RISE TIME

Among the different settings that the ventilator requires, the rise time is among those that on most of the ventilators do not figure in the main menu. Is this enough to ignore it? I really don't thinks so, lets see why!

Rise Time or ramp time, is a setting on all controlled, assisted and assisted / controlled ventilations. It represents the time taken by the curve that "controls" the ventilation (independent variable) to go from zero to its maximum value. In volumetric ventilations, it is the time taken to reach the peak of inspiratory flow, while in pressure ventilations it is the time taken by pressure to reach its highest point[1].

The image 1 shows a volumetric ventilation, in which we can observe on the graphical monitor the flow of the inspiratory flow according to the chosen setting: in the flow curve the ramp is immediate (rise time 0 seconds) and this means that at zero time the peak of flow is reached.

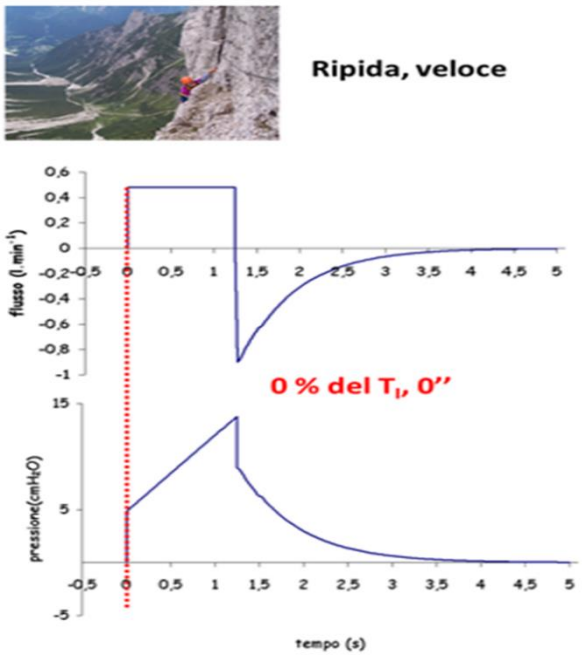

Figure 1. Rise time 0 seconds

The image 2 still shows volumetric ventilation but with a slower rise time setting, in fact the rise time is 0.125 seconds. In the flow-time curve we can see that the peak of flow is reached more slowly.

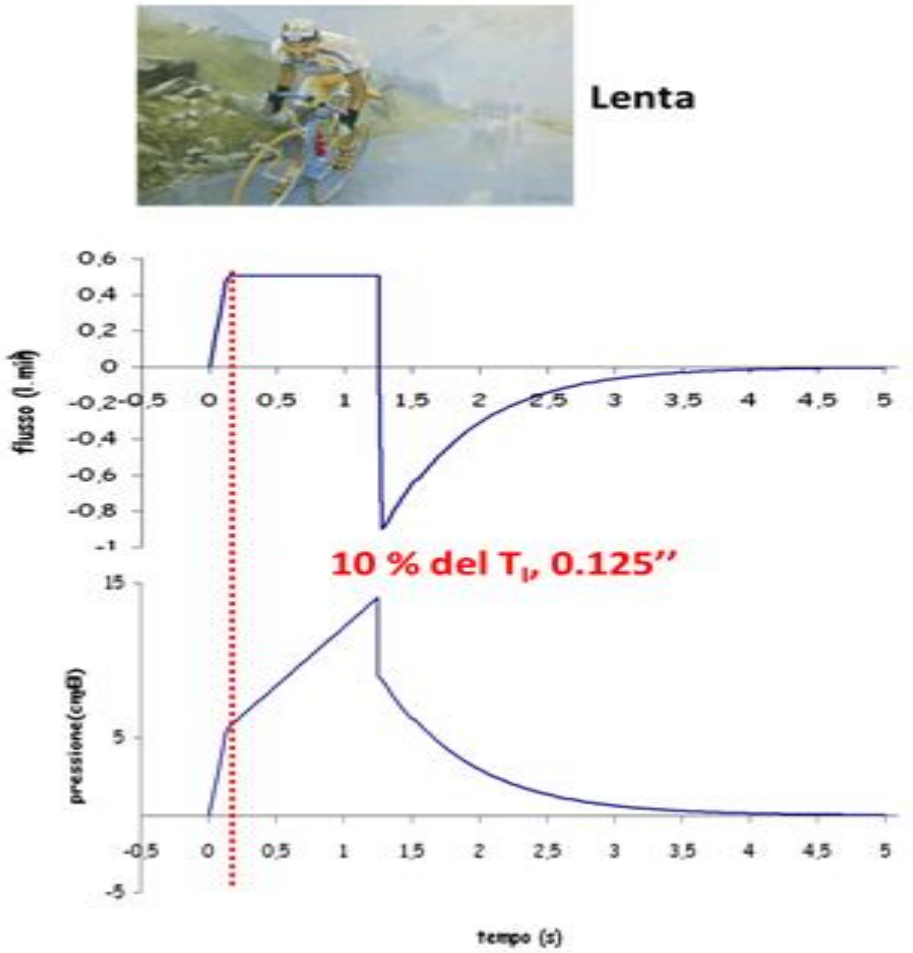

Figure 2. Rise time 0,125 seconds

At first glance these two different settings may appear to be irrelevant or an exercise in style. In reality and especially in actively breathing patients, the rise time is a tool that can improve the interaction between patient and ventilator.

The rise time is measured in fractions of a second. Some ventilators have a very intuitive setting: you have to choose the *actual* rise time (often in milliseconds), some other ventilators express it as a *percentage* of inspiratory time. However, the lower the number, the faster the rise time.

There are also ventilators (countercurrent!) that indicate with 100% an instantaneous rise time and if the percentage decreases the rise time increases: in this case, the lower the number, the slower the rise time. To this, in general theoretical terms, it must be added that the performance of each ventilator may differ in reaching the inspiratory peak, even if they are set with similar settings[2].

The rise time expresses the rapidity with which the insufflation begins. Rise time regulation is especially important in patients who interact with the ventilator, while it is much less important in passive patients.

In patients with restrictive disorders, the rise time must be set with a fast / short ascent time. There is evidence that a slow rise time increases respiratory work and the incidence of asynchronies [3-6].

A ramp that is too fast, on the other hand, can sometimes generate discomfort because the flow is supplied so suddenly that it overcomes the patient's ability to inhale, a phenomenon defined in the literature as **pressure overshoot**. Graphically it manifests itself with a single spike or more spikes with decreasing trend, (figures 3-4)

Figure 3. Pressure overshoot with more spikes

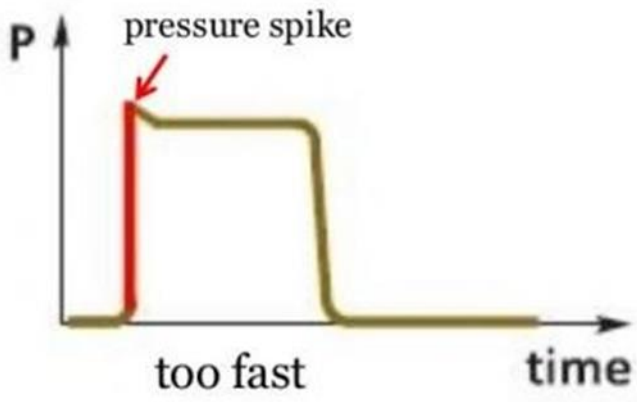

Figure 4. Pressure overshoot with a single spike

An excessively slow ramp in an active patient who does interact with the ventilator can lead to increased work of breathing. When the pressure rises too slowly it may be correct to make the rise time faster.

Take home message:

1. A too fast rise time can generate patient discomfort;
2. A too slow rise time can result in increased respiratory work, asynchronies and a lower tidal volume;
3. Graphic monitoring is essential to evaluate the correct setting of the rise time;
4. The rise time, if set correctly, can improve the interaction between patient and ventilator.

Greetings to all, Cristian

References

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