The Holter ECG Breakthrough for the Sleep Apnea Patient

Sleep-related breathing disorders are not only common, but they bear significant health consequences because they represent severe daytime repercussions as well as increased cardiac morbidity. OSAS (obstructive sleep apnea syndrome) has been largely under diagnosed in the middle-aged population where its prevalence approaches 10%. Because of limited financial resources in the USA for healthcare, it would be very cost-effective to establish OSAS diagnosis, as well as to perform its follow-up, using 24-hour ambulatory ECG techniques instead of in-hospital full night monitoring. Young, Barbe, et al.

Frequency domain analysis with specially designed Holter ECG monitoring is an efficient tool for detecting positive OSAS patients. Its ease of use and interpretation is highly interesting, considering the high prevalence of sleep-related breathing disorders in a general middle-aged population. In addition, it is a tool for monitoring post-treatment efficacy. Roche, et al

Time-domain HRV analysis represents an accurate and inexpensive screening tool in clinically suspected OSAS patients, and helps focus resources on those at highest risk. The strength of our study was deriving and validating variables of day-night differences in SDNN, SDNN Indes, and rMSSD to obtain a high sensitivity (90%) and high specificity (98%) in the diagnosis of OSAS. A high sensitivity would allow exclusion of the threat of OSAS by use of a single Holter recording in patients at risk, such as obese cardiac patients. Whereas, a high specificity would help to increase the probability of the disease if performed as a pre-test for polysomnography. Gaspoz, et al.

The novel findings in this study are that (1) cardiovascular variability is altered in patients with OSAS, and this alteration occurs even in the absence of hypertension, heart failure, or other disease states; and (2) the degree of derangement in cardiovascular variability is linked to the severity of OSAS. Altered cardiovascular variability affects predominantly patients with moderate-to-severe sleep apnea. Normalized Low-Frequency variability of RR and LF-toHF ratio of RR variability are increased, and normalized High-Frequency variability of RR is decreased. Somers, et al.

These abnormal breathing patterns lead to a marked increase in HRV, particularly by giving rise to a dominant oscillation in the VLF band of power spectral analysis. Mortara, et al.

Frequency domain analysis of HRV during nocturnal sleep, especially VLF (very-low-frequency) and VLF peak is a non-invasive low-cost approach to diagnose, and is better monitoring for patients undergoing treatment at home. Shiomi, et al.

We concluded that power spectral analysis of heart rate variability is a means of identifying episodes of sleep-related breathing disorders. Analysis of HRV is a valuable additional diagnostic tool in patients undergoing Holter ECG recording. Keyl, et al.

Total LF and HF power were measured using a Holter ECG recording. Differences between day and night values were more pronounced in the sleep apnea group and related to the apneahypopnea-index and low oxygen saturation. HRV aids differentiating between scorers and patients with severe sleep apnea syndrome. Dworschak, et al.

The OSAS patient elicits a unique heart rate rhythm that basis for an effective screening tool. In non-REM sleep, spectral analysis of HRV appears to be significantly better indicator of OSAS than the current screening method of oximetry, and in REM sleep, it is comparable with oximetry. Hilton, et al
Spectral analysis of heart rate variability (HRV) is useful as a non-invasive means of assessing autonomic function in patients with OSAS. Khoo, et al

The LF band showed a constant increase, leading to significant change in sympathovagal balance (LF/HF ratio). In conclusion, concordantly with previous peripheral sympathetic-nerve recordings, frequency domain analysis of HRV is able to detect sympathetic activation during sleep apnea episodes, leading to marked change in the sympathovagal balance. Vanninen, et al.

Long-term CPAP treatment reduced biochemic markers of sympathetic activity. It is concluded that obstructive sleep apnea is associated with high sympathetic activity both during sleep and waking periods. Hedner, et al.

These results favor HRV for inclusion in future risk stratification models in patients with sleep-related breathing disorders. Bauer, et al.

We conclude that OSAS alters beat-to-beat variation in characteristic fashions in children, that the variability changes occur at all heart rates but are most significant at slow heart rates, and that these heart rate patterns assist in screening of suspected cases of OSAS. Aljadeff, et al.

Heart rate and heart rate variability are under the control of the autonomous nervous system. It can be assumed that during sleep internal influences dominate the autonomous nervous system. We conclude that detrended fluctuation analysis is able to separate the influences of sleep stages and sleep apnea on heart rate variability. Penzel, et al.

Differences in the QT interval corrected (QTc) just before the onset of apnea, at the end of apnea and during the postapnea hyperventilation period were compared. As expected, the RR interval prolonged considerably during OSAS (1,499 +/- 128 ms) compared to quiet sleep (1.019 +/- 131 ms) and decreased during the postapnea hyperventilation period (969 +/- 152 ms). The QT interval was prolonged at the onset of apnea (482 +/- 34 ms) compared to the active awake state (421 +/- 10 ms). Further prolongation of the QT interval was observed during OSAS (528 +/- 64 ms). The QT interval shortened abruptly during the postapnea hyperventilation period (435 +/- 34 ms). The QTc was also prolonged during the the onset of apnea (482 +/- 34 ms) and during the postapnea hyperventilation period (423 +/- 39 ms). Gillis, et al.

Patients with sleep apnea have a high prevalence of ventricular arrhythmias. Javaheri, et al.
INDICATIONS THAT HAVE BEEN APPROVED FOR SLEEP APNEA MONITORING

General Indications:
1) Male, Snores, Over 35
2) Obese, Snores, Over 35

The following ICD-9-CM diagnosis codes have been identified as meeting the above criteria for Sleep Apnea monitoring:

- 786.09 Shortness of Breath, Apnea, Resp. Distress
- 427.60 Premature Beats: Ectopics, Extrasystoles
- 427.61 Supraventricular Premature Beats
- 427.69 Ventricular Premature Beats, Contract/Systoles
- 780.4 Dizziness/Giddiness: Light-Headed, Vertigo
- 785.1 Palpitations: Awareness of Heart Beat
- 786.0 Respiratory Abnormality, unspecified
- 786.50 Chest Pain, unspecified
- 786.59 Chest Discomfort, Pressure, Tightness
- 794.31 Abnormal EKG
- V67.59 Drug Therapy Follow Up