

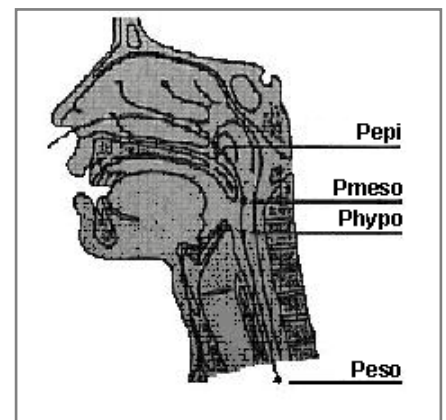
Measuring Esophageal Pressure during Sleep

Medcare solutions for the esophageal analysis of Sleep Disordered Breathing

Medcare offers tools that simplify the use of Esophageal pressure, a golden standard for measuring respiratory effort and pleural pressure.

What You Need to Be Successful

- Tools to easily measure esophageal pressure without the cumbersome details of calibration. It is important to measure pressure with an accuracy of 0.1cmH₂O with only a simple two-step process of calibrating a high and low pressure value.
- Sensors that are minimally invasive and allow multiple measurement sites. For example: obstruction in the palatal area can be distinguished from obstruction in the central area. The typical sites for measurement are shown here.
- Comprehensive reporting that includes:
 - Breath-by-breath pressure
 - Maximum pressure swing and duration of events
 - Pressure trends
 - Pressure profiles for sleep stages and body position
 - Relation of esophageal pressure with detailed arousal analysis
- Online reporting of esophageal pressure by breath calculations so that intervention such as CPAP can be applied to meet clinical requirements.



Medcare's Measurement of Esophageal Pressure

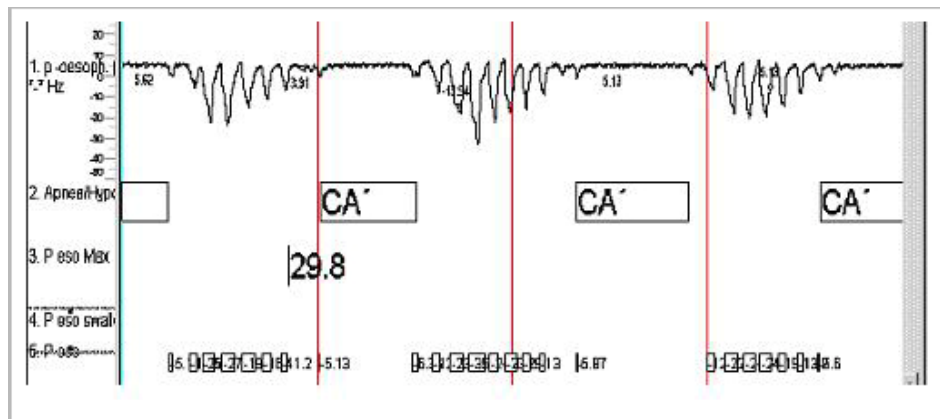
- Simplified two-command user-interface for linear calibration
- Analog interfaces on devices so that any type of sensor can be used
- Auto-adaptive analysis for the detection of breath-by-breath pressure swing so that the effect of temperature drift does not interact with the results
- Online methods for auto-adaptive detection
- Comprehensive reporting

Calibrating Esophageal Pressure

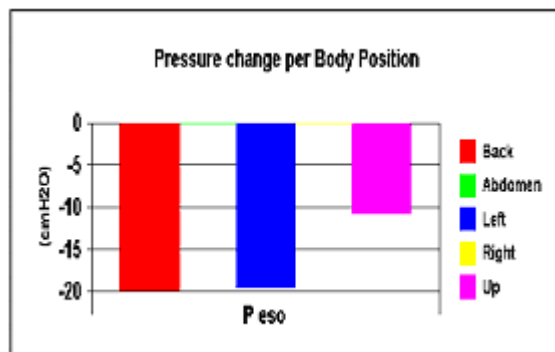
Medcare uses esophageal pressure sensors that are linear in the operating range of 0-300mmHg. For easy calibration, the sensor is placed in a closed chamber and pressure is applied at two operating levels. The recommended values are 0cmH2O and -40cmH2O.

Analyzing Esophageal Pressure

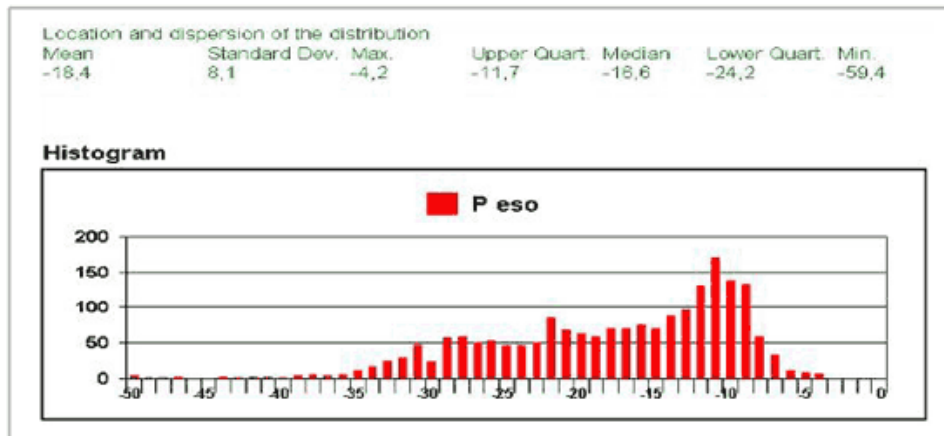
After sensors are properly applied, the measurement and analysis is very straightforward. The example below shows an esophageal pressure trace, *Peso*, during a central apnea episode. The effort per breath and the pressure swing are graphically presented together with the maximum effort per event.



The pressure change per event can also be reported in combination with body position or sleep stages. The example below shows the average values for various body positions.



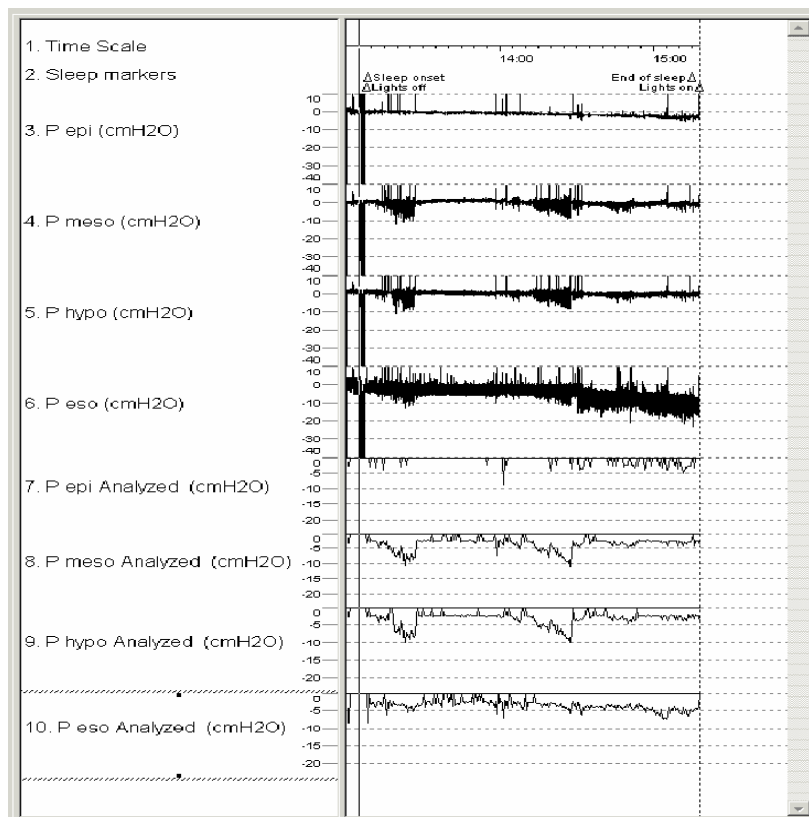
Detailed statistics can also be reported with a single click, as in the following histogram example:



Measuring Multiple Sites

Medcare amplifiers feature multiple inputs to simplify the measurement of multiple sites. However, balloon or drip-type pressure measurements are not recommended for this procedure. Instead, sensors with solid state technology should be used. Solid state technology allows multiple sensors within a silicon catheter tubing of about 3 mm at multiple locations.

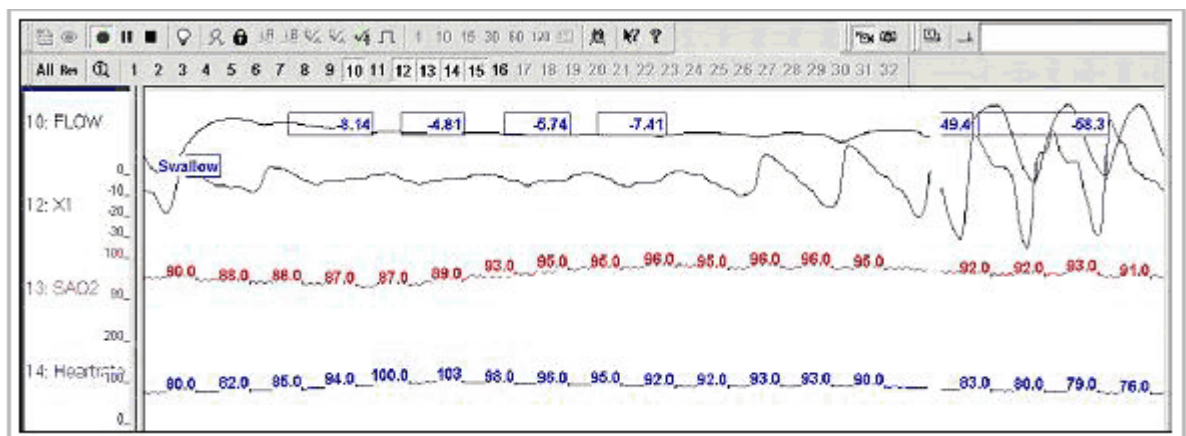
A trend of Esophageal Pressure at four sites is shown below:



The four traces (numbers 3 to 6) show the pressure values of all breaths. The Peso channel is showing the central effort. The central effort is present at all times with an increase during apnea. Peso also shows that the baseline is drifting. However, the analysis per breath automatically corrects for the baseline as shown in trace 10. This trace is showing maximum swing of pressure for each epoch. This measurement shows that there is no obstruction in the soft palate area and the obstruction predominantly occurred in two bouts. The positive swings above zero cmH₂O resulted from the swallowing reflex. This is also automatically corrected in the analysis of pressure swings per breath.

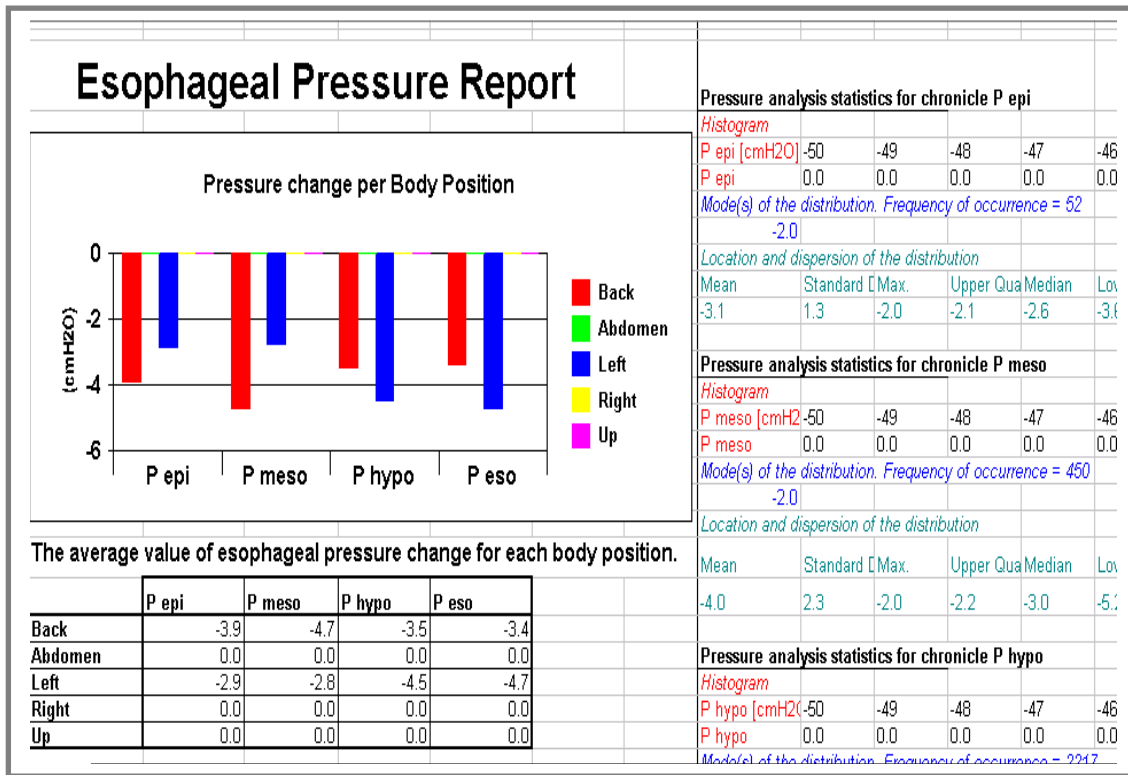
Online Analysis

Online analysis of pressure per breath is a very powerful aid in optimizing interventions. The online analysis in Medcare software provides pressure per breath and marks swallow artifacts.



Reporting

A detailed report for each pressure location supports the statistical analysis. The report example below shows that the upper airway obstruction is higher in the supine position and that central effort is reduced in the supine position, which can be caused by abdominal obesity. See the following example:



Sensors

Medcare provides catheter sensors and sensor adapters to measure Esophageal pressure at 1, 2 or 4 sites.

Further Information

For further information contact support@medcare.com or sales@medcare.com.