SensorMedics Critical Care
3100B Advanced Training Course - Adult Applications

Day 1

75 Minutes: SensorMedics Lecturer

- **A. Background for Development of HFOV**
  - 1. Animal Data
    - a) Lung architecture
    - b) Chronic lung disease
    - c) Inflammatory changes
    - d) Airway pressures
- **B. Ventilators**
  - 1. Conventional Ventilators
    - a) Alternative Strategies
    - b) Large Tidal Volume Ventilation
    - c) Pressure Control Inverse Ratio Ventilation
    - d) Permissive Hypercapnea
    - e) ITPV
  - 2. Modes of Ventilation
  - 3. High Frequency Ventilators
    - a) Passive Exhalation
      - (1) Jets
      - (2) Set-Back Jets
      - (3) Flow Interrupters
    - b) Active Exhalation
      - (1) Oscillators
- **C. Mechanisms of Gas Exchange**
  - 1. Conventional Ventilation
    - a) Convective (Bulk Flow)
    - b) Molecular Diffusion
  - 2. High Frequency Oscillation
    - a) Convective (Bulk Flow)
    - b) Taylor Dispersion
    - c) Asymmetrical Velocity Profiles
    - d) Molecular Diffusion
    - e) Pendeluft
    - f) Cardiogenic Mixing
- **D. 3100B Theory of Operation**
  - 1. Mean Airway Control
  - 2. Delta-P

45 Minutes: Physician Lecturer

- **A. Human Data**
  - 1. Non Randomized Data
    - a) Arnold: CCM 1993; 21:272
    - b) Fort: CCM 1994; 25:

2. Prospective Randomized Controlled Trial Data
    a) Arnold: CCM 1994; 22:1530
    b) MOAT2

60 Minutes: Physician Lecturer

A. Adult Applications

1. Indications
    a) ARDS
    b) Air Leak
    c) Pneumonias
2. Precautions
    a) Chronic Obstructive Lung Disease
    b) Intractable Shock
    c) Increased ICP

B. Oxygenation

1. Indicators
2. Mean Airway Pressure
    a) Effects of changes
    b) How to adjust when recruiting
    c) How to adjust when weaning
3. FIO2
    a) How to adjust when weaning
4. Disease Specific Strategies (How to manage each, experiences)
    a) ARDS
    b) Pneumonia
    c) Air Leak
    d) Smoke Inhalation
        (1) Airway injury

C. Ventilation

1. Indicators
2. Attenuation effects
    a) Larger ET tubes
    b) Frequency and I-time effects
3. Strategies (How to adjust and when)
    a) Hypoventilation
    b) Hyperventilation
    c) Frequency Selection
    d) I-Time Control

D. Patient Care Issues

1. Sedation and Paralysis
   a) Selection of agents
   b) Monitoring neurologic function
2. Nutrition
   a) Enteral vs. Parenteral
   b) Caloric requirements

30 Minutes: Physician Lecturer

A. Hemodynamics

1. Review of HFOV Interaction
   a) Relationship of lung volume and PVR
   b) Guttierrez Int Care Med 1995; 21:505
   c) Fort CCM 1997; 25:
   d) Arnold CCM 1994; 22:1530
   e) Nicol Ped Pulmonol 1994; 18:317
2. Fluid Management
   a) IV rates
3. Vasopressor Use
   a) Selection
   b) Dosage
4. Monitoring
   a) Swan Ganz
   b) CVP
   c) Use of Echocardiography

30 Minutes: Respiratory Care Practioner/Nursing Care Practioner

A. Clinical Assessment and Patient Care

1. Patient Set-up
2. Monitoring
   a) Blood Gases
   b) Pulse Oximetry
   c) Auscultation
   d) Chest Wall Palpation
   e) Chest Wiggle Factor
   f) Chest X-rays
      (1) Special requirements
      (2) Frequency
   g) Lung Mechanics
   h) Flow charts
3. Suctioning
   a) Frequency of suctioning
   b) Open versus closed suctioning
   c) Handling disconnects
4. Complication Management
   a) Skin breakdown management
   b) Positioning and turning patients

45 Minutes: SensorMedics Lecturer

A. Description of System Components

1. Patient Circuit
2. System Control Functions
3. Alarms and Indicators
4. Calibration
   a) Circuit Calibration
   b) Ventilator Performance Calibration
5. Humidification Systems

2 Hours: Respiratory Care Practitioners

A. Simulation Laboratory

Physician Lecturer

B. ICU Tour/HFOV Rounds

May be on day 2

Day 2

30 Minutes: Physician Lecturer

A. Case Studies

1. Three cases selected to demonstrate the thought process in patient management or unique experience.

45 Minutes: SensorMedics or Physician Lecturer

A. Experimental CO-Therapies

1. Nitric Oxide with HFOV
2. TGI with HFOV
3. Liquid Ventilation with HFOV
4. ECMO Data

30 Minutes: Respiratory Care Practitioners and Participants

A. Summary

1. Ventilator Set-up Re-demonstration
2. Calibration Re-demonstration

4 Hours: Physician and Respiratory Care Practitioners

A. Animal Laboratory

Divide the group into 2 teams with specific assignments (usually RT's as MD's and MD's as RT's). Have them manage the animal and be certain that along the way, all of the points and experiments below are covered either as they manage the animal or once the management is completed. Allow the animal to return to the injured state and have the second team duplicate the experiment.

1. Management of DAD
   a) Lung volume recruitment
      (1) Use of monitoring techniques taught previously
      (2) Use of X-rays
      (3) Demonstrate the effects of MAP on PaO2
      (4) Inflate to 45 cmH2O to demonstrate safety
      (5) Change % I-time to demonstrate effects on distal mean airway pressure as recorded on distal pressure monitor

b) Ventilation
(1) Partially clamp ET tube and demonstrate decreased CWF
(2) Change Power settings to effect PaCO2
(3) Change Frequency to effect PaCO2
(4) Change % I-time to effect PaCO2
(5) Partially deflate cuff to demonstrate effects on PaCO2

2. Management of Air Leak
a) Create air leak via a thoracotomy
(1) Demonstrate physiologic response
b) Insert chest tube and manage oxygenation and ventilation
(1) Demonstrate frequency effects
(2) Demonstrate Power setting effects
(3) Demonstrate MAP management

3. Trouble Shooting during lab session (teams to detect failures established with them out of room)
a) Problems associated with the circuit
(1) Circuit leak at temp probe port or water trap
(2) Circuit leak at cap/diaphragm
(3) Circuit leak at humidifier
b) Problems associated with the gas source
(1) Loss of cooling flow
c) Mechanical failures
(1) Low battery alarm

45 Minutes: SensorMedics and Physician Lecturer

A. Closing and Summary

1. Written Test

Laboratory Objectives

Management of DAD

Lung volume recruitment

- Use of monitoring techniques taught previously
- Use of X-rays
- Demonstrate the effects of MAP on PaO_2
- Inflate to 45 cmH_2O to demonstrate safety
- Change % I-time to demonstrate effects on distal mean airway pressure as recorded on distal pressure monitor

Ventilation

- Partially clamp ET tube and demonstrate decreased CWF
- Change Power settings to effect $PaCO_2$
- Change Frequency to effect $PaCO_2$
- Change % I-time to effect $PaCO_2$
- Partially deflate cuff to demonstrate effects on $PaCO_2$

Management of Air Leak

Create air leak via a thoracotomy

- Demonstrate physiologic response

Insert chest tube and manage oxygenation and ventilation

- Demonstrate frequency effects
- Demonstrate Power setting effects
- Demonstrate MAP management

Trouble Shooting during lab session

Problems associated with the circuit

- Circuit leak at temp probe port or water trap
- Circuit leak at cap/diaphragm
- Circuit leak at humidifier

Problems associated with the gas source

- Loss of cooling flow
- Mechanical failures
- Low battery alarm