESSIONE MALATTIA ATEROSCLEROTICA



STROKE

- Increased CRP (inflammation) and atherogenesis
- Increased thrombotic risks (clotting of blood)
- Increased blood pressure
- Hypoxia

SCREENING

Table 4. Recommendations for Screening for OSA

Screen for OSA	Consider sleep study if concerning signs/symptoms of sleep apnea are present
Resistant/poorly controlled hypertension	NYHA class II–IV HF symptoms
Pulmonary hypertension	Tachy-brady syndrome
Recurrent atrial fibrillation (after either cardioversion or ablation)	Sick sinus syndrome
	Ventricular tachycardia
	Survivors of sudden cardiac death
	Stroke

DIAGNOSI

Strumento	Descrizione	Vantaggi	Svantaggi
Questionari			
Epworth Sleepiness Scale	Valuta e classifica la sonnolenza diurna in diverse situazioni	– Utile strumento di screening – Stima accurata della sonnolenza – Valutazione efficace della risposta terapeutica	– Non specifica per OSA
Berlino	Valuta la probabilità di avere OSA in base a russamento, apnee, astenia, sonnolenza, obesità, ipertensione	– Utile strumento di screening – Un punteggio basso è associato a un rischio basso di OSA	– Scarsa specificità nello stratificare la severità delle OSA
STOP-Bang	Valuta la probabilità di avere OSA in base a russamento, sonnolenza, apnee, ipertensione, obesità, larghezza del collo, età, sesso	– Utile strumento di screening – Un punteggio basso è associato a un rischio basso di OSA	– Scarsa specificità nello stratificare la severità delle OSA
Sistemi di monitoraggio			
Polisonnografia tradizionale	Registrazione multicanale (EEG, EOG, EMG, ECG, SaO ₂ , movimenti toraco-addominali, flusso d'aria)	– Accuratezza diagnostica – Fasi del sonno e risvegli – Attuale <i>gold standard</i>	– Alto costo – Bassa disponibilità – Effetto <i>first-night</i> – Solo notturna
Polisonnografia ambulatoriale	Registrazione multicanale (EEG, EOG, EMG, ECG, SaO ₂ , movimenti toraco-addominali, flusso d'aria)	– Fasi del sonno e risvegli – Ambulatoriale – Minor effetto <i>first-night</i>	– Alto costo – Minore accuratezza e validazione – Solo notturna
Monitoraggio cardiorespiratorio	Registrazione multicanale (ECG, SaO ₂ , movimenti toraco-addominali, flusso d'aria)	– Ambulatoriale – Maggiore compliance – Durata fino a 24 h – Basso costo – Alta disponibilità	– Assenza EEG – Possibile sottostima eventi – Minore accuratezza e validazione
Ossimetria transcutanea/ flusso d'aria	Registrazione monocanale (SaO ₂ o flusso d'aria)	– Ambulatoriale – Maggiore compliance – Basso costo – Alta disponibilità	– Assenza EEG – Possibile sottostima eventi – Non distingue tra OSA e apnee/ipopnee centrali
Dispositivi impiantabili	Valutazione impedenza transtoracica da sensori in PM/ICD	– Ambulatoriale – Registrazione continua – Integrazione con altri dati (aritmie, stima congestione)	– Limitato a portatori di PM/ICD – Differenze <i>intervendor</i> – Limitata distinzione tra OSA e apnee/ipopnee centrali – Assenza EEG e SaO₂

EEG, elettroencefalogramma; EEG, elettroencefalogramma; EMG, elettromiogramma; EOG, elettrooculogramma; ICD, cardioverter-defibrillatore impiantabile; OSA, apnea ostruttiva del sonno; PM, pacemaker; SaO₂, saturazione d'ossigeno.

Diagnosi di OSAS

- La diagnosi si basa sulla presenza di più di 5 episodi di apnea/ipopnea durante la notte. Per la valutazione della gravità dell'OSAS viene abitualmente preso in considerazione l'indice di apnea/ipopnea (somma degli episodi respiratori durante un'ora di sonno).
- L'apnea ostruttiva è definita come una pausa respiratoria di almeno 10 secondi in presenza di sforzi respiratori a livello del torace e dell'addome. L'ipopnea è definita come la presenza di una riduzione del flusso d'aria di almeno 10 secondi, con o senza interruzione del sonno e desaturazione di ossigeno.

OSAS NELLA DONNA

Prevalenza: Gli uomini hanno un rischio significativamente maggiore di sviluppare l'OSAS rispetto alle donne in età fertile, con un rapporto stimato di circa 2:1. Tuttavia, questo divario si riduce dopo la menopausa, quando la prevalenza tra uomini e donne diventa più simile.

La riduzione dei livelli di estrogeni e progesterone, ormoni che proteggono le vie aeree superiori aumentando il tono muscolare e la stabilità respiratoria, è considerata una delle cause principali di questo cambiamento.

OSAS NELLA DONNA

Presentazione clinica: Gli uomini tendono a presentare sintomi classici di OSAS, come russamento cronico, apnee osservate e sonnolenza diurna. Le donne, invece, possono manifestare sintomi meno tipici, come insonnia, stanchezza cronica, mal di testa mattutino e depressione.

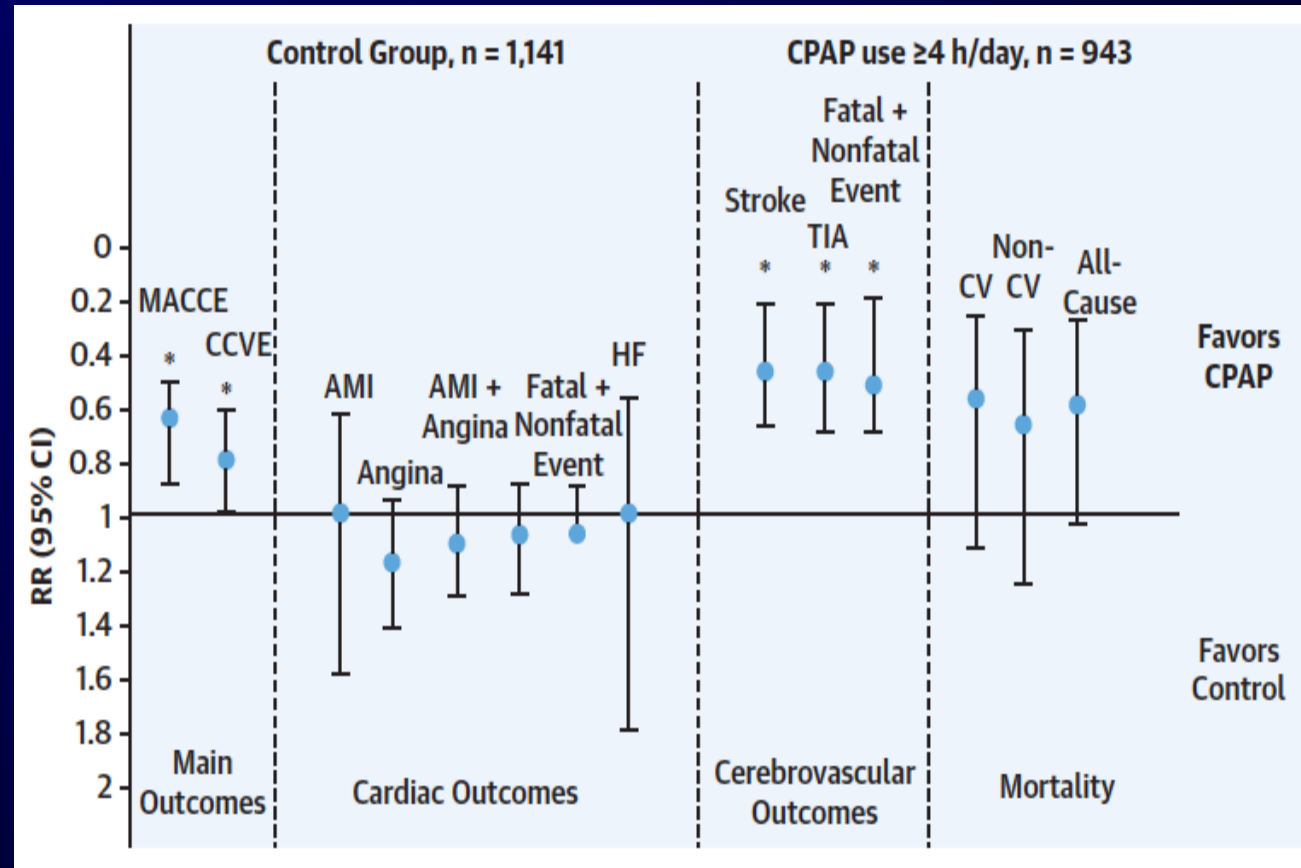
Questa differenza nella presentazione clinica può portare a una sottodiagnosi dell'OSAS nelle donne.

Risposta al trattamento: Gli uomini e le donne possono rispondere diversamente alla terapia CPAP.

Le donne tendono a tollerare meglio la terapia e ad aderire maggiormente al trattamento, anche se spesso ricevono una diagnosi in uno stadio più avanzato del disturbo.

TREATMENT OF OSA

- Weight loss
- Positional treatment
- Positive airway pressure
- Surgery
- Oral appliances
- Oxygen



Tirzepatide for the treatment of obstructive sleep apnea: the SURMOUNT -OSA 3 trial

- Among persons with moderate-to-severe obstructive sleep apnea and obesity, tirzepatide reduced the AHI, body weight, hypoxic burden, hsCRP concentration, and systolic blood pressure and improved sleep-related patient-reported outcomes.

PROSPETTIVE

More comprehensive use of wearable devices and remote monitoring technologies to provide opportunities for robust validation studies in terms of screening and treatment of sleep-disordered breathing

Use of artificial intelligence/machine learning for processing and identifying actionable data in patients with OSA and developing personalized therapies

Improvements in home diagnostic tools to include unobtrusive sensors for other variables (eg, electroencephalogram, electromyogram, electrooculogram)

Better cardiovascular risk stratification in patients with OSA

Better identification of which patients with OSA should be treated with the goal of preventing or mitigating CVD

Addressing structural racism and health inequities that undoubtedly underlie the higher prevalence and the variation in outcomes at the intersection of OSA/CVD

Innovative and effective options for therapy that are better tolerated and cost-effective