

Principles of Inhalation Therapy*

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With the increasing complexity of ventilatory equipment and the rapid development of new techniques for respiratory care, it has become progressively more difficult for the average physician to keep pace with clinical and technical advancements. The management of acute respiratory failure is now a demanding art which requires a broad knowledge of cardiopulmonary physiology and sophistication in the use of complicated equipment. Careful attention to detail is often the critical factor that determines survival. The mortality from acute respiratory failure has been substantially reduced in respiratory intensive care units where there are well trained teams of physicians, nurses, and technicians to manage patients during life-threatening episodes of ventilatory failure (6).

In many hospitals such facilities and specialized teams do not exist. The busy physician often finds that he has neither the time nor technical skill to provide optimum patient care. Valuable assistance can be provided by medical personnel, such as inhalation therapists, who have been trained in respiratory physiology, principles of good patient care, and the proper application of mechanical devices to aid in the management of respiratory disease. With the continuing shortage of physicians and nurses trained in pulmonary disease, the inhalation therapists can be expected to assume a larger role in the care of respiratory patients. The practicing physician must be aware of the services available and be able to utilize these to the best

possible advantage to improve the quality of care for patients in the hospital and at home. A review of some of the basic principles of inhalation therapy is presented.

Intermittent Positive Pressure Breathing (IPPB).

Intermittent positive pressure breathing is commonly employed in the treatment of atelectasis, bronchitis, and pneumonia and may be useful for the prevention of postoperative respiratory complications. Its effectiveness in these areas is a subject of considerable controversy and any beneficial effects appear to be related more to the technique of administration than to any other single factor (1). The routine use of IPPB without adequate patient instruction and without a well trained person to administer therapy appears to be of little benefit (5). Long-term home treatment with IPPB in patients with chronic obstructive lung disease has failed to demonstrate measurable improvement, as indicated by arterial blood gases and pulmonary function testing; yet many of these patients feel that IPPB helps them to raise secretions, breathe more easily, and live more comfortable lives (3). Aerosol bronchodilators may be delivered very effectively by IPPB equipment. These agents are of benefit in reducing bronchoconstriction and aid in the removal of secretions. IPPB is also indicated in the management of acute pulmonary edema with severe hypoxemia.

Aerosol Therapy. Aerosol therapy is of considerable importance in helping to facilitate removal of abnormal secretions. Accumulation of thick, tenacious secretions represents one of the most important reversible factors in acute and chronic respiratory disease. The terms "aerosol" and "mist" imply that water or a liquid substance is delivered as small particles suspended in air. Water particles

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are generally unstable and are deposited primarily in the upper airways. Ultrasonic nebulizers deliver a high-density mist with relatively small particles. They are effective in thinning secretions in the upper airway but may be poorly tolerated by some patients and are potentially hazardous with prolonged continuous use (4). Mist tents are commonly used in pediatrics for the management of pneumonia, bronchiolitis, and cystic fibrosis. Heated aerosols from reservoir nebulizers are often helpful for removal of secretions in patients with bronchitis, asthma, and acute respiratory failure. Induced sputum specimens may also be obtained for diagnostic studies. When gas is heated, more water may be transported in the gaseous state, significantly increasing the humidity. Careful attention to the principles of humidification is important in mechanical ventilation and frequently may mean the difference between success and failure in the management of patients with endotracheal tubes and tracheostomies.

Oxygen Therapy. Many of the physiologic alterations present in acute respiratory failure occur as a result of hypoxia. Oxygen is therefore one of the most important drugs used in managing this disease. Like any other drug, it must be ordered and administered with care, and its effects must be observed carefully. Oxygen transport to the tissues depends upon multiple factors, including cardiac output, arterial oxygen content, and metabolic requirements. All of these factors have to be considered for safe and intelligent administration of oxygen therapy. Excessive oxygen may result in damage to the lungs or depression of ventilation in patients with respiratory failure and hypercapnia. In the treatment of patients with acute ventilatory failure, the proper administration of oxygen may mean the difference between successful conservative management or failure of such therapy with endotracheal intubation or tracheostomy necessary for survival. The inhalation therapist may provide assistance in all areas of oxygen therapy.

Respiratory Monitoring. Patients in respiratory failure need careful monitoring, regardless of whether they are being managed conservatively or with mechanical ventilatory support. Clinical evaluation of the patient by a trained observer is essential with administration of bronchodilators, oxygen, mechanical ventilation, or other forms of therapy that may result in cardiac or respiratory alterations. Bedside spirometry can aid in determining changes in lung

volumes and minute ventilation. Portable oxygen and carbon dioxide analyzers are valuable for monitoring inspired and expired gas mixtures. Evaluation of lung mechanics, particularly when patients are on respirators, can detect significant changes in airway resistance and lung compliance. Arterial blood gases are the ultimate laboratory guide to therapy and must be available at all times to adequately manage patients with acute respiratory failure.

Mechanical Ventilation. The indications for mechanical ventilation are frequently based on a combination of clinical observations and physiologic changes which can be measured at the bedside with equipment that is readily available and familiar to the inhalation therapist (2). Once mechanical ventilation has been instituted, continuous observation is necessary and adjustments in therapy must be made, as indicated by arterial blood gases and clinical response. Advances in the design of ventilators and in techniques of ventilation have resulted in increased survival and less morbidity for patients requiring artificial ventilation. Continuous positive pressure ventilation has proved to be of considerable value in managing the adult respiratory distress syndrome and acute pulmonary edema when severe hypoxemia is present. With such therapy the effects on venous return, cardiac output, and oxygen delivery must be known and fully appreciated. Careful physiologic evaluation is necessary to determine when the patient is ready for weaning from the respirator and to follow his progress during the weaning period. Improper weaning often results in rapid deterioration of the patient and reversal of much that has been previously accomplished by good respiratory care.

Home Care. Home care is often neglected in the comprehensive medical management of patients with respiratory disease. The respiratory equipment and techniques for home care must be individualized for each patient, depending upon his disease and needs. Often simple and inexpensive equipment will give results equal to or better than more expensive and complicated devices. Instruction in cleaning and maintaining respiratory equipment at home is best given by persons who constantly concern themselves with these problems. Discharge from the hospital is sometimes dependent upon the ability of the family to render appropriate respiratory care at home. Some families are able to manage extremely complicated situations when good training and su-

pervision are provided by interested respiratory nurses and inhalation therapists. Home visits are often necessary to assure that the best possible care is given and to assist with problems that may be unrecognized by the patient, family, and physician. Frequently the practicing physician has neither the time nor awareness for the many technical and mechanical aspects of home care. Techniques for chest physiotherapy should be taught to the patient and family when indicated, and continued instruction and supervision are necessary for maximum effectiveness of this therapy. The multiple problems of outpatient care are best handled by a team of respiratory specialists, but when such a team is not available, much can be accomplished with the aid of the well trained inhalation therapist of today.

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