

A Features Trends View of CO² Breaths Signals

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Background: One of the main drawbacks of current monitors' displays is the limited options of reviewing parameters trends. The trend is typically a single line presenting a specific parameter's values over time. Here we propose two distinct display options that are composed of complex not-easily discerned information from CO₂ waveforms. These trend views promote a comprehensible and simpler means of recognizing patterns and trends that are indicative of patient physiology and condition.

Methods: First the CO₂ signal was segmented into separate breaths, artifacts were filtered out, and then different features were calculated per breath. The features include (but not limited to): maximal CO₂, breath width, area under the curve (AUC) and inhalation exhalation ratio (i2e ratio). The display options were developed for those features, where the AUC display reflects the AUC, max CO₂, and breath's width using color coding (Fig. 1L). The i2e ratio display presents for each time point the average and variability of the parameter over a specified time period (Fig 1R).

Results: A working algorithm and software package for display on PC, Tablet or a CO₂ monitor with input coming from a Covidien Capnograph has been completed. The software algorithm tool is used to evaluate patient condition by providing an overview of the parameters over a large time period. The display tool enables scrolling, browsing, zooming in/out and event marking is provided for retrospective evaluations.

Data from patients under procedural sedation and ICU patients during weaning was reviewed retrospectively using the displays, demonstrating easy detection of inefficient breathing periods that either was not revealed by respiration rate or EtCO₂ values, or was otherwise unnoticed due to view over large time periods.

Conclusion: Features Trends Display has been developed as a software tool. It provides innovative visualization tools to simplify assessment of patient condition from Capnography waves' features. The methodology could be applied on other periodic signals.

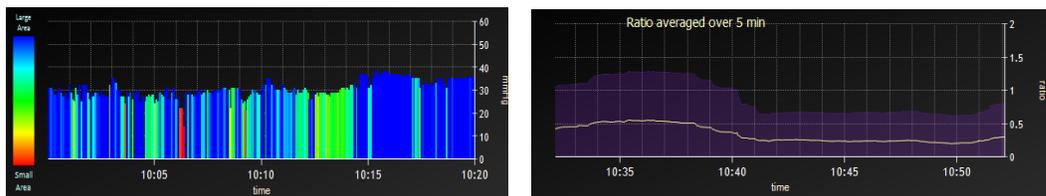


Fig. 1: (Left) Example of AUC display over 20 min (Red-inefficient breaths, Green-Normal healthy breaths, Blue- Large breaths); (Right) example of i2e ratio display (yellow line: average over 5 min, Purpul area \pm STD).