**Role of Imaging patients with Suspected or Confirmed Covid-19 Infection in ED/In-patient and Ambulatory Settings**

**Situation:**
No guidelines exist for enhancing the safety process for imaging patients with suspected or confirmed COVID-19 infection. There also remains lack of clarity on the role of chest imaging.

**Background:**
The goal of imaging in COVID-19 patients is to provide high level care while minimizing risks to healthcare staff and other patients. For in-patients and ED patients some radiology exams can be performed portably (US, radiographs, head CT, minor procedures), other exams require patient transport off the floor (MR, CT, Nuclear Medicine, Fluoroscopy, IR).

**Assessment:**
The transport of suspected/confirmed COVID-19 patients for imaging should be minimized. As such, ensuring appropriate imaging utilization is necessary. For ED and in-patients, portable alternatives to off floor imaging should also be used whenever possible. The use of chest imaging should follow best practice guidelines. Any non-critical imaging or procedure should be deferred until COVID-19 diagnosis is either confirmed (and patient recovers from their illness) or excluded.

**Recommendation:**
1. For in-patients and ED patients, all imaging requests (excluding radiographs) for patients with pending or confirmed COVID-19 will be approved by a radiologist whenever possible. For out-patients, medical necessity of any imaging test should be determined by the ordering provider and/or radiologist. COVID test results are not necessary to proceed with indicated ED imaging orders.
2. From 8am to 5pm approval will be sought by the relevant radiology technologist before performing the study (Appendix A, B, C for technologist work-flow).
3. After normal business hours, the technologist may need to discuss case with relevant working/on call radiology teams.
4. Best practice guidelines should be followed for a) chest imaging (Appendix D) and b) technologist use of PPE (Appendix E).
5. Radiology COVID Call Center has been established to assist in Radiology related questions for Yale New Haven Health. Call center number is 475-246-9660. Hours are currently 7am-7pm seven days a week.
Appendix A: Ultrasound and X-Ray ED and In-Patient Tech workflow for CONFIRMED or SUSPECTED COVID-19 cases. All studies should be PORTABLE whenever possible.
Appendix B: CT/MRI/Nucs/Fluoro ED and In-Patient workflow for CONFIRMED or SUSPECTED COVID-19 cases

Order for radiology exam that CANNOT be performed portable

For MRI, CT, Nuc Med, Fluoroscopy, and invasive procedures on inpatients/ED

*Note* Expected that radiographs and ultrasounds will rarely have to be performed in diagnostic radiology department

Radiologist contacts clinical team

Discuss the exam to determine medical necessity with a radiologist

Discuss transport with nurse. Precautions need to be taken during transport to minimize spread.

Equipment in the pavilion closest to the patient unit should be used to limit travel time

Before entering the imaging room, proper PPE must be put on. Proper PPE currently includes:
- N95 Mask
- Gown
- Gloves
- Face shield (or any type of eye protection)

*Face mask may be used instead of N95 depending on supply availability.

Confirm patient wearing face mask (if they can tolerate) before performing exam

Properly take off all PPE before exiting the imaging room. Reuse select PPE per most current hospital protocol

For select studies, technologists may need to remain in the room for the exam in order to conserve PPE

If the patient wears their face mask properly throughout their entire stay in our imaging room, the room can be used again after proper disinfection of all imaging equipment and surfaces

If a patient mask was not utilized, or has been deemed compromised during any part of the exam, the room must be cleaned and left vacant for a specified time (1 hour for most rooms, shorter for some CT scanners)
Appendix C: NON-“HOT-SITE” OUT-PATIENT work-flow for technologist/front-desk staff

Patients should wear their own face mask to ALL out-patient appointments. Mask should be given if patient does not have one.

In the last month, have you been in close contact with someone who was confirmed or suspected to have COVID-19?

OR

Do you have any of the following?
- Fever > 100F
- New cough
- New shortness of breath
- New sore throat
- New chills or muscle pain
- New loss of taste or smell
- New vomiting or diarrhea

OR

Have you been advised to stay home by a medical professional due to illness that might be COVID-19 or have you been tested for COVID within last 2 weeks?

OR

Are you currently living in or have you been discharged (within last 2 weeks) from nursing facility, senior housing, rehab facility, extended care, shelter, or correctional facility?

Proceed as routine visit. Staff and patient should wear face mask. Disinfect room and all patient surfaces after.

Some sites can offer temp. check at front desk

SCREENER isolates patient per facility protocol. Emphasize to the patient that mask needs to stay on.

Tech confirms with referring provider or responsible radiologist when needed on medical necessity of exam

*If medical indication clearly necessary (acute DVT/PE, obvious fracture deformity, stroke/hla, etc) additional confirmation will be unnecessary.

CHEST XRAY is not part of routine respiratory infection work-up currently. See next page

If possible, obtain patient’s cell phone number or phone in the waiting room. Use phone communication whenever possible.

For the safety of patients and staff, the patient will not be permitted to proceed with the appointment, and should return to his or her car. They patient can contact the responsible clinician for further guidance. If patient does not have a responsible clinician or PCP, instruct to call contact Yale COVID-19 Call Center 203.688.1700.

Route to designated “hot” site where staff will use appropriate PPE

Technologist performs imaging.

*If the patient wears the face mask properly throughout their entire stay in our imaging room, the room can be used again after proper disinfection of equipment and surfaces. If the patient has NOT worn the face mask throughout the procedure, the room will need to be left vacant for a specified time (1 hour for most rooms, shorter for CT suites).
Appendix D.1:

Role of Chest Radiographs (CXR):

CXR plays a role in the imaging management of pneumonia in immunocompetent patients, despite known low sensitivity.

Any CXR of a suspected or confirmed COVID infection should be done portably for ED or In-Patient.

- CXR should NOT be obtained to rule out COVID infection
  - A normal CXR does not rule out the possibility of COVID. CXR is reported to have 25-60% sensitivity in detecting pneumonia for these patients. Ground glass opacities commonly seen with COVID can be occult on CXR.
- CXR should only be obtained when absolutely necessary and xrays should be minimized when possible (e.g. for line placement, get one film after all lines placed).
- Examples of indications for CXR
  - Initial baseline imaging for a COVID Suspect or Known patient being admitted
  - To evaluate for complicated pneumonia (cavitation, effusions, etc)
  - To assess ETT placement after intubation or after line placement if concerned for malposition
  - When change in clinical status raises concern for possible superimposed pulmonary process

Role of Chest CT:

Chest CT plays a role in the imaging work-up of immunocompetent patients with pneumonia, mainly to detect complications such as cavitation, intra-parenchymal abscess and empyema. The role of CT in patients with suspected viral pneumonia is controversial.

Following recent statements by the American College of Radiology (ACR) and the Society of Thoracic Radiology (STR), CT is considered indicated in the following situations involving patients with suspected or confirmed COVID-19 infection:

1. CT should NOT be used to screen for or as a first-line test to diagnose COVID-19. It may play a role in helping triage and make management decisions in select cases where PCR test is negative, chest xray is negative and clinical suspicion for COVID remains high.
2. CT may be indicated in patients with positive COVID PCR testing AND suspicion for complications such as cavitation, intra-parenchymal abscess and empyema not adequately assessed via portable CXR.
Appendix D.2 - Current ADULT in-patient COVID treatment guide - See full guideline posted on YNHHS COVID clinical resource site

**YNHHS Initial Treatment Algorithm for Hospitalized ADULTS with Non-Severe® COVID-19**

**Disclaimer:** There are no FDA-approved treatments for COVID-19, supportive care is standard of care. Limited treatment data are available & clinical judgment is warranted. Algorithm updated 5/18/20

**Patient with confirmed POSITIVE SARS-CoV-2 by PCR**

Assess all patients routinely for clinical trial eligibility (see Appendix 1)

*If mechanically ventilated or on ECMO, proceed to Severe algorithm*

- Oxygen saturation ≤ 94% on room air (≤ 95% if pregnant)
- 24-hour 

**ADJUNCTIVE TREATMENT CONSIDERATIONS**

- If ≥ 2 liter O2 requirement OR ≥ 2 liter O2 requirement & Hs-CRP > 70
  - Tobinilumab x 1 dose (see Appendix 2 for exclusion criteria)
  - Remdesivir availability under the EUA is limited. Potential candidates will be identified. Pharmacy will contact primary provider of eligible patients.
  - Consider MUCI evaluation if ≥ 4 liter O2 requirement or hemodynamic instability
  - YNHHS: ID consult is not mandatory; consider ID input if immunosuppressed® or clinically decompensating
  - If nil, CRP, LFTs, Ferritin, Procalcitonin, BNP, Renin, PTT, Mg
  - Baseline or ICU transfer: Cysto panel
  - Baseline and with acute kidney injury (AKI): urinalysis and urine protein/albumin ratio
  - Baseline EKG (see Appendix 3 for further guidance)
  - Repeat Chest X-Ray: If clinical deterioration (CRP not indicated for discharge or to document clinical improvement)
  - May extend longer if clinically indicated
  - Obtain LFTs daily if on remdesivir

- Report suspected adverse events related to therapeutics through RL solutions

Algorithm reviewed by YNHHS SAS and YNHYSM Ad-Hoc COVID-19 Treatment Team

**YNHHS Initial Treatment Algorithm for Hospitalized ADULTS with Severe COVID-19**

**Disclaimer:** There are no FDA-approved treatments for COVID-19, supportive care is standard of care. Limited treatment data are available & clinical judgment is warranted. Algorithm last updated 5/18/20

**Patient with confirmed POSITIVE SARS-CoV-2 by PCR**

Assess all patients routinely for clinical trial eligibility (see Appendix 1)

- Continue supportive care
  - Consider adjunctive treatment

**ADJUNCTIVE TREATMENT CONSIDERATIONS**

- If ≥ 3 liter O2 requirement OR ≥ 2 liter O2 requirement & Hs-CRP > 70
  - Tobinilumab x 1 dose (see Appendix 2 for exclusion criteria)

- Remdesivir availability under the EUA is limited. Potential candidates will be identified. Pharmacy will contact primary provider of eligible patients.

- Baseline and with acute kidney injury (AKI): urinalysis and urine protein/albumin ratio
- Baseline EKG (see Appendix 3 for CL recommendation)
- Report suspected adverse events related to therapeutics through RL solutions

Algorithm reviewed by YNHHS SAS and YNHYSM Ad-Hoc COVID-19 Treatment Team

**YNHHS Initial Treatment Algorithm for Hospitalized ADULTS with COVID-19**

**Disclaimer:** There are no FDA-approved treatments for COVID-19, supportive care is standard of care. Limited treatment data are available & clinical judgment is warranted. Algorithm last updated 5/18/20

**Patient with confirmed POSITIVE SARS-CoV-2 by PCR**

Assess all patients routinely for clinical trial eligibility (see Appendix 1)

- Continue supportive care
  - Consider adjunctive treatment

**ADJUNCTIVE TREATMENT CONSIDERATIONS**

- If ≥ 3 liter O2 requirement OR ≥ 2 liter O2 requirement & Hs-CRP > 70
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Algorithm reviewed by YNHHS SAS and YNHYSM Ad-Hoc COVID-19 Treatment Team

**YNHHS Initial Treatment Algorithm for Hospitalized ADULTS with COVID-19**

**Disclaimer:** There are no FDA-approved treatments for COVID-19, supportive care is standard of care. Limited treatment data are available & clinical judgment is warranted. Algorithm last updated 5/18/20

- Cardiogenic: 
  - Monitor electrolytes: Bpate Mg > 2, K > 4
  - Baseline EKG and monitor telemetry closely for QTC prolongation (Appendix 2 for recommendations)
  - Caution combining QTC prolonging medications
  - If significantly elevated troponin or EKG abnormalities and/or hemodynamic instability, consider POCUS for LV function assessment and cardiology consult

- Obestrr: 
  - Treatment protocol is similar.
  - Alternative cut-offs for: Treatment administration with oxygen saturation of < 95%
    - D-dimer cutoff for anticoagulation (see Appendix 5b)
  - Remdesivir is available to pregnant patients under Expended Access / Compassionate Use requests. Request only if potential benefits outweigh risks

*Immunosuppressed hosts include: Cancer treatment within 1 year, use of immunosuppressive drugs (biologics, chronic prednisone 20mg/day), solid organ transplant, bone marrow transplantation, YNHHS (regardless of COVID status), Leukemia, lymphoma, IIE, vasculitis, and pregnancy*
Appendix D.3- Current adult URI work-up for out-patients

**ADULT OFFICE TRIAGE for Patient Calls w/ Respiratory Symptoms – DO NOT BRING PT INTO OFFICE**

**START: Telephone Triage**
- If Pt has Moderate/Severe Symptoms
  - Asymptomatic COVID exposure
  - Minor respiratory symptoms: Sore throat, Hoarse voice, Cough
  - Nursing or Clinician: Review exposure

**URI, Fever & Cough**
- COVID Suspect
  - Home isolation minimum 7 days and ≥ 3 days symptom resolution *
  - Consider treatment for influenza or bacterial infection only if highly suspected

**Severe Symptoms**
- Unable to get out of bed
- Dyspneic (RR > 25)
- Chest pain
- Tachycardic (HR > 110)
- Difficulty completing sentence
- Confused

- Needs ED and hospital admission
- Call before sending to inform “COVID Suspect” can self transport
- If ambulance needed must inform “COVID Suspect”

**Negative COVID Test**
- Home isolation
  - 7 days & ≥ 3 day resolution
  - Symptom management
  - Call back for worsening

**Positive COVID Test**
- Home isolation
  - 14 days & ≥ 3 day resolution of symptoms (assess for safety) & resolution of cough
  - Symptom management
  - Regular patient outreach
  - See COVID positive pathway

**ADVICE FOR ALL ASYMPTOMATIC PATIENTS:**
- Self monitor per CDC
- Call back for fever or respiratory symptoms
- We do not recommend testing at this time
- Exposures/recommendations:
  - Work exposure: HCW – monitor for symptoms and continue to work
  - Household exposure: Self isolate ≤ 14 days, monitor for symptoms

**ADVICE FOR ALL SYMPTOMATIC PATIENTS:**
- Self isolation per CDC
- Call back for worsening
- Advise against emergency room or walk-in
- We do not recommend testing at this time (inadequate supplies)
- Home isolation minimum 7 days and ≥ 3 days resolution of symptoms in the absence of test results

* SIM COVID AMBULATORY GUIDELINE 3/29/20
  * Aligned with CDC guidelines as of 3/29/20
Guidance for PPE use can be found at

- [https://vimeo.com/397424618/5e69e27680](https://vimeo.com/397424618/5e69e27680)
- [Radiology.yale.edu](https://www.radiology.yale.edu)

**CLICK HERE FOR FULL PPE GUIDANCE POLICY INCLUDING REUSE PROCEDURES**

References:


4. YNHHS Covid Resource Website