



Patient Care Practice Management and Education

Interventional radiology during the coronavirus disease 2019 pandemic: A tertiary care community hospital's initial experience

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ABSTRACT

Coronavirus disease 2019 (COVID-19) was declared a global pandemic by the World Health Organization on March 11, 2020, and has significantly impacted nearly every facet of medicine. Interventional radiology (IR), of course, has been no exception. This article highlights the experiences of a community-based IR department as they create a safe environment for patients and staff during the pandemic while continuing to provide high-quality care.

Keywords: Coronavirus disease 2019, Interventional radiology, Resident education, Telehealth, Wellness

INTRODUCTION

Coronavirus disease 2019 (COVID-19) was declared a global pandemic by the World Health Organization on March 11, 2020, after 118,000 people were diagnosed with the novel coronavirus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).^[1] The first reported case was detected in December 2019 in Wuhan City, China, with the first reported case in the United States on January 20, 2020, in Snohomish County, Washington.^[1] Since then, this novel coronavirus has continued to significantly impact the world with 16,396,954 cases and 651,902 deaths as of July 27, 2020.^[2] Research has suggested that the primary mode of person to person transmission is through respiratory droplets during close exposure to an infected individual when they speak, sneeze, or cough.^[3,4] COVID-19 symptoms can be fairly non-specific and range from none (asymptomatic) to severe pneumonia and death, but typically present with fever and mild respiratory symptoms.^[4] Early data have shown that the patients most at risk for severe disease and death are those above the age of 60, as well as comorbid conditions such as heart disease, hypertension, diabetes, chronic respiratory disease (including COPD and asthma), and cancer.^{[1],[4-6]} Almost every aspect of medicine has been significantly impacted by the COVID-19 pandemic, and interventional radiology (IR) has been no exception given that a large number of our patients fall into the above high-risk categories. This article will break down the impact of the pandemic on our patients, staff, trainees, and system, as well as look into the future outlook.

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DISCUSSION

Patient impact

As the number of COVID-19 cases climbed across the country, there has been a strong emphasis on social distancing with many states enacting stay at home orders to limit community spread.^[7,8] These practices have significantly impacted many aspects of daily life for our patients, including their ability to attend outpatient clinic appointments, schedule procedures, and enter the hospital.

Many professional organizations and medical societies have recommended the use of telehealth to facilitate safe routine medical care for patients during the pandemic.^[1,3,7,9] Telehealth and its related term telemedicine are generally viewed as the use of electronic communication to facilitate long-distance interactive clinical health care.^[8] Various telecommunication technologies are utilized, ranging from telephone calls, to online audio-visual platforms such as Google Hangouts Video, Skype, Zoom, Apple FaceTime, or WhatsApp video chat, to dedicated online patient portals.^[8] Given the urgency of the situation to expand telehealth during the pandemic, the Centers for Medicare and Medicaid Services (CMS) has temporarily broadened access to Medicare telehealth services.^[7] In addition, the U.S Department of Health and Human Services Office for civil rights will exercise discretion on HIPAA violation enforcement when using

non-public facing telecommunication technologies during the pandemic.^[8] The platforms covered by this typically use end-to-end encryption and include those listed above.

CMS separates telemedicine into three types of visits: Medicare Telehealth Visits, Virtual Check-ins, and E-Visits, as detailed in Figure 1.^[7] Our practice had not routinely used telehealth services before the pandemic. At the beginning of the transition, our staff began using telephone calls and Apple FaceTime for brief virtual check ins. We also took the opportunity to inform our patients about our systems dedicated patient portal and how it can be utilized for e-visits. These methods allowed us to check in on our patients health, answer any questions they might have regarding follow-ups and future procedures, as well as triage their needs in an attempt to keep them safe and avoid unnecessary trips to the doctor's office or hospital. For new patients and those requiring a more formal encounter, our institution created an official IR zoom account to conduct telehealth visits. The platforms share screen function was especially helpful for patient education and reviewing imaging. When implementing telehealth, it was especially important for us to work with billing and administration to create standard note templates that met CMS documentation requirements. Although telemedicine has allowed our patients to be safely evaluated while limiting community spread, the impact of social distancing also extends to the very procedures they are being evaluated for.

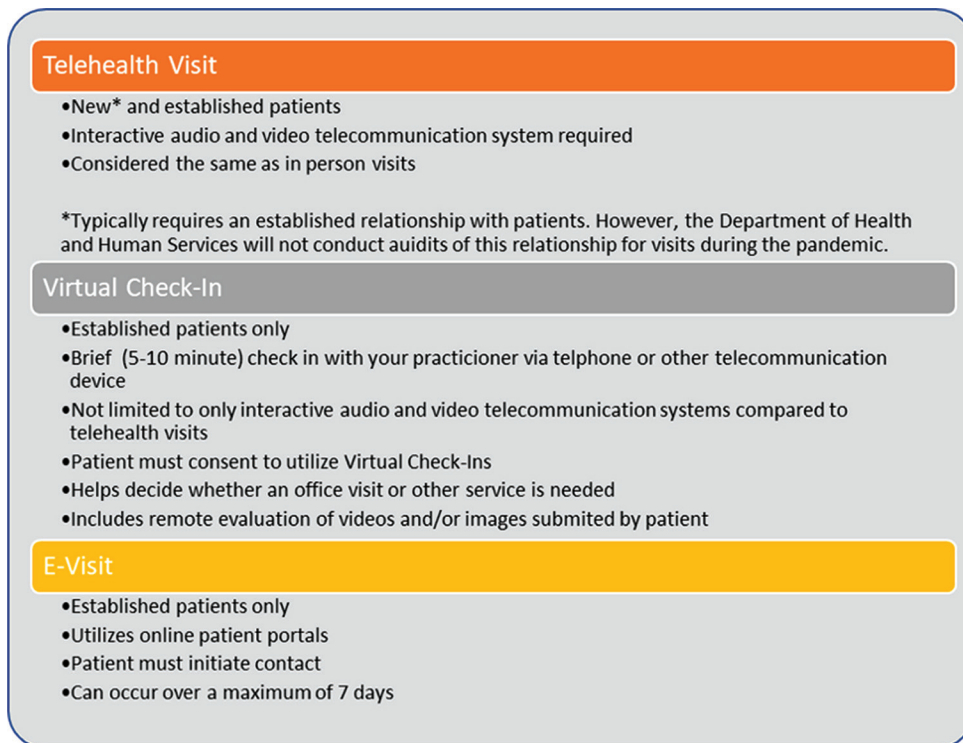


Figure 1: Overview of Medicare Telemedicine Services, compiled from Medicare Telemedicine Health Care Provider Fact Sheet. <https://www.cms.gov/newsroom/fact-sheets/medicare-telemedicine-health-care-providerfact-sheet>.

At the start of the pandemic SIR, in agreement with statements released by the CDC, CMS and many other organizations and radiologists recommended the cancellation/postponement of all elective procedures.^[5,10-12] These recommendations were further reinforced by mandates from state and local governments across the country in hopes of limiting community spread and preserving critical hospital resources. Given the broad scope of IR procedures, defining what procedures are elective and could be postponed depended on multiple factors including the type of procedure, the patient's comorbidities, the disease state, and expected outcomes.^[10,13] To facilitate case classification, SIR posted an IR – Procedure Acuity Scale that utilizes a three-tiered system.^[13] Tier 1 encompasses low acuity procedures that are typically outpatient and for not life-threatening illness and should be postponed. Tier 2 is intermediate acuity and should be postponed if possible, while Tier 3 is high acuity and should not be postponed.

Our IR department first created a list of cases for the schedulers that could be automatically cancelled or postponed. This included procedures such as routine tube changes for functioning nephrostomy and biliary tubes, as well as thyroid biopsies for incidental nodules. All other procedures were then reviewed on a case-by-case basis by the assigned interventional radiologist before being scheduled. Given the importance of many IR procedures for disease outcomes, we found that it was helpful to include both the ordering providers and the patients in a multidisciplinary discussion to make the best decision for that particular case outside of the specific procedure. This was especially true for our interventional oncology patients who are at increased risk of severe disease and death from the novel coronavirus but may not have the option of delay.^[1,5,6] These cancellations and postponements led to an approximately 30% reduction in case volume for our department. Patients whose procedures were postponed after a multidisciplinary discussion were sent back to their referring provider who was instructed to rerefer the patient once they both felt comfortable proceeding. We also kept a log of these cases, as well as those that were automatically postponed so that these patients could be contacted when outpatient procedures restarted. If a procedure was deemed urgent and scheduled, the patient would then undergo screening and augmented pre-procedure logistics.

In accordance with CDC and other professional organizations recommendations, our institution incorporated questions into the pre-procedure telephone encounter aimed at screening for high-risk exposure and symptoms of COVID-19.^[3,10] If the patient's answers were concerning, they were referred to one of the institution's screening clinics and the procedure was postponed pending further evaluation. If a patient passed the initial pre-procedure screening, they

were instructed on the day-of logistics that included hospital entrance, further screening, and visitor policy.

At our facility, all patients and their visitors were screened before entering the hospital. The screening incorporated both questions regarding high-risk COVID-19 exposure and symptoms, as well as temperature checks. In an effort to increase the success and efficiency of these screenings, outpatients and visitors were limited to only one hospital entrance. Only one visitor was allowed for an outpatient encounter and was also expected to serve as their ride if the patient was to receive sedation. Inpatient visitors were not allowed except for a few extenuating circumstances. All patients and visitors were requested to wear their own facemask on arrival to the facility. If the patient or visitor did not have a facemask, a surgical mask was provided.

System impact

As can be expected, significant changes had also been made at the system level due to the COVID-19 Pandemic. These changes were aimed at protecting the essential health-care professionals while still providing safe and quality care to the community. For the IR department, this included staff screening, exposure tracking, augmented staffing, personal protective equipment (PPE) protocol, and procedure logistics.

All staffs were required to enter through an official entrance where they were screened for elevated temperature and common symptoms of COVID-19. An infrared camera had also been utilized at the busiest entrance to aid the screening personnel in locating those with elevated body temperature during high traffic times such as shift change. Those staffs with concerning findings on screening were sent for further evaluation at the official screening clinic on campus. For those staffs that tested positive for COVID-19, described concerning symptoms, or were involved in a high-risk exposure, a dedicated team was created to advise them on their next steps and provides them with valuable resources. This team also tracked all patients and staffs who tested positive or was a person under investigation (PUI) and notified those who were exposed. To help decrease the number of those exposed in this scenario, the total number of staff had been decreased to essential personnel only across the system, including IR.

Our IR department optimized staffing by minimizing the amount of personnel in the procedure room, as suggested by SIR.^[9,10] In most cases, this includes an operator, a scrub technician, a circulator, and a nurse. The role of residents was also augmented and is detailed in its own section below. Additional signage was created for the control room doors to inform others that a procedure is in process and what PPE is required if entrance is necessary.^[9] Total staffing was also

minimized due to the postponement of elective cases. Of the five vascular and interventional suites, two were temporarily closed and the staffing was used to create a backup pool in case individuals became exposed or sick. Since the onset of the pandemic, there has been a total of five staff members exposed to COVID-19 while at work. At the time, asymptomatic testing was not available. These individuals quarantined for 14 days and none became symptomatic. We have also had two staffs become symptomatic and test positive for COVID-19 from exposures outside of work. In this instance, contact tracing determined, no other staffs were exposed to them at work to warrant further quarantine.

With the potential for exponential growth in COVID-19 cases, it became important to minimize the use of essential items, especially PPE given the reported shortages from major U.S. distributors.^[3] This goal was first aided by decreasing to essential staffing only. The next consensus step was to secure the supply of PPE and define clear instructions for PPE usage based on patient and procedure status.^[9,10] All health-care personnel were allotted one surgical mask every morning. They were instructed to wear them in all patient care areas, exchange them for a new one if theirs became soiled, and discard them at the end of shift. In addition, N95 respirator masks can be signed out from the department control desk for use on appropriate patients and procedures. These were expected to be utilized with reuse and/or extended use practices and turned in for decontamination under specific guidelines. A virtual refresher course was also provided to staff on how to properly don, doff, and dispose of PPE with additional links to related CDC resources.^[14]

N95 reuse describes the practice of using the same respirator for multiple patient encounters while storing in-between.^[15] The CDC recommends storing them in breathable containers such as a paper bag or hanging and clearly identifying them in a dedicated storage area with enough space to avoid cross-contamination.^[15,16] At our institution, we utilized a combination of takeout boxes and paper bags. To avoid touching the mask, the takeout box was held in front of one's face and both straps were lifted up and over the outside of the box, suspending the mask, as shown in Figure 2. The box with the mask was then slipped into a labeled bag. Extended use of N95s describes the practice of using the same respirator for multiple patient encounters without removing in-between.^[15] This is preferred over reuse because it involves less touching of the mask, decreasing the chance of contact transmission. When wearing an N95 during an encounter, it was also encouraged for staff to wear a surgical mask covering to prevent droplet spray contamination. Either at the end of the day, after an aerosol-generating procedure (AGP) in a COVID-19-positive patient or PUI, or once a mask became visibly soiled, the N95 was to be turned in for decontamination.



Figure 2: N95 mask suspended within plastic takeout box. Once the mask is suspended, the box is inserted into a labeled paper bag for storage when practicing N95 reuse.

Although typically a disposable product, there has been a need to explore decontamination of N95s given the public health emergency and worldwide shortages. Limited research has shown that on average ultraviolet germicidal irradiation, vaporous hydrogen peroxide and moist heat have been the most effective methods.^[16] Our facility utilized the vaporous hydrogen peroxide method for decontamination. When considering decontamination, it should be noted that the process may lead to decreased fit, filtration efficiency, and breathability due to effects on the filtering material, straps, or nose bridge.^[16]

During the pandemic, procedures were classified as AGPs versus non-AGPs. Patients were also classified as COVID-19-negative/non-suspected patients versus COVID-19 positive/PUI. An AGP either induces the patient to produce aerosols by irritating the airway causing coughing or mechanically creates and disperses aerosols.^[17] For IR, this includes advanced airways, lung biopsy or ablation, chest tube placement, thoracentesis, bronchial artery embolization, nasogastric (NG) or orogastric tube placement, or any procedure that requires NG tube placement such as percutaneous gastrostomy. AGPs for COVID-19-negative or not-suspected patients require an N95 respiratory in addition to standard operating room PPE. If the patient is COVID-19 positive or PUI, a powered air-purifying respirator (PAPR) is recommended. If one is not available, an N95 may be worn with goggles and a face shield. Non-AGPs in COVID-19 positive or PUI require at least an N95 with goggles and a face shield, although a PAPR is still used in most instances. Non-AGPs in COVID-19-negative or not-suspected patients only require the standard PPE.

All procedures for COVID-19-positive or PUI patients were reviewed for urgency and postponed if possible. If essential and a simple procedure such as a NG tube or PICC placement, it was performed at bedside. Procedures that necessitated a

trip to the department were performed in a dedicated room that was free of all non-essential equipment. For general anesthesia cases, the patient was preferably intubated and extubated in their own room to decrease aerosolization contamination. Strict guidelines were created for all intubations performed in the procedural suites regardless of COVID-19. Only essential airway personnel were allowed in the room during these airway procedures and proper PPE for AGPs had been required. This typically included one anesthetist and one nurse. Following intubation, there was a strict 10 min hold before other staffs could enter the room. This hold could be extended if there was a significant aerosolization from coughing. These guidelines also applied to extubations in the procedural suite, except the hold period were increased to a minimum of 15 min, as it is believed patients cough more than during intubation. Similar to these airway procedures, all NG tubes placed in the procedure suite also required a holding period of at least 10 min before other staffs may enter due to aerosolization of particles from coughing.

SIR strongly recommends negative pressure rooms for all COVID-19-positive patients or PUIs, especially when performing an AGP.^[9] However, only positive pressure procedure suites available in our IR department. To reduce the risk to our staff, we worked with engineering to determine how long it takes to exchange the air in the room and remove aerosolized infectious particles. With this information, a minimum of 15 min room downtime was enacted for after these patients exited the room, which could be lengthened if there was a suspected high level of contamination. After this period, as well as after all other procedures, the room and equipment were thoroughly disinfected. For procedures in COVID-19 positive of PUIs, UV light was additionally used. It is especially important to remember to disinfect the lead aprons as they are used for different patient encounters and sometimes by different staff members depending on availability.

Educational impact

Our institution sponsors both a diagnostic radiology residency and an early specialization in IR (ESIR) spot for one PGY-5 resident. Depending on skill level, residents typically either first assist, serve as primary operator with the attending scrubbed, or serve as primary operator with the attending supervising from the control room. During the initial stages of the pandemic, residents would only scrub for cases where they could serve as primary operator with the attending supervising from the control room to limit the amount of PPE used and potential exposures. In addition, only attendings performed procedures on COVID-19-positive patients or PUIs. Thankfully, this took place during the second half of the academic year and all residents on IR

had previously rotated through the service and were already trained on a variety of procedures.

Normally, residents received both individual and residency wide lectures from the IR attendings. To promote social distancing during the pandemic, in person IR lectures were moved to a virtual format using Cisco Webex. Attendings were able to lead both formal lectures and case-based conference utilizing the share screen function. A list of resources was also compiled for residents to self-study during the rotation to supplement the education that was lost due the pandemic. These resources included IR review book chapters, research papers, and online IR videos.

Wellness impact

One facet that should not be overlooked by a health-care system when responding to a pandemic is the wellness of essential personnel on the frontlines. Prior studies have shown a prevalence of adverse psychological reactions in health care workers during a pandemic.^[18] In the case of COVID-19, early data from China showed that over 70% of their frontline health care workers were experiencing psychological distress, with 50.4% reporting symptoms of depression, 44.6% anxiety, and 34% insomnia.^[18] Reported reasons for the mental burden included increasing number of cases and workload, inadequate PPE supply, mass media coverage, and not feeling adequately supported. It is important for institutions to be proactive in addressing the wellness of employees, whether through changes to system policies or distribution of resources that promote self-care.

Our institution prioritized mental well-being through system changes, complimentary services, and compiling high-impact resources. Essential health care workers were given additional breaks per shift during the pandemic. With the help of the Institutional Wellness Committee, they also created a “Zen Den” that they encouraged personnel to use during their break. This space was open 24/7 and provided a quiet respite for staff through individual meditation stations that included noise cancelling headphones and a peaceful atmosphere while still upholding social distancing recommendations. The committee was also instrumental in creating a COVID-19 Wellness Resources webpage. This included institution created resources, as well as links to those offered by national organizations and covered a variety of topics including coping with stress, meditation/relaxation, crisis management, and help for families and children. A few of the recommendations for health care workers included finding activities that bring one joy, staying socially connected, keeping a balanced diet, regular exercise, and adequate sleep.^{[1], [19]} The institution also hosted weekly town hall virtual meetings to address any concerns that may arise and stay connected with staff, as well as post-weekly COVID-19 updates on the dedicated webpage.

Outlook

As the COVID-19 pandemic continues to evolve, so must the institution policies. On May 1, 2020, the increased availability of PPE, expanded testing capabilities, and decreased threat of local case surge allowed for the resumption of non-urgent and elective procedures on a case-by-case basis at our institution, including within the IR department. When evaluating these cases, our department referred to the American College of Radiology's (ACR) recommendations that included continued pandemic safety measures and risk-benefit decision-making, as well as respecting local pandemic statistics, preparing for possible deengagement of non-urgent care if new local case peaks occur, and prioritizing the backlog of deferred and delayed cases.^[20] We found that their suggested tiered system especially helpful, where first previously delayed non-urgent time sensitive cases are performed, then elective cases, and lastly research cases.

To safely perform these non-urgent and elective procedures, all outpatients are now tested for COVID-19 within 5 days of their case in addition to the other pre-procedure screening protocols. It should also be noted that inpatients who are not COVID-19 positive or PUI are now allowed one visitor over the age of 12 that passes the previously described entrance screening. Rather than set fixed timetables and goals, our protocols have remained fluid with department leadership and hospital administration meeting regularly to monitor the current regional trends of the pandemic and are prepared to deengage these procedures and reimplement the stricter protocols or eventually further deescalate as warranted.

Restrictions on resident procedural operations also relaxed in May. From that point on residents could once again serve as first assist or as primary operator with the attending scrubbed. However, they are still restricted from performing a procedure in a COVID-19-positive patient or PUI. The virtual format for dedicated IR lectures also remains. Program leadership analyzed case logs for the academic year and determined that the decrease in case volume and cases performed as primary operator during the initial stages of the pandemic did not warrant an extension of residency for either the diagnostic or ESIR residents.

Given their success, it is also likely that some COVID-19-related changes will remain after the pandemic ends. The biggest example is the utilization of telehealth given its benefit. Although initially expanded due to the need for social distancing, clear benefits have been seen to promote continued usage. Although no official satisfaction survey has been conducted, we have had many patients, especially those with transportation issues, say how much they enjoy these types of visits and hope they remain an option post-pandemic. Even as our clinic and other physician offices reopen for in-person appointments, there will hopefully

remain a place for these visits. Wellness will also remain a pivotal part of the institutional policy moving forward to help staff transition toward a new normal and continue to address the routine challenges of working within health care. There are already plans for the expanded institutional wellness committee to continue providing resources and address the needs of the staff post-pandemic.

CONCLUSION

The COVID-19 Pandemic has demonstrated how fast a contagion can spread in the modern world. It has also brought to light the tremendous impact a pandemic can have on local medical institutions, as well as national and international infrastructure. Although our institution was not alone in facing this impact, it is important to forget the lessons that have been learned. They will not only aid in facing potential second spikes of COVID-19 but also help us prepare for any future pandemics that our world might face.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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