Widespread use of the aerosolized antibacterial agents ribavirin and pentamidine has resulted in controversy over whether exposure to these agents is hazardous to care-givers. Those who consider exposure hazardous have recommended maximum exposure limits and methods to minimize environmental levels, while others consider these measures excessive in relation to the potential risk. pentamidine has become the standard of care for prophylaxis against Pneumocystis carinii pneumonia in patients with acquired immunodeficiency syndrome. As a result, many respiratory care practitioners are administering aerosols of this agent on a daily basis. Ribavirin is used on a regular basis for the treatment of respiratory syncytial virus (RSV) infections in small infants. It is normally administered by tent for 12 to 20 h/d for three to seven days. Exposure to ribavirin during RSV season is virtually continuous for some practitioners.

Both of these drugs inhibit or interfere with protein or nucleic acid synthesis. Ribavirin is a potent inhibitor of inosine monophosphate dehydrogenase, with activity against a spectrum of DNA and RNA viruses, while pentamidine may be a folic acid inhibitor, although its exact mechanism of action is unclear. The teratogenic effects of ribavirin have been studied extensively in mammals. A single oral dose of 2.5 mg/kg produced teratogenicity in hamsters, as did a single oral dose of 10 mg/kg in the rat. These animals demonstrated malformation of the skull, gastrointestinal tract, eye, jaw, palate, and skeleton, and the survival of offspring was reduced. Doses as low as 1 mg/kg resulted in embryo deaths in rabbits. Similar findings were noted in ferrets. However, no teratogenic effects were noted in baboons that received 120 mg/kg administered in four-day pulses during critical periods of gestation. Unfortunately, similar studies evaluating teratogenicity are not available regarding pentamidine.

A number of groups have sampled blood and urine from nurses and respiratory therapists exposed to ribavirin over an 8- to 12-h period. Ribavirin concentrations of 0.44 µg/ml were detected in only one nurse among those studied. However, caution must be exercised when interpreting these data. First, exposure to ribavirin in these studies was generally short-term, over a one- to three-day period, although ribavirin is not generally cleaned from the blood for a four-week period. During periods when ribavirin is used, care-givers are frequently chronically exposed to the drug. Second, since ribavirin is highly water soluble, it is distributed throughout the body. The body fluid assay detection limit is 0.02 µg/ml. Thus, ingestion of over 2,000 µg, when distributed over the entire body in the average adult, is well below the detection limit.

As important as the potential teratogenic effects of these agents is their effect on the respiratory system. The California Department of Industrial Relations has documented acute episodes of shortness of breath; cough and chest tightness; burning sensations in the eyes, nose, and throat; sinus irritation; sneezing; nausea; light-headedness; and headache in a group of

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**Care-giver Protection from Exposure to Aerosolized Pharmacologic Agents**

**Is It Necessary?**

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As important as the potential teratogenic effects of these agents is their effect on the respiratory system. The California Department of Industrial Relations has documented acute episodes of shortness of breath; cough and chest tightness; burning sensations in the eyes, nose, and throat; sinus irritation; sneezing; nausea; light-headedness; and headache in a group of
respiratory therapists administering pentamidine without protection from exposure to the drug. In addition, a decreased diffusing capacity was noted in a 47-year-old respiratory therapist after 18 months of chronic exposure to pentamidine.25 Similar effects on the respiratory system have not been documented during the administration of ribavirin, although some therapists and nurses complain of nasal, pharyngeal, and bronchial irritation, as well as eye irritation when exposed to the drug.

As a result of the real and potential hazards associated with the administration of these agents, maximum efforts should be made to minimize, with the goal of eliminating, environmental exposure of care-givers. The California Department of Health3 and the Massachusetts Department of Labor and Industries4 have defined the maximum time-weighted average (TWA) exposure to ribavirin as 2.7 μg/cu m. Environmental levels beyond this limit are normally not noted during administration via a mechanical ventilator if filters are inserted in the expiratory limb and delivery of the drug is stopped before disconnection. However, TWA exposure levels greatly exceeding the 2.7 μg/cu m limit are achieved when ribavirin is administered by tent (≥150 μg/cu m).14,15 As a result, environmental and engineering controls are essential during administration by tent. High efficiency particulate air-filtered negative pressure isolation rooms with six air exchanges per hour, double-tent scavenger systems, and barrier protection are required.19,20

Although no TWA maximum exposure to pentamidine has been defined, both the California Department of Industrial Relations5 and the Massachusetts Department of Public Health,6 as well as the Centers for Disease Control,21 have established guidelines for the administration of pentamidine and the prevention of the spread of droplet nuclei in patients with tuberculosis. Pentamidine should be administered in a negative-pressure HFPA-filtered room with at least six exchanges per hour or with use of a booth or hood designed for scavenging the drug. Nebulizers should incorporate a hand control for aerosol production and exhalation filters. Barrier protection should also be used. In addition, pregnant practitioners and those trying to conceive should not be exposed to these drugs, and all should limit their exposure to these agents.8-5

It is difficult to determine at this time whether the stringent controls discussed above are an overreaction to unfounded emotional reactions or reflect appropriate concern over real health hazards, since the available data are inconclusive. However, it seems prudent to this care-giver to err on the side of conservatism when the potential well-being of care-givers and future offspring is at stake. We need to be able to balance the critical needs of patients with the well-being of care-givers, but in doing so we need to incorporate engineering and administrative controls to prevent exposure of care-givers to potentially dangerous drugs.

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