APPENDIX A. Protocol : Adult High Flow Nasal Cannula (HFNC) Therapy for Outside the ICU

SECTION 1. Indications

1. Determine if the patient is **appropriate** for HFNC therapy. Patient may potentially benefit from this therapy if:

    - Traditional nasal cannula does not meet patient flow demand and/or oxygen (FiO_2) requirement
    - Patient with tracheostomy requires higher flows and/or heated, humidified gas
    - Patient has COPD, asthma, or other pulmonary diseases
    - Patient has rib fractures or pulmonary contusions that need further splinting open of the airways during healing process. Injuries must be documented in X-ray report, CT report, or physician notes.
    - Patient requires hydration of thickened secretions
    - Patient experiences dyspnea and/or increased work of breathing
    - Patient experiences hypoxia requiring >4 Lpm oxygen
    - Patient is intolerant to noninvasive ventilation.
    - Emergency department patient arrives via ambulance with CPAP +7 or less
    - Emergency department patient must have an initial pH of 7.30 or greater on ABG
    - Patient requires palliation for air hunger, dyspnea, and/or hypoxia at the end of life

2. Determine if the patient is **inappropriate** for the high flow therapy. Patient will be excluded from this therapy if:

    - Patient is obtunded and unable to maintain airway
    - Patient has severe respiratory acidosis (ventilatory failure)
    - Patient has suspected facial fractures or skull fractures
    - Patient is in shock
    - Patient has upper airway obstruction

SECTION 2: HFNC Procedure

1. Verify physician orders for therapy and SpO_2 range. Note: Pulmonology or Trauma Services must be admitting or consulting service for any patient utilizing the therapy outside the ICU.
2. Follow Standard Precautions.
3. Identify yourself to patient. Verify correct patient and evaluate appropriateness of therapy.
4. Explain procedure and educate patient and family (if present) about HFNC therapy.
5. If patient is a trauma patient who meets inclusion criteria for rib fracture or pulmonary contusions, follow the steps listed in Section 3 before moving to step 6. All other patients continue to step 6.

6. Patient will have an ABG drawn prior to initiation of therapy. Order follow-up ABG per protocol with attending trauma surgeon or pulmonologist co-signature for 30 minutes after initiation of therapy.
7. Assemble HFNC equipment for use.
    a. Attach patient circuit to device. Use either the inspiratory limb of the adult heated ventilator circuit or adult heated non-invasive ventilator circuit. You will also need a humidification chamber to connect the circuit.
    b. Fill the humidifier chamber via sterile water bag and tubing.
    c. Insert temperature probes and heated wire adaptor to inspiratory limb of circuit.
    d. Connect air and oxygen hoses from blender into wall outlets.
    e. Turn on heater setting to invasive mode. Let it warm to at least 33°C before placing on patient. Note: Device can be used in non-invasive mode if patient complains that it is too warm in invasive mode. Some COPD patients may need to start in invasive mode if they are accustomed to cooler air blowing in their faces.
    f. Set FiO_2 to at least 10% higher than FiO_2 of previous device. FiO2 may be set as high as 95% to start. Set flow rate at 50 Lpm.
    g. Select appropriate delivery device (nasal cannula or trach adaptor) and attach to circuit. Nasal cannula should be appropriate size and should not take up more than one-half of the nares and should not be pushed against septum.
    h. Perform heaterplate test, leak test, blockage test and tube check test prior to placing on patient.
    i. Attach delivery device to patient and re-check flow and FiO2. Adjust flow and FiO2 to meet patient demands and oxygen requirements.
8. Perform routine bedside checks, including skin assessments, dyspnea scoring, and overall function of the HFNC equipment.
9. If patient demands and oxygen requirements cannot be met, contact attending physician or emergency department physician for further orders.

SECTION 3: Trauma Patients with Rib Fractures or Pulmonary Contusions

Initiate bedside spirometry to ascertain predicted Forced Vital Capacity (FVC). Initial settings will be based on FVC value. Bedside spirometry will be repeated at 24 and 48 hours and upon discontinuation of therapy. If FVC % predicted is less than 50%, RT will consult with Trauma team to determine placement of patient, but consideration should be given to ICU for closer monitoring. Follow all procedures in Section 2.

FVC % Predicted	**Liter Flow**	**FiO_2**
≥80%	40 Lpm for initiation for at least first 24 hours of therapy. May begin to wean flow once FiO2 is less than 35% Return patient to regular NC at 5L once flow is at least 10 Lpm and wean per weaning guidelines (Section 5).	Set device 10% higher than FiO_2 of previous device as long as SpO_2 remains ≥92% at initiation and for at least 24 hours. May begin to wean FiO2 after 24 hours down to less than 35% as long as SpO2 ≥92%.

FVC % Predicted	Liter Flow	FiO_2
51-79%	50 Lpm for initiation for at least first 24 hours of therapy. May begin to wean flow once FiO2 is less than 35% and FVC value is improving.	Set device 20% higher than FiO_2 of previous device as long as SpO_2 remains ≥92% for initiation and for at least 24 hours. May begin to wean FiO2 after 24 hours down to less than 35% as long as SpO2 ≥92%.
50% or lower	60 Lpm for initiation for at least first 24 hours of therapy. May begin to wean flow once FiO2 is less than 35% and FVC value is improving.	Set device 30% higher than FiO_2 of previous device as long as SpO2 remains ≥92% for initiation and for at least 24 hours. May begin to wean FiO2 after 24 hours down to less than 35% as long as SpO2 ≥92%.

SECTION 4: Emergency Department
Follow all procedures in Section 2. Therapy can be managed by the Emergency Medicine physician in the ED, but if patient is to be admitted to floor, a pulmonologist or trauma surgeon must be consulted to manage the therapy.

SECTION 5: Weaning from Device
Weaning of HFNC therapy is based on sound clinical judgment and is accomplished through patient tolerance and effect as well as teamwork and communication among the various caregiver groups.

Wean FiO2 in increments of 5-10% until you reach FiO2 ≤ 35%, then begin to wean the flow in increments of 5-10 Lpm, monitoring patient tolerance and maintaining acceptable SpO_2 levels. If patient decompensates, return to previous flow and monitor for tolerance. When liter flow is 10 Lpm or less and FiO2 is 21%, discontinue therapy unless directed differently by physician.

SECTION 6: Cleaning Devices
Per manufacturer recommendation.

SECTION 7: Other
- If the patient is a trauma patient on Volume Expansion Protocol (VEP), discontinue VEP while on HFNC therapy. If patient receives bronchodilators per home regimen, continue per home regiment. Continue VEP only on request of trauma physician.

- This device cannot be marketed as a CPAP device but does provide dynamic positive pressure to the airways. Flow of 60 Lpm = 6cm H_2O, 50 Lpm = 5cm H_2O, 40 Lpm = 4cm H_2O, and so on.
- Invasive mode of heater delivers humidity at 37°C and 44 mg/L and will display temperature at approximately 37°C.
- Noninvasive mode on the heater delivers humidity at 31°C and 32 mg/L and will display temperature at approximately 31°C.
- Patients should still be able to take their oral meds as prescribed, but it should be noted that patients may feel like there is something stuck in the back of their throat. That is often from the positive pressure generated from the device. To ensure that medications are swallowed, nurse may remove nasal cannula from nares temporarily to administer medications to patients and then place nasal cannula back in nares afterwards.
- Feeding via nasogastric (NG) tube or Corpak – Placement of tubes for feeding purposes should continue as noted. However, the NG is larger in diameter and may need to be considered when sizing the nasal cannula. The Corpak should not interfere with the nasal cannula itself.