Title: A COMPUTERIZED PATIENT ADVICE SYSTEM FOR THE MANAGEMENT OF ADULT RESPIRATORY DISTRESS SYNDROME

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Introduction: We have undertaken a randomized, controlled clinical trial to test a new form of respiratory support which includes Extracorporeal Carbon Dioxide Removal (ECODR), against traditional continuous positive pressure ventilation for patients with Adult Respiratory Distress Syndrome (ARDS). Since the experimental procedures were complex, detailed treatment protocols were developed to describe the care for all modes of respiratory support in the clinical trial. The treatment protocols had the potential to make the clinical approach to patients more uniform by equalizing the frequency of monitoring and the intensity of care for clinical trial patients. Since this clinical trial is being performed at a hospital with a well established computerized clinical information system, we converted the experimental treatment protocols into computer logic using the HELP system (the LDS Hospital Clinical Information System). The treatment protocols were implemented in computer patient advice system (COMPAS). COMPAS provided the clinical staff with ventilator or extracorporeal circuit adjustment advice when new observational or laboratory data were entered into the computer system by respiratory therapists, nurses, or members of the radiology, pharmacy, or the blood gas laboratories (Fig. 1). Using a blackboard control architecture, the system was intended to function continually for each patient’s entire stay in the ICU.

Data entered for routine charting HELP computer system Automatic suggestions
- Blood Gas Lab
- Respiratory Therapy
- Nursing
- Pharmacy
- Radiology

Data entered for routine charting HELP computer system Automatic suggestions
- Bedside terminal: Ventilator & Extracorporeal adjustments

Figure 1

Description of protocols: The medical logic contained in COMPAS’s knowledge base recommended ventilator adjustments for 5 different modes of ventilation (A/C, IMV, CPAP, Pressure controlled inverted ratio ventilation, and ECODR). Suggestions for adjusting FiO2, PEEP, Peak inspiratory pressure, respiratory rate, exhalation, decannulation (for extracorporeal circulation), mode of ventilation, time to wait before reevaluating patient (draw blood gas), membrane lung ventilation and blood flow, tidal volume, and sedation and paralysis were sent to the patient’s bedside computer terminal for review by the clinical staff.

Methods: COMPAS was evaluated through 3 phases:
1) To test the speed and reliability of the computer system, COMPAS generated ventilator therapy advice for all patients (274) in one 12-bed ICU over a 6 month period.
2) An assessment of the number of COMPAS generated therapy suggestions that the clinical staff followed (320, on 5 patients) provided a measure of the clinical staff’s compliance with COMPAS’s medical logic.
3) The effect of COMPAS on patient care was determined through retrospective computer comparison of patients with similar traits treated without COMPAS generated therapy suggestions.

Results: COMPAS has been used clinically to direct the respiratory management of the first 5 patients in the randomized clinical trial. When new observational or laboratory data were entered, the system was intended to function continually for each patient’s entire stay in the ICU.

Discussion: The speed and reliability of the system were adequate as shown by the average response time (2.2 min), the percent of suggestions generated in under 2 minutes (82.3%), clinical staff acceptance of the therapy suggestions (84.4%), and the overall reduction in the time required to reduce therapy when needed (86 to 46 min). The high compliance with COMPAS ventilatory therapy suggestions (84.4%) showed that the respiratory management of complex ARDS patients can be accomplished using COMPAS’s computerized medical logic. The number of data entry errors (accounting for 10% of staff overrides) can be reduced by implementation of an automatic ventilator charting system (The Medical Information Bus is currently in the clinical testing phase of development). Refinements of the medical logic contained in the COMPAS knowledge base should further reduce discrepancies between COMPAS and bedside clinical decisions. Both the frequency of monitoring and the intensity of patient care within the clinical trial was more uniform after COMPAS was implemented, thus enhancing the standardization of patient care crucial to the interpretation of the results of our clinical trial.

References:
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