Clinical and team management in the COVID-ICU:
Successful strategies from the first week

COVID-19 CLINICAL ROUNDS

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Introduction

- Critical care attending, Emory University Hospital
- Large academic hospital system with high acuity
- Focus today on one of three COVID units: 14 bed relatively new unit
- Co-credit to Dr. Sara Auld, Dr. Will Bender and Dr. Lisa Daniels for development of these protocols, numerous others for the broader effort

Objectives and Caveats

- Aimed for those directly providing care to critically ill patients
- Recommendations are practical, observable, common sense and within standards of care
- Outcomes likely to vary based on patient mix, location and resources available (a rapidly moving target)
- Have to go fast, more information on slides than can discuss
- More than anything: there is hope and things we can do better

Our approach

1. Need to deliver great critical care with high level of attention to detail and accountability
2. No luxury of time, get them better FAST for:
   - Sake of patient's chance of recovery
   - Sake of the next patient that will need that ventilator
3. Procedures should be pre-emptive
   - unpredictable and rapid declines
   - Constraints and delays of PPE and provider safety

Prepare the Team

- Leaders, attendings, managers: you need to step up, anticipate long hours
- Call in every friend and favor you are owed
- Daily huddles with entire unit are critical
  - Single most useful thing that got us through the first week
  - 15 minutes every morning before rounds
- Document algorithms and protocols, it saves times later
- Be thorough with transitions between providers

Disease Course

- As observed, although fair amount of confirmation by others
- Slow plateau phases with rapid, unpredictable transitions
- Created our protocols around these phases

Phase 1 - Prodrome

- Pre-admission
- Non-specific viral syndrome/symptoms
- Often with poor PO intake and/or N/V

Phase 2 – Slow smoldering with silent hypoxia

- Generally experienced on floor
- Require between 2 – 10L O2
- Do not feel much SOB subjectively while on oxygen
- Objectively can be tachypneic but otherwise comfortable appearing
- CXR with the well described diffuse infiltrates
- Difficulty mobilizing thick secretions
- Often require volume resuscitation, often overdone
- Can last for days before progressing

Phase 3 – the Struggle Bus

- O2 requirements start to get into 10-15L range NC
- Should prompt movement to COVID-ICU and beginning of bundle
- Coughing requires increasing effort, secretions worse
- More anxiety and subjective SOB
- CXR with progressive consolidation, infiltrates and edema
- Can last from hours to days

Phase 4 – Respiratory Collapse

- Requires NRB, HFNC, NIPPV or Intubation to maintain saturation
- Duration seems dependent on initial mode of therapy
  - Our typical intubation time has been 4-5 days
  - HFNC and NIPPV seem to delay time to intubation at the cost of de-recruitment, accumulation of secretions and worse compliance

Phase 4 – Respiratory Collapse

- Characterized by
  - Relatively normal compliance, even when needing high PEEP
  - Moderate to severe V/Q mismatch
  - Pulmonary edema and effusions
  - Initial apparent single organ failure (but other mild derangements)
  - Lack of vasodilatory shock or leukocytosis, low procalcitonin
  - Lack of cardiogenic shock
  - Thick, copious secretions
  - Waxing/waning fevers
  - AKI not related to any hemodynamic or volume status (early ATN, then AIN on microscopy)
  - Mild transaminitis
  - Rapidly rising CRP that seems to immediately precede failure (peaks in 200-450 range)

Phase 5 – Rapid Death or Steady Resolution

- Rapid progression to MOSF and death
  - Reported, but not observed in our patient set
  - Described elsewhere as hyperinflammatory phase or cytokine storm
    - Fast onset and short-lived
  - Fulminant viral myocarditis with malignant arrythmias
  - May be amenable to MCS if rapid intervention
- OR resolution over several days to extubation with rapid return to near baseline

Decision points and actions

- 2-10L NC
  - Cohorted floor or ICU depending on overall frailty, subjective experience of symptoms or other ICU-defining co-morbidities (e.g. CHF)
  - Standard floor care or standard ICU monitoring
  - Antibiotics if concern for super-imposed bacterial infection (leukocytosis is suggestive)

Decision points and actions

- >10L NC or worsening WOB
  - Move to ICU
  - CXR and pre-emptive A-Line
  - Surveillance labs (daily ABG, CBC with diff, CMP, CRP, D-dimer, LDH, PT)
  - Strict I&O's (not necessarily with foley)
  - Guafensin and aggressive pulmonary hygiene
    - almost on par with CF therapy
    - inhaled mucolytics as needed, incentive spirometry, flutter valve

Decision points and actions

- 15L NC or requiring NRB or >10L with respiratory distress
  - No HFNC or NIPPV
    - Both: mask progression of pulmonary damage by making the PaO2 look better
    - Both: allow secretions to accumulate
    - HFNC: allows continued de-recruitment
    - NIPPV: likely actively harmful by newer Italian reports
  - Controlled intubation
  - Central line (regardless of pressors), us
  - Surveillance labs
    - daily ABG, CBC with diff, CMP, CRP, D-dimer, LDH, PT
    - Baseline urine studies (U/A, lytes)
    - BID ScvO2 and troponin
  - Strict I&O's WITH foley
  - Baseline echocardiogram by POCUS or Cardiology, preferably with stored images for comparison
  - Begin Phase 4/Intubated management (highlights to follow)

Neuro

- Highlights
  - Marked encephalopathy and delirium that resolves about 2 days post-extubation
  - Minimize sedation, RASS -1 as respiratory status allows
    - Uncomfortable, inconvenient … have to do it
  - Prophylactic restraints
  - Early PT as able
- Marked encephalopathy with agitation and high sedation requirements has been uniformly observed (suspect encephalitic component)
- Pulmonary recovery has preceded neurological recovery, waking them up to tolerate SBT is rate limiting step
- Minimize sedation as much as possible, goal RASS -1 if pulmonary status tolerates
- Prophylactic restraints – can be difficult to get in room quickly to prevent pulling
- Start physical therapy as soon as patient participatory, even if still intubated

Phase 4 Mgmt –Sedation Comments

- Highlights:
  - Cost of over-sedation is prolonged vent time and delirium that the patient and resource utilization cannot afford
  - Accept some risks of recall, self-extubation and inconvenience that we normally don't (for right or wrong)
- Requires modification of practice that will be the most uncomfortable/inconvenient for both nurses and providers
- Metabolism of sedatives likely impaired by mild to moderate hepatic and renal dysfunction
- We avoided versed/ativan assiduously, even with paralysis
  - those that got them took significantly longer to extubate (by about 2 days)
  - use BIS monitor if that reassures (goal 50-60)
  - consider the balance of very low risk of recall balanced by risk of mortality d/t vent unavailability
  - If use, stop immediately after discontinuation of paralysis
- Suggest combinations of: propofol, ketamine, quetiapine, narcotics. We used klonopin low dose in some younger. Be mindful of volume with dexmedetomidine
- Be prepared for drug shortages: consider oral or push regimens, may need to get creative
- Accept some increased risk of self-extubations with the PPE delay, snowing them is not the answer

Phase 4 Mgmt - Pulmonary

- Highlights: nothing magical
  - LPV, wean vent as frequently as possible
  - PEEP over FiO2 (although high peep usually not required)
  - Early paralysis, early epo/iNO, early pronation
- Lung protective ventilation
- Wean actively and diligently! Can't turn the fiO2 down by 10% each day, must be weaning frequently
- In general very responsive to:
  - PEEP
    - usually doesn't need more than 12-14, but can be higher
    - Favor PEEP over FiO2 (aka high PEEP ladder)
  - Early Paralysis
    - Usually not prolonged, consider single bolus to get control of dysynchrony
  - Early Inhaled pulmonary vasodilators
    - epoprostenol or iNO
    - There is already an anticipated shortage … use selectively
  - Early pronation if fails above
  - If your hospital is unable to do these, transfer before gets to vent settings that preclude transfer
  - ECMO by and large has not been required at this stage but we are prepared to do, almost no data yet on success

Phase 4 Mgmt - Pulmonary

- Highlights:
  - Pulmonary edema: Dry them out
  - Pronounced secretions: Clean them out
  - Extubate to HFNC or face mask for 12-24 hours
- Prophylactic guafensin, PRN inhaled mucolytics, frequent suctioning, percussive therapy if needed
- We avoided bronchoscopy at first for theoretical aerosol risk, less concerned currently
- Dry. Them. Out.
- Once on reasonable PEEP/IP requirements, PST or SBT twice daily … try hard!
- Extubate to face mask or HFNC until sure stable (12-24 hours)
- Continue aggressive incentive spirometry post-extubation

Phase 4 Mgmt - Cardiovascular

- Highlights:
  - Maximize perfusion, MAP > 75
  - Replete lytes aggressively
  - Monitor for myocarditis
- Maintain good perfusion pressure for renal and hepatic protection (typically we aim for MAP > 75)
- Monitoring for myocarditis
  - Little data on predicting onset, so we are overcautious at this time
  - New admissions get baseline echo and EKG
  - Significant, unexplained drop in ScvO2 gets repeat EKG, stat troponin and repeat echo (can be POCUS)
  - Avoid long-acting beta-blockade if possible, use judgement with CAD/CHF
  - New, unexplained or markedly increased pressor requirements should prompt immediate call to attending with repeat ScvO2 and trop. Consider reculture and abx
  - Consider VA-ECMO if function declines significantly, but before it reaches 10-20%
- Fix arrhythmias
- Correct anemia
- Have a plan for CPR
- Aggressive electrolyte replacement, especially K and Mg

Phase 4 Mgmt - Renal

- Highlights:
  - Diurese diurese diurese
  - AKI is generally not pre-renal
  - Aggressively replete lytes
- Pulmonary and renal congestion will slow recovery
- Diurese diurese diurese
- Don’t assume that rising creatinine is hypovolemia
  - Echo can help differentiate
  - ATN and AIN, even subclinical, has been noted in most of our patients
  - If creatinine rises, spin the urine for casts
  - Low threshold for dialysis for volume management
- Pressors are NOT a contraindication to diuresis unless in first hours of septic shock
- Consider blood or other oncotic agents (25% albumin) to support
- Aggressive electrolyte replacement, especially with diuresis
  - Aim for K >= 4.5, Mg > 2.5, Phos > 2.5
  - Ensure that always at goal, not just for the 4 hours post-rounding

Phase 4 Mgmt – GI

- Hightlights:
  - Immediate Dobhoff, early feeds
  - Formal swallow eval after
- Immediate placement of Dobhoff tube and initiation of enteral feeds
- HIGHLY suggest bridle
- If no DHT prior to extubation, place one immediately prior while sedated
  - Avoids procedure that involves coughing/gagging
- Good bowel regimen
- No PO post-extubation until formal swallow eval

Phase 4 Mgmt – ID

- Antivirals
  - Remdesevir: only available now through trial, we highly advocate enrolling
  - Hydroxychloroquine: unclear efficacy, almost certain to run out in near future, we are not generally using unless patient not improving and not in trial. LFT's and QT prolongation
  - Kaletra: reasonable data that is not effective
- Anti-inflammatories
  - NSAIDs are probably safe in our opinion, but controversial
  - APAP cannot be used on Remdesevir trial
  - Steroids are probably harmful, but may be necessary in particular settings (COPD, transplant, etc)
- COVID+ does not preclude other infections
  - Leukocytosis atypical to COVID, suggests other infection
  - New pressors suggest sepsis or developing cardiomyopathy
  - Waxing/waning moderate fevers seem typical but sustained high fevers are not
    - In our set: 1 drug fever, 1 staph bacteremia, 1 staph pneumonia

Not helpful

- Experimentation outside of a trial or accepted off-label use
  - however well meaning, it's unethical
- Advice from those without direct experience or recognized expertise
  - Lots of well-meaning colleagues will be forwarding every protocol sent by their friends of friends of friends
  - Pick someone else NOT on service to sift through the chaff
  - Use vetted material, the CDC is a great starting point
- Reinventing the wheel with every change of attending

Patients & Statistics

- 14 known positive patients that were critically ill
  - Age range 26 – 83, average 60, median 65
  - Variety of co-morbidities including HTN, asthma, sarcoid, renal transplant, myxedema with TSH > 50, CAD, morbid obesity
- 12 required intubation, 1 proning, 3 paralysis, 2 Flolan, no MCS
- 5 successfully extubated with continued recovery, 3 of which sent to floor on 0-4L O2
- 2 more remain in smoldering or near-struggle bus (pre-intubation state)
- 7 more remain intubated, about half on clear recovery trajectory
- 0 deaths

How achieved

- Optimally, rapidly and pro-actively provided good critical care across the board regardless of the time of day
- Intervened early in phases
- Focus on lung and renal protection, rapid restoration of normoxemia, maintenance of normal physiologic parameters
  - I.e. what we should be doing all the time, but we don't always achieve
- Focus on actually achieving goals, not just having intentions
  - Specifically applies to electrolyte replacement, vent goals and weaning, and diuresis
- Created a bundle of practices/protocols based on phase/progression of disease
- We stuck to our guns and held ourselves accountable

Final thoughts

- Prepare early
- It will be hard
- There is hope
- It is worth the effort

Thank you to my team last week in 5G/6G. I am beyond privileged to work with every one of you everyday, and I could not be prouder of what we accomplished.

Our first extubation