

# Checklist for preparing your IR service for COVID-19

The primary consideration in preparing the IR service for COVID-19 is prevention of intra hospital transmission so as to protect patients and health care workers (HCW) from being contaminated or infected, while providing safe IR care for patients.

We hope the checklist below will help you prepare your IR service for the COVID-19 pandemic.

## 1. SET UP COVID-19 TASK FORCE OR CRISIS MANAGEMENT TEAM IN RADIOLOGY/IR TO SORT OUT ALL COVID-19 RELATED ISSUES

- a. Include all the key appointment holders in the IR service including the Director, managers in charge of nurses, radiographers, administrative support, logistics and IT personnel.
- b. Have daily meetings as the situation is fluid and changes to IR workflows and processes may need to be made at short notice.
- c. Plug into your institution COVID-19 task force or management to provide input from IR as well as to get updated with institution wide measures.

## 2. INFECTION PREVENTION AND CONTROL (IPC) PRACTICES

- a. Ensure every member of the IR team (including doctors, nurses, radiographers, patient assistants, cleaners) are up to date and aligned with your institution's IPC measures.
- b. Organize refresher training on
  - i. Hand hygiene
  - ii. How to don and doff personal protective equipment (PPE) properly
- c. Organize N95/FFP2 mask fitting sessions for all staff.
- d. Organize powered air purifying respirator (PAPR) training sessions.
- e. Put up posters/visual aids at strategic locations around the interventional suites to remind staff of proper IPC practices including how to perform hand hygiene, how to don and doff PPE, how to put on and remove PAPR.
- f. Assign a team to walkabout and conduct audits to ensure IPC measures are properly and consistently practised.
- g. Make available the IPC teaching material online.

### **3. COVID-19 SUSPECT CASE DEFINITIONS AND EXPANDED CASE DEFINITIONS**

- a. Create a case definition to pick up patients who might have COVID-19.
- b. A person is suspected of COVID-19 if the person has acute respiratory infection (ARI) and travel history to regions affected by COVID-19 within 14 days of onset of symptoms or the person has been in close contact with a known COVID-19 patient.
- c. Different institutions may have different thresholds in the case definitions as these are largely influenced by the degree of community viral spread. It is best to use the case definition already developed by your institution or local health authority to ensure alignment with the rest of the institution.
- d. Patients suspected of COVID-19 are handled in the same manner as known or confirmed COVID-19 cases. This is because large numbers of staff can get infected or quarantined if appropriate PPE was not donned during the care of suspected COVID-19 cases who subsequently test positive for the virus.
- e. Note that the discriminatory value of a travel history declines when there is transmission within the community and all patients with fever and respiratory symptoms may have to be considered as suspected COVID-19 cases.

### **4. PPE**

- a. Be familiar and align with your institution IPC team's recommendations for PPE requirements for the different clinical settings including ward rounds, clinic consults, surgery, endoscopy, diagnostic radiology and IR
- b. PPE recommendation for performing IR procedures on known COVID-19 patients and patients suspected of COVID-19 is: surgical cap, N95/FFP2 mask, eye protection (face shield or goggles), full length long-sleeved gown and gloves. For aerosol generating procedures (AGP), PAPR is recommended.
- c. For all other categories of patients, the PPE recommendation is stratified according to COVID-19 infection risk. For low risk patients ie. without COVID-19 risk factors, surgical mask is used. For moderate to high risk patients including patients with pneumonia and patients under quarantine for close contact with known COVID-19 patients, N95/FFP2 mask is recommended.
- d. There should also be a PPE guide for patients and visitors. For example all known COVID-19 patients, patients who are suspected of COVID-19, patients with ARI symptoms and all immunocompromised patients should wear surgical masks at all times if possible. Note that oxygen masks can be worn over surgical masks in these patients.

### **5. AEROSOL GENERATING PROCEDURES (AGPS)**

- a. The following procedures are considered Aerosol Generating Procedures (AGP):
  - i. Positive pressure ventilation (BIPAP, CPAP)
  - ii. Intubation and extubation
  - iii. Airway suctioning (if not closed suctioning system)
  - iv. Oral suctioning
  - v. Tracheostomy suctioning
  - vi. Chest physiotherapy
  - vii. Nebulizer treatment
  - viii. High flow nasal cannula therapy
  - ix. Naso-pharyngeal/oral pharyngeal swab collection
  - x. Sputum induction

- xi. Endoscopy (including bronchoscopy)
  - xii. Cardio-pulmonary resuscitation (CPR)
  - xiii. Manual ventilation (air-viva bagging) before intubation
  - xiv. High speed devices used for surgical procedures
  - xv. Dental procedures
  - xvi. Tracheostomy creation/insertion
  - xvii. Nasogastric tube insertion
  - xviii. Any other procedures via the nasal or oral routes
- b. Lung biopsy per se is not an AGP but some patients can have hemoptysis during the procedure which can incite violent coughing and aerosolization hence it may be considered an AGP. Other similar considerations are made for procedures like pleural drainage, lung ablation and bronchial artery embolization.
- c. PAPR is recommended when performing AGPs on suspected or confirmed COVID-19 patients. For all other patients, N95/FFP2 mask with eye protection is recommended.

## **6. SCREENING MEASURES**

- a. There should be active screening at all entry points of the institution, including temperature screening to pick up febrile persons and filling up of health declaration forms (according to institutional protocols) to detect potential COVID-19 cases.
- b. All persons coming into the institution including staff, patients and visitors need to be screened. Those who fit suspect case definitions will be isolated immediately.
- c. For all other persons who do not fit suspect case definitions, a clear and unambiguous disposition guide needs to be drawn up so that screening staff know what to do. The disposition guide can change as the outbreak evolves and infection control measures are ramped up.

## **7. VISITOR POLICY**

- a. There must be an institutional policy for visitors and IR must align with the prevailing policy. This would include which visitors are allowed entry, the number allowed at each time and the criteria for screening.
- b. Vendors and application specialists coming to support an IR case should be restricted as these personnel may cover multiple institutions and travel regularly.
- c. Most institutions will severely limit or completely exclude visitors during the pandemic.

## **8. DESIGNATED WARDS FOR COVID-19 MANAGEMENT**

- a. IR must be fully aware of the institution policy on where the various categories of patients are located.
- b. It is therefore important to have an updated list of bed/ward locations of the institution's bed management strategy so that there is no lapse in the appropriate infection prevention measures when patients come down to IR for procedures.

## **9. PATIENT SEGREGATION**

- a. Segregation of inpatients from outpatients is necessary to prevent cross infection
- b. Separation can occur by physical location or by time. Inpatient and outpatient cases are performed in different parts of larger departments, or at separate times (morning vs afternoon; alternate days) in smaller centers.

- c. Procedures are performed in the outpatient setting as far as possible as this reduces patient risk for potential nosocomial infection and also frees up inpatient beds.
- d. Facilities for COVID-19 cases should be pre-designated, preferably in locations with low footfall.

## **10. WORKLOAD REDUCTION**

- a. Ramping up of IPC measures is time consuming and labor intensive. The workload needs to be reduced to free up time and manpower to implement these measures properly
- b. Non urgent electives are postponed by 1 to 3 months (for example fibroid embolization, prostate artery embolization, varicocele embolization, fallopian tube recanalization, thyroid nodule fine needle aspiration, peripheral AVM embolization, leg angioplasty for claudicants) to reduce workload.
- c. Cancer related procedures (TACE, Y90, tumor ablations) including biopsies and port insertions and vascular interventions for critical limb ischemia should continue as far as possible although the wait time may have to be adjusted to allow for the reduced workload.
- d. It is advisable to assign senior personnel to vet requests and optimize procedure planning based on clinical needs/urgency and operational capability.

## **11. VETTING AND PRIORITIZATION OF IR PROCEDURES**

- a. All requests for IR procedures for suspected or confirmed COVID-19 patients must be carefully vetted and prioritized.
- b. If the procedure is non urgent, it is advisable to defer it till the patient has cleared COVID-19 from his or her swabs. If the procedure is urgent, then the patient is managed as per a confirmed COVID-19 case.
- c. For COVID-19 patients, an IR procedure is performed as a portable case by the patient's bedside in the isolation room if the procedure can be done solely under ultrasound guidance (for example pleural or ascitic drain insertions, PICC or central venous catheter insertions, abscess drainages). This is to avoid transferring the patient out of isolation.
- d. If the procedure requires fluoroscopic guidance in addition to ultrasound guidance, it is advisable to perform the procedure in a designated "hot" operating room using a mobile C-arm (for example percutaneous nephrostomy or percutaneous biliary drainage). If the C-arm has DSA capability, simple vascular interventional procedures can be performed in such a facility as well.
- e. If the procedure requires high end angiographic imaging (for example stroke thrombectomies, embolization procedures for gastrointestinal bleeding or trauma, thrombolysis for acute lower limb ischemia), the patient should be brought down to a predesignated IR suite. If capacity allows, one IR suite should be designated the COVID-19 IR suite and be used exclusively for COVID-19 cases with all other interventions performed in the other IR suites. In the COVID-19 IR suite, all sterile interventional inventory should be stored elsewhere with only equipment required for the specific case brought into the room.
  - i. The patient should be transferred along a pre-planned route directly into the predesignated IR suite. Crowd control by security is needed to ensure expedient transfer and to minimize cross transmission to bystanders.
  - ii. Similarly, the patient should be transferred directly back to the isolation ward from the IR suite and not recover in the recovery area.

## **12. DEDICATED WORKFLOWS TO PREVENT CROSS TRANSMISSION**

- a. Detailed workflows need to be drawn up for performing IR procedures on suspected and confirmed COVID-19 patients in all 3 settings (point 11c, 11d, 11e) described above, including a patient transfer plan along a predesignated route.
- b. The workflows need to be formulated together with internal (IRs, nurses and radiographers) as well as external stake holders including anesthesiologists, infectious disease specialists, the institutional IPC team, isolation ward staff, security, environmental services/hygiene department.
- c. Simulations and rehearsals are conducted so that everyone is familiar with their roles. After action reviews are performed to refine and improve the workflows.
- d. Every step of the workflows and processes is clearly written up and endorsed before implementation and dissemination to all staff.
- e. Before each case, the IR team huddles together and go through the written workflow for a final pre procedure briefing to optimize co-ordination and reduce errors.

## **13. STAFF SEGREGATION**

- a. Segregation of staff into smaller functional teams is a key strategy to prevent the entire service from being decimated due to HCW infection or quarantine.
- b. Staff segregation can be by physical or temporal segregation. The segregated teams should not meet at work and socially to reduce risk of HCW to HCW transmission.
- c. Temporal segregation requires 1 team to stay home and the other team to work which means the working staff strength is reduced by half. It can only work if the workload is dramatically reduced. Physical segregation remains the more plausible option.
- d. The segregated teams ideally need to have the capability to provide the full spectrum of the IR service. They need to comprise of doctors, nurses and radiographers of the appropriate mix of skill sets. The shift duration must be calibrated to avoid fatigue of the team members.
- e. For larger IR teams that cover multiple institutional sites, there should be restriction of staff movement between sites to prevent cross institutional transmission.
- f. For smaller practices, it would be difficult to implement team segregation and strict adherence to infection prevention measures as well as social distancing remain the only ways to protect the team from cross infecting each other.

## **14. SOCIAL DISTANCING**

- a. Social distancing is a key strategy in preventing HCW to HCW infection.
- b. All referrals to IR should be by phone if possible rather than through face-to- face consult. A single designated number provided for IR referrals during the working day and after hours works best, often set up to automatically forward to the relevant IR's individual mobile phone.
- c. All large scale events need to be postponed or cancelled
- d. Face-to-face meetings should be curtailed. If a meeting is necessary, participants should be masked and sit widely (at least 1.5 meters) apart.
- e. Tele or video conferencing technologies should be leveraged upon for meetings, including tumor boards and multi-disciplinary team discussions.
- f. Segregated teams should not meet each other at work or socially.

- g. Meal times are the most vulnerable as masks are removed. Staff should be encouraged to eat alone or in small groups within their respective teams, sitting far apart.
- h. As community spread of COVID-19 becomes more rampant, the likelihood of a HCW acquiring infection in the community may be higher than while at work. If social distancing measures are not implemented, a large group of HCW can potentially be infected or quarantined should a staff member acquires COVID-19.

## **15. STAFF LEAVE AND TRAVEL ADVISORY**

- a. This must be aligned with the prevailing institutional policy. For example, all non-essential leave is put on hold so that there is sufficient manpower available.
- b. This is necessary as infection prevention measures are labor intensive and there is the possibility of medical leave or staff quarantine which can reduce manpower dramatically at short notice.
- c. The policy for overseas travel and return to work must be aligned with the prevailing institutional policy.

## **16. STAFF SURVEILLANCE**

- a. Temperature monitoring of all staff twice a day is recommended. This serves as an early warning system to detect fever clusters among institutional staff which could indicate HCW disease transmission.
- b. All staff who are unwell should not come to work. The institutional policy for medical leave should be adhered to.
- c. The manpower status should be monitored daily.
- d. As N95/FPP2 mask is not recommended for pregnant women due to risk of hypoxia, pregnant staff should not be deployed to work in areas where N95/FPP2 masks may need to be worn.

## **17. CONTACT TRACING**

- a. The names and designation of all staff involved in every IR procedure should be recorded. Staff rosters should be updated daily and archived. This is to facilitate contact tracing in the event that a patient or staff member is diagnosed with COVID-19.
- b. The institutional policy for HCW quarantine in such a situation should be adhered to.

## **18. COMMUNICATIONS**

- a. Rapid dissemination of accurate information is critical as the situation can be fluid and infection prevention measures can escalate at short notice.
- b. There are several web-based communication and social media platforms that can be leveraged for rapid information sharing. Institutionally approved encrypted messaging platforms or emails should be used for sharing confidential information like patient specific data.
- c. Timely, transparent and accurate sharing of information in an evolving epidemic helps to alleviate anxiety and reduce confusion. Importantly, this keeps staff updated with the latest infection prevention measures and institutional directives.

## **19. STAFF MORALE, WELFARE AND PSYCHOLOGICAL SUPPORT SYSTEMS**

- a. Staff may be worried for personal and family safety, particularly with transmission to vulnerable family members. They may refuse to participate in procedures involving COVID-19 patients or demand routine use of "excessive PPE" beyond institutional recommendations which can alarm colleagues.

- b. On the other hand, there may be staff who seem excessively unconcerned about the risk and do not fully comply with recommended precautions thus placing themselves and co-workers at risk.
- c. IR leadership should monitor and engage with all staff during this crisis period.
- d. Peer support groups should be formed and access made easily available to staff.

## **20. LOGISTICS**

- a. PPE usage and available stocks need to be tracked
- b. It is important to stress at the institutional level that IR is given priority for PPE.

## **21. MANAGEMENT OF RESIDENTS AND FELLOWS**

- a. There should be an institutional policy on how residents and fellows are managed.
- b. If feasible, residency and fellowship teaching should continue using video conferencing platforms.
- c. The situation presents a rare opportunity for education in the management of a disease outbreak, while at the same time, safety of all members-in-training must be prioritized.

## **22. RESEARCH ACTIVITIES**

- a. Research activities are likely to be curtailed and IR should align with the prevailing institutional policies and directives.

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## References

1. Lau TN, Teo N, Tay KH, Chan LL, Wong D, E.H.Lim W, et al. Is your Interventional Radiology service ready for SARS?: The Singapore experience. *Cardiovasc Intervent Radiol*. 2003;26:421–7.
2. Gogna A, Tay KH, Tan BS. Severe acute respiratory syndrome: 11 Years later - A radiology perspective. *Am J Roentgenol*. 2014;203(4).
3. Wilder-Smith A, Chiew CJ, Lee VJ. Personal View Can we contain the COVID-19 outbreak with the same measures as for SARS ? *Lancet Infect Dis* [Internet]. 2020;3099(20). Available from: [http://dx.doi.org/10.1016/S1473-3099\(20\)30129-8](http://dx.doi.org/10.1016/S1473-3099(20)30129-8)
4. Zhuang KD, Tan BS, Tan BH, Too CW, Tay KH. Old Threat , New Enemy : Is Your Interventional Radiology Service Ready for the Coronavirus Disease. *Cardiovasc Intervent Radiol* [Internet]. 2020;10–1. Available from: <https://doi.org/10.1007/s00270-020-02440-6>
5. Cheng LTE, Chan LP, Tan BH, Chen RC, Tay KH, Ling ML, et al. Déjà Vu or Jamais Vu? How the Severe Acute Respiratory Syndrome Experience Influenced a Singapore Radiology Department’s Response to the Coronavirus Disease (COVID-19) Epidemic. *AJR Am J Roentgenol*. 2020;215(Feb):1–5.
6. Tsou IY, Goh JS, Kaw GJ, Chee TS. Severe acute respiratory syndrome: management and reconfiguration of a radiology department in an infectious disease situation. *Radiology*. 2003 Oct;229(1):21–6.
7. Mirza SK, Tragon TR, Fukui MB, Hartman MS, Hartman AL. Microbiology for radiologists: How to minimize infection transmission in the radiology department. *Radiographics*. 2015;35(4):1231–44.
8. Wong J, Goh QY, Tan Z, Lie SA, Tay YC, Ng SY, et al. Preparing for a COVID-19 pandemic: a review of operating room outbreak response measures in a large tertiary hospital in Singapore. *Can J Anesth Can d’anesthésie*. 2020 Mar 11;
9. Protecting Healthcare Personnel | HAI | CDC [Internet]. [cited 2020 Mar 14]. Available from: <https://www.cdc.gov/hai/prevent/ppe.html>
10. World Health Organisation five moments of hand hygiene [Internet]. [cited 2020 Mar 1]. Available from: <https://www.who.int/gpsc/5may/background/5moments/en/>
11. Report on Aerosol Generating Procedures (AGPs) by National Health Service (NHS) and Health protection Scotland [Internet]. 2019. Available from: [https://hpspubsrepo.blob.core.windows.net/hps-website/nss/2893/documents/1\\_tbp-lr-agp-v1.pdf](https://hpspubsrepo.blob.core.windows.net/hps-website/nss/2893/documents/1_tbp-lr-agp-v1.pdf)
12. Tran K, Cimon K, Severn M, Pessoa-Silva CL, Conly J. Aerosol generating procedures and risk of transmission of acute respiratory infections to healthcare workers: A systematic review. Vol. 7, *PLoS ONE*. Public Library of Science; 2012.
13. Roberts V. To PAPR or not to PAPR? Vol. 50, *Canadian Journal of Respiratory Therapy*. Canadian Society of Respiratory Therapists; 2014. p. 87–90.
14. Person B, Sy F, Holton K, Govert B, Liang A. Fear and stigma: the epidemic within the SARS outbreak. *Emerg Infect Dis*. 2004;10(2):358–63.
15. PE Chandy, MU Nasir, S Srinivasan, D Klass, S Nicolau, SB Babu. Interventional radiology and COVID-19: evidence-based measures to limit transmission. *Diagn Interv Radiol* 2020; epub 27 Mar 2020
16. Apoorva Gogna, Sundeep Punamiya, Anil Gopinathan, Farah Irani, Luke Toh et al. Preparing IR service for the COVID-19 pandemic – the Singapore Experience. *JVIR* 2020 (in press)
17. Chow Wei Too, David Wen, Ankur Patel, Jian Liu, Abdul Syafiq Abdul Rahman et al. Interventional Radiology procedures for COVID-19 patients: how we do it. *CVIR* 2020 (in press)