UCSF Department of Radiology and Biomedical Imaging

Guidance for Image-Guided Procedures and Diagnostic Imaging under Anesthesia During the COVID-19 Pandemic

Approved: 4/24/20
Last Updated: 5/7/20 – revised timing of COVID-19 testing for inpatients (now within 7 days instead of 4 days), Tables 1-4

Background: This document provides guidance for the management of patients and facilities during image-guided interventions and diagnostic imaging performed under anesthesia in the Department of Radiology and Biomedical Imaging. This document updates previously published interim guidance on the same topic. The interim guidance was created in the context of a new UCSF Anesthesia and Perioperative Care policy approved on March 26, 2020. The goal of this guidance is to align our practice with UCSF Health practice and national standards.

Several important concepts underpin the anesthesia and radiology guidelines. These include: 1) asymptomatic patients may be sources of SARS-CoV-2 disease transmission, 2) disease transmission may occur by aerosol inhalation in addition to droplet spread, 3) certain surgeries and procedures carry higher risk than others for disease transmission to healthcare workers due to aerosolization of virus, and 4) intubation, extubation, and certain forms of respiratory support are aerosol-generating. **On April 24, these key changes were incorporated:**

- Incorporation of COVID-19 test results: Based on current estimates of COVID-19 prevalence among asymptomatic patients in San Francisco and surrounding areas and the performance of the UCSF RT-PCR test, the likelihood is very high that a patient with a negative test result does not have COVID-19 infection (~99.7% negative predictive value) (see Appendix A). Pre-procedural testing has begun for all patients undergoing anesthesia and for selected patients undergoing image-guided interventions under local anesthetic or conscious sedation. Pre-visit testing is expected to expand in coming weeks.
- Incorporation of site-specific air exchange into room downtime guidance: At the time of interim guidance publication, air exchange data was not available for the majority of imaging suites. These data are now available (see Appendix B).
- Incorporation of changes in the UCSF Anesthesia and Perioperative Guidance: An updated guidance document was published on 4/21/20. This document reflects these changes while providing additional information to allow this policy to be operationalized in the Department of Radiology and Biomedical Imaging.

Definitions:

- **High-Risk Surgeries and Procedures:**
  - Any procedures on the airway, throat, mouth or sinuses (bronchoscopy, tracheostomy, glossectomy, laryngoscopy procedure…etc)
  - Endoscopy, Transesophageal echocardiography, Electroconvulsive therapy
  - Surgery under regional anesthetic with high likelihood of requiring GA
  - Active CPR
  - Thoracic surgery/procedures
  - **See Appendix C for Society of Interventional Radiology list of procedures performed by radiologists that should be considered aerosol-generating**

- **Symptomatic or High-Risk Patient:**
  - Any of the following *new acute* symptoms:
    - Fever (objective or subjective)
    - Myalgias
    - Respiratory symptoms (dyspnea or cough)
    - URI symptoms (headache, rhinorrhea, sore throat)
    - GI symptoms (diarrhea, nausea, vomiting)
    - ENT symptoms (loss of taste or smell)
    - Eye symptoms (conjunctivitis)
    - Other clinical concern for COVID-19
  - Chest imaging findings suggestive of COVID-19 (bilateral, ground glass, peripheral distribution)
  - Sustained close contact (e.g. household contact) with a known case of COVID-19
  - Unable to provide history and no collateral regarding symptoms available
  - Newborns born to mothers with known COVID-19

- **Asymptomatic patient:**
  - Meets none of the Symptomatic or High-Risk patient criteria

Guidance: Tables 1-4 summarize recommended personal protective equipment (PPE) use and imaging suite management for each scenario in adult and pediatric patients. Please continue to follow UCSF Health guidelines for safe re-use of PPE. For any individual case, critical information to know when consulting these tables:

1. COVID-19 testing status and results
2. Category of image-guided intervention (High Risk = aerosol-generating procedure (AGP))
3. Anesthetic plan
4. For procedures or imaging under general anesthesia, whether the patient will be intubated and extubated in the imaging suite or elsewhere and then transported to/from the imaging suite

Additional operational details:

- At Parnassus, Fluoroscopy Rooms 5 and 6 (M345 and M347, respectively) have been outfitted as independent negative pressure suites. Whenever possible, these suites should be used for intubation and extubation of patients undergoing general anesthesia for diagnostic imaging or intervention in CT or body interventional radiology, provided a negative COVID-19 test is not available within the last 4 days for outpatients and within the last 7 days for inpatients.

- At Mission Bay, the MRI induction room (C1755) has very fast air exchange. Whenever possible, asymptomatic pediatric patients without a negative COVID-19 RT-PCR test within the appropriate timeframe should enter and emerge from anesthesia in this room and be transported to and from imaging suite on the 1st floor of Mission Bay Hospital (Table 4, Scenario 2b). This applies only to diagnostic imaging under anesthesia in pediatric patients. Pediatric patients undergoing interventional radiology and neurointerventional radiology procedures should be anesthetized in the interventional suites on the 2nd floor of Mission Bay Hospital.

  For all pediatric cases under anesthesia on the 1st and 2nd floors: Pediatric anesthesiologists may elect to use manage the airway with an endotracheal tube or a laryngeal mask airway (LMA). Alternatively spontaneous mask ventilation or simple nasal cannula may be used. General rules (see also Table 4):
  - Intubation with placement and removal of an endotracheal (ET) tube will always be considered aerosol-generating.
  - LMA placement and removal will usually not be aerosol-generating, however these may be aerosol-generating under certain conditions that cannot be predicted prior to placement/removal. Therefore airborne PPE should be used by any providers present in the room where LMA placement and removal occurs. Pediatric anesthesia staff will make a determination in every case to guide room management and PPE use for providers not present during placement and removal.
  - Spontaneous mask ventilation or simple nasal cannula will not be considered aerosol-generating.

- Minimize opening doors whenever an aerosol-generating procedure is underway. When caring for asymptomatic patients in whom a recent COVID-19 test is NOT available, providers and patients may quickly exit the imaging suites during the imaging suite downtime. When doing so they should minimize the time that the door is open in order to prevent possible contamination of adjacent airspaces.

- Room-specific downtimes are posted **inside** of every room where an aerosol-generating procedure might occur in the department. Imaging suites should be marked on **outside** doors with signs indicating that an aerosol-generating procedure is underway. The start time for room downtime is the time that the last aerosol-generating procedure occurs in the room. If this is not indicated by the proceduralist team and/or the anesthesia team, then this should begin upon patient departure**. See Appendix D for sign templates currently in use.**

Table 1: Guidance for ADULT PATIENTS with COVID-19 test results within last 4 days (outpatients) or 7 days (inpatients)

Scenario	Anesthesia PPE	Radiology Personnel PPE	Room Management	Room Cleaning
1. COVID-19 Positive/PUI for ANY **image-guided intervention** (diagnostic imaging will continue to follow existing guidelines)	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Minimize number of providers present • **No radiology trainees present** • Last case of day preferable • Room downtime 1 hour after patient departure	• Technologist cleans equipment 1 hour after patient departure • Terminal clean
2. COVID-19 test negative within last 4 days (outpatients) or 7 days (inpatients), any procedure	• Standard PPE	• Standard procedural PPE	• No room downtime required	• Routine cleaning upon patient departure

Table 2: Guidance for ADULT PATIENTS without COVID-19 test results within last 4 days (outpatients) or 7 days (inpatients)

Scenario	Anesthesia PPE	Radiology Personnel PPE	Room Management	Room Cleaning
1. Asymptomatic patient for HIGH RISK procedure (aerosol-generating procedure (AGP)) under local anesthetic, conscious sedation, or general anesthesia	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Non-anesthesia personnel should leave room for intubation and extubation • Minimize number of providers present • Room-specific downtime after last AGP, per signs in room and Appendix B	• Routine cleaning after downtime complete
2a. Asymptomatic patient for LOW RISK procedure (non-aerosol-generating) or diagnostic imaging under general anesthesia, **intubation/extubation take place in imaging suite**	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• For rooms with 15 minute downtime, enter after 15 minutes with standard PPE • For all other rooms, enter after intubation with: o Reusable N95 + face shield/goggles or PAPR o Gown o Double Gloves	• Non-anesthesia personnel should leave room for intubation and extubation • Room-specific downtime after last AGP, per signs in room and Appendix B	• Routine cleaning after downtime complete
2b. Asymptomatic patient for LOW RISK procedure (non-aerosol-generating) or diagnostic imaging under general anesthesia, **intubation/extubation take place elsewhere and patient is transported to/from imaging suite**	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Standard procedural PPE	• No room downtime required	• Routine cleaning after patient departure
3. Asymptomatic patient for LOW RISK (non-aerosol-generating) procedure under local anesthetic, conscious sedation, or monitored anesthesia care	• Standard procedural PPE	• Standard procedural PPE • Conscious sedation/MAC: if airway rescue is necessary, support patient and transition to #2a PPE instruction	• No room downtime required	• Routine cleaning after patient departure

Table 3: Guidance for PEDIATRIC PATIENTS with COVID-19 test results within last 4 days (outpatients) or 7 days (inpatients) at BCHSF

Scenario	Anesthesia PPE	Radiology Personnel PPE	Room Management	Room Cleaning
1. COVID-19 Positive/PUI for ANY **image-guided intervention** (diagnostic imaging will continue to follow existing guidelines)	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Minimize number of providers present • **No radiology trainees to be present** • Last case of day preferable • Room downtime 1 hour after patient departure	• Technologist cleans equipment 1 hour after patient departure • Terminal clean
2. COVID-19 test negative within last 4 days (outpatients) or 7 days (inpatients), any procedure	• Standard PPE	• Standard procedural PPE	• No room downtime required	• Routine cleaning upon patient departure

Table 4: Guidance for PEDIATRIC PATIENTS without COVID-19 test results within last 4 days (outpatients)/7 days (inpatients) at BCHSF

Scenario	Anesthesia PPE	Radiology Personnel PPE	Room Management	Room Cleaning
1. Asymptomatic patient for HIGH RISK procedure (aerosol-generating*) under local anesthetic, conscious sedation, or general anesthesia	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Non-anesthesia personnel should leave room for intubation and extubation • Minimize number of providers present • Room-specific downtime after last AGP, per signs in room and Appendix B	• Routine cleaning after downtime complete
2a. Asymptomatic patient for LOW RISK procedure (non-aerosol-generating) or diagnostic imaging involving general anesthesia, **induction and emergence take place in imaging suite**	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• ET tube used, room downtime = 15 minutes: enter 15 minutes after intubation with standard PPE • ET tube used, room downtime ≧ 30 minutes: o Reusable N95 + face shield/goggles or PAPR o Gown o Double Gloves • Some forms of anesthesia will not be aerosol-generating. Follow anesthesia provider instructions for safe timing of entry in standard PPE	• Non-anesthesia personnel should leave room for intubation/ extubation • Room-specific downtime after last AGP, per signs in room and Appendix B • If anesthesia provider does not place endotracheal tube and confirms absence of aerosol generation, no room downtime required	• Routine cleaning after downtime complete
2b. Asymptomatic patient for LOW RISK procedure (non-aerosol-generating) or diagnostic imaging involving general anesthesia, **induction and emergence from anesthesia take place elsewhere and patient is transported to/from imaging suite**	• Reusable N95 + face shield/goggles or PAPR • Gown • Double Gloves	• Standard procedural PPE	• No room downtime required	• Routine cleaning after patient departure

Appendix A: Performance of the COVID-19 RT-PCR test

COVID-19 Diagnostic Testing in Perioperative Setting:

Reverse transcriptase PCR (RT-PCR) testing for COVID-19 detects RNA from SARS-Coronavirus-2 and is the primary test used for diagnosis of acute infection. Analytical sensitivity of PCR testing is very high at >98%[1].

Clinical sensitivity of RT-PCR varies by site of sampling, likely due to variation in quality of sampling technique, time of sampling with respect to disease course (viral titers are highest early in infection[2]), and variation in the distribution of virus in the lower versus upper respiratory tract. Our understanding of clinical sensitivity of RT-PCR is based on a) prior studies using RT-PCR to detect respiratory viruses, and b) limited data on SARS-CoV-2[2,3]. Prior studies of respiratory viruses have found that sampling by nasopharyngeal (NP) swab may be more sensitive than oropharyngeal (OP) swab sampling, and that a combination of NP + OP may increase sensitivity, although variation by virus was observed[3–5]. Two limited studies of SARS-CoV-2 have compared percent test positivity based on sampling site but were not done in a way that allowed accurate calculation of sensitivity. The larger study (213 patients, not-yet peer reviewed) found that test positivity in the first 14 days of symptom onset was higher in NP swabs (72%) versus OP swabs (61%)[2]. The smaller study (9 patients) found 100% test positivity during the first five days of symptoms and 46% test positivity after the first five days, independent of swab type[6]. Additional studies suggest that sputum and lower respiratory specimens (endotracheal aspirate) may have higher viral loads and thus possibly higher sensitivity when tested compared to the nasopharynx or oropharynx, especially earlier during disease course[2,7,8].

What does a negative RT-PCR test mean? The negative predictive value [(true negatives)/(true negatives + false negatives)] allows us to understand the significance of a negative test, which depends on the prevalence of disease in the population being tested. In asymptomatic patients, the prevalence of SARS-CoV-2 in the Bay Area and in the U.S. is not yet known, but based on data in other countries[9], is estimated to be approximately 1%. Given that the estimated prevalence of asymptomatic patients in the Bay Area is very low, the negative predictive value for a test in an asymptomatic patient prior to surgery is very high. For example, if the COVID-19 prevalence is assumed to be 1% and the sensitivity/specificity of a NP swab test is estimated at 75%/98%, then the negative predictive value of the test is 99.7%.

References:

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4. Lieberman, D. *et al.* Identification of Respiratory Viruses in Adults: Nasopharyngeal versus Oropharyngeal Sampling. *Journal of Clinical Microbiology* **47**, 3439–3443 (2009).
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7. To, K. K.-W. *et al.* Temporal profiles of viral load in posterior oropharyngeal saliva samples and serum antibody responses during infection by SARS-CoV-2: an observational cohort study. *The Lancet Infectious Diseases* (2020) doi:10.1016/S1473-3099(20)30196-1.
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Appendix B: Imaging Suite Downtimes

Imaging suite downtimes are derived from airflow characteristics in each imaging suite to achieve a 99% air turnover**. If anyone is present in the suite during or after an aerosol-generating procedure in this time period, airborne PPE should be utilized.**

The most efficient way to achieve the desired air exchange is to keep the doors closed. When caring for asymptomatic patients, providers and patients may exit the imaging suite. However care should be taken to minimize the time that the door(s) to the suite are open to minimize potential contamination of adjacent airspace and maximize air turnover.

Parnassus		
Room Number	**Radiology Name**	**Room Downtime**
M365	IR Room 8	30 minutes
M375	IR Room 9	45 minutes
M337	IR Room 4	15 minutes
L367	NIR Z	30 minutes
L382	NIR S	15 minutes
L389	NIR Q	30 minutes
L361	CT 2	15 minutes
L363	CT 4	30 minutes
L300	MRLP	45 minutes
L314	MR4	30 minutes
M345	Room 5	30 minutes
M347	Room 6	30 minutes
M337	ERCP	15 minutes
L376	US Room 2	15 minutes

Mt. Zion		
Room Number	**Radiology Name**	**Room Downtime**
A237	MZ IR 1	30 minutes
A239	MZ IR 3	30 minutes
A241	MZ Holding Room	45 minutes
A134	MZ CT	30 minutes

Mission Bay		
Room Number	**Radiology Name**	**Room Downtime**
C2675	IR Hybrid/OR23	15 minutes
A2683	IR/OR24	30 minutes
C1769	MBCT1	30 minutes
C1716	MBCT2	30 minutes
C1714	MBCT3	30 minutes
C1755	MRI Induction Room	15 minutes
C1729	Nuclear Medicine	45 minutes
C1721	PET/CT	45 minutes
C1778	Fluoro 1	45 minutes
C1782	Fluoro 2	45 minutes
C1758A	RN Holding 1	45 minutes
C1758B	RN Holding 2	45 minutes
C1758Q	US1	45 minutes
C1758V	US4	60 minutes

PCMB		
Room Number	**Radiology Name**	**Room Downtime**
L2141-A	PCMB1	30 minutes
L2141-B	PCMB2	30 minutes
L2171	PCCT1	15 minutes
L2131	Holding Room 3	45 minutes
L2131	Holding Room 4	45 minutes
L3180E	Breast Biopsy	45 minutes
L2128	US Room 2	45 minutes

Appendix C: Aerosol-Generating Procedures Performed by Radiologists

Any procedure involving a patient who:	Aerosol-generating procedures performed by radiologists
• requires intubation/extubation • is receiving a form of ventilatory support associated with the risk of mechanical dispersal of aerosols* • requires active airway suctioning (i.e. tracheostomy patient) *Note: Any patient undergoing sedation may require airway rescue, which would require utilization of aerosol precautions.	• Lung biopsy • Lung ablation • Thoracentesis • Pleural drains • Chest tube for pneumothorax • Bronchial artery embolization • Bronchial stenting • Nasogastric Tube (NG tube) or Orogastric tube (OG tube) placement • Any procedure that requires NG tube placement: • Gastrostomy • Gastro-jejunostomy tube placement • Jejunostomy • GI stent placement

Adapted from https://www.sirweb.org/practice-resources/covid-19-resources/covid-19-clinical-notification-3-26-20/

APPENDIX D: Signs in Radiology

ROOM DOWNTIME REQUIREMENTS

Location: **M365 (IR 8)**

Aerosol-Generating Procedure (AGP) in Asymptomatic Patient

30 Minutes after last AGP

* Patient and providers may leave after procedure. Minimize door opening and closing until downtime complete.

Any Procedure in COVID-19+ Patient or Patient Under Investigation (PUI)

60 Minutes after patient departure

Example of room-specific sign permanently posted inside imaging suite

Aerosol-Generating Procedure in Progress

DO NOT ENTER

AUTHORIZED TRAINED PERSONNEL ONLY

- **PAPR or N95 + Eye Protection Required While Inside**
- **Keep Door Closed**

ROOM DOWNTIME

Date:	Start :_____ Room Open:_____

Example of sign to be posted OUTSIDE room during HIGH-RISK (aerosol-generating) procedure and to stay posted until room downtime is complete

APPENDIX E: Isolation Status Links

CONTACT ISOLATION: https://infectioncontrol.ucsfmedicalcenter.org/sites/g/files/tkssra4681/f/Contact_Isolation.pdf

DROPLET ISOLATION: https://infectioncontrol.ucsfmedicalcenter.org/sites/g/files/tkssra4681/f/Droplet_Isolation.pdf

AIRBORNE ISOLATION: https://infectioncontrol.ucsfmedicalcenter.org/sites/g/files/tkssra4681/f/Airborne_Isolation.pdf

ENTERIC CONTACT ISOLATION: https://infectioncontrol.ucsfmedicalcenter.org/sites/g/files/tkssra4681/f/Enteric_Contact_Isolation.pdf