to our own (*7*).

Although we have had several personal communications with other workers involved in indium-oxine labeling of platelets, we have yet to achieve satisfactory results using the saline labeling technique. We believe the divergence in results described merits careful attention by proponents of this method with a view toward clarifying any ambiguity or unidentified pitfall in the procedure that prevents others from obtaining favorable results. Concluding that the problem can be attributed to the handling of delicate blood components, as did Welch et al. in their previous letter (*8*), does not necessarily provide the answer. If the method is to enjoy wide use, an explicit procedural outline is needed.

MILO M. WEBBER
BIESHIA CHANG
DONALD BUFFKIN
RAMESH VERMA
L. R. BENNETT
Center for the Health Sciences
Los Angeles, California

REFERENCES

1. WEBBER MM, CHANG B, BUFFKIN D, et al: In-111 labeled platelets or iodinated fibrinogen for the detection of deep venous thrombosis. *J Nucl Med* 20: 459, 1979
2. KNIGHT LC, PRIMEAU JL, SIEGEL BA, et al: Comparison of In-111-labeled platelets and iodinated fibrinogen for the detection of deep vein thrombosis. *J Nucl Med* 19: 891-894, 1978
3. HARKER LA, FINCH CA: Thrombokinetics in man. *J Clin Invest* 48: 963-974, 1969
4. COHEN P, GARDNER FH, BARNETT GO: Reclassification of the thrombocytopenias by the Cr-51-labeling method for measuring platelet life span. (Part 1) *N Engl J Med* 264: 1294-1299, 1961
5. ALTMAN PL, DITTMER DS: *Biology Data Book*, Washington, D.C., Federation of Societies for Experimental Biology, 1964, pp 263-265
6. THAKUR ML, WELCH MJ, JOIST JH, et al: Indium-111 labeled platelets: Studies on preparation and evaluation of in-vitro and in-vivo functions. *Thromb Res* 9: 345-357, 1976
7. GOODWIN DA, DOHERTY PE, LIPTON MJ: Observations on the use of In-111 labeled autologous platelets in the detection of thrombosis in humans. World Federation of Nuclear Medicine and Biology, Second International Congress, September 17-21, 1978, Washington, D.C. p 129 (abst)
8. WELCH MJ, KNIGHT LC, SIEGEL BA: Reply. *J Nucl Med* 20: 460, 1979

Increased Specificity in the Diagnosis of Pulmonary Embolism

In the April issue of the *Journal*, Dr. Ahmad et al. (*1*) reported an increase in specificity for pulmonary embolism from 74 to 93% by the addition of radionuclide venography to lung scanning. Although we appreciate the use of radionuclide venography followed by perfusion lung scanning for the diagnosis of thromboembolism in clinical routine, we somehow doubt that it is possible to achieve a specificity of 93% for pulmonary embolism by this method only. By Bayes's theorem it is logical that in cases of established thrombosis, the diagnostic value of the perfusion lung scan for pulmonary embolism would be improved.

Nevertheless the value of radionuclide venography for the diagnosis of deep-vein thrombosis is quite different in the pelvis and thigh region in comparison with the lower legs. Radionuclide venography fails to detect thrombosis in the calves, which in our experience (confirmed in the literature), is the most frequent location of thrombosis. We found thrombi in the calf in 55% of all thromboses of the legs. In our institute we have performed about 2,000 fibrinogen uptake tests since 1972, and about 700 radionuclide venographies (*2*) followed by perfusion lung scanning. Perfusion defects were found in 69% of patients with thrombosis, but also in 43% of patients without thrombosis, thus giving a specificity for pulmonary embolism of only 57%. Using additional assessment criteria—such as clinical findings, radiographs, ECG, evaluation of the shape of the defects and of temporal changes of the perfusion pattern—the number of false-positive findings could be reduced to 11%, giving a specificity of 89%. A real improvement of specificity to 95%, which is comparable to that cited by Dr. Ahmad et al., could be achieved only by additional ventilation scanning either with xenon-133 or krypton-81m. By use of combined ventilation-perfusion scintigraphy we found an embolism rate of 57% in patients with established thrombosis (n = 105) and only three false-positive findings (4.7%) in patients lacking thrombosis (n = 64), thus giving a specificity of 95%; this compares well with angiography without carrying the risks of this invasive method (*3,4*).

Although we consider radionuclide venography followed by perfusion lung scanning a very useful method for the detection of thromboembolism, we consider the fibrinogen uptake test a necessary tool for detection of thrombosis of the calves—the most frequent thrombus location. We therefore suggest the combination of fibrinogen uptake tests, radionuclide venography, and ventilation-perfusion lung scanning in order to achieve optimal diagnosis of thromboembolism in clinical routine.

H. KOEHN
B. KOENIG
A. MOSTBECK
H. PARTSCH
Nuclear Medicine Institute, Wilhelminenspital,
Vienna, Austria

REFERENCES

1. AHMAD M, FLETCHER JW, PUR-SHAHRIARI AA, et al: Radionuclide venography and lung scanning: Concise communication. *J Nucl Med* 20: 291-293, 1979
2. MOSTBECK A, LOFFERER O, PARTSCH H: Nuklearmedizinischer Nachweis von venösen Abflussstörungen im Bereich der Beine und des Beckens. *Acta Medica Austriaca* 1: 120-125, 1976
3. MOSTBECK A: Nuklearmedizinische Diagnostik von Lungenembolien mittels der kombinierten Perfusions-Ventilationsszintigraphie. *Acta Medica Austriaca* 5: 146-148, 1978
4. KÖHN H, KÖNIG B, MOSTBECK A, et al: Improved diagnosis of pulmonary embolism by means of combined ventilation-perfusion lung scanning. In *Nuklearmedizin*. 16th International Annual Meeting, Madrid Oct. 24-27, 1978. Stuttgart/New York, F. K. Schattauer Verlag, 1980 (In press)

Reply

We agree with Koehn et al, that the lower leg is the most frequent site of thrombosis. While controversy exists over the potential of calf-vein thrombosis for propagation (*1*), the ileofemoral segment is recognized as the site of the most clinically significant thrombi (*2*) and is the area where radionuclide venography has the greatest sensitivity. Although we do not know precisely what type of patient population Koehn et al. were working with, almost all of our patients gave strong clinical suspicion of pulmonary emboli; though 20 patients were admitted with a primary diagnosis of thrombophlebitis, pulmonary emboli were suspected clinically.