Understanding and Interpreting Pulmonary Artery Catheter Waveforms

By Lisa Kirkland, FACP

Last month's column covered the many factors you need to keep in mind when using a pulmonary artery catheter. To interpret the wedge tracing correctly, however, you also need to understand your patient's respiratory physiology.

The heart and major arteries sit inside the bellows of the thorax, and are affected to various degrees by the negative and positive pressures generated by the chest wall and lungs. The wedge pressure reading must be performed when the patient is at the end of exhalation, before the next breath starts. That is when intrathoracic pressure has the least effect on intravascular pressure. The wedge pressure represents the mean left atrial pressure, so the reading is taken at the mean of the highest and lowest points of the tracing. Usually, we "eyeball" where the reading should be, setting the cursor between those points. But that task is made more difficult because the tracing oscillates up and down with respiratory cycles. For example, do you read it at A, B, C, or D in the figure to the right?

Unlike our radiology colleagues—who can interpret an x-ray without clinical information if necessary—you must know if the patient is spontaneously breathing or receiving positive pressure ventilation, such as a ventilator. Spontaneous breathing creates negative pressure on inhalation, and returns to baseline on exhalation. There is usually a pause before the next breath starts. Line A in the figure represents the best guess of the mean of the wedge tracing in a spontaneously breathing patient, as it appears to be at baseline, before the negative deflection of inhalation (Line B).

If a patient is receiving positive pressure ventilation, inhalation is associated with an upward deflection of the tracing (Line C). You must wait until the patient has exhaled fully before measuring the wedge pressure (Line D). If the patient is receiving positive end expiratory pressure (PEEP), the tracing will not return to zero, but will settle at a baseline of the set PEEP. It is not clear how much the PEEP contributes to the true wedge, or ultimately, left ventricular end diastolic pressure. When the PEEP exceeds 10 cm H2O, this may become an important issue to consider in interpreting wedge pressure.

Finally, wedge pressures in patients with rapid or irregular breathing patterns are very hard to measure and interpret, as there may be no pause between the respiratory cycles. Patients with conditions that cause severe air trapping, such as severe acute asthma or chronic obstructive pulmonary disease, may not fully exhale before beginning another breath.

The pulmonary artery catheter should be viewed as an adjunct to clinical decision-making, rather than the final word. It does not supplant careful history and physical examination. Trends in wedge values may be more helpful than absolute numbers in determining a course of action or response to therapy.

For more information, Drs. Raper and Sibbald's “Misled by the Wedge: the Swan Ganz Catheter and Left Ventricular Preload” (Chest. 1986;89;427-434) is a wonderful article describing all the uses and pitfalls of the pulmonary artery catheter. Every practitioner who cares for patients with these catheters should read it.

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Letter to the Editor

Bundled Fee System Can Work

I would like to comment on “A Bundle of Joy or Trouble?” (ACP Hospitalist, December 2009). I believe there will be more bundled money available to the hospitalist as well as to hospitalist groups if they are willing to adopt a new strategy of practice—advancing from low-scale, resident-like history takers to procedural hospitalists.

Their tasks could include echo reading, managing patients on ventilators in intensive care, intubation in emergency settings, etc. I have worked with groups of hospitalists who, when they encounter a new patient, can only pick up the phone and start paging all of the other specialties—infectious disease, hematology, nephrology. I believe you should not call these specialists in any inpatient setting except for very difficult or rare situations. You do not need to call the neurologist or endocrinologist to the hospital unless it is clinically necessary and will change the medical management. If a hospitalist is able to manage meningitis and perform a lumbar puncture, I see no reason to call ID and a neurologist to share a payment with them.

If this policy were adopted, hospitalists would generate a lot of RVUs and financial revenue.

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