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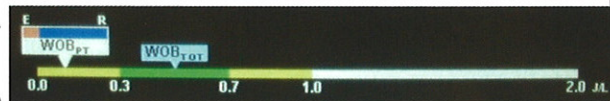
What does Work of Breathing (WOB) mean? It's a measurement of the amount of energy expended to move a litre of gas into a patient. Total WOB is affected by compliance of the lung and thorax, resistance of the patient's airways and the ETT or trach, inspiratory flow rates, and inspiratory volume. WOB is measured in units of Joules/Litre. Normal WOB (on a non-intubated, spontaneously breathing patient) is .3 to .7 J/L.

The WOB graph on the Puritan Bennett 840 ventilator equipped with the PAV+ software option shows us a scale of 0.0 to 2.0 J/L. It is further divided into sections: 0.0 to 0.3 is considered low WOB, 0.3 to 0.7 is normal, 0.7 to 1.0 is high WOB, and 1.0 to 2.0 is very high.

There are two arrow indicators to watch. The highest one will always be *Total* WOB. This indicates how much work must be done in order to move a certain volume at a certain flowrate into the patient. If the patient breathes in very quickly with a high flowrate, more work needs to be done due to the higher resistance and WOB_{TOT} will increase. If the patient takes a large V_T, more work needs to be done to stretch the lungs open and WOB_{TOT} will increase. Anything that increases resistance (secretions, biting ETT, bronchoconstriction) or decreases compliance (pulm edema, atelectasis) will increase the work required to get the breath in and cause the

WOB_{TOT} arrow to move to a higher number. This arrow will change breath by breath.

The second arrow indicator shows us the proportion of WOB the *patient* is doing of WOB_{TOT}. This is determined by the %Support setting. If the %Support setting is at 75%, the WOB_{PT} arrow will be at 25% of the WOB_{TOT}.



If the %Support setting is at 25%, the WOB_{PT} arrow will be at 75% of the WOB_{TOT}. This arrow is further subdivided into E and R, indicating the proportion of work being done by the patient that is due to Elastance and Resistance.



When PAV+ mode is first selected, look to see where the WOB_{TOT} is. Then look at the WOB_{PT} and consider the patient plan; do you want to rest them? If so, keep the WOB_{PT} in the lower yellow section. Do you want the patient to work hard to build respiratory muscle? Consider keeping the WOB_{PT} in the upper yellow section. For most cases, adjust the %Support to keep WOB_{PT} in the green section so they are not over or undersupported.

WOB_{TOT} varies breath by breath and is determined by:

- Lung Compliance
- Thoracic Compliance
- Tidal Volume
- Patient Resistance
- Insp Flow
- Airway Size
- Airway Length

WOB_{PT} is determined by the %Support setting and will move breath by breath but stay at the same proportion of the WOB_{TOT} until the %Support is changed

Using WOB Bar to Wean

When weaning, the WOB_{TOT} is an important indicator. If it is higher than normal (>.7 J/L) consider the reason. It may be irreversible and 'normal' for the patient to have a high WOB, for example in chronic fibrosis. If so, the patient must be able to tolerate it as

the %Support is weaned and the WOB_{PT} bar moves closer to the WOB_{TOT}. Otherwise, they will not wean from the ventilator.

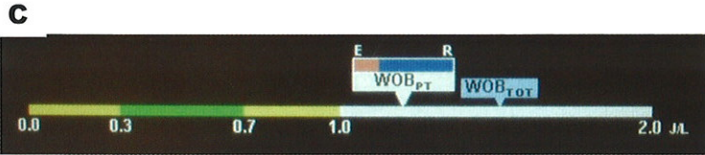
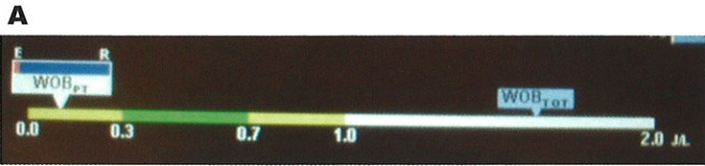
The high WOB_{TOT} may be reversible; perhaps it can be reduced as the patient is diuresed, or atelectasis is re-

solved, or changed to a larger diameter ETT, or bronchospasm is treated. If so, the WOB_{TOT} may be reduced to normal (.3-.7 J/L) and the patient may not show signs of distress as the %Support is weaned and the WOB_{PT} moves closer to the WOB_{TOT}.

Use it to Anticipate a Difficult Wean:

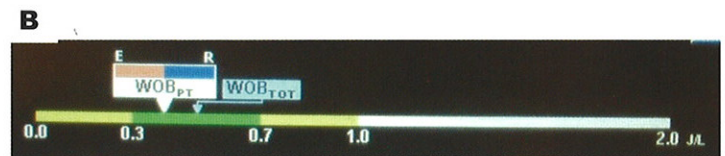
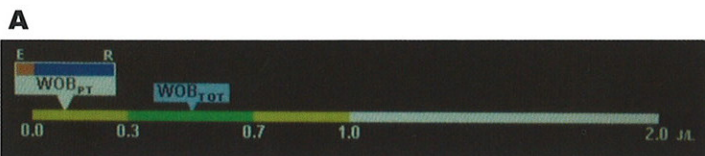
- If you have a patient on PAV+ and you notice respiratory distress when the WOB_{PT} arrow is in the bottom yellow section (0.0-0.3 J/L), this indicates the patient cannot even tolerate a normal WOB and will have difficulty weaning; especially if the WOB_{TOT} they have to reach is high.

Respiratory Services



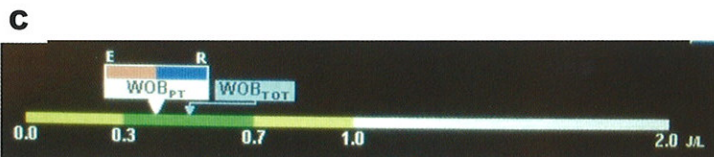
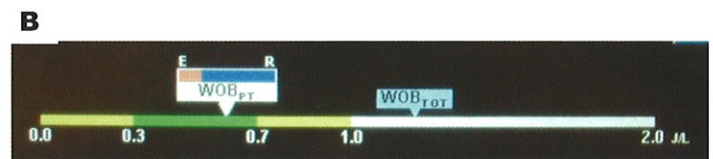
Scenario: End-stage COPD patient with severe bronchitis

- A. WOB_{TOT} is very high due to chronic airway inflammation. We set the %Support at 95% to rest him while we optimize his dose of inhaled steroids and maximize nutrition. Notice most of the WOB_{PT} is due to resistance.
- B. We start weaning him and decrease his %Support to 75%. The WOB_{TOT} has not changed, but the WOB_{PT} increases so he is now doing 25% of the work.
- C. The steroids take effect, decreasing inflammation, and the WOB_{TOT} lowers slightly. WOB_{TOT} is still much higher than 'normal' due to his chronic disease, but we want to get him off the ventilator. We decrease his %Support to 25% and extubate him. This patient will always have a higher than normal WOB .



Scenario: Mild closed head injury postop craniotomy

- A. The patient has normal lungs, the WOB_{TOT} is within normal range. We want to completely rest the patient to avoid increasing ICP. We set the %Support to 75% to keep WOB_{PT} at below normal levels.
- B. Head injury resolves, we want to wean patient off ventilator. We decrease the %Support to 20% and extubate the patient.



Scenario: Elderly patient with pneumonia

- A. The WOB_{TOT} is very high; the patient has a lot of secretions and areas of infiltrates. We set the %Support at 75%.
- B. After bronchoscopy, secretions have been minimized and WOB_{TOT} decreases. We change %Support to 50% but keep WOB_{PT} within normal levels so as not to tire patient out.
- C. Antibiotics rid the lung of infection and infiltrates resolve. WOB_{TOT} has decreased to normal levels and we wean %Support to 20%, then extubate.