Pulmonary Artery Wedge Pressure
Local Variation and Quality Control

In their article in this issue (see page 491), Henriquez et al point out that in patients with chronic lung disease, distal mechanically wedged pressure measurements are higher than proximal balloon occlusion wedge pressure and that the variability is highest in regions with abnormal wedge angiograms. Their description of the technical problems associated with wedge pressure measurements evokes echoes of previous recommendations of caution in the measurement and interpretation of wedge pressure. They recommend (summary paragraph) that sequential measurements of wedge pressure be made with the catheter in the same site (same pulmonary vessel) and that unexpectedly high wedge pressure measurements be confirmed by repeated measurements obtained in another lung region. This requires radiographic documentation of wedge catheter position and limits such studies to angiography suites or other specially equipped environments. Their suggestions may be practical in the case of the outpatient referred to a cardiac catheterization laboratory, but may be difficult to follow in hospitalized COPD patients in whom many wedge pressure measurements may be made over a short period of time.

The association of technical problems with wedge pressure measurements was first reported by the early workers who developed the technique in the cardiac catheterization laboratory, as well as by those who introduced the flow-directed balloon tipped catheter to clinical practice. In both the cardiac catheterization laboratory and in the intensive care unit, the wedge pressure could be successfully measured only 3/4 of the time. My colleagues and I subsequently reported a 30 percent incidence of technical problems in ICU wedge pressure measurements and a 33 percent incidence of wedge pressure errors of at least 4 mm Hg when technical problems were present. Attention to the technical problems of wedge pressure measurement is therefore mandatory.

Henriquez et al confirmed their wedge pressure measurements by noting the presence of “a” and “v” waves in the pressure waveform when the catheter was wedged, and a phasic pulmonary artery pressure waveform when the catheter was subsequently withdrawn, as well as the absence of reflux of injected contrast material. Rapaport and Dexter recommended more extensive documentation of valid wedge position, and others have indicated that the waveform itself may be misleading. We have utilized dynamic response using a continuous flush system with aspiration of blood in the wedge position as a practical technique for eliminating most errors likely to be encountered in wedge pressure measurements. Henriquez et al were able to obtain a blood specimen in only 31 of 66 attempts when no capillary blush was present on the angiogram. That suggests that free communication of the wedged catheter with a distal blood pool, a mandatory requirement for others, was absent. They also indicate that when the blood was sampled, low oxygen saturations were present, in contrast with the high oxygen saturation found by others. After flushing the deadspace of their catheter, they discarded only the first ml of blood, a volume which other workers would consider too small for sampling pulmonary wedge blood. In fact, Brewster and McIlroy point out that the likely mechanism for obtaining high oxygen saturations in wedge blood samples is the induction of a region with extremely high V/Q, due to obstruction of the blood vessel and elimination of blood flow. Even in regions of extremely low initial V/Q, the obstruction of the perfusing vessel with a wedged catheter should produce a high V/Q region, and therefore, a high oxygen saturation in the withdrawn blood. This was observed by others. In addition, it would have been useful to know the ventilatory rates of the these patients when studied, since the wedge pressures were averaged over the respiratory cycle and since respiratory variations during spontaneous breathing can produce significant changes in wedge pressure.

Although not proven, the observations of Henriquez et al are certainly compatible with local vascular changes produced by the pulmonary disorders in this group of COPD patients. It would not only be interesting, but of practical importance to know whether the addition of dynamic response testing and wedge blood sampling with a larger flush volume would eliminate the need for radiographic confirmation of catheter position.

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REFERENCES

5 Morris AH, Chapman RH, Gardner RM. Frequency of technical
8 Suter PM, Lindauer JM, Fairley HB, Schlobohm RM. Errors in data derived from pulmonary artery blood gas values. Crit Care Med 1975; 3:175-81