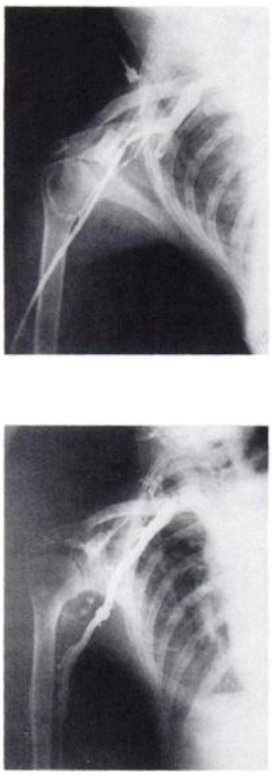

FIG. 3. (A) Top, normal cephalic venogram. (B) Bottom, normal basilic venogram.

Reply

Review of Dr. Goldberg's case is quite interesting. The second scintigraphic study (Fig. 1) shows that radioactive embolization to the superior segment of the right lower lobe occurred between the anterior and right lateral views. The anterior view of the lungs reveals three hot spots in the right arm, and it is tempting to speculate that one of these was the source of a radioactive embolus.

The initial observation of radioactive MAA accumulation at sites of endothelial damage and/or clot formation was made on patients who had received intravenous fluids via indwelling catheters (*1*). As Rosenthall has pointed out, "any sort of endothelial damage may attract or trap the radioactive particles . . ." (*2*). Driedger et al. have demonstrated that up to 25% of patients with lower-extremity thrombophlebitis experience radioactive microembolization during lower extremity venous scintigraphy (*3*).

In the present case, the upper-extremity hot spots correlate quite well with areas of slight irregularity in the cephalic vein (Fig. 3A), or possibly with venous valves seen on the basilic study (Fig. 3B). The insertion site of the central venous catheter is also a potential area of endothelial damage. We have not seen radioactive embolization in the performance of a large number of pulmonary perfusion scintigrams in patients with severe cardiac decompensation but no upper-extremity thrombophlebitis. We are reluctant to agree that cardiac decompensation alone can cause this phenomenon and suggest that an area of minimal venous endothelial damage, labeled with the injected MAA, may have provided the source of the hot embolus.

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Reply

Goldberg and Lieberman have reported another case of hot spots from upper-extremity injection and have nicely excluded upper-extremity thrombophlebitis as the cause. In addition, they suggest that hot spots may appear when circulation is greatly slowed by congestive heart failure, which causes prolonged statis of the undispersed bolus of macroaggregates, thus permitting gross clumping within the arm veins and subsequent transport of those clumps to the lungs.

Perfusion lung scans are commonly performed on patients in severe congestive failure, yet it is seldom that radioactive "thrombi" in the veins of the upper extremities or hot-spot "emboli" in the lungs are noted. Use of a diverging collimator makes it quite likely that such intravenous hot spots would be easily detected.

The proper technique of injecting microspheres or macroaggregates of albumin involves more than the avoidance of withdrawing blood into the syringe. Macroaggregates and microspheres can be seen to settle at the lowest point of the syringe and it must be shaken to provide resuspension immediately prior to injection. It is to the physician's advantage to use a small needle (e.g. 25 gage) while making the injection, as this causes significant shear forces at the distal end of the needle which are probably of great importance in fragmenting remaining clumps. If blood enters the needle, and if there is going to be an obvious delay before an adequate vein is found, and if no new dose is available, it has been useful to change needles and shake the syringe with its contaminating blood, thereby distributing the blood evenly throughout the suspension of macroaggregates. This technique has not been associated with hot spots or untoward patient reaction. Injection of air bubbles should be avoided as small intravenous air bubbles have been associated with intravenous hot spots in dogs (*1*).

The production of pulmonary hot spots by congestive failure has yet to be proven. There are possible explanations other than just the withdrawal of blood into a syringe of macroaggregates. In my opinion, factors of injection technique remain the most likely caues of the phenomenon, and adherence to venous valves is the most likely cause of hot spots in the arm.

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REFERENCE

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