Daily Assessment of Patients

Introduction

At least once a day, likely in the setting of morning ICU rounds, all patients on mechanical ventilation must be assessed by a multidisciplinary team. The ideal structure will vary with institutional norms, however, we recommend rounds with all members of the care team, including the attending physician, residents, nurse practitioners, physician assistants, bedside nurse, and respiratory therapist as available.

While the exact structure of rounds will vary between institutions and between units, we recommend a systematic approach. Some intensive care units will take a problem-based approach, reviewing each medical problem in detail, then developing a plan to address that problem. (eg, Respiratory failure, renal failure, etc). Others take a systems-based approach, using each body system as a prompt for considering the relevant problems and developing

an assessment and plan. Which approach is preferable is a matter of personal preference and local norms, but what is most important is maintaining a thorough, detailed approach to the recent clinical data. A sample ICU rounding script is included at the end of these readings. Please note that this is provided in a data/assessment/plan format. Some ICUs will provide all data together, including vital signs, ventilator settings, infusions and other medications, physical exam findings, lab data, and imaging, then move to assessment, then plan; others organize things differently.

The daily assessment usually starts with review of the vital signs, including any vasoactive medications required to maintain those vital signs. For COVID patients, most authors are recommending one member of the care team perform a physical exam and report back to the rest of the team.

Neurologic System: Many patients with COVID-19 are requiring very high doses of sedation and even occasionally neuromuscular blockade to maintain ventilator synchrony. Each day, the medical team should assess the patient's current level of sedation, appropriate analgesia, current trajectory on the ventilator including synchrony or the ability to liberalize, and make a determination about the appropriate sedation and analgesia plan. In general, while a patient continues to have moderate-to-severe ARDS requiring controlled ventilation, most patients will require fairly deep sedation. However, as soon as the patient is demonstrating pulmonary improvement, lightning sedation and especially allowing for daily awakening trials, is one of the most important things one can do to reduce ventilator days.

Delirium is a very common problem in the Intensive Care Unit, and this can contribute to prolonged mechanical ventilation. While specific medical treatments for delirium have not proven to reduce its incidence, close attention to the ambient environment can be beneficial.

An excellent recent article[1] recommends the following points:

- Agitation and delirium
    - Minimize sources of environmental agitation, such as ventilator dyssynchrony and ambient noise
    - Attend to patients' audiovisual disortentation by helping re-orient
    - Do not use physical restraints to address agitation, whenever possible, rather determine and address the source of the agitation
- Sedation and pain management
    - Use of sedation should be minimal and include daily sedation interruptions
    - Frequently assess and treat pain
    - Be aware of painful stimuli, including suctioning, turning, and the mobilizing patient
- Sleep
    - Use of hypnotic drugs should occur only when strictly necessary and only after addressing sleep disruptions caused by pain and noise

- Early mobilization
    - As a patient begins to demonstrate clinical Improvement, early mobilization is critical to reducing deconditioning and improving the odds of extubation
    - Patient should engage in bed rest as little as possible and participate in multidisciplinary rehabilitation

Cardiovascular System: Hypertension is common with COVID-19, due in large part to use of high doses of sedatives and analgesics to maintain ventilator synchrony, relative volume depletion in an effort to optimize the lungs, and vasoplegia from sepsis. Trends in heart rate and blood pressure over the last 24 hours should be assessed every day, including evaluation of the doses of vasopressin required to maintain blood pressure goals. The blood pressure goal for most patients should be a mean arterial pressure of 65 mmHg. In patients with chronic hypertension, a study found that maintaining a mean arterial pressure greater than 75 mmHg was associated with a reduced risk of need for renal replacement therapy. Therefore, given the patient's underlying conditions and kidney function, the clinician may adjust the MAP goals accordingly.

The patient should be assessed for improving, worsening, or unchanged hemodynamic status. Attempts should be made to verify the etiology of any hemodynamic perturbations, including worsening or recurrent sepsis, hypovolemia, cardiogenic shock, or far less likely, unobstructive cause of shock. As indicated given the underlying concern, the cardiac function can be evaluated with an EKG or echocardiogram.

In addition to assessing the patient's hemodynamic status and determining goals, the patient's hemodynamics must be monitored closely after any change in the ventilator. Changes in the intrathoracic pressure can lead to variations and heart rate and blood pressure.

The hemodynamic goals for the day should be clearly delineated, and the plan for achieving them outlined.

Pulmonary System: The initial assessment of the patient on the ventilator begins with reviewing their current ventilator settings as well as the trends over the last 24 hours. The basic vital signs that should be reviewed every day include the motors in elation, title volume, pressure, plateau pressure, driving pressure, PEEP, respiratory rate, and FiO_2. Additionally, the milliliters per kilogram of predicted body weight, and PaO_2/fiO_2 ratio should be assessed every day.

Specifically, for different modes of ventilation, it is important to check different parameters:

- In volume assist control, check peak pressure and plateau pressure.
- In pressure assist control and pressure support, check peak tidal volume and minute ventilation.
- When patients are breathing spontaneously, it is important to monitor changes in minute ventilation.

The appropriate limits for these parameters are patient-specific. Alarms are generally set slightly above or below the current monitored values, to alert the patient's care team if their condition changes.

In addition, make sure that plateau pressure is < 27 cm H_2O (or 30 in patients with ARDS) and consider if higher PEEP is appropriate. Aggressive action should be taken to decrease PEEP and wean the patient off.

Any changes in trends over the last 24 hours that should be evaluated for etiology. In reviewing these settings, the clinician can begin to make assessments as to whether the patient is doing better, worse, or staying the same.

If the patient is doing worse, indicated by increasing FiO_2, the need to increase the PEEP, or decreased compliance, the clinician should assess for the underlying issue. Issues can include derecruitment, pulmonary edema, or the development of pneumonia, and others. Additionally, specifically in COVID-19, patients require prolonged weaning from the ventilator. Attempting to make rapid ventilator changes may result in some deterioration. The clinicians should decide what the next best step is, often including deepening sedation, ensuring ventilator synchrony, increasing the PEEP, performing a recruitment maneuver, or proning.

If the patient is doing better, defined as requiring less FiO_2, lower PEEP, or improved compliance, the clinician may consider liberalizing the ventilator settings. Many will use a PaO_2/FiO_2 ratio greater than 200 as a cut-off for changing the patient to pressure support ventilation.

Note that not every patient who appears ready for a pressure support will be. The ventilator screen below shows a patient in severe respiratory distress on pressure support, with a high respiratory rate (36) and very high tidal volume (1013), indicating lung-injurious ventilation. This patient was changed back to volume control ventilation.

Patients should be evaluated every day for readiness for a spontaneous breathing trial (SBT). To determine, consider if:

- The patient is stable and/or improving medically.
- The FiO_2 requirements are 0.5 or less.
- The PEEP requirements are 10 cm H_2O or less.
- The patient can make spontaneous efforts

After changes to ventilator settings, be sure to monitor:

- Blood pressure
- Arterial blood gas for sufficient oxygenation and acid-base balance
- When using venous blood gases consider pH and use SpO_2 for oxygenation

Arterial blood gases

When it comes to checking arterial blood gases (ABGs), the American Thoracic Society outlines six steps, which we summarize here:

1. Assess that consistency of pH and hydrogen
2. Check if acidemia or alkalemia is present by checking if the pH < 7.35 or pH > 7.45, respectively
3. Check if the disturbance is respiratory or metabolic by checking in which direction the pH and PaCO2 change (if opposite directions they indicate a respiratory disturbance and if same direction that means metabolic)
4. Does the disturbance have a high enough correction factor (will generally NOT return the pH to normal)?
5. Calculate the anion gap (AG= [Na+]-([Cl-] + [HCO3-])-12 ± 2) and see if it is normal (12 meq/L)
6. If there is an anion gap, evaluate its relationship to the decrease in bicarbonate.

Renal: Approximately 35% of patients with ARDS well developed acute kidney injury at some point during their critical illness. Acute kidney injury has a high attributable mortality. However, simply providing more fluids does not necessarily improve renal outcomes. A large study published in 2006 found that keeping a negative fluid balance in patients who were not in shock was associated not only with better pulmonary outcomes, but also renal outcomes. The hourly urine output, total body balance for the last 24 hours, BUN, creatinine, as well as other electrolytes should be assessed daily.

The patient should be determined to have improving or worsening acute kidney injury, and a decision should be made regarding the patient volume status.

For patients with worsening renal failure, determined by lower urine output despite adequate circulating volume, rising creatinine, or failure to clear medications or electrolytes, the next step is to evaluate when the patient might need dialysis. The indications for emergency dialysis are severe acidemia, hyperkalemia, toxic ingestions (unlikely), volume overload leading to pulmonary compromise, or uremia.

GI/Nutrition: Nutrition is essential for healing in any critically ill patient. The patient should be assessed for an appropriate nutrition plan including tolerance of tube feeds. Liver injury is common and critically ill patients, often due to shock liver. Bowel regimens are essential in patients who are receiving Opioids as this can cause substantial constipation.

Heme: The hemoglobin, platelets, coagulation factors should be assessed as indicated. In patients with COVID-19, Ddimers are frequently elevated, and higher levels correspond to worse outcomes. Patients with unexplained drops in hemoglobin should be evaluated for bleeding or hemolysis. Please note that the average critically ill patient loses 40 to 70 mL of blood a day simply from phlebotomy. Most patients should be transfused if there are signs of hemodynamically significant, active bleeding or a hemoglobin of less than 7. Additionally, the anticoagulation plan should be determined, if indicated.

ID: The white blood cell count, maximum temperature for the last 24 hours, current temperature, and culture data should all be reviewed. If the patient is on antibiotics, they should be reviewed as well as the day of antibiotics noted. For patients with isolated COVID-19, procalcitonin levels are often low, but they can be used to evaluate the patient for a superimposed bacterial pneumonia. Imaging should be reviewed for evidence of ongoing infection. If the patient has a known infection, it should be assessed as to whether it is improving for worsening. The patient should also be assessed for any evidence of new infections. If the patient is showing clinical improvement on antibiotics, but does not have any clear evidence of infection and negative cultures, stopping antibiotics should be considered. All antibiotics in the ICU should have a planned duration.

Endo: The patient's glucose control should be reviewed. Steroids are not routinely recommended for patients with COVID-19, but can be administered if the patient has another condition that is steroid-responsive. Patients who have underlying thyroid issues should have their medications continued while they are in the intensive care unit. If the patient does not have adequate glucose control, the regimen should be adjusted, using an insulin drip if necessary.

Reduce risk for ventilator-associated pneumonia (VAP)

- Hand wash diligently
- Raise head of bed to 30-45 degrees (if permissible given patient's specific situation)
- Use aseptic technique while suctioning
  - Suction as minimally as possible using the lowest pressure possible
  - Hyperoxygenate the patient pre and post suctioning
  - Do not add normal saline to the ET tube
- Give sedation interruptions
- Evaluate viability of extubation
- Provide prophylaxis for deep vein thrombosis

Ventilator Alarms

There are some alarms that must be considered:

- Minute ventilation: when using pressure targeted modes it can mean that respiratory system mechanics have changed or the patient's respiratory drive has changed.
- The peak pressure alarm is important in volume assist control. It indicates that respiratory system mechanics have changed, but whether that is due to a change in resistance or elastance (compliance) needs to be assessed by looking at the peak and plateau pressure.
    - Changes in plateau pressure are a result of changes in compliance
    - Changes in PEEP and/or tidal volume will also alter plateau pressure.

When troubleshooting high-pressure ventilator alarms, PIP is key.

The peak airway pressure (PIP) should be displayed on the ventilator screen, while the plateau pressure (Pplat) is obtained by holding the "inspiratory hold" or "inspiratory pause" button on the ventilator. An elevated PIP and normal Pplat is indicative of increased airway resistance. An elevated PIP and elevated Pplat is indicative of abnormal compliance. Determining whether the patient has a resistance problem or a compliance problem can assist in the differential diagnosis of respiratory failure.

SAMPLE ICU ROUNDING SCRIPT

In general, approach each patient presentation with a snapshot in your mind. Before starting the presentation, ask yourself:

- **Is this patient getting worse, getting better, or staying the same?**
- **What are the patient's top 1,2,3,4 issues? (As indicated.)**

Thinking about this global assessment will focus your presentation. An example would be, "Mr. P is now ICU day #7, and he is not really getting better. His major issues are the COVID-related ARDS, now with a superimposed pneumonia, as well as acute kidney injury." – then you know what issues below you really need to focus on.

Different ICUs will organize these data differently, but these are the key concepts to focus on, using a data/assessment/plan structure in an organ system-based approach.

Neuro: (Data) Neuro exam, delirium – CAM; Current RASS and RASS goals, sedative requirements, pain medication, results of any recent neuro imaging

(Assessment) Is pain well controlled? The sedation plan appropriate? Mental status improving/declining?

(Plan) Do we need to lighten or deepen sedation? Do we need to change pain/sedation medications? Do we need imaging? Do we need EEG? Neuro consult?

Cardiovascular: (Data) HR, BP, - and trends for both over last 24 hours, cardiac rhythm, the type of shock – distributive, cardiogenic, hypovolemic, obstructive; current volume status, current pressor or inotrope requirements – include medication, current dose, and any trends or changes, EKG, troponin, BNP, use of any antihypertensives or anti-arrhythmics

(Assessment) Is the hemodynamic status improving/worsening? Is the patient hypo/eu/hypervolemic? Is the rate/rhythm controlled?

(Plan) What are our hemodynamic goals (HR, MAP)? Will we give fluid/diurese? Will we change our pressors/inotropes? Do we need an echo? Should we consult Cardiology?

Pulmonary: (Data) Type of respiratory failure – hypoxemic, hypercarbic; h/o underlying lung disease, current ventilator settings – the mode, the TV, RR, PEEP, FiO2, the PIP, Plat, the minute ventilation; PaO2/FiO2 ratio, recent proning, use of inhaled pulmonary vasodilators, most recent ABG, use of bronchodilators, any home medications for pulmonary conditions, incentive spirometry, results of any recent SBT, results of any recent chest imaging

(Assessment) Is the respiratory failure improving/worsening? List barriers to extubation

– recent SBT results, mental status, airway patency, unresolved shock, deconditioning;

(Plan) Can we change the ventilator? Can the patient be put on pressure support? SHould we perform an SBT, if not already done? Can we extubate? Does the patient continue to require proning or pulmonary vasodilators? Do we need to add medications?

Renal: (Data) BUN, Cr, UOP, total body balance for last 24 hrs, Na, K, other lytes, AKI - causes of AKI

(Assessment) Improving/worsening AKI, Volume status – can include here or CV, or can repeat as appropriate,

(Plan) Volume goals for the day. Do we plan to diurese/give fluids? Does the patient meet any criteria for dialysis?

GI/Nutrition: (Data) underlying liver condition, acute liver injury, abdominal exam, LFTs, INR as indicated, nutrition plan and tolerance

(Assessment) Is the liver function improving/worsening? Are the bowels working?

(Plan) Nutrition plan for the day. Bowel regimen? Do we need to check imaging?

Heme: (Data) Underlying condition, Hgb, Plts, coags, Ddimer, fibrinogen

(Assessment) Are counts improving? Any evidence of bleeding or clotting?

(Plan) Anticoagulation plan, transfusion goals

ID: (Data) WBC, Tmax, Tcurrent, culture data, current abx with day, procalcitonin

(Assessment) Is the infection improving/worsening? Any concern for new infections?

(Plan) Planned course, any other evaluations for sources (like CT or US)

Endo: (Data) Glucose, steroids, thyroid issues

(Assessment) Adequate glucose control?

(Plan) Changes to regimen?

Ppx: GI prophylaxis, DVT prophylaxis, PT, up OOB

1. Urner M, Ferreyro BL, Douflé G, Mehta S. Supportive care of patients on mechanical ventilation. *Respir Care*. 2018;63(12):1567-1574. doi:10.4187/respcare.06651