A PROGRAMME FOR CRITICAL CARE VENTILATOR MANAGEMENT

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Computer-based critical care monitoring systems provide a continuous display of cardiopulmonary data.\(^1\) The Ventilator Management Programme (VM) uses these data to identify trends in the patient's clinical course and to make specific therapeutic suggestions.

VM is designed for use in the management of post-operative cardiovascular patients (e.g. coronary artery bypass graft). The overall goal is to aid the clinician in weaning patients from mechanical ventilation and discontinuing endotracheal intubation.

**INTERACTION**

![Diagram of interaction between patient, clinician, monitor, and VM]

Fig. 1. Interaction between the patient, clinician, monitor and VM.

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O. Prakash et al. (eds.), *Computers in Critical Care and Pulmonary Medicine*

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Based on the received monitored data, VM (Fig. 1):

1. provides a current summary of the patient's cardiopulmonary status,
2. gives a physiological interpretation of the data,
3. suggests appropriate therapy,
4. detects possible measurement errors.

The programme uses a set of rules which are based on statements of a group of expert clinical practitioners of critical care medicine. Each rule is of the form: if statements about measurements and previous conclusions are true then make a conclusion. Use of rules for representation and manipulation of knowledge is taken from the sub-discipline of Artificial Intelligence called "Knowledge Engineering."

The rule set divided into different sections, each serving a unique function:

Transition determines the mode of ventilation. Since no ventilator presently provides direct computer sensing its operating mode, the ventilatory mode is inferred by analysing characteristic changes in the times of inspiration and expiration (e.g. I/E ratio), the respiratory rate and the maximum inspiratory pressure.

Initialising defines expected values for measured parameters based upon the ventilatory mode. These values are then converted to symbolic ranges such as "ideal," "acceptable," "high" and "low." Thus, limits of acceptability for different parameters vary depending on the clinical context (i.e. ventilatory mode). For example, when a patient is advanced to the T-piece, the upper limit of acceptability for arterial pCO₂ (PₐCO₂) is raised because alveolar ventilation normally decreases temporarily when the mechanical ventilator is disconnected.

Status compares the monitored data and the expected values to make statements about the cardiopulmonary status of the patient. In addition, many status rules incorporate time-dependent trends in measured parameters (Table 1).

Therapy suggests therapeutic interventions for abnormal states, provides a differential diagnosis for particular clinical states (e.g. hypoxaemia indicates the need to repeat a laboratory value) (e.g. follow-up arterial blood gas when hypoxaemia has recently occurred, and defines readiness for the next ventilatory mode in the weaning process) (Table 2).

Instrument detects possible measurement errors and recognises interventions which may cause spurious data (e.g. suctioning).