

Use of the Odds Ratio Product to Investigate Subjective Excessive Sleepiness

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Abstract Number: 0768
 Poster Number: 256

Introduction

- Subjective reports of excessive daytime sleepiness (EDS) may have multiple causes, including poor sleep quality, inadequate amount of sleep (sleep deprivation), or primary disorders of sleepiness such as narcolepsy and idiopathic hypersomnolence.
- The Epworth Sleepiness Scale (ESS) [1] is currently the most widely used tool for measuring daytime sleepiness. It asks people to rate, on a 4-point scale (0 - 3), their usual chances of dozing off or falling asleep in 8 different situations or activities that most people engage in as part of their daily lives, although not necessarily every day.
- The total ESS score is the sum of the 8 item-scores and can range between 0 and 24. The higher the score, the higher the person's level of daytime sleepiness. However, the ESS does not provide insight as to any distinguishing causes of sleepiness.
- Current methods of scoring sleep (Rechtschaffen & Kales) [2] do not include a method to rate sleep quality. The Michelle scoring system (MSS) [3] is a computer assisted scoring system that incorporates a new algorithmic value called ORP (odds ratio product), which is a continuous measure of sleep quality [4].
- ORP is the probability that the power spectrum of EEG patterns analyzed in three second intervals reflects a wake pattern. A higher ORP signifies lighter sleep or wake.
- Average ORP can be determined over specific time intervals or by sleep stages and the index ranges from 0 to 2.5 with a value of 1.5 seen as a cut-off between sleep and wake. The value implies the degree of sleep depth [4].
- We used the ORP in this study to identify excessive somnolence due to poor sleep quality and other factors.

Methods

- 101 patients with suspected obstructive sleep apnea underwent full polysomnography.
- Subjective sleepiness was evaluated by the 24-point ESS. Excessive daytime sleepiness (EDS) is defined as an ESS ≥ 10 .
- ORP values were calculated in 30-second epochs from the electroencephalogram (C3/A2 and C4/A1). ORP was expressed as the average of all 30-second values in total sleep time (TSTORP), this value representing the overall sleep quality during the PSG.
- ATSTORP value <0.8 was considered normal while TSTORP >1.0 was considered poor sleep quality.
- Data was analyzed using the SPSS statistical software, version 20.

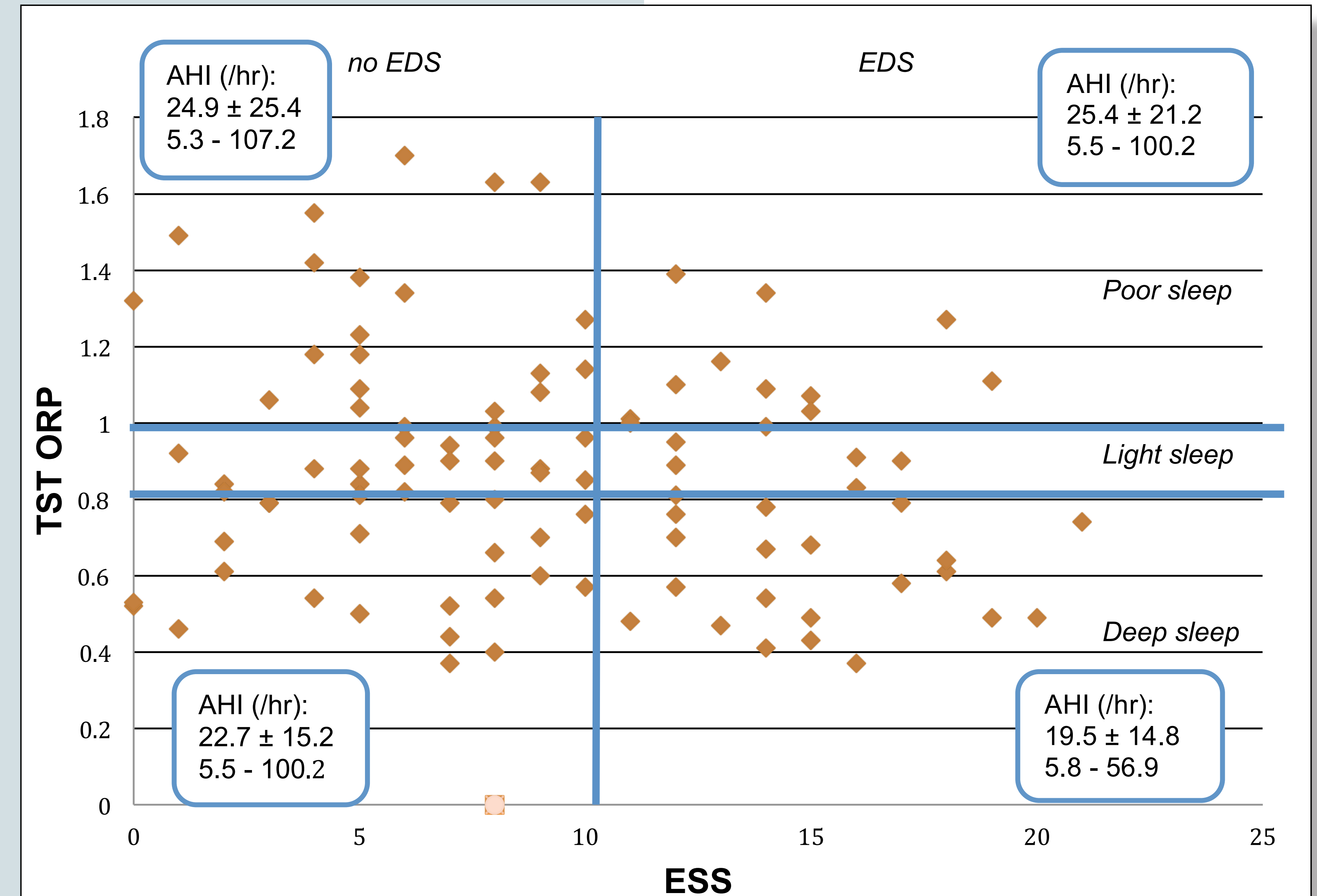
Results

- AHI of the 101 patients showed obstructive sleep apnea of different severity (AHI 23.4 ± 21.2 , range: 5-107/hr) (Table 1).
- The patient population was categorized into 4 groups: good or poor sleep quality in the presence or absence of EDS (Figure 1).
- 44 patients had excessive sleepiness (ESS=14.1 \pm 3.0). Of these, 22 had a normal TSTORP (0.59 \pm 0.13), while the remaining showed evidence of light and fragmented sleep, TSTORP 0.81 to 1.39 (1.05 \pm 0.16).
- 18 patients had normal ESS scores (5.3 \pm 2.6) despite unambiguous poor sleep quality (TSTORP >1 ; Average, 1.30 \pm 0.22).
- The average AHI values for each group were generally similar.

Table 1. Characteristics of patients with obstructive sleep apnea (n=101)

Characteristics	Patients
Age (yrs)	
Mean (SD)	53.0(12.7)
Range	17.0-84.0
Sex (n [%])	
Female	56(55.4)
Male	45(44.6)
BMI	
Mean (SD)	34.8(8.4)
Range	18.2-53.5
AHI(/hr)	
Mean (SD)	23.4(21.2)
Range	5.0-107
ESS	
Mean (SD)	9.2(5.2)
Range	0-21
TST ORP	
Mean (SD)	0.87(0.3)
Range	0.14-1.70

Figure 1. Classification of OSA patients by ESS and TSTORP



Conclusion

- The data provide insight into why some OSA patients complain of EDS while others with similar AHIs do not. Normal ESS scores despite poor sleep quality (high TSTORP) is consistent with the common clinical observation that some patients do not show sleepiness despite severely fragmented sleep.
- The Odds Ratio Product may be a useful new tool to categorize patients with subjective sleepiness into those in whom the problem may be poor sleep quality and those in whom sleep quantity is inadequate due to limited time in bed or excessive sleep needs.

References

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