수면센터에서의 응급상황

강 경 욱
전남대병원 신경과

Sleep center emergencies

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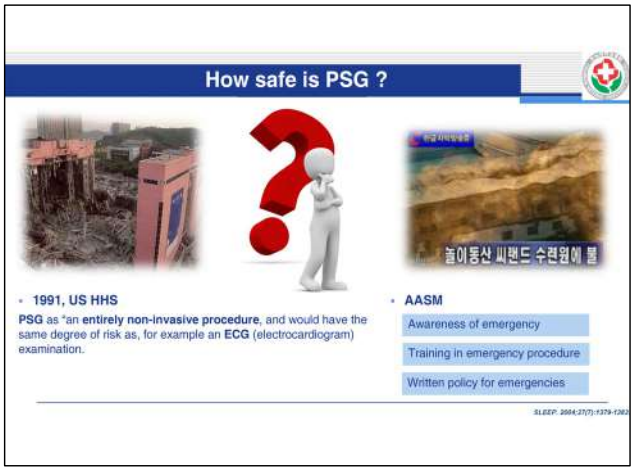
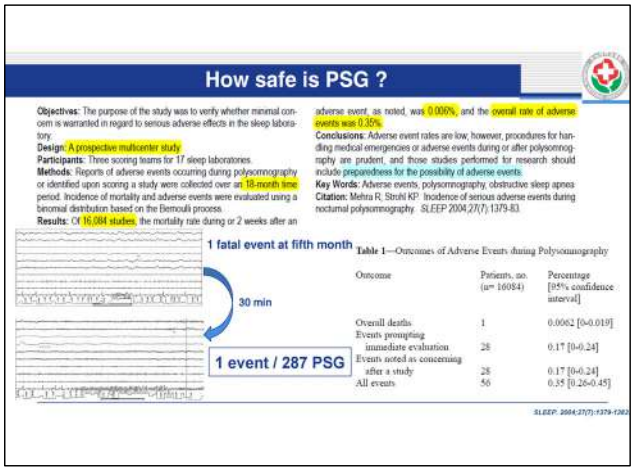
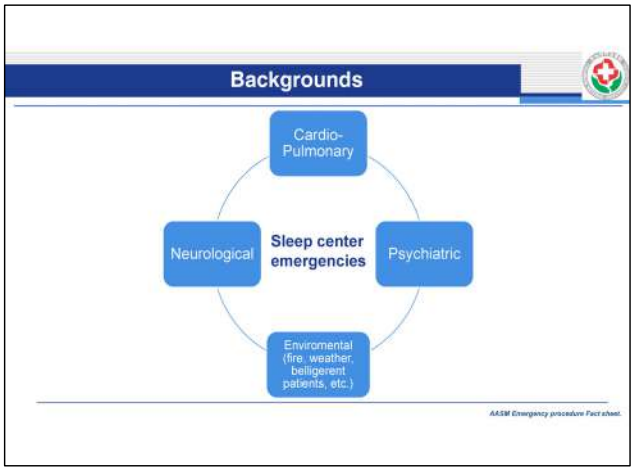
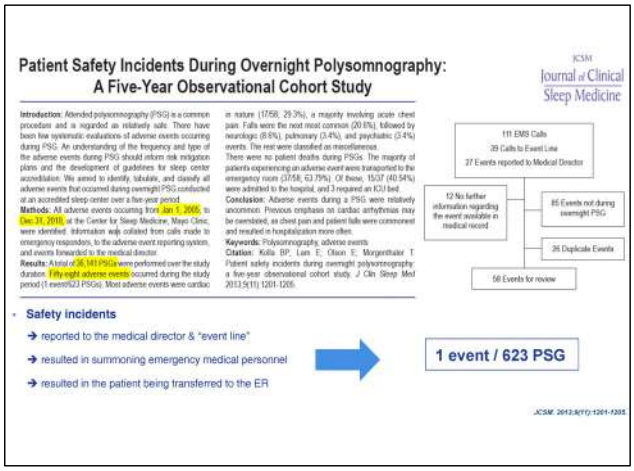








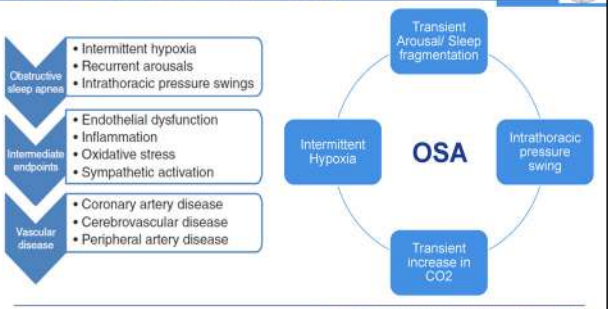
Patient Safety Incidents During Overnight Polysomnography: A Five-Year Observational Cohort Study

JCSM Journal of Clinical Sleep Medicine

Event	Specification	No. of event (%)	ER visits (%)	No. of adm. (%)
Cardiovascular	Chest pain (12)	17 (29.3%)	15 (40.5%)	7 (46.7%)
	Arrhythmia (4)	Sinus tachycardia (1), 2nd AV block (1), A-flb(2)		
	Cardiogenic syncope (1)			
Falls	Zolpidem (42%), Fall precautions (58%)	12 (20.6%)	2 (5.4%)	0 (0)
Neurological	Sz. (1), Syncope (2), TIA (1), Meningitis (1)	5 (8.6%)	3 (8.1%)	1 (6.7%)
Psychiatric		2 (3.4%)	1 (2.7%)	1 (6.7%)
Pulmonary		2 (3.4%)	2 (5.4%)	1 (6.7%)
Others	Epistaxis (2), Hyperglycemia (2), Child abuse (2), Others (14)	20 (34.5%)	14 (37.8%)	5 (33.3)

JCSM. 2013;9(11):1201-1205.

Cardio-vascular events in OSA pt.



Compr Physiol. 2015;6(2):1519-38. Metabolism Clinical and Experimental. 2018;84:5-16.

AF in OSA pt.

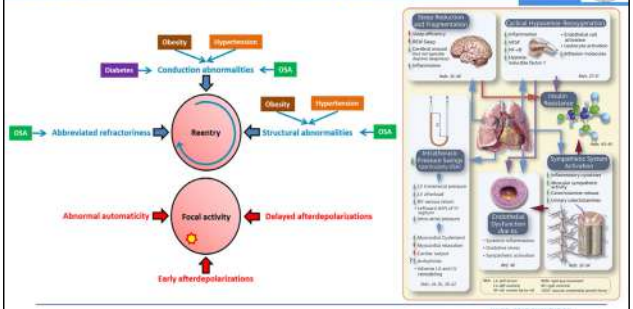
✧ ESC Guidelines for AF, 2020

Class IIa	Weight of evidence/opinion is in favour of usefulness/efficacy.	Should be considered
Class IIb	Usefulness/efficacy is less well established by evidence/opinion.	May be considered

Opportunistic screening for AF should be considered in patients with OSA.[172]	IIa	C
Optimal management of OSA may be considered, to reduce AF incidence, AF progression, AF recurrences, and symptoms.[650,651,1057–1061,1064,1065]	IIb	C

European Heart Journal. 2020;0(3):375-428.

AF pathomechanisms in OSA pt.



JACC. 2017;3(10):715-23.

AF in OSA Pt.

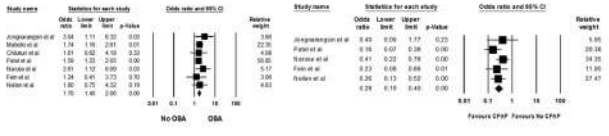
Effect of obstructive sleep apnea and its treatment of atrial fibrillation recurrence after radiofrequency catheter ablation: A meta-analysis

After ablation, risk of recurrence of AF

1.7 fold ↑

After ablation, reduction of AF recur

70% ↓

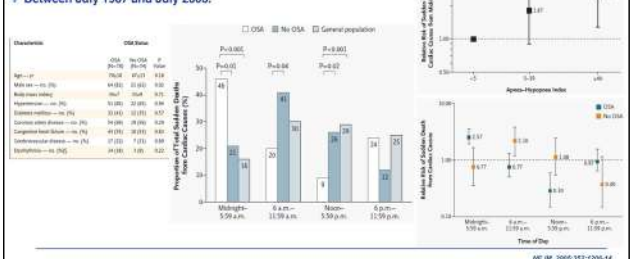


J Evid Based Med. 2018;1-7.

Sudden death in OSA pt.

✧ 112 Minnesota residents who had undergone PSG and had died suddenly.

✧ Between July 1987 and July 2003.



NEJM. 2005;352:1206-14.

Sudden death in OSA pt.

Objectives This study sought to identify the risk of sudden cardiac death (SCD) associated with obstructive sleep apnea (OSA).

Background Risk stratification for SCD, a major cause of mortality, is difficult. OSA is linked to cardiovascular disease and arrhythmias and has been shown to increase the risk of nocturnal SCD. It is unknown if OSA independently increases the risk of SCD.

Methods We included 10,701 consecutive adults undergoing their first diagnostic polysomnogram between July 1987 and July 2003. During follow-up up to 15 years, we assessed incident resuscitated or fatal SCD in relation to the presence of OSA, physiological data including the apnea-hypopnea index (AHI), and nocturnal oxygen saturation (O_2sat) parameters, and relevant comorbidities.

Results During an average follow-up of 5.3 years, 142 patients had resuscitated or fatal SCD (annual rate 0.27%). In multivariate analysis, independent risk factors for SCD were age, hypertension, coronary artery disease, cardiomyopathy or heart failure, ventricular ectopy or nonsustained ventricular tachycardia, and lowest nocturnal O_2sat (per 10% decrease, hazard ratio [HR]: 1.14; p = 0.029). SCD was best predicted by age >60 years (HR: 5.53), apnea-hypopnea index >20 (HR: 1.60), mean nocturnal O_2sat <93% (HR 2.93), and lowest nocturnal O_2sat <78% (HR: 2.60; all p < 0.0001).

Conclusions In a population of 10,701 adults referred for polysomnography, OSA predicted incident SCD, and the magnitude of risk was predicted by multiple parameters characterizing OSA severity. Nocturnal hypoxemia, an important pathophysiological feature of OSA, strongly predicted SCD independently of well-established risk factors. These findings implicate OSA, a prevalent condition, as a novel risk factor for SCD. (J Am Coll Cardiol 2013;62:610–6) © 2013 by the American College of Cardiology Foundation

Obstructive Sleep Apnea and the Risk of Sudden Cardiac Death
A Longitudinal Study of 10,701 Adults

✧ **Factor associated with an increased risk of SCD.**

- Age (>60yrs, HR 5.53), AHI (>20/hr, HR 1.6), Mean nocturnal O_2 sat. (<93%, HR 2.93), Lowest O_2 sat. (<78%, HR 2.6)

JACC. 2013;62:610-616.

ASSM Cardiac rule

✧ **Technical Specifications** (Version 2.6)

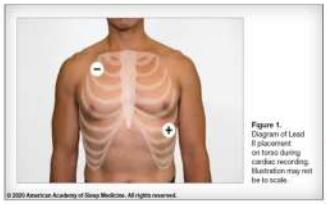
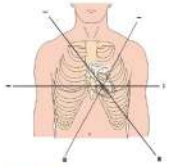


Figure 1.
Diagram of Lead II placement on torso during cardiac recording. Illustration may not be to scale.



- Additional leads may be placed.
- Increasing the image size on the display may improve detection of arrhythmia.
- Standard ECG electrode applications are superior to EEG electrodes in minimizing artifact.

JCSM. 2007;3(2):147-154.

ASSM Cardiac rule

✧ **Classification of Arrhythmia**

- **Rhythm disorders**
  - **Formation disorders**
    - **Bradyarrhythmias** → **Sick sinus syndrome**
      - Sinus bradycardia
      - Sinus pause
      - Sinoatrial exit block
      - Tachycardia-bradycardia syndrome
    - **Tachyarrhythmias** → **Site of origin?**
      - Sinus tachycardia
      - Atrial tachycardia
      - Atrial fibrillation
      - PSVT; AVNRT, AVRT
      - Junctional tachycardia
      - Ventricular tachycardia
      - Torsades des pointes
      - Ventricular fibrillation
  - **Conduction disorders**
    - **Bradyarrhythmias** → **Site of block? Degree of block?**
      - Atrioventricular block;
        - 1st degree
        - 2nd degree; Mobitz 1, 2
        - High degree
        - 3rd degree = complete
      - BBB; right, left
      - LFB; anterior, posterior

JCSM. 2007;3(2):147-154.

ASSM Cardiac rule

✧ **Bradycardia**

- Unpublished data from 2,607 adults subjects (F: 1,448, M: 619, Mean age: 62.1yrs)
  → Minimum normative value (F: 47.5 bpm, M: 43 bpm)
- In nocturnal holter study from 50 healthy young males: Mean HR (43 bpm), minimum HR of <40bpm in 24%.
- In the SHHS data, females have consistently been shown to have higher average HR than male.
- Scoring: sustained heart rate < 40bpm for ages 6 years through.

$118.1 - (0.57 \times \text{age}) = X \pm 14\%$ (normal heart rate)

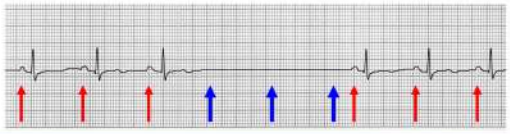
Heart Rate	Rhythm	P wave	PR interval	QRS
<40 bpm	Regular	Before each QRS, identical	0.12 to 0.20 sec	< 0.12 sec

ASSM Scoring Manual V 2.6 & JCSM. 2007;3(2):147-154.

ASSM Cardiac rule

✧ **Asystole**

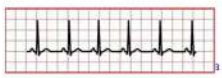
- In young healthy subjects, sinus pause is longer during sleep than wakefulness.
- More prolonged in males than in females
- 37 percent of trained athletes have been reported between 2-3 sec during sleep.
- Scoring: cardiac pause greater than 3 sec for ages 6 years through.

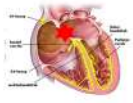


ASSM Scoring Manual V 2.6 & JCSM. 2007;3(2):147-154.

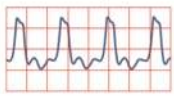
Tachyarrhythmia

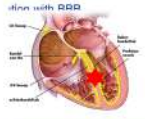
Narrow QRS tachycardia (QRS < 120msec, 작은눈금 3칸 이내)





Wide QRS tachycardia (QRS > 120msec, 작은눈금 3칸 이상)





ASSM Cardiac rule

- Sinus tachycardia
  - HR: >90 bpm during sleep or >100 bpm during wake (100-150 bpm during wake)
  - P wave appearance: similar with NSR
  - Rhythm: Regular
  - Action: Monitor closely. In most cases, no action is needed.
    If symptomatic, notify physician on call

ASSM Scoring Mauel V 2.0 & JCSM. 2007;2(2):147-154.

ASSM Cardiac rule-Tachyarrhythmia other than sinus

- Narrow complex tachycardia (작은 눈금 3칸 이내)
  - Scoring: lasting a minimum of 3 consecutive beat at a rate > 100bpm with QRS duration < 120msec.
- Atrial flutter
  - Rapid well organized contraction of atrium at a rate of 250-350 bpm.
  - Atrial activity is represented by sawtooth-like deflections.
  - Usually the AV conduction is 2:1.
  - Rarely, the AV conduction is 3:1, 4:1 or variable.
  - Sudden onset or symptomatic: Notify physician on call

ASSM Scoring Mauel V 2.0 & JCSM. 2007;2(2):147-154.

ASSM Cardiac rule-Tachyarrhythmia other than sinus

- Atrial Fibrillation
  - Scoring: Irregulary irregular QRS complexes +
    Replacement of P waves by rapid oscillation (vary in size, shape, and timing).
  - *Irregularly irregular.*
  - When rate of QRS complex > 100 bpm,
    atrial fibrillation is described as having a rapid ventricular response .
  - Acute hemodynamic instability (i.e. syncope, acute pul. Edema, ongoing MI, symptomatic hypotension, or cardiogenic shock) ➔ needed prompt intervention.

Recommendations	Class[a]	Level[b]
Emergency electrical cardioversion is recommended in AF patients with acute or worsening haemodynamic instability.	I	B
In AF patients with haemodynamic instability, amiodarone may be considered for acute control of heart rate.	IIb	B

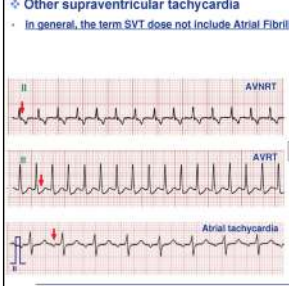
European Heart Journal 2020. ASSM Scoring Mauel V 2.0 & JCSM. 2007;2(2):147-154.

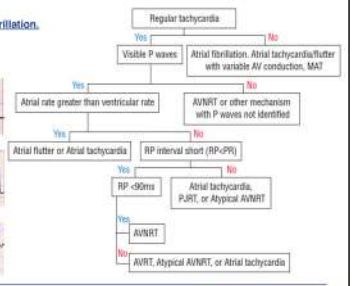
ASSM Cardiac rule-Tachyarrhythmia other than sinus

- Atrial Fibrillation

ASSM Cardiac rule-Tachyarrhythmia other than sinus

- Other supraventricular tachycardia
  - In general, the term SVT dose not include Atrial Fibrillation.



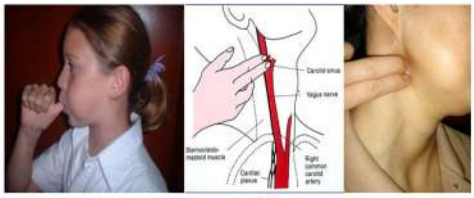


European Heart Journal 2020;41:655-720.

ASSM Cardiac rule-Tachyarrhythmia other than sinus

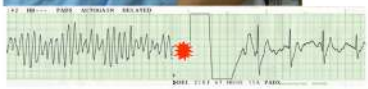
- Other supraventricular tachycardia

미주신경 항진술 (Vagal Maneuver)



Valsalva술 Carotid Sinus Massage

Defibrillation



ASSM Cardiac rule-Wide QRS complex Tachyarrhythmia

❖ Ventricular tachycardia

- Scoring: lasting a minimum of 3 consecutive beat at a rate > 100bpm with QRS duration > 120msec.
- Can occur with many variations of the QRS morphology, depending on where the arrhythmia originates.

- 지속 기간
  비지속성 (nonsustained): persisting less than 30sec
  ➔ 증상 있을 시, 검사자는 바로 보고가 필요함.
  지속성 (sustained) -30초이상, 혈역학적 허탈 동반

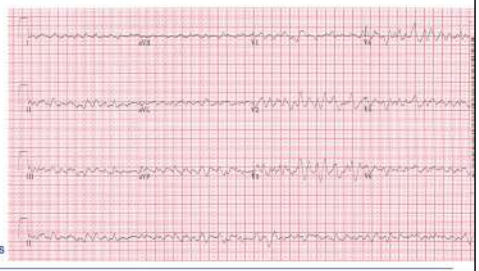
- QRS파 모양
  단형 (monomorphic) 심실 빈맥
  다형 (polymorphic) 심실 빈맥

- 구조적 심질환의 유무
  특발성 (idiopathic) - RVOT VT, ILVT
  구조적 (structural) - MI, Cardiomyopathy, Brugada, ARVC

European Heart Journal 2020; ASSM Scoring Maual V 2.0 & JCSM; 2007;3(2):147-154.

ASSM Cardiac rule-Wide QRS complex Tachyarrhythmia

❖ Ventricular fibrillation



✓ Mechanism
➔ Multiple wavelets of reentry
✓ ECG
➔ Irregular with no discrete QRS

Cardiac Events reports

❖ Average HR, Highest HR during sleep, Highest HR during recording

❖ Occurrence of bradycardia; lowest HR

❖ Occurrence of asystole; longest pause

If observed,

❖ Sinus tachycardia, (Narrow or Wide) complex tachycardia during sleep
; highest HR

❖ Occurrence of AF; average HR

❖ Occurrence of other arrhythmia....

ASSM Scoring Maual V 2.0.

Respiratory emergencies

❖ Persistent low oxygen saturation

- Adults with sleep disordered breathing commonly tolerate SpO_2 levels between 80 and 90% for prolonged periods.
- SpO_2 <88% in patients with COPD: oxygen therapy can be administrated.
- SpO_2 <85% in patient without a history of hypoxemia: potential medical emergency.
- COPD exacerbation signs: Activate emergency medical systems.
- Never start supplemental oxygen therapy routinely, especially in patient with history of COPD .

Chest. 2017;152(6):1210-1226. & Thoracic Society of Australia and New Zealand Clinical Practice guideline.

Summary

❖ Cardioplumonary emergencies

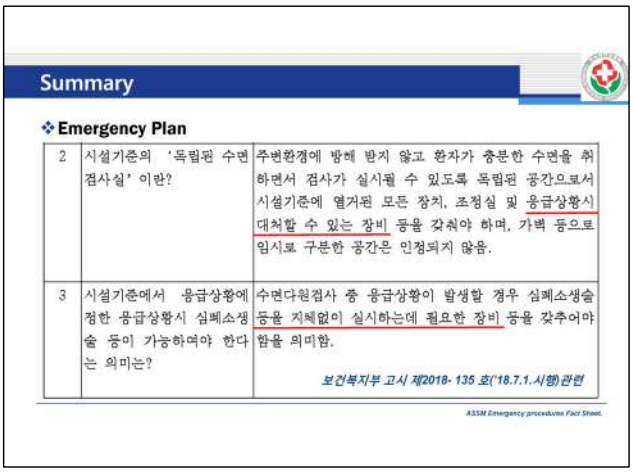
- Cardiac arrest (Asystole greater than 10 sec)
- VT > than 10 seconds
- Vf
- Apnea greater than 2 minutes
- Changes in cardiac rhythms: Persistent bigeminy or trigemini, AF, Af,
  > 6 PVCs per min for > 2min, Tachycardia or Bradycardia

❖ Neurological emergencies: Seizure or Stroke

❖ Psychiatric emergencies: Suicide ideation, Acute psychosis, etc.

❖ Enviromental-Non-medical emergencies

ASSM Emergency procedures Fact Sheet.



Summary

❖ Emergency Plan

2	시설기준의 '독립된 수면 검사실' 이란?	주변환경에 방해 받지 않고 환자가 충분한 수면을 취하면서 검사가 실시될 수 있도록 독립된 공간으로서 시설기준에 열거된 모든 장치, 조정실 및 응급상황시 대처할 수 있는 장비 등을 갖춰야 하며, 가벽 등으로 임시로 구분한 공간은 인정되지 않음.
3	시설기준에서 응급상황에 정한 응급상황시 심폐소생술 등이 가능하여야 한다는 의미는?	수면다원검사 중 응급상황이 발생할 경우 심폐소생술 등을 지체없이 실시하는데 필요한 장비 등을 갖추어야 함을 의미함. *보건복지부 고시 제2018- 135 호('18.7.1.시행) 관련*

ASSM Emergency procedures Fact Sheet.