

Title : A MEDICAL STUDENT COURSE IN MECHANICAL VENTILATION

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**Introduction.** For medical students interested in careers in anesthesiology, internal medicine, surgery and pediatrics, the principles involved in the mechanical ventilation of patients with respiratory insufficiency are important. Because of large numbers of students, severity of patient illnesses, competition with housestaff, and coincidence between student schedules and presence of appropriate patients, it is difficult to offer students an educational opportunity that includes decision-making in the care of such patients. To teach applied respiratory physiology to medical students, we have designed and implemented a course that includes a workshop in mechanical ventilation of an animal model that allows students to use and expand their knowledge.

**Description.** This one-week course is part of the required curriculum of clinical clerkships and allows for approximately twenty students. Appropriate reading material is distributed in advance. Lectures begin the course and include interpretation of blood gases, acid-base balance, pathophysiology of acute respiratory failure, monitoring of cardiovascular and respiration, treatment of near-drowning, and principles of respiratory support. After the lectures have been completed, the students are divided into small groups with a faculty member assigned to each one. The application and operation of a volume-limited ventilator with intermittent mandatory ventilation circuitry is demonstrated to each group. Then each group is provided with a mongrel dog anesthetized with intravenous pentobarbital. The dog's trachea has been intubated, a femoral artery catheterized, and a flow directed thermidilution pulmonary artery catheter inserted through an external jugular vein. Pressures are transduced and displayed on a Grass polygraph. The students are then instructed to ventilate their animals to obtain normal pH and PaCO<sub>2</sub> values. Baseline values for total venous admixture and cardiac output are determined by the students. Alternate animals are then near-drowned with 22 ml/kg of

either distilled water or normal saline. Alterations in systemic and pulmonary arterial pressures, cardiac output, pH<sub>a</sub>, PaCO<sub>2</sub>, PaO<sub>2</sub>, pH<sub>v</sub>, P<sub>v</sub>CO<sub>2</sub>, and P<sub>v</sub>O<sub>2</sub> are observed by students. Then they are instructed to treat the animals with the therapies learned and to evaluate the results of therapy with appropriate measurements. Faculty guidance is provided continuously during the laboratory session. Before the conclusion of the workshop, each animal's chest is opened to demonstrate the change in appearance and volume of the lung with and without intermittent positive pressure ventilation and positive end-expiratory pressure. The animals are sacrificed after study. Subjective evaluation by students and faculty of the workshop as a teaching instrument has been excellent.

**Results.** Objective assessment is obtained through a written exam administered to one half of each group after the lectures and before the workshop and to the second half after the workshop. The exam is designed to test the students for knowledge they should have acquired. Twenty students were separated according to their grades in a basic science respiratory physiology course. There was no significant difference between these groups. The results of the evaluative tests were 61.6 ± 10.0 (mean ± SD) percent for the pre-workshop group, and 70.0 ± 5.7 percent for the post-workshop group. Comparison by two-sample t-test yielded p < 0.05.

**Discussion.** We have evaluated a course with a workshop in mechanical ventilation and supplementary didactic presentations for medical students. The workshop provides practical experience in respiratory care without the need for appropriate patients at the time the students are scheduled to take the course. The results of therapy are well illustrated to the students and reinforce the principles already learned by conventional methods. The results of a written test reflect enhanced knowledge after the workshop.