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PATACSI COVID-19 Crisis-Driven Recommendations on Thoracic Surgery

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Introduction

The COVID-19 pandemic has changed the landscape of the medical field. With the allocation of most resources, infrastructure, and personnel to the fight against COVID-19, the emphasis on minimizing the spread of the virus among patients and healthcare professionals while maintaining the flow of services by healthcare professionals to their patients is paramount. These recommendations are given in order to aid surgeons who may need to perform thoracic cases on patients in order to provide the best quality of care without causing harm either to the healthcare professional or the patient.

I. Patient Preparation and Staff Safety:

1.1. ***ALL patients should be approached as COVID-19 POSITIVE without the benefit of a swab test AND regardless of the degree of symptoms.***

1.2. **ELECTIVE surgery should be DEFERRED** as long as patients are **NOT** clinically compromised and/or the prevailing hospital conditions are **NOT** amenable to such surgeries.[1]

1.3. For all **ELECTIVE thoracic surgery cases, patients should be proven COVID-19 NEGATIVE prior to surgery.**

1.3.1. For asymptomatic patients with unknown COVID-19 status, recommend one (1) COVID-19 swab test result as negative to show COVID-19 negative status.

1.3.2. For symptomatic patients with unknown COVID-19 status, recommend resolution of symptoms AND one (1) COVID-19 swab test result as negative to show COVID-19 negative status.

1.3.3. For COVID-19 positive patients, recommend two (2) consecutive COVID-19 negative results (3 days apart) as per recommendations of existing guidelines, as well as resolution of symptoms.

1.4. All patients for **EMERGENCY and URGENT thoracic surgery should have COVID-19 testing done, but timing of surgery should NOT be delayed** by awaiting COVID-testing and/or results.

1.5. All **emergent and urgent cases should have a chest CT scan prior to any procedure** to aid in risk stratification[2], but timing of surgery should **NOT** be delayed by having the diagnostic done. This is due to the following findings that may point to COVID-19 disease in asymptomatic patients:

1.5.1. COVID-19 positive patients showed both lung parenchyma and interstitial involvement.

1.5.2. Early phase findings reveal ground glass opacities (GGO) and a single lesion.

1.5.3. Advance phase findings reveal pleural effusion with multifocal lesion distribution in the middle and lower lung regions and in the posterior lung area.

1.6. ***Consider all thoracic procedures as Aerosol Generating Procedures (AGP) regardless of COVID status***.

1.6.1. To protect from aerosol- generating procedures CDC recommends:[3]

1.6.1.1. NIOSH-certified, fit-tested N95 or higher respirator, or a PAPR (powered air purifying respirator)

1.6.1.2. Standardized attire under PPE (level A PPE) - Figure A

1.6.1.3. SURGICAL SCRUBS or disposable garments and DEDICATED WASHABLE FOOTWEAR

1.6.1.4. Footwear should be closed-toe, soft-soled, washable, and have a closed back

1.6.1.5. COVERALLS with either an integrated hood or a surgical hood with integrated full-face shield

1.6.1.6. Non-sterile gloves

1.6.1.7. Disposable shoe covering

1.6.2. Operating room attire should be worn over PPE

1.6.2.1. Sterile disposable gown

1.6.2.2. Sterile gloves

1.6.3. Donning and Doffing of PPEs should be done in accordance with CDC-approved guidelines at all times.

1.7. For bedside procedures, it is recommended to do procedures in negative pressure rooms.[4]

1.8. Workflow of procedures and operations should be such that only the most relevant and experienced personnel for the procedure are present, minimal unnecessary movement of personnel in and out of work areas, streamlining operative movements to ensure the timely performance of a procedure in the smallest amount of time without compromising patient and personnel safety, and ensuring minimizing contamination of equipment during the operative process.[4]

1.8.1. Electrosurgery units, when used, should be set on the lowest possible setting while still producing its desired effect. Use of monopolar electrosurgery, ultrasonic dissectors, and advanced bipolar devices should be minimized, if possible, as these may generate aerosols. A smoke evacuator is suggested when using these devices.[4]

1.9. For **ELECTIVE cases, a multidisciplinary approach** is recommended in assessing the best care possible for patients on a case-to-case basis, putting emphasis on the resources available for each patient's pre-operative, operative, and post-operative phase of care.[1]

II. Recommendations for Pleural Effusion

2.1. Decision to do fluid drainage should be based on the patient's clinical status, volume of effusion, hospital readiness phase, and surgeon's expertise.

2.2. Consider EMERGENT drainage for symptomatic (respiratory compromise) patients with effusion, patients with non-loculated empyema thoracis.

2.3. Consider URGENT drainage for moderate (≥½ opacification of hemithorax on CXR, or ≥500ml volume by ultrasound) to large (≥2/3 opacification of hemithorax on CXR, or ≥1000ml volume by ultrasound)[12] effusion with only mild symptoms OR patients with recurrent pleural effusion refractory to medical / conservative management.

2.3.1. Perform pre-procedure imaging studies (chest ultrasound, CT scan when applicable) to guide drainage placement and limit failure of drainage.

2.4. Drainage for malignant effusion should be done on an ELECTIVE basis.

2.4.1. Perform pre-procedure imaging studies (chest ultrasound, CT scan when applicable) to aid in decision-making for most appropriate drainage procedure (pigtail, tube thoracostomy, indwelling pleural catheter).

2.5. For organized loculated effusion, the decision to perform open surgery vs. VATS is dependent on surgeon expertise and hospital readiness for performance of the procedure.

2.5.1. Perform pre-procedure imaging studies (chest ultrasound, CT scan when applicable) to aid in decision-making for most appropriate procedure.

2.5.2. Choose to perform procedure that offers less operative time, minimal or no pleural air leaks, short post-op hospital length-of-stay.

2.6. For patients with pleural effusion requiring admission for hospital care:

2.6.1. Connect chest tube or indwelling pleural catheter (IPC) to a Pleur-evac, Sinapi or equivalent tube drainage system prior to tube insertion and hook to wall suction to minimize aerosol generation.[5]

2.6.1.1. In the absence of a wall suction:

2.6.1.1.1. A Heat and Moisture Exchange (HME) filter will be attached to an RCI Multi-adapter (HME adapter), which in turn will be connected to an endotracheal tube connector. The assembled filter will then be attached to the atmospheric outlet (wall suction port on the Sinapi chest drain) using a piece of suction tubing. The filter, will just serve as a germ trap preventing any organisms from leaving the system. (Appendix A)

2.6.1.2. In the absence of such drain device:

2.6.1.2.1. A custom chest drain system (Annex A) can be made by attaching a cut segment of an endotracheal tube to an antimicrobial breathing filter/ HME filter (used in respirators, ventilator circuits and gas lines) is then connected to the chest drain suction port leaving the drain off suction and occluding the safety valve. The filtration efficacy is >99.99% for microorganisms ≥55nm in diameter (COVID-19 diameter is 65-125 nm).[6]

2.7. For patients with pleural effusion that can be discharged for home care:

2.7.1. Connect chest tube or indwelling pleural catheter to a portable chest drain system (Pleur-evac, Sinapi or equivalent) prior to tube insertion to minimize aerosol generation. Connect

the HME filter set-up described above to the atmospheric outlet of the drainage system. (Annex A)

2.7.2. Use of drainage system should be tailored to the patient's ability to do drainage system care at home, with the goal of minimizing frequent hospital visits or re-admission for troubleshooting.

2.8. Those with Rocket pleural vent or chest tube with Heimlich valve (or equivalent) should be advised to continue self-isolation due to a small risk of aerosol generation.

2.9. Pleurodesis is NOT advised at this time due to the possibility of complications necessitating frequent hospital / clinic visits.[5]

2.10. Pleural fluid samples should be handled as Category 3 pathogen and double-bagged with warning stickers.[3,5]

III. Recommendations for Pneumothorax

3.1. **For symptomatic patients with pneumothorax, or cases of tension pneumothorax**:

3.1.1. Should be managed as EMERGENT cases and perform surgical intervention at the soonest possible time AND in Level A PPEs.

3.1.2. Consider using an integrated device (Rocket pleural vent or equivalent) and in the absence use of a chest tube with Heimlich Valve attachment as out- patient.

3.1.3. Advise to self-isolate due to minimal risk of aerosol generation.

3.2. For patients with large pneumothorax (defined as having a visceral pleural separation of > 2cm at the level of the hilum on CXR), or for patients with expanding pneumothorax by serial CXR → recommend URGENT surgical intervention to avoid development of severe symptoms or prolonged hospital stay due to serial observation.

3.3. For large air leak or failed chest drain, and while patient is symptomatic, admit for further management.[5] Such cases should be treated as ELECTIVE cases.

3.3.1. Proceed with definitive surgery only if patient tests negative for COVID-19 AND provided the hospital has a separate operating suite for non-COVID patients… otherwise transfer to a non-COVID hospital.

3.3.2. Consider sending patient home with a drainage device (Rocket pleural drain, Heimlich valve, or the equivalent) once symptoms related to admission have improved.

3.3.2.1. May opt to maintain drainage device at home and consider removal once air leak has resolved.

3.3.2.2. May prepare patient for definitive surgery (VATS or open surgery) on an outpatient basis → perform definitive surgery in a Phase I hospital.

3.4. Novel modifications to air filtration, such as the use of HME filters set-up on the drainage system's suction port or air vent was introduced and concocted to close the system from leaks that may cause aerosol generation. This set-up may be used provided that hospital resources are not drained by such modifications. (see ANNEX A for system set-up) It should be noted that currently there are no studies validating the efficacy of the said set-up in closing the drainage system thereby preventing escape of viral load to the air.[7]

IV. Recommendations for Airway Management

4.1. For airway compromise:
- 4.1.1. Intubation rather than tracheostomy would be preferable.[8]
  - 4.1.1.1. Avoid use of high flow oxygen.
  - 4.1.1.2. Most skilled airway manager (anesthetist) present should manage airway to maximize first pass success.
  - 4.1.1.3. Reduce unnecessary team members to essential staff.
- 4.1.2. In trauma patients with acute airway compromise NOT amenable to tracheal intubation, OR in other patients with difficult airway (very obese, airway obstruction from oropharyngeal or tracheal malignancy:
  - 4.1.2.1. transport to the optimal environment of the operating room is often preferred.
  - 4.1.2.2. If transportation is not desirable, consider the feasibility of performing a safe bedside procedure or delaying the procedure.

4.2. Tracheostomy for **PROLONGED INTUBATION**:
- 4.2.1. For patients with unknown COVID-19 status, advocate for COVID testing prior to tracheostomy.
  - 4.2.1.1. Perform procedure in standard Level A PPE.
  - 4.2.1.2. Use of novel devices / equipment (aerosol box, acrylic shields, etc.) dependent on surgeon expertise in performing the procedure with such devices.
- 4.2.2. In COVID-19 positive patients:
  - 4.2.2.1. An acceptable strategy is to wait for the disease to become non- transmissible (COVID-19 negative by 2 consecutive swab procedures as per protocol) prior to performing a high-risk aerosol- generating procedure such as tracheostomy.[9]
  - 4.2.2.2. Tracheostomy procedure should be considered in these patients with no less than 21 days of prolonged intubation AND with ascertained benefit from a tracheostomy procedure AFTER testing negative for COVID-19.
  - 4.2.2.3. Tracheostomy may be deferred indefinitely in poor-risk COVID-19 patients, or when COVID testing results are persistently positive.[10]
- 4.2.3. Choice between open tracheostomy or percutaneous dilatational tracheostomy is dependent on surgeon-expertise and hospital readiness for the procedure, with emphasis on the performance of the procedure in Level 4 PPE for the entire operating room team, and with coordination between the surgical and anesthesia teams to minimize risk of exposure to aerosols during the procedure. (see ANNEX B and C)[11]

V. Recommendations for Thoracic Malignancy

5.1. A PHASED APPROACH on HOSPITAL READINESS is recommended based on the prevailing COVID-19 status in the hospital, the availability of hospital resources, and the status of the of COVID-19 burden in the community.[1]

5.1.1. **PHASE I**: Few COVID-19 cases, AND hospital resources are intact, AND COVID-19 cases are not rapidly rising.

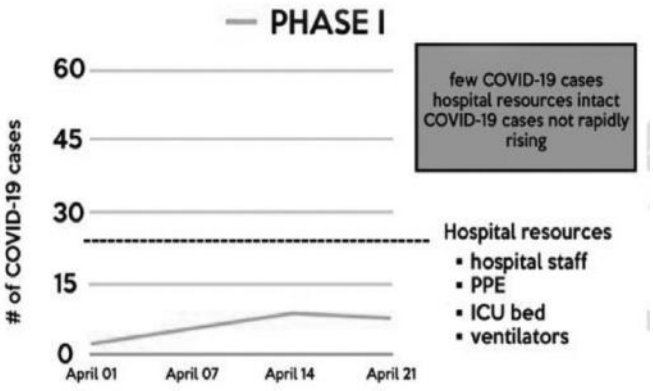
5.1.1.1. Surgery restricted to patients likely to have survivorship compromised if surgery not performed within next 3 months.

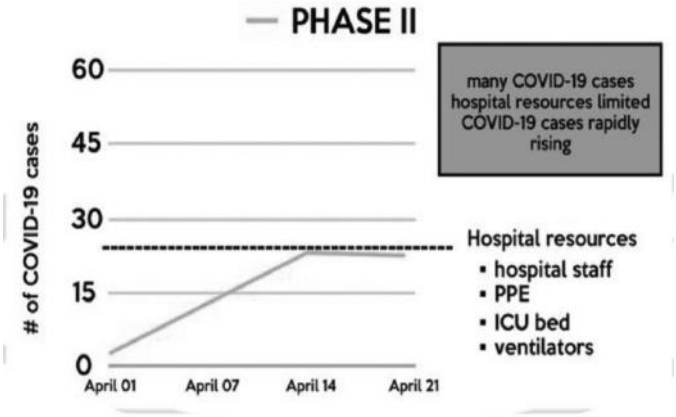
5.1.2. **PHASE II**: Many COVID-19 cases, OR hospital resources are limited, OR COVID-19 cases rapidly rising.

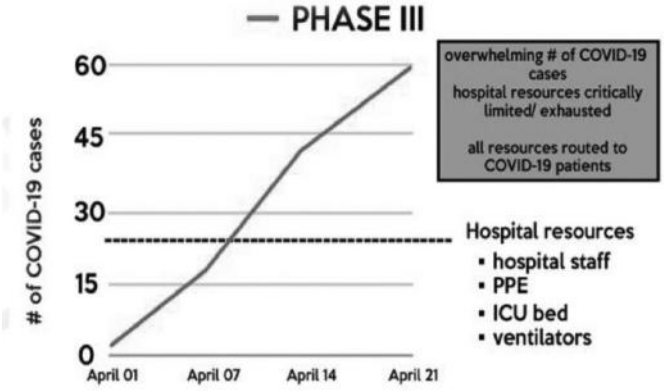
5.1.2.1. Surgery restricted to patients likely to have survivorship compromised if surgery NOT performed within next few days.

5.1.3. **PHASE III**: Overwhelming number of COVID-19 cases, OR hospital resources are critically limited / exhausted, OR hospital resources are routed to COVID-19 patients.

5.1.3.1. Surgery restricted to patients likely to have survivorship compromised if surgery NOT performed within next few hours.







Phase I	*Surgery limited only for patients whose survival is compromised if delayed for 3 months*		
Emergency	**Surgery as soon as feasible**	**Surgery deferred for 3 months**	**Alternative treatment**

• Rigid bronchoscopy for Malignant central airway obstruction with critical airway stenosis
• Pleural drainage for massive malignant pleural effusion (refer to pleural disease)
	• Pulmonary nodule presumed or known lung cancer clinical stage IA3 to Clinical stage IIIA (T3N1 or T4N0/N1); Non N2
	• Patients with strong clinical evidence of N1 should undergo mediastinoscopy with FS, (+) N2 proceed with induction chemotherapy; (-) N2 proceed with anatomic lung resection
	• If with recent PETCT showing N0, may omit invasive mediastinal staging
	• After favorable response to induction chemotherapy (Stage IIIA NSCLC)
	• Invasive staging procedure to start treatment (mediastinoscopy, thoracoscopy)
	• Esophageal cancer T1b or greater
	• Stenting for obstructing esophageal tumor
	• Malignant chest wall tumors
	• Symptomatic mediastinal tumors – diagnosis not amenable to core biopsy
		• Pure GGO
		• GGO with <50% solid component
		• Solid nodule or lung cancer < 2 cm (clinical stage IA1 or IA2)
		• Indolent histology (e.g.lepidic adenocarcinoma, carcinoid)
		• Thymoma (asymptomatic, no compression symptoms)
		• Pulmonary metastases
		• High-risk patients Likely to require prolonged ICU stay
		• Tracheal resection Tracheostomy
		• Endoscopic procedures:
		  • Diagnostic Bronchoscopy
		  • EBUS/EUS
		  • Upper GI Endoscopy
			• For symptomatic mediastinal tumors core needle biopsy is preferred over more invasive procedures (mediastinoscopy/ mediastinotomy)
			• Clinical stage IIIA (N2) single station, non-bulky may proceed with induction chemotherapy
			• Clinical stage IIIA with multi-station bulky N2 should undergo definitive chemoRT
			• Endoscopic therapy for early stage esophageal cancer (T1a lesions)
			• cT2 or higher and node positive esophageal tumors should be treated with induction chemotherapy
			• Stereotactic Ablative Radiotherapy (SABR)
			• Ablation (e.g. cryotherapy, Radiofrequency ablation)

Phase II	*Surgery limited only for patients whose survival is compromised if **NOT** performed within a few days*		
Emergency	**Surgery as soon as feasible**	**Surgery deferred for 3 months**	**Alternative treatment**
• Malignant central airway obstruction with critical airway stenosis	• Perforated esophageal cancer without sepsis • Tumor associated infection without sepsis (e.g. coring out for post obstructive pneumonia) • Tumor associated with hemorrhage, not amenable to nonsurgical treatment • Management of surgical complications (hemothorax, empyema) in a hemodynamically stable patient	All thoracic procedures typically scheduled as elective	• Transfer patient to another hospital that is phase I • If eligible for Adjuvant therapy, then give neoadjuvant therapy instead • Stereotactic Ablative Radiotherapy (SABR) • Ablation (e.g. cryotherapy, radiofrequency ablation) Reconsider neoadjuvant as definitve Chemoradiaton and follow patients for salvage surgery

Phase III	*Surgery limited only for patients whose survival is compromised if **NOT** performed within the next few hours*		
Emergency	**Surgery as soon as feasible**	**Surgery deferred for 3 months**	**Alternative treatment**
• Malignant central airway obstruction with critical airway stenosis	• Perforated esophageal cancer with sepsis • Tumor associated sepsis • Management of surgical complications in an unstable patient (active bleeding not amenable to nonsurgical management, dehiscence of airway anastomosis)	All thoracic procedures typically scheduled as elective	same as phase II

VI. Recommendations For Chest Trauma

6.1. Trauma protocols for patients with chest trauma should be followed.

6.2. Proceed with EMERGENCY surgery as soon as possible

6.3. Recommend to do COVID-19 testing at the soonest possible time when feasible.

VII. Triaging of Common Thoracic Cases for Surgery

	EMERGENT	URGENT	ELECTIVE
PLEURAL EFFUSION	• Pleural effusion with respiratory compromise • Empyema thoracis	• Moderate* to massive** pleural effusion with mild respiratory compromise • Recurrent pleural effusion refractory to medical / conservative management	• Minimal Pleural effusion • Loculated effusion • Malignant pleural effusion with co-morbidities or **NOT** amenable to systemic anti-cancer therapy
PNEUMOTHORAX	• Symptomatic primary pneumothorax • Tension or secondary pneumothorax	• Asymptomatic, large (>2cm visceral pleural separation at the level of the hilum) OR expanding pneumothorax	• Post-thoracostomy cases with persistent air leak
TRACHEOSTOMY / AIRWAY	• Tracheal intubation as necessary for appropriate disease conditions (ARDS from COVID-19, severe pneumonia, COPD, etc.) • Imminent obstruction / trauma – emergent tracheostomy		• Tracheostomy for prolonged intubation • Greater than 14 days intubated for unknown COVID status • Greater than 21 days prolonged intubation AND COVID(+) → should have good prognosis AND conversion to COVID(-) case prior to tracheostomy • Open tracheostomy or percutaneous tracheostomy dependent on surgeon expertise and hospital readiness
THORACIC TRAUMA	• All chest trauma cases managed as per protocol, with LEVEL A PPE for OR team • Testing for COVID-19 status done at the soonest possible time		

moderate effusion: ≥½ opacification of hemithorax on CXR OR ≥ 500ml volume by ultrasound

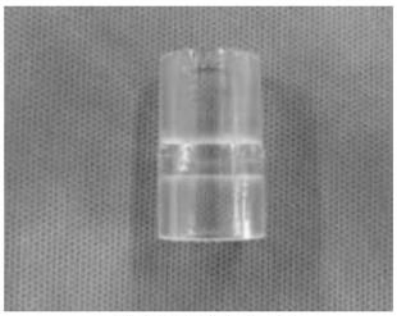
**large / massive effusion: ≥2/3 opacification of hemithorax on CXR OR ≥ 1000ml volume by ultrasound*

Annex A: Modified HME filter for air leak [7]

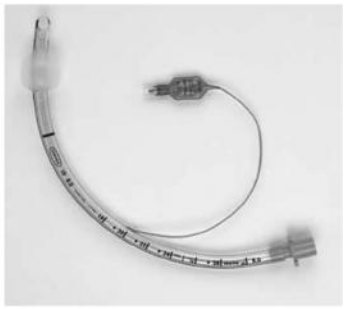
Materials:

- HME (Heat and Moisture Exchange) filter: usually used in endotracheal anesthesia
- ET-tube (select size appropriate for connection on suction port or air-vent port of watr seal

A. HME Breathing Filter



B. HME Adapter



C. ET tube

Procedure:

- Connect the HME filter (A) to the cut ET tube with adapter (D)
- Connect (D) to the suction port or air-vent port of the drainage bottle (E)

D. Cut ET tube connected to HME

E. Filter system set-up connected to suction port / air vent

F. Sinapi drain system

Alternative set-up:

- Connect (D) to a Sinapi drain air vent port (F)

References

1. COVID-19 Guidelines for Triage of Thoracic Patients. American College of Surgeons (online). 24 March 2020.
2. Zhou S, Wang Y, Zhu T, et al. Coronavirus, Disease 19 pneumonia in 62 patients in Wuhan, China. Am J Roentgenol 0 0:0, 1-8. https:// www.ajronline.org/doi/full/10.2214/AJR.20.22975.
3. CDC Center for Disease Control and Prevention. Coronavirus Disease 2019: Using PPE. 3 April 2020. www.cdc.gov/coronavirus
4. A Pryor. SAGES and EAES Recommendations Regarding Surgical Response to COVID- 19 Crisis. 29 MAR 2020. https://www.sages.org/recommendations-surgical-response-covid-19/
5. Halifax R, Wrightson JM, Bobby A, et al. Pleural Services during the COVID-19 pandemic. British Thoracic Society, 3 April 2020. www.brit-thoracic. org.uk
6. Heuer JF, Crozier TA, Howard G, and M Quintel. Can breathing circuit filters help prevent the spread of influenza A (H1N1) virus from intubated patients?. GMS Hygiene and Infection Control 2013; 8(1): ISSN 2196-5226

7. Bilkhu R, Viviano A, SafticI B. COVID 19: Chest drains with air leak- The silent "Super Spreader"?. CTS Net. 2020-04-08T21:56:36Z.
8. COVID-19 Airway Management Principles March 19, 2020.
9. Performing tracheostomy during the COVID-19 pandemic: guidance and recommendations from the Critical Care and Acute Care Surgery Committees of the American Association for the Surgery of Trauma
10. ENT UK Guidance for ENT during the COVID-19 pandemic
11. Tracheotomy in ventilated patients with COVID-19. Ann Surg (online).
12. May MP, Levsky JM, Berko NS, et.al. A new and simple method for estimating pleural effusion size on CT scans. Chest 2013; 143(4): 1054-9. doi:10.1378/chest.12-1292