

Delivery Efficiency of Technetium-99m DTPA Aerosol

TO THE EDITOR: Lung ventilation imaging employing radioaerosols of technetium-99m diethylenetriaminepentaacetic acid (^{99m}Tc)DTPA has now become established as an alternative to radiogases in the differential diagnosis of pulmonary emboli. However, all the commercial aerosol systems have low efficiency when the activity retained in the patient's lung is expressed as a percentage of the activity nebulized. As we have been long-time advocates of the use of radioaerosols we were very interested to read the report by Sirr et al. (1) on the increased efficiency obtained by using a solution of 10% ethanol in saline with the ^{99m}Tc]DTPA. We hoped that this might enable us to reduce the activity required for nebulization. Unfortunately we have been unable to document any significant increase in the average delivery efficiency to our patients.

The delivery efficiency was measured in 14 consecutive patients in whom the ^{99m}Tc]DTPA was prepared using 10% ethanol and compared to a previous study in 22 patients with the same nebulizer system* in whom saline alone was used. The activity retained in the lungs from the aerosol was calculated by noting the count rate from the posterior view and comparing this to the count rate from the perfusion image for the same patient for whom the perfusion activity was accurately known. The delivery efficiency in the 22 patients using saline alone ranged from 1.6% to 15.7% with a mean of 7.6%. In the 14 patients in whom 10% ethanol in saline was used, the range of delivery efficiency was 2.4% to 15.2% with a mean of 7.8%.

Sirr et al. (1) employed a different aerosol system† although this is unlikely to be the cause of the discrepancy in the results. They presented quantitative data in only 2 normal subjects although they state that several hundred patients have been imaged. It is our experience that a much wider variation in delivery efficiency is found in patients than in controls due to greater variation in depth and rate of breathing. Although small increases in efficiency may be achieved in some patients by using 10% ethanol, the average efficiency remains unchanged, thereby negating our efforts to reduce the activity.

FOOTNOTES

* Cadema Medical Products, Inc., Middletown, NY.

† Diagnostic Products Division, Mallinckrodt, Inc., St. Louis, MO (UltraVent).

References

1. Sirr SA, Juenemann PJ, Tom H, et al: Effect of ethanol on droplet size, efficiency of delivery, and clearance characteristics of technetium-99m DTPA aerosol. *J Nucl Med* 26:643-646, 1985

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REPLY: We agree with Smart et al. that ^{99m}Tc]DTPA aerosol ventilation imaging of regional ventilation is a viable alternative to radioactive gases. Our work described a simple method, the introduction of ethanol to the radioactive solution in the nebulizer, which increases the density of radioactive droplets in aerosol.

Smart et al. described clinical trials in two groups of patients some who received aerosol containing ethanol and others without ethanol. In these two groups of patients, no statistically significant increase in delivery of aerosol efficiency was achieved with ethanol.

We postulate that the apparent lack of effect of ethanol may be due to the use of different aerosol systems. Smart et al. employed an aerosol system* with a large volume "settling" bag in order to remove large droplets. We used an aerosol generator which removes large droplets by passing the aerosol through a series of baffles.† Because ethanol is hygroscopic, it is possible that when droplets containing ethanol reside within the "settling" bag, they will attract water and gain mass. This would result in a high extraction rate of particles within the "settling bag". Therefore, a gain in the delivery efficiency by introducing ethanol to the ^{99m}Tc]DTPA solution may be offset by decreased number of aerosol droplets leaving the "settling" bag resulting in no apparent gain in delivery efficiency to the patient.

We suggest that further investigation of this hypothesis is warranted.

FOOTNOTES

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Uterine Blush in Multiphase Imaging

TO THE EDITOR: We would like to add some observations to those of Mandell et al. regarding the uterine blush in multiphase bone imaging (1). We studied 28 menarchal women, ages 13-51 yr (mean 29.8 yr), who had three-phase bone scans of the anterior pelvis. Technetium-99m methylene diphosphonate was used in all cases. Images were acquired using a gamma camera fitted with a high-sensitivity parallel hole collimator. Flow studies were performed by setting the camera to collect serial 3-sec images for 45 sec. Immediately after the dynamic study, blood-pool images were acquired for a minimum of 500,000 counts.

The flow study was negative or equivocal in six cases. The absence of increased blood flow did not correlate with time of menstruation nor with the intensity of uterine activity on the