

## TIP SHEET: 'Hot Spots', TRACHEAL and CENTRAL DEPOSITION

It has long been thought that 'hot spots', tracheal and central deposition are the result of the clumping of particles, particles which are either too large or sticking together. At Medi/Nuclear®, we would suggest that none of this is completely accurate. 'Hot spots' have largely been eliminated as nebulizers have improved. Tracheal and central deposition however, remain a problem. It is worse with ventilators, but still a problem.

Because of the hands-on nature of our research and our involvement in papers presenting the results, we have come to the conclusion that particle size, largely, determines the differential deposition in either the upper or lower respiratory tract. 'Hot spots', tracheal and central deposition, rather than being related to particle size, are almost entirely a function of velocity.

This velocity has its origins in one of two places. Intrinsicly, it results from conditions within the patient's lungs. This might be mucous plugs, tumor invasion or a narrowing of the passages by any number of disease states. Extrinsicly, the cause is uncontrolled deep breathing or tachypnea. In the first instance, as the aerosol passes a narrowing of the breathing passage, it accelerates. Immediately upon passing the narrowing, it decelerates. Upon decelerating, an eddy current is created which deposits the aerosol on the distal side of the narrowing. In the second instance, an uncontrolled deep breath is by its very nature a high velocity breath. In this case, the aerosol will be deposited anywhere a bend is too sharp for the particle's own inertia to allow it to turn. This is usually in the throat or at the bifurcation. This is equally true with regards to ventilators. If a ventilator is being used, the Respiratory Therapist should be instructed to use as slow an inspiration as is possible, taking into account the patient's condition and patient safety.

Remember, regardless of the aerosol device being used, velocity is an enemy. Patients should be instructed to breathe normally and respirators should be operated as slowly as is safe.



***To avoid 'Hot Spots' and central deposition keep the inhalation velocity as low as possible by avoiding deep breathing (deep breathing works only if it is controlled and done very slowly). Tidal breathing will assure the best peripheral penetration and distribution.***



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