Relevance of ECG and SpO2 Frequency Spectra for Patient Respiratory Status Monitoring During Remifentanil-Induced Conscious Sedation for Lithotripsy

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In an Extracorporeal Shock Waves Lithotripsy (ESWL) procedure, patients are sedated to relieve pain and prevent them from moving. The standard sedative drug Remifentanil has an effect on the central nervous system and eventually silence the respiratory commands. Patients then no longer breathe spontaneously. These apneic episodes can lead to serious consequences to patient safety. Standard patient monitoring during ESWL includes four-lead ECG, pulse oximetry (SpO2) and expired gases analysis (EtCO2). In order to improve patient safety during ESWL, a method to anticipate the breathing pattern during conscious sedation based on monitoring standard patient biomedical signals has been developed. The method uses Fast Fourier Transform as the main feature extraction tool and Partial Least Square (PLS) regression for the modeling. Patient data collected during the procedure have been used to develop the model. The presentation will show that limited regression parameters are sufficient to explain the variance in ECG and Sp02 spectra and that there is a significant correlation with the upcoming CO_2 spectrum. Therefore, apneic or pre-apneic states during conscious sedation are predictable from the model. As a result, patient safety can be improved by having a automated warning system.