BI-LEVEL VENTILATION/APRV

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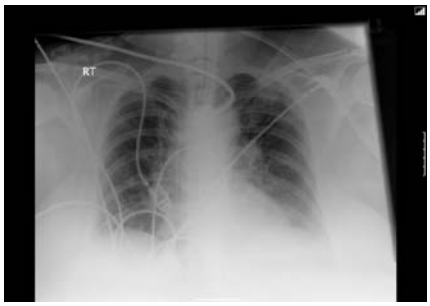
Bi-Level/APRV

- 69yo WF presents to local ER 3 days after having hysterectomy with an acute abdomen. Pt found to be in respiratory failure and septic. She was intubated and life-flighted to SHH.
- On presentation she had BP 98/53 on dopamine drip with sat 92% on 100% FIO_2 on the vent.

CXR



Bi-Level/APRV

- Pt found to have perforated bowel by CT scan and sent for emergent surgery.
- Pt transferred to CCU post-op where her hospital course is complicated by progressive hypoxia and pulmonary infiltrates c/w ARDS.
- Hypoxia does not respond to increasing PEEP and her sats remain in the mid to high 80's.
- What next?

Bi-Level/APRV

- Continuous positive airway pressure is applied to inflate the lungs
- Alternate between two levels of CPAP
- Time cycled mode of ventilation (not respiratory rate dependent)
- Pressure controlled mode of ventilation

Bi-Level/APRV

- Pressure high (P_1) and pressure low (P_2)
- Time high (T_1) and time low (T_2)
- P_1 results in alveolar recruitment for better gas exchange
- P_2 allows the airway pressure to drop, gas to leave the lungs, and CO_2 to be removed
- T_1 and T_2 determine time spent at each level

Bi-Level/APRV

- Time cycled mode of ventilation
- Cycles independently of respiratory effort by the patient
- In a paralyzed patient, it is the same as PC-IRV
- Much more comfortable than PC-IRV because of the uncoupling of the cycle and the respiratory effort of the patient

Bi-Level/APRV

- CPAP levels allow spontaneous respirations (circuit remains open)
- PC-IRV locks the patient out at the two pressure levels (circuit is closed)
- Bi-Level/APRV gives the patient the sensation that they are breathing at a normal as opposed to an inverse I:E ratio
- Much more comfortable for the patient

Advantages

- Much more comfortable than PC-IRV so less sedation is required
- Better V/Q matching (favors distribution of ventilation to dependent and poorly aerated but perfused lung zones)
- Improved PaO_2/FIO_2 ratios due to alveolar recruitment (able to decrease FIO_2)

Hemodynamically Advantageous

- Spontaneous respirations decrease intrathoracic pressures
- Majority of blood moves in a spontaneously breathing patient during inspiration
- The opposite is true in mechanically ventilated patients (expiration)

Hemodynamically Advantageous

- Spontaneous respirations:
  1. Increased cardiac index
  2. Increased O_2 delivery
  3. Decreased vasopressor requirement
  4. Increased renal perfusion

Studies

- In comparison to VC-IRV, resulted in decreased shunt and improved oxygenation
- Even at high I:E ratios, PCO_2 compensated with increased spontaneous respirations
- In comparison to PCV-IRV, lowered cardiac shunt, improved oxygenation, less sedation was required, shorter ventilatory requirement, and shorter ICU stay
- Mortality did not differ between groups
- Appropriate study?

Indications

- ARDS/ALI
- Severe CHF
- Severe hypoxia
- Hemodynamically unstable patients

Contraindications

- Obstructive lung disease
- High minute ventilation requirement
  1. Dynamic hyperinflation
  2. High alveolar pressures
  3. Barotrauma

Settings

- Start with the "respiratory rate": 60/RR gives you your cycle time. Example RR 15 gives cycle time of 4 seconds
- Set T1 and T2: Example I:E ratio 4:1 results in T1 of 3.2 seconds and T2 of 0.8 seconds
- Set P1 and P2: Set P2 at the PEEP set on previous mode of ventilation. Set P1 to appropriate TV

Weaning

- Titrate I:E ratio first to something more reasonable
- Option then to wean down on P1 and P2 until simply on CPAP or change back to a more conventional mode of ventilation
- Proceed with daily PS trials and if the pt does well then proceed with extubation

Pearls

- Improve oxygenation: increase time at P1 level or increase P1 or P2
- Decrease PCO_2: increase TV by either increasing P1 or decreasing P2. Increase amount of time spent at P2.

Case Study

- Placed on Bi-Level with RR of 15 with T1 3.2 and T2 0.8. P1 titrated to keep TV's around 6cc/kg IBW and P2 of 15.
- Hypoxia dramatically improved with better recruitment of alveoli.
- After long hospital and rehab stay she recovered and I now follow her in my medicine clinic.

Questions?

References

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