ECG DERIVED RESPIRATION AS A VALID RESPIRATORY SIGNAL FOR DETECTION OF APNEA/HYPOPNEA EVENTS

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Introduction : Surface ECG is a robust, easy to acquire physiological signal. Many studies have used ECG derived parameters, mainly heart rate variability, as a measure of central autonomic control during sleep. Our objective is to demonstrate that additional variables derived from the ECG signal provide valuable information on respiration during sleep. The purpose of this study is to show that ECG derived respiration is as effective as any other measure of respiratory activity, in detecting apnea events.

Methods : ECG derived respiration (EDR) is extracted by measuring the effect of slight anatomical displacements (which accompany normal and abnormal the respiratory movements) on the morphology of the ECG complexes. This concept was introduced by Moody et al (1985).

128 whole night polysomographs, including SpO2, abdomen and thorax effort signals, and oronasal airflow (thermistor), were analyzed using gold standard manual scoring and an automatic score based on EDR and SPO2 signals.

Results : EDR was calculated and yielded a signal that resembles effort signal during normal and abnormal breathing. The linear correlation between the results of manual score of apnea events and the automatic score was very good (R=0.88). The replacement of the EDR signal with any one of the recorded respiratory signals (thorax, abdominal movement and flow), in the automatic score, resulted in similar RDI results (R=0.87, R=0.85, R=0.86 respectively). The correlation between the total number of respiratory events automatically detected using EDR and SPO2 and any respiratory signal (thorax, abdomen and flow) and SPO2 (R2=84, R2=91, R2=85 respectively). The breathing frequency calculated minute by minute for each signal, was identical (difference was below 1 breath per minute) for all signals for 90%, 89%, 90% of the time for abdomen, thorax, and flow respectively.

Conclusion : Respiration measured by means of thorax/abdomen effort or flow yield similar results to those obtained when EDR is used, concerning respiratory frequency, total respiratory events and RDI. The use of EDR is limited to patients with sinus rhythm.

The use of EDR as an alternative respiratory signal is based on a signal with an excellent signal to noise ratio, may be more comfortable for the patient.