December 2, 2020

COVID-19
ICU Refresher & Primer
Adult Pandemic Education

INDEX

Revision History

Version	Summary of Updates
March 25, 2019	First Version
April 1, 2020	• Delete "control severe agitation" as an indication for NMBAs
November 30, 2020	• Add information for staff new to ICU • Align with Care of the Adult Critically Ill COVID-19 Patient Annex D (November 26, 2020)

Author: Clinical Transition Education (CTE), Associate Chief Nursing Office (ACNO)

Please email OPACCA@albertahealthservices.ca for content concerns/updates.

A. INTRODUCTION

Welcome and thank you for your willingness to support critically ill Albertans during the coronavirus disease (COVID-19) pandemic.

The exponential growth of COVID-19 in Canada is impacting the health of Albertans and may influence the accessibility of health services as cases continue to grow, limiting the availability of hospital beds and services. Detailed Canadian COVID-19 case report data (n=327,076) indicate 7.9% (n=21,270) of reported cases were hospitalized, of whom 19.7% (n=4,190) were admitted to the ICU with 4.8% (n=1.027) requiring ventilation (Government of Canada website, November 26, 2020). As a result of the pandemic, AHS is asking health care providers (HCPs), with or without previous ICU experience, to support ICU operations as necessary to meet the growing demand of specialized health services for Albertans in need.

This information package contains key information to support your transition to the ICU and to care, or assist with care, of a patient with COVID-19. Depending on your skills, knowledge, and the specific needs of your unit, you may receive additional educational supports.

While reading, reflect on your previous experiences and skills, making connections between the information in this package to previous learnings, while refreshing and advancing your knowledge. Pay particular attention to items requiring you to possibly act, as indicated by this symbol: ❑.

For Nurses new to ICU- It is not an expectation for you to fully comprehend the ICU specific information in this booklet (e.g. intubation, arterial lines, etc.). The goal is to introduce terminology and care modalities you are likely not familiar with.

For new to ICU staff:

❑ Please see the **ICU Support Nurse Passport** on the ICU Support Nurse Education Google Classroom to assist planning your transition. Contact your CNE for details.

For staff with ICU experience:

❑ Complete and submit **Returning ICU Nurse Profile** to your Unit Manager or CNE to assist planning your transition

❑ Complete and submit **ICU Nurse Skills Self-Checklist** to your Unit Manager or CNE to assist planning your transition back to ICU.

Regardless of your background, you have valuable skills and knowledge to contribute to the ICU team. The expectation is not for you to function independently as a current ICU nurse, but for you to support critical care within your scope of practice. At no time will you be expected to perform a skill that is beyond your abilities or scope.

COVID-19

COVID-19 is an infectious syndrome caused by SARS-CoV-2, a novel coronavirus that has not been previously detected in humans. Though information is rapidly evolving, at this point it is noted that though the majority of patients have only mild symptoms, a small portion develop critical illness, in particular hypoxemic respiratory failure. COVID-19 is believed to be spread primarily via respiratory droplets (similar to influenza and other coronaviruses such as MERS and SARS) and/or contact (e.g., contaminated hands to mucous membranes).

❒ Find the latest novel coronavirus (COVID-19) information on Insite: https://insite.albertahealthservices.ca/tools/Page24291.aspx

Sign up for Insite COVID-19 Alerts to get updates to your inbox by clicking on this symbol on the right side of the Insite page.

B. INFECTION PREVENTION AND CONTROL

1. Patients who are suspected, probable or confirmed positive COVID-19 status admitted to the ICU will be cared for using contact and droplet precautions.

   Respiratory Illness: Assessing the Need for Additional Precautions (Isolation)

2. A point-of-care risk assessment (PCRA) must be performed before every patient interaction with a suspected, probable or confirmed positive COVID-19 status irrespective of location. The PCRA should include the frequency and probability of routine or emergent aerosol generating medical procedures (AGMP) being required.

   AHS Point of Care Risk Assessment (PCRA)

3. N95 respirators or approved equivalent protection must be used by all heath care workers in any patient care area where aerosol generating medical procedures (AGMP) are being performed, are frequent or probable (e.g. ventilator disconnection), or with all suspected, probable or confirmed positive COVID-19 intubated patients.

4. A current list of AGMP can be found here:
   Aerosol Generating Medical Procedure Guidance Tool

   Aerosol generating medical procedures (AGMP) require an N95 respirator if the patient has a suspected or confirmed acute viral respiratory infection. This includes viral respiratory pathogens such as influenza A or B or other common seasonal respiratory viruses including respiratory syncytial virus, rhinovirus, enterovirus, adenovirus, human metapneumovirus, coronavirus, and parainfluenza virus; novel pathogens such as COVID-19, SARS, MERS-CoV, avian influenza; and for suspected or confirmed viral hemorrhagic fever.

5. Due to the high risk of aerosol generation, critically ill patients with suspected, probable or confirmed positive COVID-19 will be admitted to single patient rooms when available.

6. Negative pressure (airborne isolation) rooms are not required and should be reserved for patients with disease processes requiring airborne isolation but may be utilized if available.

7. If all single patient rooms are occupied, then attempt to cohort COVID-19 patients in one area with a minimum 2-meter separation between patients. IP&C guidance on cohorting of patients should be reviewed.

   IP&C Cohorting Recommendations for COVID-19 in Acute Care
   IP&C Recommendations for Cohorting Inpatients on Additional Precautions in Acute Care Facilities

8. Close room doors with enough of an opening to allow for hearing in-room alarms. Keep doors closed fully during AGMPs.

9. Stock isolation cart with adequate supply of N95 respirators (all brands and sizes), goggles, face shields, gloves (all sizes), isolation gowns, surgical masks and disinfectant wipes. Ensure the entire spectrum of brands and sizes of N95 masks are available and placed on the isolation cart outside of the patient room and at the entry to a COVID-19 cohort area. Ensure disinfectant wipes are located inside and outside the patient room and cohort areas and are adequately full.

10. Enter order for “Contact and droplet isolation precautions” in the patient record, adding the comment “Use N95 respirators for aerosol generating medical procedures, and for all suspected, probable or confirmed positive COVID-19 patients receiving heated humidified high flow oxygen delivery non-invasive ventilation or invasive mechanical ventilation” as additional information.

11. Review Interim IP&C Recommendations COVID-19 and PPE Checklist: Contact and Droplet Precautions.

12. Post the AHS Contact and Droplet Isolation Sign.

13. Ensure appropriate viral diagnostic tests have been performed prior to admission to ICU. If viral diagnostic studies have not been performed – consult with MRHP to order appropriate studies.

Infection Prevention Precautions

Suspected, probable or confirmed positive COVID-19 cases in the ICU should be managed with contact and droplet precautions. Use N95 respirators for all aerosol generating medical procedures (Aerosol Generating Medical Procedure Guidance Tool) and for all suspected, probable or confirmed positive COVID-19 intubated patients.

Interim IPC Recommendations COVID-19

1. All staff providing care must be successfully N95 fit tested and masks must be seal checked when applying.

2. Prescription glasses do not meet Workplace Health and Safety regulations for eye protection. IPC COVID-19 PPE Recommendation for Preservation and Reuse of Eye Protection

3. PPE buddy system is recommended when possible.

4. Wear new PPE to enter patient room or bed space.
   - If continuous masking, same mask can be worn into the patient's room or bed space.
   - Healthcare workers are to wear Contact and Droplet PPE (procedure/surgical mask, eye/face protection, gown, gloves) even if the patient is wearing a mask. Fit tested N95 is only required with AGMP.
   - Remove soiled PPE as soon as possible using proper doffing process.
   - Do not wear PPE outside a patient room or bed space unless transporting contaminated items.

5. Change gloves between care activities for the same patient (e.g., when moving from a contaminated body site to a clean body site).
   - Sterile gloves are for sterile procedures. Best Practice Recommendations: Glove Use and Selection

6. When an AGMP is in progress the following poster may be utilized: AGMP Poster

**There is no settle time required after AGMP is complete **

7. Remove soiled PPE as soon as possible. Change mask when it becomes moist or soiled.

8. Use of a dedicated reusable stethoscope is preferred. When not available refer to IP&C guidance document. Stethoscope Use for Patients on Contact and Droplet Precautions including COVID-19 Patients

9. Effective and appropriate use of PPE will keep staff uniforms and clothing clean. Staff should change before leaving healthcare facility and take soiled clothing home in a bag. Soiled uniforms/clothing do not need any special handling in the laundry.

   Healthcare Attire Information Sheet
   Staff Tips: COVID-19 Personal Clothing and Cleaning Surfaces

10. Hand washing is critical to prevent spread of COVID-19. Special attention to hand hygiene is essential for staff, patients and visitors; wash hands with soap and water or use antiseptic hand rub before and after each and every contact with patients or their environment. Remind colleagues if you see lapses in hand hygiene behavior. Educate patients and visitors about how and when to use hand hygiene products. Hand Hygiene Education

11. For patients with suspected or probable but not confirmed COVID-19 infection, maintain contact and droplet isolation precautions including fit tested N95 respirators for AGMP and intubated patients until the COVID-19 AND full respiratory pathogen panel results are confirmed on all respiratory samples sent (ETA, NPS and BAL). If any results are positive – maintain current precautions. If results are negative, check with IP&C before discontinuing isolation as patient may still call for isolation per Public Health Self-Isolation Guidelines.

12. Discontinuation of Isolation for patients with confirmed COVID-19 infection: Discontinuation of Contact and Droplet Precautions for Suspected or Confirmed COVID-19

PPE Guidance

The following link contains all up to date information on PPE and should be reviewed periodically: Personal Protective Equipment (PPE).

Applying N95 respirators: All health care workers must have been fit tested within the last two years. Hold mask in your hand and pull both elastic ties, bottom first, over your hand for ease of putting mask on. Test to ensure that mask is secure and that there are no leaks. Discard immediately outside of room after use. Do not touch the outside of the mask while discarding as it is considered contaminated.

Proper wearing of an N95 respirator includes:

- Putting on the respirator before entering the patient's room.
- Molding the metal bar over the nose.
- Ensuring an airtight seal on the face, over top of the nose and under the chin.
- Donning eye protection after N95 for AGMP.
- Leaving the room and changing the respirator when it becomes moist.
- Removing the respirator after leaving the patient's room by touching elastic only.
- Not wearing respirator around the neck.

Personal Protective Equipment (PPE) Guidance to Help Make Continuous Masking Work for You

Eye protection (disposable face shields/goggles): Face shields or goggles are to be worn upon entering the patient room. Personal eyewear (glasses) is not sufficient. Face shields are single use. Discard face shields outside of the room after use. If googles are re-used they must be fully wiped down with disinfectant wipes prior to re-use.

Gloves: Always perform hand hygiene prior to putting on gloves and after removal.

Gowns: Remove lab coat before donning. Ensure the back of the gown is secured – do not leave open.

Donning: https://www.albertahealthservices.ca/assets/Infofor/hp/if-hp-ipc-donning-ppe-poster.pdf

Doffing: https://www.albertahealthservices.ca/assets/Infofor/hp/if-hp-ipc-doffing-ppe-poster.pdf

Meals: Used meal trays and dishes do not require special handling. Disposable dishes and utensils are not required.

❒ Brush up on your PPE skills using the following online resources:

- Video (12 min): Donning and Doffing (scroll to bottom of page) https://insite.albertahealthservices.ca/shc/Page6461.aspx
- Module: AHS IPC Personal Protective Equipment Contact and Droplet, COVID-19

C. ICU QUICK TIPS

Some basic tools have been made to assist you with basic ICU nurse skill concepts and skills. You will find more quick tips as you move through this document.

❒ **ICU Quick Tips** have been developed to support your daily work in the ICU. These tips may be used during your shifts at the bedside.

- **ICU Worksheet** (sample 1)
- **ICU Worksheet** (sample 2)
- **Beginning of Shift Safety Checks**
- **Adult Patient Assessment**
- **Central Lines**
- **Arterial Lines**

D. ICU TOPICS

Care of the critically ill adult COVID-19 (suspected and confirmed) patient continues to evolve. The AHS critical care community has compiled a living document that adapts prior pandemic knowledge and Influenza-like illness (ILI) guidance to the current COVID-19 crises. The intention of the document is to guide all providers of critical care in Alberta as to the basic care of adult critically ill patients with known or suspected COVID-19 infection. Our goal is to ensure such patients receive optimal, consistent and equitable care throughout the ICUs in Alberta. For the most current document iteration, refer the novel coronavirus (COVID-19) page on Insite, under 'Staff and Physician Resources'.

Direct link: Care of the Adult Critically Ill COVID-19 Patient Annex D

The Adult Critically Ill COVID-19

Critically ill adult COVID-19 patients:

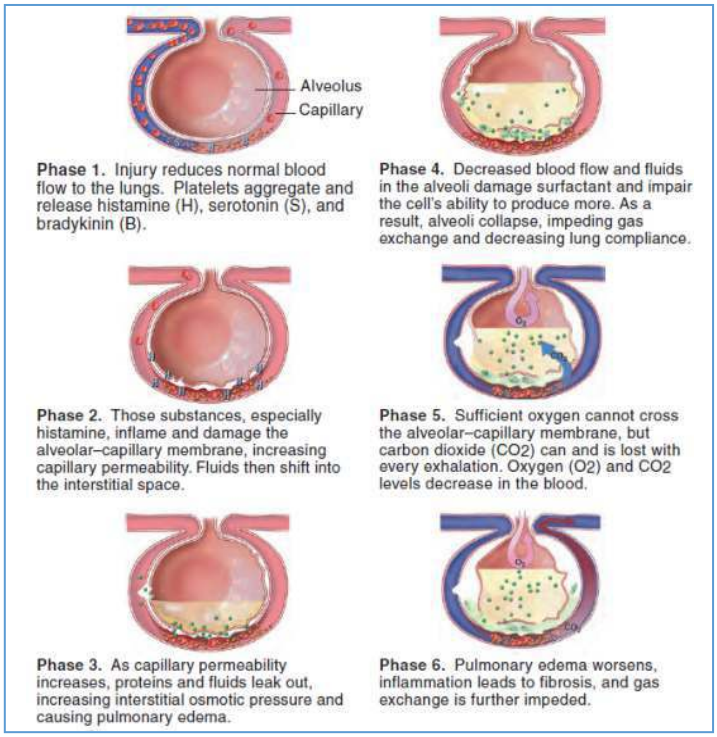
- Develop Acute Respiratory Distress Syndrome (ARDS)
- Frequently require intubation and invasive ventilation

- May benefit from prone positioning
- May benefit from conservative fluid management
- May require specific pharmacological agents:
    - Analgesia
    - Sedation
    - Vasopressors, inotropes
    - Non-depolarizing Neuromuscular Blockading Agents (NMBAs)
- Require consideration in special circumstances (i.e. Code Blue Management)

1. Acute Respiratory Distress Syndrome (ARDS)

ARDS, a complex clinical syndrome involving a sudden and potentially life-threatening deterioration in pulmonary gas exchange, is the most severe form of acute respiratory failure. The SARS-COV-2 virus triggers ARDS by directly affecting the epithelium in the lungs. The alveolar-capillary membrane is damaged causing increased capillary permeability and increased alveolar-capillary membrane permeability. The increased permeability allows fluid, plasma proteins, and blood to leak out of the vascular compartment into the interstitial and alveolar spaces. A good visual of this concept is to imagine the lung interstitium and alveoli being flooded with fluid (see 'ARDS Pathophysiology' image below). This interstitial and alveolar edema causes respiratory failure due to the lungs inability to remove CO_2 and/or failure to promote O_2 uptake at the alveolar-capillary level.

ARDS Pathophysiology



Lippincott Manual of Nursing Practice, 10e, 2009

ARDS Signs and Symptoms

- Increased work of breathing (tachypnea, dyspnea) as there is increased intrapulmonary blood shunting
- Worsening hypoxia with persistently low SaO_2 despite increasing FiO_2 levels
    - The PaO_2/FiO_2 ratio provides information about the severity of intrapulmonary shunt secondary to lung injury
- Impaired gas exchange with hypercarbia due to impaired ventilation
- Accessory muscle use, exhaustion
- Decreased breath sounds, coarse crackles
- Chest x-ray revealing bilateral infiltrates ("ground glass" appearance), and eventual complete "white-out"
- Arterial blood gases (ABGs) reflecting initial alkalosis followed by acidosis as condition does not improve

❒ **ABG ICU Quick Tip**

The management priority for the patients experiencing COVID-19 related ARDS includes promoting gas exchange by optimizing oxygenation and ventilation.

2. Respiratory Care

The basic principles are to always use personal protective equipment in addition to appropriate isolation precautions and minimize the use of aerosol-generating procedures.

Non-Intubated Patients

1. Provide O2 as ordered with continuous SpO2 monitoring.

2. Patients receiving oxygen of any type of nasal cannula outside of single rooms should be given a procedure mask to wear, so to reduce others exposure to cough/sneeze droplet spread, as tolerated.

3. Patients should be cared for with the head of bed elevated 30-45 degrees.

4. Minimize use of sedative and analgesic therapies (other than for palliative care).

5. No peak flow monitoring.

6. Nebulization should be avoided and be used only as an exception.

Memorandum: Restricted use of Nebulized Treatment for Covid-19

7. Bronchodilator delivery via MDI via spacer is preferred if patients can effectively utilize.

8. If patient is on HHHF or NIV, aerosolization should be administered via in-line devices, rather than disconnection and delivery of MDI.

9. The efficacy and safety of awake prone positioning of non-intubated COVID-19 patients with hypoxemic respiratory failure is not established and hence this practice is not recommended for routine application in this population of patients, unless enrolled in an ongoing clinical trial. The following trials are currently underway in Alberta:
    - COVI-PRONE CLINICAL TRIAL
    - CORONA

    AHS Scientific Rapid Evidence Report: Awake Proning in Non-Intubated Patients

Heated Humidified High Flow Oxygen (HHHF) therapy devices (AIRVO, Optiflow or Vapotherm)

- Aerosolization of respiratory secretions may result from high flow heated humidity oxygen therapy devices and use of this therapy is considered a continuous AGMP.

- As such it is **not recommended** for routine use in patients with suspected or confirmed COVID-19 infection.

- If used in patients with suspected or confirmed COVID-19 infection, treatment must be performed in a single patient room with the door closed and with staff using appropriate contact and droplet precautions, including use of N95 respirators.

Non-Invasive Ventilation (CPAP or BIPAP)

- Non-invasive positive pressure ventilation (NIV) may result in aerosolization of respiratory secretions and is considered a continuous AGMP and thus is **not recommended** for routine use in suspected or confirmed COVID-19 patients.

- If used in patients with suspected or confirmed COVID-19 (or other ILI) and hypoxemic respiratory failure or ARDS, selected evidence has suggested NIV is associated with high failure rates and need for emergent intubation.

- Patients with hemodynamic instability, multi-organ failure, or abnormal mental status are at high risk for failure and should not receive NIV.

- Pro-active intubation under less emergent conditions is the preferred strategy and should be considered.
  AHS Scientific Rapid Response Report: Oxygen Therapy Recommendations

- If NIV is used in patients with suspected or confirmed COVID-19 infection, NIV treatment must be performed in a single patient room with the door closed and with staff using appropriate contact and droplet precautions, including use of N95 respirators.

- During the COVID-19 pandemic, nocturnal CPAP will not be routinely used for hospitalized patients with OSA since it is an AGMP. Chronic NIV should be continued when deemed essential (i.e. life-sustaining). If therapy is deemed non-essential while the patient is admitted, then consider routinely reassessing to determine when it may safely be resumed. Consult pulmonary medicine if questions arise.

Tracheostomy care and management in the non-ventilated patient:
Patients spontaneously breathing via a tracheostomy and remaining on contact and droplet precautions for COVID-19 should:

1. Continue to be managed in single patient rooms with use of appropriate PPE.
2. Provide humidity as indicated and per current practice.
3. Closed suction systems are recommended for these patients.

If single patient rooms are unavailable patients with COVID-19 may be cohorted.

Intubation and Mechanical Ventilation

The hypoxemic respiratory failure and ARDS triggered by the COVID-19 virus often requires intubation and mechanical ventilation.

Intubation Guidelines

Moderate to severe hypoxemic respiratory failure/ARDS usually requires support with endotracheal intubation and mechanical ventilation. NIV and high-flow oxygen therapies frequently fail to adequately support such patients making intubation necessary. Close monitoring is crucial in order to detect failure of non-invasive support means so that intubation can be performed in a timely and controlled manner using all optimal infection prevention strategies.

1. Endotracheal intubation should, be performed by the most experienced MRHP available.
2. Minimize number of people involved. **Close the room door**. Nursing and RRT support ideally should be provided by the same individuals assigned to patient.
3. In units with adjustable room airflow rates, increase the rate of airflow (or put the room in "bronchoscopy mode") prior to intubation.
4. Don full PPE including N95 respirator, face shield, gown and gloves. Proper application of PPE should be verified by an independent observer prior to entry into the patient room.
5. Consider the additional use of goggles given the potential for expectorated secretions to flow around front-covering face shields. If goggles are re-used, they must be fully wiped down with disinfectant wipes prior to re-use.

6. Patients with hypoxemic respiratory failure usually have poor oxygenation reserves. Pre-oxygenate as much as possible using non-invasive oxygen. Reserve use of bag- valve-mask ventilation via facemask to situations where non-invasive oxygen delivery is failing (to reduce aerosolization risks).
7. The best pharmacotherapy for induction and intubation will be determined by the MRHP on a case-by-case basis but in general should include strategies that minimize chances of cough or aerosol generation via use of agents inducing deep sedation and often use of neuromuscular blockade when clinically appropriate (e.g. no signs predicting difficult intubation).
8. Consider use of visual technological devices (e.g., video laryngoscope) for the initial attempt at intubation (to reduce the risk of aerosol contact by reducing the need to look directly down the airway); however, the MRHP should use the technique most familiar to them that will ensure the greatest probability of successful intubation.

   AHS Scientific Advisory Rapid Evidence Report: Video Laryngoscopy
9. Use in-line suction catheter on in all patients. Use either HME filter or heated humidity systems (if they are fixed integral system of a particular ventilator).
10. In patients with suspected COVID-19, if sputum samples have not already been collected, collect endotracheal aspirate while all infection control precautions are already in place for intubation.
11. If difficult airway cart or other stand-by equipment is brought to the area, do not bring entire cart/equipment into the room – bring in only the necessary equipment as it is needed.

❒ **Assisting with Intubation ICU Quick Tip**

Intubated Patients

Critically ill COVID-19 patients frequently require advanced ventilator modes and patient management. The following strategies should be considered to support failing gas exchange in COVID-19 infected patients:

a. Targeted deep sedation +/- neuromuscular blockading agents (some medications have known shortages – review pharmacy bulletins when selecting sedatives and paralytics).

b. Elevation of head of bed to 30-45 degrees.

c. Lung protective ventilator strategies that restrict tidal volumes to 4-8 mL/kg of Ideal Body Weight (IBW).

d. Limit plateau pressures to ≤ 30 cm H_2O and driving pressures to ≤ 18 cm H_20, as applicable.

e. Permissive hypercapnia.

f. Optimal titration of PEEP.

g. Selective use of recruitment maneuvers, as tolerated.

h. Early consideration for a trial of prone positioning - refer to site specific policy and procedures.

❒ **Mechanical Ventilation Modes and Suctioning ICU Quick Tip**

Prone Positioning

Prone positioning may be used in mechanically ventilated patients experiencing COVID-19 induced ARDS by increasing pulmonary capillary perfusion, improving oxygenation, and reducing ventilator-induced lung injury.

Proning has been shown to:

- Expand dependent lung areas
- Improve postural drainage
- Reduce the work of breathing due to reduced pressure on lungs from cardiac structures and abdominal organs

Turning a patient from the supine to prone position is a coordinated effort, accomplished by a multidisciplinary team and lead by experienced ICU staff. The first prone or proning of an unstable patient should be in the presence of the MRHP. Proning may cause a temporary hemodynamic instability immediately after the procedure or may not be tolerated, requiring quick return to supine position. Dislodging of essential lines is also a risk and as such proning should be carefully coordinated and performed in a controlled manner.

COVID-19 Education Resources for Proning during Pandemic

Neuromuscular Blockading Agents

Mechanically ventilated critically ill COVID-19 patients may benefit from deep sedation

and paralysis. Neuromuscular blockading agents (NMBAs) provide skeletal muscle relaxation, and when used for greater than 24 hours:

- Facilitate oxygenation and ventilation in patients with severe respiratory failure
    - More advanced modes alter normal respiratory patterns (pressure control, inverse ratio, permissive hypercapnia). This may cause the patient respiratory effort to be asynchronous with the ventilator.
        - If aggressive sedation/analgesia is ineffective to ensure optimal peak/mean airway pressures and oxygenation, paralytic therapy may:
            a) Optimize ventilation
            b) Improve gas exchange
            c) Minimize barotrauma
            d) Decrease airway
            e) Improve tidal volume
            f) Allow hypercapnia
- Reduce metabolic demands by stopping muscle movement: In instances of hemodynamic instability with increased metabolic demands, pharmacologic paralysis with sedation/analgesia and mechanical ventilation reduces the metabolic demands until supportive therapies can be effective.

Reminders

- Patient must be intubated and ventilated, with a ventilator mode with a set respiratory rate as the respiratory muscles will be paralyzed.
- Sedation must be administered prior to NMBAs. Neuromuscular blocking agents do not have sedative or analgesic properties; in the absence of adequate sedation/analgesia the patient is aware of the surroundings, experiences and pain and unable to communicate or respond to this stimuli. Chemical paralysis can mask changes identified with clinical assessment.
- Reversal agent: Anticholinesterase agents (e.g. neostigmine (Prostigmine))

The patient's need for subsequent doses of NMBAs may be assessed by using a peripheral nerve stimulator (PNS)/Train of Four (TOF) or $ETCO_2$ monitoring as per your unit procedure.

Fluid Management

Following initiation resuscitation, use conservative fluid management in patients with COVID-19 when there is no evidence of shock or overt hypovolemia. Patients with COVID-19 should be treated cautiously with intravenous fluids, because aggressive fluid resuscitation and fluid accumulation may worsen oxygenation. Hypotonic fluids, starches and albumin should generally be avoided. Minimize fluid accumulation by reducing non-essential fluid intake. Diuretic therapy or mechanical fluid removal

with dialysis may be considered to optimize fluid status.

3. Pharmacology

Critically ill COVID-19 patients may benefit from deep sedation and paralysis as part of their overall treatment plan.

❑ **Pharmacology ICU Quick Tip**

4. Code Blue Resuscitation of the Suspected, Probable or Confirmed Positive COVID-19 Patient

Guidelines for Code Blue Resuscitation of Suspected, Probable or Confirmed COVID-19 Patients in Acute Care

Guiding Principles

1. Point of Care Risk Assessment (PCRA) should be completed by all health care workers before initiating any resuscitation.
2. The AHS Scientific Advisory Committee has determined that the provision of chest compressions alone is not considered to be an aerosol generating medical procedure (AGMP) and only require contact and droplet PPE.
3. Assume patient is COVID-19 positive, unless otherwise identified/known.
4. Consideration that the location of resuscitation may influence response and team processes (i.e. Critical Care Unit vs. Inpatient Unit or Emergency Department (ED)).
5. Minimize the number of participants in the patient room during resuscitation.
6. Minimize equipment in the room wherever possible.
7. If CPR is indicated, chest compressions alone can be initiated safely by a provider wearing contact/droplet PPE.
8. Contact and droplet precautions (including a fit-tested N95 respirator) shall be donned prior to initiating any AGMP (including manual ventilation and airway management) by all response team members, even if there is a perceived delay in resuscitation efforts.
9. Routine practices, such as defibrillation are otherwise unchanged from non- COVID-19 patients.

Communication

- Current paging/notification processes should be followed.
- Clear identification of isolation requirements should be made to the response team on arrival.
- Clear communication of current GOC status should be made to the responding resuscitation team members on arrival, where available/known.
- Upon arrival to the code, team members should quickly clarify roles and which members will be working inside versus outside the room.

Arrival to Code Blue

- Ensure that PPE is readily available for responding team members and that there is an available "safety/logistics officer' to monitor donning/doffing. Chest compressions alone are not an AGMP and an N95 respirator is not required to initiate hands-only CPR. Healthcare workers completing manual chest compressions are directed to continue to wear recommended PPE in alignment with our continuous masking directive, the point-of-care risk assessment, with the addition of contact and droplet precautions for patients with suspected, probable or confirmed positive COVID-19.
- Place loose clothing/sheet over the mouth and nose of the patient, as airway source control while awaiting individuals who are wearing PPE including fit-tested N95 respirators.
- CPR with manual ventilation or airway management is an aerosol generating medical procedure. Only individuals who are wearing PPE, including fit-tested N95 respirators should manage the airway.
- Donning should be carried out quickly but meticulously, even if there is a perceived delay to resuscitation. If multiple individuals arrive at the same time, priority for donning and entering the room should be given to the Code Blue team leader and/or airway expert physician, and to the ICU RN (assuming compressors are already in place with appropriate PPE).

Inside the room

- Code cart with defibrillator and arrest drugs should be brought into the room if feasible and if enough clean carts are available on site. The code cart may be left just outside the resuscitation area and the defibrillator and medication drawer may be removed and passed into the patient's room upon the resuscitation team's arrival.
- Intubation equipment:
    - Video laryngoscopy is highly recommended for the first attempt at intubation (where available).

- Priority should be placed on intubation and obtaining a secure airway with closed ventilation, especially in an unresponsive patient.
- If the patient has a Laryngeal Mask Airway (LMA) in situ, it should be swapped to a cuffed endotracheal tube as soon as possible.
- If manual bagging of the patient is required because of unsuccessful initial intubation (see below), it should be provided via a bag valve mask with a Heat Moisture Exchange Filter (HMEF).
- When intubation is successful and manual bagging is required, it should be provided via a bag valve mask with a HEPA filter, capnography (where available) and include placement of inline suction.

**** There is no settle time required after AGMP is complete ****

- Suggested response team members:
  - Code Blue Team Leader
  - Airway expert physician (if available)
  - RRT to assist with intubation and ventilation
  - RN to administer medications, cardioversion/defibrillation and update code blue team leader regarding changes in cardiac rhythm (ICU RN)
  - Health Care Worker (HCW) to do CPR (1) – Usually first responder
  - HCW to do CPR (2)
  - RN for documentation and time-keeping

Outside the Room

- RN/HCW "runner", to assist with supply of equipment stored on the unit and the activation of other HCWs, if required.
- "Logistic/Safety Officer", who should be a senior HCW, to regulate access to the patient's room, monitor proper PPE donning and doffing, ensure that protocols and the opening and closing of doors is followed and communicate with the ICU prior to the initiation of patient transport.

Modifications to Advanced Cardiac Life Support (ACLS) in COVID-19 Patients

- Intubate patients early and hold CPR during intubation to minimize aerosolization of particles and optimize intubation success.
- The best pharmacotherapy for induction and intubation will be determined by the MRHP on a case-by-case basis but in general should include strategies that minimize chances of cough or aerosol generation via use of agents inducing deep sedation and often use of neuromuscular blockade when clinically appropriate (e.g. no signs

predicting difficult intubation).

- Manual bagging of non-intubated patients using a BVM should be avoided if possible. If necessary because of unsuccessful initial intubation, use two experienced practitioners to establish an intact seal and minimize the risk of aerosolization.
- Avoid disconnections between the ETT and resuscitation bag. If required due to gas trapping, the plan to disconnect should be announced loudly in advance and the ETT should only be disconnected beyond the HEPA filter.

Post-Arrest

- PPE Doffing: DO NOT RUSH. BE METHODICAL
- Remove PPE slowly and carefully to avoid inadvertent contamination of yourself or others, performing hand hygiene in between each step while doffing.
- Logistic/safety officer to monitor member PPE doffing.
- Team to decontaminate specialty equipment as per standard routines and IP&C guidelines.
- Discard any opened supplies or any that cannot be cleaned appropriately.

Post ROSC Care

- Ensure adequate and appropriate required staff available before any transportation attempted. Follow site specific policies if family members are present.
- Designate one runner 'clean' to pre-scout/secure transport route, open doors and touch elevator buttons.
- If patient is intubated, use of transport ventilators (with filtering systems) is preferred to minimize the need for manual bagging.
- Transportation to a critical care unit should follow guidelines listed in the Care of the Adult Critically Ill COVID-19 Patient Annex D.
- For patients being transported to an ICU or an advanced care unit in a facility, consideration should be given to testing that can be safely completed on route to minimize the need for additional transports (e.g. CT scan).

Charting Considerations

- Computer code narrator may be utilized with existing computers within the room or immediately outside the resuscitation room.

- No portable computer devices should be brought into the room.
- All efforts to maintain a clean paper chart should be taken.
    - Papers are not a means of transmission. Handle all paper with clean hands, clean any shared items (like chart binders, pens or binders) with a low-level disinfectant wipe.
    - Transcribing for purposes of infection prevention will not be required.

Alberta Health Services

Pandemic Education Planning
Returning ICU Nurse Profile

Instructions: Complete this form and return to your Manager or Clinical Nurse Educator.

General Information	
Name:	
Phone/Cell:	
Email:	
ePeople Number:	

Current Status/Employment			
❑	Retired	Number of years:	
❑	Staff Nurse	Number of years:	Department/Site:
❑	Management	Number of years:	Department/Site:
❑	Education	Number of years:	Department/Site:
❑	Research	Number of years:	Department/Site:
❑	Other:	Number of years:	Department/Site:
Comments:			

Past Critical Care Experience		
Location(s) of ICU experience (City, Site, ICU Specialty):		
Number of years of ICU experience:		
Time elapsed since active duty:	❑ Less than 6 month ❑ 6 months to 11 months	❑ 1 to 3 years ❑ Greater than 3 years
Comments:		

Mgr/CNE comments:

Pandemic Education Planning
Returning ICU Nurse Skills
Checklist

Instructions: Please print and complete this form and return to your Manager or Clinical Nurse Educator.

General Information	
Name:	
Phone/Cell:	
Email:	

Skills Checklist

This self-assessment skills checklist will be used in planning to meet additional education needs should you be asked to support patient care in the ICU. Instructions: Please consider each ICU skill listed below and **assign a number score to two skill elements**:

1. Your knowledge base surrounding the listed skill, AND
2. Your comfort in performing the skill with your current knowledge base

Knowledge Assessment	
4	Well-developed/advanced knowledge
3	Some knowledge
2	Limited knowledge
1	No current knowledge

Comfort to Perform	
3	Comfortable to perform
2	Somewhat uncomfortable: need experience/demo refresh, and/or support at bedside before performing
1	Not comfortable: require full education before performing

	Knowledge Assessment	Comfortable to Perform	What would be helpful to you?
Central Nervous System			
Sedation vacation			
Restraints (monitoring & documentation)			
ICU Delirium			
Physical Assessment:			
Pupil assessment			
Glasgow Coma Scale			
Seizure management			
Stroke management			

	Targeted Temperature Management			
	Train of Four			
	Advanced neuro monitoring (EVD, LICOX, etc.)			
	Cerebral tissue perfusion alterations			
Cardiovascular				
Physical Assessment				
	Heart sound auscultation			
	NIBP			
	Peripheral pulses			
	Edema			
Cardiac Monitoring				
	Normal sinus rhythm			
	Common arrhythmias			
	Lethal arrhythmias			
	ECG strip analysis			
Assist with Line Insertion				
	Central line/Introducer			
	Dialysis catheter insertion			
	Intraosseous needle insertion			
Hemodynamics/Lines				
	Arterial pressure line setup			
	Arterial line insertion assistance			
	Arterial line levelling and zeroing			
	Arterial line waveform			
	Arterial line blood sampling & flushing			
	Central line blood sampling			
	Central venous pressure line setup			
	Central venous line levelling and zeroing			
	Central venous pressure monitoring			
	Pulmonary artery pressure line setup			
	Pulmonary artery pressure insertion assistance			

	Pulmonary artery pressure waveform			
	Pulmonary artery pressure management			
	Intra-aortic balloon setup			
	Intra-aortic balloon counterpulsation			
	Intraosseous infusion management			
Temporary Pacemakers				
	Transcutaneous pacing			
	Transvenous pacer insertion assistance			
	Transvenous pacer management			
	Epicardial pacing			
Procedures				
	Cardioversion			
	Defibrillation			
ECMO/Nova Lung				
Ventricular Assist Device				
Fluid Management				
	Blood & blood product administration			
	Rapid transfuser use			
	Fluid warmer use			
Code Blue				
	ACLS algorithms			
	CPR			
Respiratory				
Physical Assessment				
	Lung sounds			
	Peripheral perfusion			
	Pulse oximeter			
	ABG analysis			
Bag valve mask use				
Assisting with intubation				

Pre-oxygenation & suctioning				
Endotracheal tube management				
Mouth care				
Oral airway management				
Trach management				
Proning				
Non-invasive ventilation (CPAP, BiPAP)				
Mechanical Ventilation				
	Modes			
	FiO_2			
	PEEP			
	Rate			
	Tidal volume			
	Weaning			
Chest Tubes				
	Assist with insertion			
	Management			
	Changing drainage system			
	Monitoring			
Gastrointestinal & Genitourinary				
Bowel sound assessment				
Abdominal pressure monitoring				
Feeding tubes				
OGT/NGT insertion				
OGT/NGT management				
Blood glucose monitoring				
Intake and output				
Hemodialysis				
CRRT				
Medication Administration				
Direct IV administration				
Administration/Titration				

	High dose analgesia			
	High dose sedatives			
	Inotropes & vasoactives			
	Neuromuscular blocking agents			
	Electrolyte replacement			
	Diuretics			
	Insulin			
	Bronchodilators			
	Anticoagulants/antiplatelets			
	Antihypertensives			
	Antiarrhythmics			
	Patient controlled analgesia			
	Epidural analgesia			
Safety				
	Safety checks			
	Setting alarm parameters			
Infection Control				
Routine universal precautions				
PPE use				
Isolation precautions				
Donning and Doffing				
Musculoskeletal				
CSM Assessment				
Sequential Compression Device				
Wound care				
Laboratory & Diagnostics				
	Nasopharyngeal swab collection			
	Patient transport for tests (i.e. to CT)			
	Interpretation of electrolyte imbalance			

	Interpretation of coagulopathies			
	Cardiac markers			
	Hepatic markers			
	Renal markers			
	Sepsis markers			
Psychosocial				
Collaboration with spiritual care				
Collaboration with social work				
End of life care				
Family involvement in resuscitation				
Post-mortem care				
Equipment				
Setup, Use and Troubleshooting				
	IV infusion pump			
	Patient monitor			
	Central station monitor			
	Transport monitor			
	Telemetry			
	Automated medication dispenser			
	Defibrillator			
	Ventilator			
	Heating/cooling blanket			
	CRRT/IHD machines			
	Tube feed pump			
Other				

ICU Worksheet 1				
Date:	**Room:**	**Pt Initials:**	**Age:**	
GOC:	**Isolation:**		**MD/NP:**	

	Assessment		Notes	
CNS	GCS: RASS: ICDSC:			**CNS**
	Pain: CPOT/NPS:			
	Sleep:			
	Mobilization:			
	Restraints:			
CVS	Rhythm: HR:			**CVS**
	BP: T:			
	MAP: Artline:			
	Pulses: Edema:			
	Infusions:			
RESP	O2/ Ventilation:			**RESP**
	RR: SpO2:			
	Suctioning:			
	Breath Sounds:			
GI	Abdomen:			**GI**
	NG/OG:			
	Diet: PN:			
	Enteral Feeds:			
	Nausea/Vomiting: Last BM:			
	Drains:			
	Dressings:			
GU	Urine Output:			**GU**
	Fluid Balance:			
	Dialysis:			

Labs/Tests:	**Outstanding:**
Family:	

ICU Worksheet 2

Date:	**Room:**	**Pt Initials:**	**Age:**
GOC:	**Isolation:**		**MD/NP:**

	Assessment	Shift Planner
CNS	GCS: Pupils:	0730 / 1930
	Analgesic: CPOT/NPS:	
	Sedation: RASS:	0800 / 2030
	ICDSC:	
	Paralytic:	0900 / 2100
	Restraints: Mobilization: Sleep:	
CVS	Rhythm: HR:	1000 / 2200
	BP: T:	
	MAP: Artline:	1100 / 2300
	Pulses: Edema:	
	Infusions:	1200 / 2400
		1300 / 0100
RESP	O2/ Ventilation: FiO2:	1400 / 0200
	ETT/Trach Size:	
	Difficult Airway: Y / N RR: SpO2:	1500 / 0300
	Suctioning:	
	Breath Sounds:	1600 / 0400
	Drains & Tubes:	
		1700 / 0500
GI	Abdomen:	
	NG/OG:	1800 / 0600
	Diet: PN:	
	Enteral Feeds: Rate: Residuals:	1900 / 0700
	Glucometer: Oral Health:	
	Nausea/Vomiting: Last BM:	**To Do:** ❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
	Drains:	
	Dressings:	
GU	Hourly Intake:	
	Urine Output: Characteristics:	
	Fluid Balance: Fluid Balance Goal:	
	CRRT/Dialysis:	

Labs/Tests:	**Outstanding Issues:**

Family:

Beginning of Shift Safety Checks

Safety Check	Comments
Patient Identification • Patient wristband • Allergy wristband • Crossmatch wristband	❑ Legible wristbands must be on wrists or ankles • NOT taped to bed • Call Transfusion Medicine if a Crossmatch wristband needs to be moved
Goals of Care (GOC)	❑ Know your patient's GOC • Check green sleeve on chart • If not written, patient is R1
Bag Valve Mask (BVM) • Bagger • Positive End Expiratory Pressure PEEP valve • Mask / 10mL syringe	❑ Bagger must be present, operational and able to reach the patient • PEEP valve required for ventilated patients on a PEEP greater than 5cmH20
Oxygen Source	❑ Oxygen wall regulator and/or tank (1000 PSI minimum) present and functional
Suction • In-line suction • NG/OG suction • Yaunker suction • EVAC/CASS suction	❑ Suction must be functional and patent • In-line suction no more than 125mmHg • NG/OT set on intermittent / low • Yaunker readily available • EVAC/CASS: Responsibility of RRT
Siderails	❑ Are up and locked at all times
Bed Brakes	❑ Are ON at all times
Restraints • Wrist/ankle	❑ Confirm MP/NP Order ❑ Ensure adequate circulation to extremities • Be able to insert two fingers under each wrist and/or ankle restraint
Cardiac Alarm Limits • Heart rate / Respiratory rate • Blood pressure / Arterial line pressure • Oxygen saturation (SpO2)	❑ Alarms set based on knowledge of patient condition and 'normal values' ❑ **Alarms are NEVER turned off**
Oxygen Therapy • Non-Invasive (Bi-PAP) • Invasive (mechanical ventilation)	❑ Non-Invasive: know respiratory rate / FiO2 ❑ Invasive: know mode / FiO2 / PEEP
Intravenous Infusions • Critical Care profile	❑ All lines must be labelled ❑ Maintenance/main line should be labelled and readily available

Adult Patient Assessment

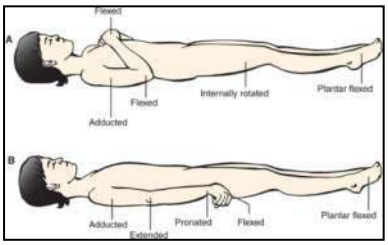
CNS

Level of Consciousness (LOC): Most important aspect of neurological exam as LOC usually deteriorates before other changes noted. Baseline assessment essential. Two major components:

- Arousal: ability to respond to verbal or noxious stimuli
- Awareness: orientation to person, place, and time

Glasgow Coma Scale (GCS): Determines level of arousal. Objective 15 point scale, scoring three items *(score in parenthesis):*

1. **Eye Opening:** Spontaneous *(4)*; To speech or command *(3)*; To noxious stimuli *(2)*; None regardless of stimulation *(1)*
   - Pupils normally round, average size 3.5, with brisk reaction to light.
   - Sudden dilated or fixed pupil is an emergency.
2. **Best Verbal Response** (ask "what is your name"): Oriented to person, place, and time *(5)*; Confused as answers not appropriate to question, but use of language correct *(4)*; Inappropriate words that are disorganized, random, no sustained conversation *(3)*; Incomprehensible sounds that are moans, groans, mumbles *(2)*; None with no verbalization despite stimulation *(1)*
   - Some units will score out of 10 (eliminating verbal response) for intubated pts.
3. **Best Motor Response** (ask "show me your thumb", not "squeeze my hand"): obeys commands: Obeys commands, being able to perform tasks on command *(6)*; Localizes pain with an organized attempt to localize and remove painful stimuli *(5)*; Withdraws from pain, in using extremity to withdraw from pain *(4)*; Abnormal flexion, with decorticate posturing spontaneously or in response to pain *(3)*; Abnormal extension, with decerebrate posturing spontaneously or in response to pain *(2)*, none, with no response to noxious stimuli, flaccid *(0)*.



Flexion

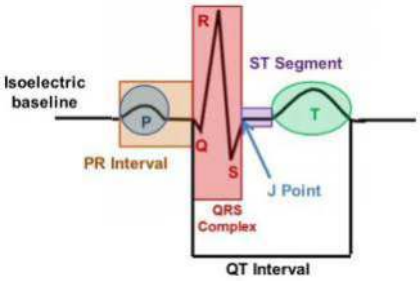
Extension

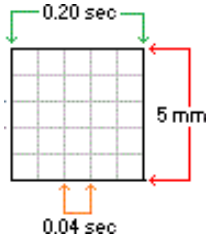
Stimulating Motor Response:

- Central Stimulation (more reliable as it assesses higher centers in the brain): trapezius squeeze, pinch
- Peripheral Stimulation (less reliable as it can be a simple spinal reflex): nailbed or interphalangeal joint pressure

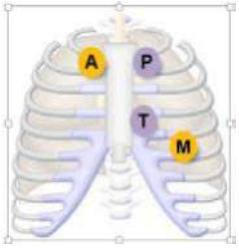
CVS

ECG Strip, HR





Heart Sounds



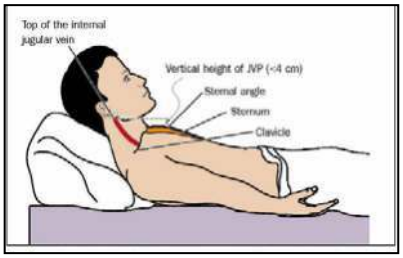
Aortic Area
- 2nd ICS
- Over aorta

Pulmonic Area
- 2nd ICS
- Over pulmonary artery

Mitral Area (apex)
- 5th ICS

Tricuspid Area
- 4th ICS

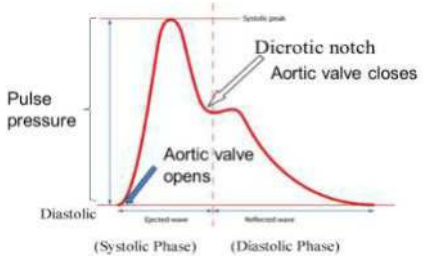
JVD/JVP



JVD implies the jugular vein was noted on assessment.

JVP implies an actual measure was made. If greater than 4 cm, the JVP is increased.

Artline, BP



Skin: color, temperature, moisture

Edema: pitting, non-pitting

Peripheral Pulses: Compare bilaterally (not carotid); presence, rate, rhythm, amplitude. If not palpable, use Doppler.

Nailbed Appearance: normally pinkish

Cap Refill: apply pressure to nailbeds for 5 seconds, then release; normally takes 3 secs for color to return

Calf Appearance: redness, swelling, tenderness

RESP

Breathing: rate, rhythm, degree of effort, use of accessory muscles

Tracheal Position

Presence of SOB, cough, secretions

Chest wall expansion

Normal Breath Sounds

- **Bronchial (Tracheal)**
  - Over major central airways
  - Loud, high-pitched / Harsh and hollow
- **Bronchovesicular**
  - Upper sternum, between the scapulae
  - Medium pitch
- **Vesicular**
  - Peripheral lung fields
  - Quiet, low-pitched / Soft and rustling

Auscultation

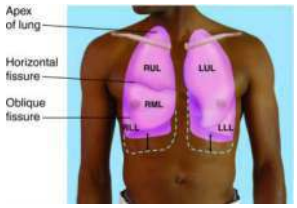
AIR ENTRY
ADEQUATE
Slightly DECREASED
DECREASED
ABSENT

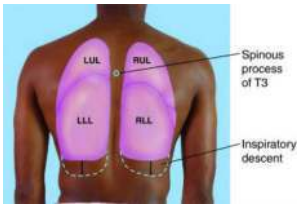
BREATH SOUNDS
NORMAL (CLEAR)
CRACKLES
WHEEZES
PLEURAL FRICTION RUB
STRIDOR

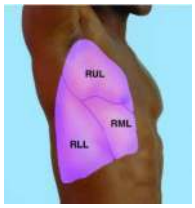
Most Common Adventia:

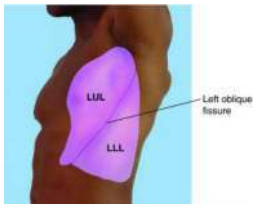
Crackles: Air moving through small amount of fluid in airways, small collapsed alveoli/airways reopening. May be crackling or popping, on inspiration or expiration, fine or coarse. May clear with breathing/coughing.
Wheezes: Air moving through narrowed airways. Continuous musical quality. Heard mainly on expiration, but may be heard throughout resp cycle.

Auscultation Landmarks



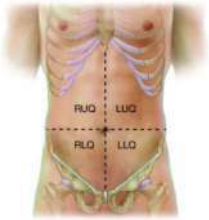






GI

Quadrants



Abdomen:

Presence of Pain

Inspect: Contour, symmetry, color, scarring

Auscultate: Each quadrant at least 1 minute. Bowel sounds: normal are faint, low-pitched occurring every 5-15 seconds. Abnormal: hypoactive, hyperactive, absent

Palpate: light palpation only

Mouth: cheeks, teeth, gums, tongue

Nutritional Status

GU

Urine

Characteristics: color, clarity

Normal Output: 0.5 mL/kg/hour

Fluid Balance

Admission & Daily Weights: most important indicator or fluid balance

- 1 kg of water = 1 liter of fluid

Positive Fluid Balance (contributes to hypervolemia) seen as: edema, dyspnea, S3, respiratory crackles

Negative Fluid Balance (contributes to hypovolemia) seen as: rapid weak pulse, tachycardia

OLIGURIA	Low urinary output (Less than 400 mL/24 hours)
POLYURIA	Excessive or abnormally large passage of urine
ANURIA	Absence of urinary output (Less than 50 mL/24 hours)
AZOTEMIA	High levels of nitrogen-containing compounds in the blood (i.e. waste)
ACUTE KIDNEY INJURY (AKI)	Previously: Acute Renal Failure (ARF) Sudden / rapid loss kidney function

Lippincott procedure and advisor. (2020). Retrieved from http://advisor.lww.com

Arterial Lines

Maintenance

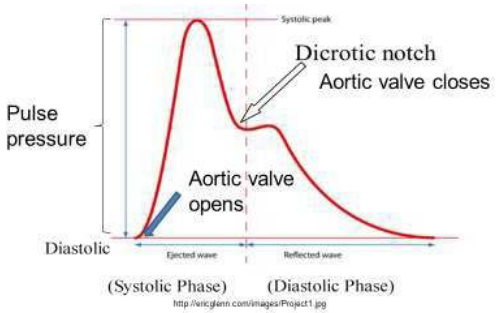
❑ Q4H assess pressure line and insertion site, ensuring:

- Insertion site healthy
- Color, sensation and warmth to distal limb
- Dressing clean and intact
- Pressure bag inflation at 300 mmHg (delivery rate 3 mL/hour)
- Adequate flush solution in pressurized bag to maintain forward flow

❑ Q96H minimum, change tubing, flush solution, dressing

❑ Ensure alarms and scales set appropriately

❑ System must be levelled & zeroed for accurate readings



Levelling & Zeroing

When to Level:

- Prior to insertion
- Beginning of shift
- After repositioning/disconnection

When to Zero:

- On insertion/initiation
- Beginning of shift
- After any disruption of pressure monitoring system such as tubing or cable disconnections/changes

How:

1. Position patient as per site direction
2. Connect pressure cable to transducer and monitor
3. Ensure waveform labeled and scale set appropriately
4. Ensure transducer positioned at phlebostatic axis
5. Close stopcock to patient and open to atmosphere, remove non-fenestrated cap
6. Select ZERO on monitor
7. Verify zero reference established on monitor
8. Close stopcock, replace cap
9. Ensure waveform return

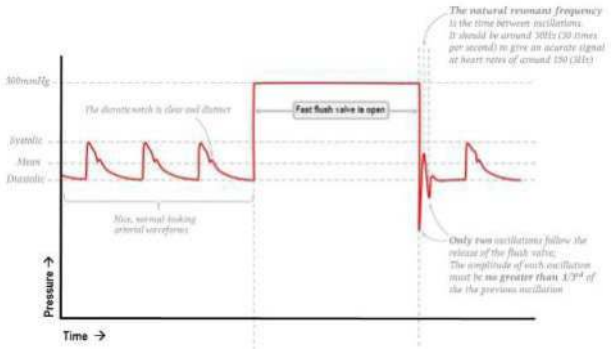
Dynamic Response Testing

When:

- Beginning of each shift
- With any change in waveform

How:

1. Quickly flush the system by pulling fast flush
2. Square waveform should appear
3. This should immediately be followed by 1 or 2 oscillations
4. Usual ABP waveform should then reappear
5. The square wave test is much more accurate than using the cuff pressure to evaluate the accuracy of the arterial pressure values



Central Lines

General

- ❑ Assess need for device daily
- ❑ Assess insertion site and path of device (PICC) every 4 hours after insertion for 24 hours, then once a shift
- ❑ Assess device function by flushing and aspirating for blood return prior to use each
- ❑ Change continuous IV tubing no more frequently than every 96 hours, and at least every 7 days or with new line insertion
- ❑ Change intermittent IV tubing every 24 hours
- ❑ Change transparent dressings weekly and as needed
- ❑ Change Propofol tubing every 12 hours
- ❑ Use aseptic technique with dressing changes: sterile gloves, mask
- ❑ CVAD Dressing Change Checklist
- ❑ CVAD Flushing and Locking Checklist

See Clinical Care Topic (CCT): Vascular Access Device Infuse Therapy: Adult & Pediatric

Non-Tunneled CVAD

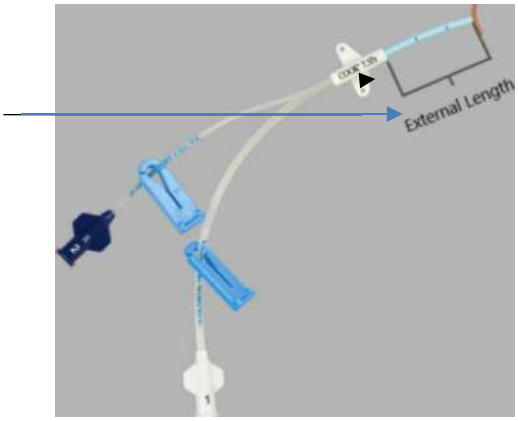
❑ Assess external length with each assessment

- Compare to external length at insertion
- Measure external length with dressing change and when dislodgement/migration suspected

❑ Flush with NaCl 0.9% 10 mL

- Exception: following lipids, blood products, blood sampling and medications known to precipitate, flash with 20 mL

❑ Flush and Lock: at least every 24 hours when not in use (see Physician Order for locking solution)



Peripherally Inserted Central Venous Catheter (PICC)

❑ Assess external length with each assessment

- Compare to external length at insertion
- See CCT for how to measure

❑ If PICC arm edematous, measure arm circumference 10 cm above ante-cubital fossa; compare to other arm

❑ Flush with NaCl 0.9% 10 mL

- Exception: following lipids, blood products, blood sampling and medications known to precipitate, flash with 20 mL

❑ Flush and Lock: at least every 7 days when not in use (see Physician Order for locking solution)

Arterial Blood Gases (ABGs)

Component	Normal Value	Notes
pH	7.35 – 7.45	• Indirect measure of the hydrogen ion (H^+) concentration: as H^+ concentration increases, pH decreases • Acidemia: when pH less than 7.35 • Alkalemia: when pH greater than 7.45
PaO2	80 – 100 mmHg	• Measure of partial pressure of oxygen (O_2) dissolved in arterial blood • PaO2 less than 80: Hypoxemia • PaO2 less than 40: Life threatening
PaCO2	35 – 45 mmHg	• Natural by-product of cellular metabolism • Measure of the partial pressure of carbon dioxide (CO_2) in arterial blood • Is the 'respiratory' component in acid-base balance • $PaCO_2$ greater than 45: Respiratory Acidosis • $PaCO_2$ less than 35: Respiratory Alkalosis
$HCO3^-$ (Bicarbonate)	22 – 26 mEq/L	• The main 'base' found in blood serum • Is the 'metabolic' component in acid-base balance • Increased $HCO3^-$: Metabolic Alkalosis • Decreased $HCO3^-$: Metabolic Acidosis

	pH	$PaCO_2$	HCO^3
Respiratory Acidosis	↓	↑	Normal
Respiratory Alkalosis	↑	↓	Normal
Metabolic Acidosis	↓	Normal	↓
Metabolic Alkalosis	↑	Normal	↑

Things to Know about ABGs and Values

1. **pH**
   - When pH is <u>LESS than 7.35</u> = patient is becoming <u>ACIDOTIC</u>
   - When pH is <u>GREATER than 7.45</u> = patient is becoming <u>ALKALOTIC</u>

2. **In ICU, we will often accept a PaO_2 of 60mmHg or higher**
   - Rationale: SaO_2 will be greater than 90% (which means over 90% of the hemoglobin is saturated with oxygen – a good thing)
   - When PaO_2 <u>LESS</u> than 60mmHg: Call RT – Need to increase FiO_2/PEEP

3. **$PaCO_2$**
   - When $PaCO_2$ is increasing = patient respiratory rate too slow
     - RT may increase respiratory rate/tidal volume
     - Decrease analgesia / sedation
   - When $PaCO_2$ is decreasing = patient breathing too fast
     - Call RT: Maybe new mode of mechanical ventilation required?
     - May need to give analgesia and/or sedation

Assisting with Intubation

Preparation

Prior to Entering Patient Room

- ❑ Notify team (RRT, Charge Nurse, etc.) of intubation
- ❑ Secure equipment
  - Use of video-laryngoscope should be considered
  - Bring only necessary equipment into room
- ❑ Prepare medications as per ordered
  - Deep sedation and paralysis may be used to minimize cough or aerosol generation.
- ❑ Prepare necessary equipment and medications outside of room
- ❑ Don full PPE: N95, face shield, gown, and gloves
  - Proper application should be verified by independent observer prior to room entry
  - Consider use of goggles as secretions can potentially flow around front-covering face shields with coughing and during head turns of intubator
- ❑ Clarify if bronchoalveolar lavage (BAL) sampling needs collection

In Patient Room

- ❑ Ensure room door closed
- ❑ Minimize number of people involved
  - Nursing and RRT support ideally should be provided by individuals assigned to patient
- ❑ In rooms with adjustable airflow, increase rate of airflow (or put room in "bronchoscopy mode")

Intubation

Before

- ❑ Ensure monitoring in place
- ❑ Ensure patent IV access
- ❑ Ensure suction functional with yankauer set up
- ❑ Pre-oxygenate as much as possible using non-invasive oxygen (nasal prongs, 15 L/min NRB mask)
  - Reserve use of bag-valve-mask ventilation via facemask to situations where non-invasive oxygen delivery is failing

During

- ❑ Administer medications as ordered
- ❑ Continue monitoring patient's tolerance of procedure
- ❑ Ensures BAL collected if needed

After

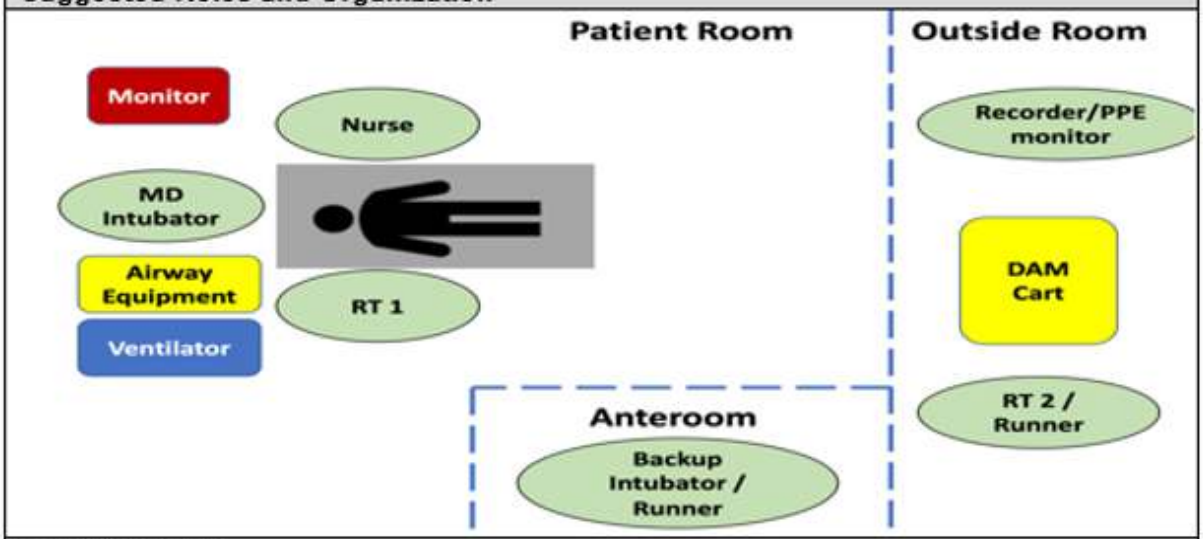
- ❑ If no contraindications, Modified RSI (avoid coughing and facilitate first pass success):
  - Use higher mg/kg dose of muscle relaxants to ensure rapid onset of optimal intubating conditions (Allow 1 minute for adequate muscle relaxation):
    - Rocuronium 1.2-1.6 mg/kg (ideal body weight)
    - Succinylcholine 1.5-2 mg/kg (total body weight)
  - Avoid BVM ventilation during apneic period unless life threatening hypoxemia
  - Wait until cuff up post-intubation to ventilate
- ❑ Assist with tube placement assessment ($ETCO_2$ monitoring, bilateral chest wall movement, air entry)
- ❑ Arrange for chest x-ray for tube placement
- ❑ Place in-line suction and heat and moisture exchangers (HME) on all patients
- ❑ Avoid ventilator circuit disconnections
- ❑ Clamp ETT for planned disconnections
- ❑ Use in-line suction for all ventilated patients; avoid opening suctioning
- ❑ Avoid use of heated humidity systems other than when they are fixed integral systems of a particular ventilator
  - Active/heated humidity systems should only be used when necessary (e.g. to manage difficult secretions or to provided inhaled epoprostenol) and only when such a system is part of a fixed integral part of a particular ventilator

ILI / COVID-19 Best Practice Considerations — V1. March 18, 2020

Preparation

1. PPE: Don full PPE including N95 respirator, goggles, face shield, gown and gloves. Proper application of PPE should be verified by an observer prior to patient contact
2. Early airway assessment for predictors of difficulty and consultation as necessary
3. Consider early, controlled intubation and avoid NIV, HHHFO and other AGMP
4. Minimize staff exposure
   a. Minimize personnel in the room as able
   b. **Negative pressure room with anteroom if available (or neutral pressure room with door closed)**
   c. Ensure HMEF is between the mask/ETT and BVM at all times
5. **Intubation should ideally be performed by most experienced practitioner to optimize first pass success**
6. Prepare necessary equipment and drugs outside of room

Suggested Roles and Organization



Intubation Plan

- ✓ Optimize pre-oxygenation using non-invasive techniques, reserving BVM to situations where non-invasive 0_2 delivery is failing
- ✓ Video laryngoscopy recommended as Plan A
- ✓ Best pharmacotherapy determined by MRHP on case-by-case basis to minimize chance of cough and aerosol generation
- ✓ If no contraindications, Modified RSI (avoid coughing and facilitate first pass success):
  - Use higher mg/kg dose of muscle relaxants to ensure rapid onset of optimal intubating conditions (Allow 1 minute for adequate muscle relaxation):
    - Rocuronium 1.2-1.6 mg/kg (IBW)
    - Succinylcholine 1.5-2 mg/kg (TBW)
  - Avoid BVM during apneic period unless life threatening hypoxemia
- ✓ Wait until cuff up post-intubation to ventilate

Post-Intubation

- ☐ Confirm ETT position with $ETCO_2$ and CXR
- ☐ Closed suction system; avoid circuit disconnections and clamp ETT for planned disconnections
- ☐ Lung protective ventilation strategy (6-8 mL/kg Vt IBW; Pplat < 30 cm H_20; Optimal PEEP)
- ☐ Strategies for failing gas exchange: deep sedation and paralysis; permissive hypercapnia; prone positioning
- ☐ Maintain AGMP + Droplet + Contact Isolation as per IP&C

NIV = non-invasive ventilation (CPAP or BiPAP); HHHFO = heated humified high flow oxygen (AIRVO, Optiflo); AGMP = aerosol generating medical procedures; RSI = rapid sequence intubation; IBW = ideal body weight; TBW = total body weight

Mechanical Ventilation Modes and Suctioning

Invasive Ventilation						
	Other Name	**Type of Support**	**What is Set**			**Notes / Variables**
			Rate	**FiO2**	**PEEP**	
Assist Control Volume Control	AC, VC	Full	Yes	Yes	Yes	• Guaranteed tidal volume (V_t) • Trend pressures
Pressure Control	PC	Full	Yes	Yes	Yes	• Peak pressure limit (PIP) set • Trend Volumes
Airway Pressure Release Ventilation	APRV (Bi-Level)	Full	Yes	Yes	Yes	• Two levels of pressure: P-high, P-low • Two time intervals: T-high, T-low • Inhalation: high pressure, long time • Exhalation: low pressure, short time
Pressure Regulated Volume Control	PRVC	Full	Yes	Yes	Yes	• Delivers set tidal volume with lowest amount of pressure
Synchronous Intermittent Mandatory Ventilation	SIMV	Partial	Yes	Yes	Yes	• For ventilator delivered breaths, a set rate and volume • For patients own breath, patients gets their own tidal volume
Pressure Support	PS	Spontaneous Breathing	No	Yes	Yes	• Patient determines own rate and tidal volume • No set respiratory rate: may need to switch mode if apnea occurs
Continuous Positive Airway Control	CPAP	Spontaneous Breathing	No	Yes	Yes	• Patient breathes spontaneously through ETT • Same level of pressure on inspiration and expiration

Suctioning

Indications for suctioning include the presence of secretions in the airway, adventitious breath sounds on auscultation, increased peak airway pressure, frequent coughing, suspected aspiration of gastric or upper airway secretions, sudden onset of respiratory distress with suspected airway obstruction, and a decrease in oxygen saturation level.

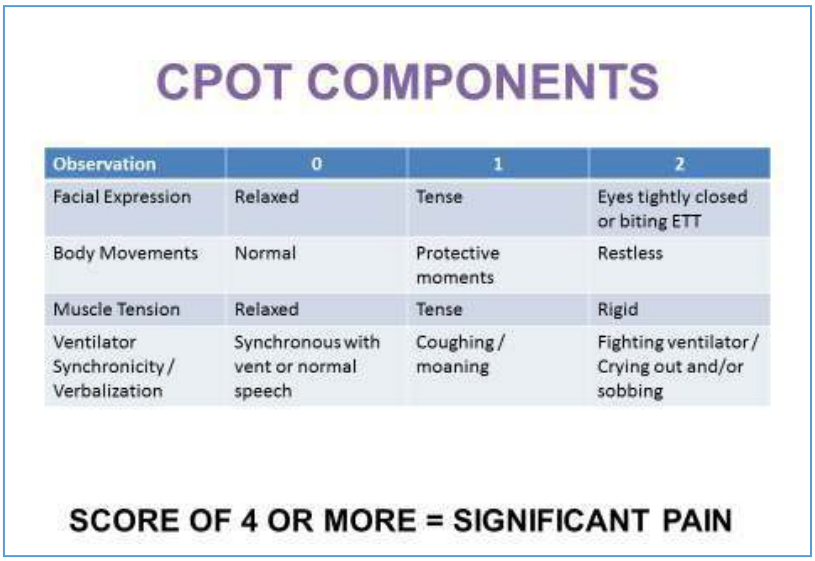
Important: Use in-line suction only. Avoid circuit disconnections.

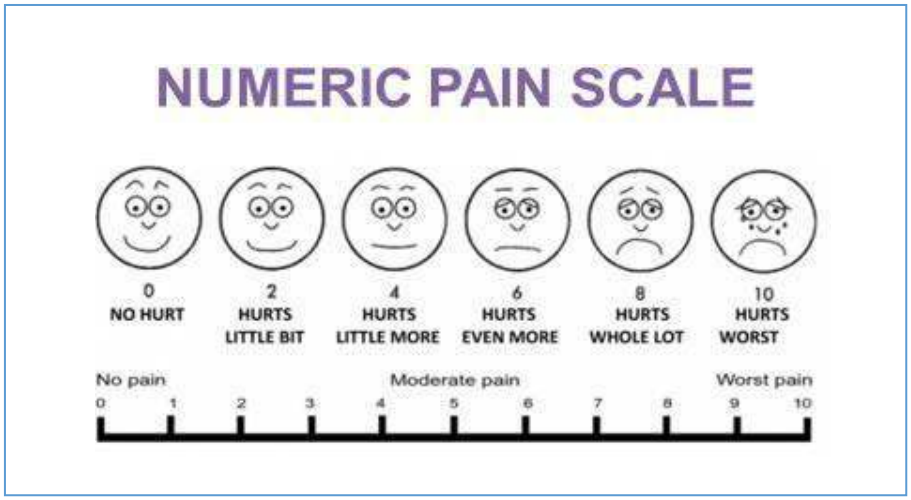
1. Note patient condition (baseline respiratory rate, chest sounds, saturation levels, etc. for post suction comparison)
2. Pre oxygenate prior to suctioning- push the 100% O2 button for 30-60 seconds
3. Pushed Silence button on the ventilator
4. While steadying the T-piece with one hand, advance the suction catheter through the ETT with the other hand
    - Do not apply suction while advancing suction catheter in
    - If you hit the carina, pull back prior to suctioning
5. Withdraw the suction catheter while applying suction
    - Suction to be set at approximately 150 mmHg
    - Activate suction by depressing the suction control valve
    - Suction passes should not exceed 5-10 seconds
6. After suctioning, place suction control valve in OFF position
7. Hyperoxygenate patient again
8. Document number of suction passes and patient tolerance

*Do not routinely instill. If instilling, do not leave the NS instill/flush attached to ETT tube when suctioning completed.

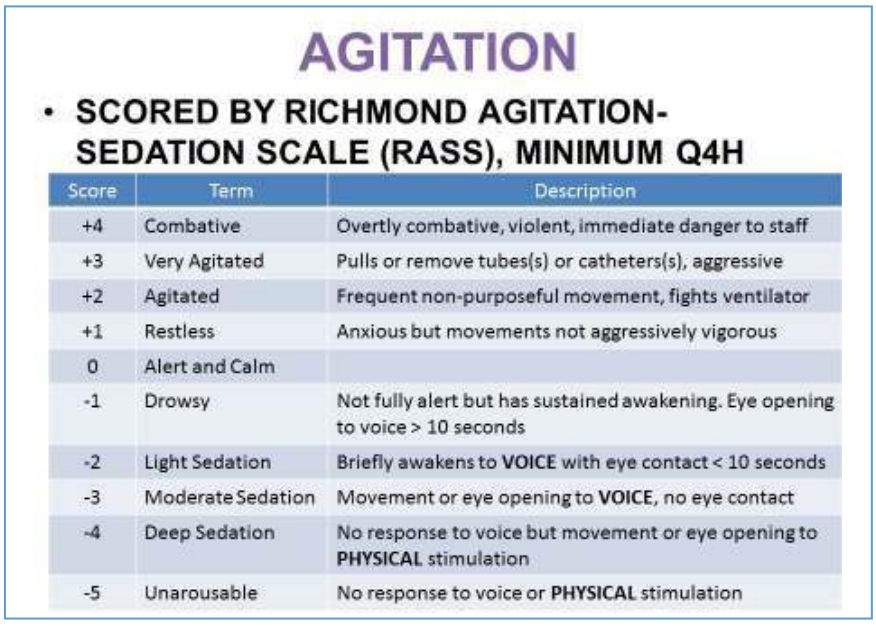
Adult ICU Pharmacology

Analgesia			***Assessment: CPOT and NPS***
Drug	**Route**	**Dose**	**Details**
Hydromorphone (Dilaudid)	Direct IV Push	0.2–1 mg IV administered undiluted over 2-5 minutes	Onset: 10-15 minutes Peak: 60 minutes Duration: 4-5 hours
	Continuous IV Infusion	0.5 to 3 mg/hour OR 7-15 mcg/kg/hour Mixing: See monograph	
Fentanyl (Sublimaze)	Direct IV Push	25-100 mcg IV administered undiluted over 1-3 minutes Maximum rate 100 mcg/min	Onset: Immediate Peak: 1-5 minutes Duration: 30-60 minutes
	Continuous IV Infusion	12.5-200 mcg/hour OR 0.5-1.5 mcg/kg/hour Mixing: See monograph (may be supplied by Pharmacy)	
Morphine	Direct IV Push	2.5-15 mg IV direct administered undiluted over 2-5 minutes Maximum concentration of 5 mg/mL	Onset: 2-5 minutes Peak: 20 minutes Duration: 3-4 hours
	Continuous Infusion	0.8 to 10 mg/hour (may titrate higher) Mixing: See monograph (may be supplied by Pharmacy)	





Sedation			*Assessment: RASS*
Drug	**Route**	**Dose**	**Details**
Dexmedetomidine (Precedex)	Direct IV Push	No	Onset: 10-15 minutes Peak: 60 minutes Duration: 4-5 hours
	Continuous IV Infusion	Optional Loading Dose: 1mcg/kg per dose Maintenance Dose: 0.2-1.1 mcg/kg/hour • Usual maximum dose 1.5 mcg/kg/hour Mixing: Add 200 mcg (2 mL) in 50 mL to 0.9% sodium chloride or D5W for final concentration of 4 mcg/mL	
Propofol (Diprivan)	Direct IV Push	5-20 mg IV direct administered undiluted over 3-5 minutes	Onset: Less than 1 minute Peak: Unknown Duration: 10-15 mins
	Continuous IV Infusion	Initiation: 5 mcg/kg/minute (0.3 mg/kg/hour) • Increase by 5-10 mcg/kg/min (0.3-0.6 mg/kg/hour) over 5-10 minutes to desired level of sedation Maintenance: 5-50 mcg/kg/minute (0.3 to 3 mg/kg/hour) or 50-30 mg/hour • Maximum rate: 5 mg/kg/hour Mixing: Available as premix Side Effects: hypotension, respiratory depression/failure	
Midazolam (Versed)	Direct IV Push	0.01-0.05 mg/kg mg IV direct administer undiluted over 2 min, repeat at 5 to 15 minute intervals • Maximum concentration of 5 mg/mL	Onset: 3-5 minutes Peak: 3-5 minutes Duration: 2-6 hours
	Continuous IV Infusion*	Initial: 0.02-0.1 mg/kg/hour (0.3-1.7 mcg/kg/minute) titrate to desired level of sedation Mixing: Standard concentration 1 mg/mL • 50 mg/50 mL: remove 10 mL from bag, add 10 mL of midazolam 5mg/mL • 100 mg/100 mL: remove 20 mL from bag, add 20 mL of midazolam 5mg/mL Side Effects: hypotension, respiratory depression/failure	



Vasopressors & Inotropes			*Assessment: SBP, MAP*
Drug	**IV Infusion Dose**	**Titrate**	**Details**
Epinephrine (Adrenalin)	Initial: 1 mcg/minute OR 0.05-0.07 mcg/kg/minute Rate range: 1-20 mcg/minute or 0.05-0.2 mcg/kg/minute Mixing: See monograph Side Effects: reflex bradycardia, arrhythmias, hypertension, decreased renal function, decreased peripheral perfusion	Yes	MD will order SBP or MAP targets Central line preferred
Norepinephrine (Levophed)	Cardiac Arrest and Hypotension: • Initial: 8-12 mcg/min OR 0.1-0.5 mcg/kg/min • Maintenance: 0.03-0.06 mcg/kg/min OR 2-4 mcg/min Septic Shock • 0.01-1.5 mcg/kg/minute Mixing: See monograph (premix may be available in fridge) Side Effects: reflex bradycardia, hypertension, decreased renal function, decreased peripheral perfusion	Yes	MD will order SBP or MAP targets Central line preferred Check VS every 5 min with titration
Vasopressin (Antidiuretic Hormone, Pressyn)	Septic Shock • 0.01 units/minute to 0.04 units/minute • Mixing: See monograph Side Effects: peripheral vasoconstriction, bronchial constriction	No	Central line preferred

Nondepolarizing Neuromuscular Blockading Agents (NMBAs)		*Assessment: TOF*, $ETCO_2$*
Drug	**IV Infusion Dose**	
Cisatracurium (Nimbex)	Acute Respiratory Distress Syndrome (ARDS) • Initial: 15 mg administered direct IV undiluted over 5-10 seconds • Maintenance continuous IV Infusion: 37.5 mg/hour for 48 hours Mixing: See monograph	
Rocuronium (Zemuron)	ICU Paralysis • Initial: 0.6-1 mg/kg administered IV direct undiluted over 5-20 seconds • Maintenance continuous IV infusion: 8-12 mcg/kg/min (0.48-0.72 mg/kg/hour) Mixing 500mg/250 mL: Remove 50 mL from 250 mL of IV solution and add 50 mL of 10 mg/mL rocuronium, for final concentration 2 mg/mL	
Airway patency must be maintained at all times (manual or mechanical ventilation) *Peripheral Nerve Simulator (PNA)- Train of Four (TOF) The need for NMBAs must be reviewed at least every 24 hours to minimize the chances of inappropriately prolonged use and post-paralytic complications. **Caution:** • Should NOT be administered before the induction of unconsciousness to avoid patient distress. • Sedation MUST be used in conjunction with NMBAs as NMBAs has no sedative properties.		