ERCAST Show Notes

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COVID-19: Weingart Q & A on Airway, Vents, Tubes, Lungs, ECMO, and CPAP

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ED-intensivist Scott Weingart has developed several protocols for airway management in COVID-19 patients, but each of those answers brings up more questions. In this episode: 'happy hypoxemia', the 4 types of COVID patients, Covid L vs H, is there a role for ECMO in severe disease, why intubation should be a last resort, the importance of patient positioning, and much more.

- **One of the most astounding things about treating COVID-19 patients is how well they can look with extreme hypoxia.**
    - Patients with saturations of 50% (and consistent ABGs) can be talking, mentating normally, and have otherwise normal vital signs. Thus, this term: "the happy hypoxemic".
    - It is not well understood why these patients are able to tolerate such low sats without having compensatory measures, such as tachycardia.
    - This led to a paradigm shift in the approach to managing hypoxemia.
- **There are 4 types of COVID-19 patients:**
    - Those with mild disease -- may never enter the medical system.
    - The "happy hypoxemics" -- many of these, if managed well, will be discharged without experiencing cytokine storm or needing intubation.
    - The hyperacute progression patients -- these patients decompensate rapidly. Many go into cardiac arrest hours after ED arrival. Weingart believes these patients likely have the highest viral load and are the most dangerous to the healthcare workers.
    - The indolent patients -- may look like the "happy hypoxemics" initially, but within 4-5 days develop cytokine storm and require intubation.
        - There are 2 phenotypes:
            - **COVID L (low elastance/not stiff/normal compliance)**
                - This is the "happy hypoxemic" phase on the vent.
                - The amount of gas in the lungs is nearly normal and there is low lung recruitability.

        - Hypoxemia may be due to loss of regulation of perfusion and loss of hypoxic vasoconstriction.
        - Don't have severe signs of driving pressure (meaning they're easy to ventilate).
        - These patients can be damaged iatrogenically if you respond to their pulse ox with standard vent modes.
        - Do poorly with low tidal volume (TV), high PEEP, and an FiO2 that isn't high enough.
        - Best managed with high FiO2 which allows you to limit the PEEP to just what you need.
        - Recommended initial vent settings:
            - 8 ml/kg TV, 100% FiO2
            - Increase the PEEP only if the patient is desaturating on a high FiO2.
        - Can turn into COVID H patients on the vent.
    - **COVID H (high elastance,/stiff/low compliance)**
        - Increased permeability of the lung leads to edema, atelectasis, decreased gas volume, and decreased TV for a given inspiratory pressure.
        - High degree of lung recruitability.
        - Manifests similar to ARDS patients and responds nicely to typical ARDS settings (ie. low tidal volume and PEEP-FiO2 ARDSNet ladder).
        - The ARDSNet ladder applies only to this subset of COVID patients.
        - Link to ARDSNet protocol.
- **How can you tell if a patient is COVID L or COVID H?**
    - Observe their plateau and driving pressures when on 8 ml/kg TV.
        - COVID L patients will respond like normal lungs.
        - COVID H patients will respond with high plateau and driving pressures, indicating terrible compliance and classic acute lung injury.
- **What is the current treatment algorithm for the query COVID patient who presents with a severe asthma exacerbation?**
    - Use MDIs rather than nebulization to deliver bronchodilators.
    - Consider terbutaline or epinephrine (0.3-0.5 mg IM)..
    - Many hospitals are not allowing CPAP, so more of these patients may need to be intubated if they deteriorate.
    - Vent management:
        - Start with 8 ml/kg TV and high FiO2.

        - Follow the expired flow graph to make sure the respiratory rate is low enough to allow the patient to fully expire between breaths.
        - Link to EMCrit Dominating the Ventilator Part 2 on Asthmatic Ventilation.
- **Which techniques can be used to minimize the aerosolization risk of intubation?**
    - Weingart argues that if you follow this procedure for intubation, the risk is very low.
    - Important measures include:
        - wearing full PPE,
        - using a negative pressure room if you can,
        - NOT intubating while the patient is getting chest compressions,
        - attaching viral filters to occlusive face masks,
        - avoiding bag-valve-mask ventilation,
        - keeping the face mask on the patient until complete paralysis,
        - releasing any pressure from the face mask before removal,
        - using video laryngoscopy rather than DL,
        - avoiding suctioning when you can, and
        - consider single operator bougie intubation technique
    - Link to video demonstration of Dr. Chris Holmes' Intubation Shield which seems ergonomically superior to other aerosol containment boxes in use.
- **Does ECMO have a role for these patients?**
    - Most centers are reserving ECMO for patients who only have single organ failure.
        - For patients with only pulmonary failure, this would be veno-venous (VV) ECMO.
        - For those who have recovered from their lung issues but who have COVID myocarditis, they might get veno-arterial (VA) ECMO.
    - Many COVID patients have multi-system organ failure and are being excluded from ECMO.
    - Old age has been another common COVID ECMO exclusion.
- **COVID fluid management: keep them dry, but not too dry.**
    - Replace insensible and external losses (ie. due to vomiting or diarrhea). Patients who you suspect are dehydrated based on history or a flat IVC on ultrasound may benefit from 500-1000 ml of fluids.
    - ED patients who you have no reason to believe are dehydrated likely need no additional fluid replacement.
    - In general, it is better to run these patients dry, but monitor urine output and your ultrasound findings to make sure the patient doesn't develop renal failure due to dehydration.

    - Consider early pressors if COVID patients are hypotensive.
- **Non-invasive ventilation, done right, should be safe.**
    - Initially, people were worried about aerosolization and cautioned against it. This is because standard noninvasive used masks which vent to the environment.
    - Weingart argues that the Italian helmets and his closed circuit CPAP masks have minimal dispersal and are much safer.
- **How is Weingart awake repositioning patients in the ED?**
    - He's repositioning everyone every 60 minutes by asking them to rotate from lying on their left side, to their right side, and then sitting upright.
    - Prone positioning is an option, but you need to verify it makes the patient feel better, not worse.
        - Complex if a patient is on CPAP (even more so if a patient is intubated).
        - Does not appear to benefit COVID H patients.
- **What is being done during the apneic period, prior to intubation?**
    - Weingart uses the CPAP set-up which allows for apneic CPAP.
        - Keeps the lungs inflated with a continuous source of oxygen, providing a high FiO2 and maintains recruitment.
        - Link to EMCrit's COVID CPAP Pre-oxygenation Set-up without nasal cannula
        - Link to EMCrit's COVID-19 Intubation Pack and Preox for Intubation
        - Video demonstrating that apneic CPAP inflates the lungs.
- **When COVID patients need supplemental oxygen, Weingart uses a stepwise progression.**
    - 1st tier -- normal nasal cannula @ 6 liter/minute
    - 2nd tier -- Venturi mask up to 50%
    - 3rd tier -- nasal cannula plus non-rebreather mask covered with a surgical mask
    - 4th tier -- high flow nasal cannula
    - 5th tier -- CPAP (using a machine that's been altered to allow filtering)
- **Post-intubation sedation**
    - Weingart likes to keep his COVID L patients lightly sedated, arguing that spontaneous breathing is good for their lungs.
    - Deep sedation is preferred by some to prevent self-extubations when patient monitoring is difficult.
- **Vent splitting**
    - Weingart is concerned about the deep sedation/paralysis required when intubated patients share vents.

- What he finds more attractive is splitting the vents between 2-4 patients to deliver CPAP, allowing the patients to spontaneously breathe. This saves the single ICU vents for patients who need individualized settings.

References:

1. Gattinoni L. et al. COVID-19 pneumonia: different respiratory treatment for different phenotypes? (2020) Intensive Care Medicine; DOI: 10.1007/s00134-020-06033-2.
2. Link to EMCrit's COVID Airway Management Thoughts
3. Link to EMCrit's COVID CPAP Pre-oxygenation Set-up without nasal cannula
4. Link to EMCrit's COVID-19 Intubation Pack and Preox for Intubation
5. Link to EMCrit Dominating the Ventilator Part 2 on Asthmatic Ventilation.
6. Link to EMCrit Wee Alternatives to Vent Splitting