Are Modifications Necessary in the Performance of Pulmonary Angiograms?

The confirmation of the diagnosis of pulmonary embolism is often an arduous, complex and expensive chore. As the sensitivity and specificity of studies have been refined, it appears that a negative radioisotope perfusion study is about 99 percent specific as an exclusionary study for pulmonary embolism.\(^1\)\(^2\) However, to establish a positive diagnosis, the selective pulmonary angiogram has been considered the most specific test for demonstrating pulmonary emboli.\(^3\)\(^4\) Due to recent reports of false negative pulmonary angiograms (see page 139) a reappraisal of pulmonary angiographic methodology seems appropriate.\(^5\)\(^6\)

It has been shown that normal individuals have normal lung scans.\(^7\)\(^8\) Therefore, an abnormal lung scan indicates lung pathology, but not necessarily pulmonary infarction.\(^9\)

Kipper et al\(^10\) studied patients with suspected pulmonary emboli and normal lung scans who remained untreated. Since none developed findings of pulmonary embolization, they concluded that the probability of a false negative lung scan was low. In that study, withholding anticoagulant treatment after a normal lung scan was not associated with morbidity or mortality; therefore, if pulmonary emboli are too small to be resolved by a perfusion scan, they are of no clinical significance.

In another study of 180 consecutive patients undergoing pulmonary angiography, 167 had positive lung scans but were untreated because of negative angiographic results.\(^11\) None died of pulmonary embolization during a six-month follow-up period. This study demonstrated that a negative angiogram is reliable when the angiography is carefully performed. These investigators used selective left and right pulmonary artery injections, sequentially filming each lung in at least two views. Superselective angiograms utilizing magnification angiography were recorded from those lung segments in which the perfusion scan indicated potential obstruction. Techniques as comprehensive as this can demonstrate emboli or vessel cut off as small as 0.5 mm, whereas in a selective main pulmonary artery injection resolution is limited to 2 mm.\(^12\)\(^13\) Furthermore, these new techniques obviated the need for using soft criteria such as blood flow slowing and oligemia, which are very subjective and unreliable.\(^14\)

The role of cineangiographic techniques in the detection of pulmonary embolus is as yet undefined. However, most cardiac catheterization laboratories are equipped with high resolution cineangiographic equipment with varying magnification potentials. Although visualization of large areas of a pulmonary field may not be possible, it is possible to obtain angiograms of smaller areas with a high degree of resolution.\(^15\) If high resolution cineangiography is capable of resolving branch vessels of coronary arteries, it should be suitable for resolving pulmonary vessels as well.

Superselective pulmonary artery injections of small volumes of angiographic contrast material into areas of the lung which have demonstrated perfusion defects by radionuclide scans can provide angiograms of high resolution. The dynamic nature of the study helps resolve lesions that would be considered suspicious by static filming techniques. Furthermore, respiratory movement, which is undesirable in static filming techniques, is helpful in separating overlying vessels in cine recordings.\(^16\)\(^17\)

The minimum goal in angiographic studies should be defined. Is it to detect all emboli or only those with clinical importance? The latter is probably more realistic. Although conventional cut film techniques have proven reliable, new methodology may be helpful or superior.\(^18\)

Patients with negative perfusion scans need not undergo pulmonary angiography because there is little likelihood of significant embolism.\(^19\) Patients with positive perfusion scans are potential candidates for anticoagulant therapy. Since anticoagulant therapy is associated with high morbidity and some mortality, a definitive diagnosis should be made whenever possible. This probably can be done most efficiently by superselective pulmonary cineangiograms in the heart catheterization laboratory. This also provides an opportunity for measuring pulmonary pressure, cardiac output and pulmonary vascular resistances.

Superselective cineangiographic pulmonary angiography has not undergone critical comparative studies with current nonselective static film tech-
techniques. Such studies are indicated.

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REFERENCES

2 Wagner HN, Strauss HW. Radiotracer studies in the differential diagnosis of pulmonary embolism. Prog Cardiovasc Dis 1975; 17:271-82
5 Bell WR, Simon TL. A comparative analysis of pulmonary perfusion scans with pulmonary angiograms. Am Heart J 1976; 92:700-06
12 Bookstein JJ. Segmental arteriography in pulmonary embolism. Radiology 1969; 93:1007-12

Nutritional Support
Whether or Not Some Is Good, More Is Not Better

In a recent editorial, I challenged the use of nutritional support of patients on respirators. As of this writing, no prospective randomized controlled trial (PRCT) has yet assessed the efficacy of parenteral or enteral feeding. Nonetheless, these therapies continue to be used, not without associated morbidity. In this issue of Chest, (see page 141) Drs. Dark, Pingleton, and Kerby have provided more information concerning the complication of nutritional support of most interest to pulmonary physicians, that of excessive CO2 production.

In 1979 Burke et al., and Askanazi and coworkers in the next year, described patients who produced increased amounts of CO2 while receiving carbohydrate-based total parenteral nutrition (TPN). Although patients without overt lung disease did not develop CO2 retention, three patients of Covelli et al. did; two of them had underlying chronic obstructive lung disease and the third bilateral empyemas. We now learn of two patients with the adult respiratory distress syndrome who also became hypercapnic as a consequence of nutritional support.

As Dark and coinvestigators report, the excess CO2 production is due to the oversupply of carbohydrate calories; those which are not immediately burned are converted to fat with an associated release of CO2. Although the reports cited above deal with patients on TPN, presumably the same phenomenon would occur with enteral nutrition.

The patients described by Dark et al did not develop hypercapnia while on mechanical respiration, even in the face of the extra CO2 load. Unfortunately, what the machine could do, nature could not; when weaning was attempted, CO2 retention appeared. It was only after the caloric infusion was reduced that the respirator could be detached. For such patients, the crucial issue is determining how many calories are really required.

When I was a fledgling in the area of nutritional support in the early 1970s, the premise seemed to be that if some was good, more had to be better; it was not at all unusual for patients to be receiving 4,000-5,000 calories per day. For some time now, we have recognized that “hyper”-alimentation increases body weight by increasing body water and fat. From more recent studies we are beginning to realize that the actual energy requirements of hospitalized patients, even the critically ill, are usually more on the order of 2,000 calories per day.

The two patients reported by Dark et al were initially begun on daily regimens containing over 4,000