Impact of COVID-19 on a cardiac catheterization lab in the post-COVID-19 era

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Abstract

Introduction: *In May 2022, there was a worldwide shortage of contrast, including Iodine 270 mg/mL Visipaque/Iodixanol Injection. Due to the severe shortage, our catheterization lab had depleted its stores of Iodine 270 mg/mL Visipaque and could only acquire the Iodine 320 mg/mL Visipaque/Iodixanol Injection. Following the switch, a subset of our patients began experiencing similar severe and some life-threatening adverse reactions that could not be attributed to other causes.*

Methods: *A retrospective review of all adverse reactions from interventional procedures performed with the new contrast in September 2022 and October 2022 was collected. Patient demographics, allergies, comorbidities, medications used (including sedation), adverse reactions, and type of contrast formulation were recorded and analyzed.*

Results: *Seven cases were identified using the Iodine 320 mg/mL Visipaque/Iodixanol Injection contrast with dilution done as per procedure. No other change was adopted in either medication used or procedure. Three patients experienced post-procedural nausea and vomiting. One patient with no psychological history experienced brief but extreme agitation and aggression. Five patients required overnight admission due to severe postoperative shivering. Two of these patients required urgent warming measures, and one patient recorded a life-threatening temperature, requiring drastic cooling measures. In addition, one patient (patient 3) was readmitted to ICU with high-grade fever and chills. The common factor in all patients was the development of shivering a few hours after administration of the new contrast. All patients recovered after receiving medications to treat symptoms and hypertension.*

Conclusion: *Our review identified several adverse reaction cases over the course of a couple months immediately following the change in contrast used. Once the supply of the original Iodine 270 mg/mL Iodixanol Injection was restored, adverse reactions ceased, and none occurred in the following months. Disruptions in the supply chain imposed by COVID-19 forced departure from preferred methods and adaptation to maintain continuity of care. Even as the worst of the global pandemic is over, health care providers must continue to be proactive and adaptive to the long-term disruptions of health care caused by the ripple effects of COVID-19.*

Keywords: COVID-19, angiography, contrast agents, adverse reactions

Introduction

In 2020, the effects of coronavirus disease, commonly known as COVID-19, went beyond the direct virological sense and caused several disruptions to vital supply chains. COVID-19 began as a highly transmissible disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and presumably thought to have emerged from Wuhan, China, in 2019.[1] Since late 2019, COVID-19 has presented innumerable challenges not only in the way health care is considered and delivered, but equally important, in the way such care is procured. The reductions in

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workforce, the unavailability of hospital beds, and shortages in operative agents/devices halted all but mandatory procedures. With the discontinuation of elective operations, disease progression increased during the COVID-19 era as patients who needed intervention, yet did not meet mandatory guidelines, were put off indefinitely. Now, in the post-COVID-19 period when elective procedures are once again available, there is a surplus of patients to treat, most with disease states more advanced than before. In an attempt to meet the needs of these patients in the face of persisting COVID-19 challenges, such as supply chain disruptions, many common reagents and tools used in medicine were replaced with alternatives.

In May 2022, a COVID-19 related lockdown in Shanghai, China, temporarily resulted in the shutdown of a major GE Healthcare production factory, halting production of iohexol, a major component in iodinated contrast media (ICM).[2–3] The shutdown led to a shortage of 270 mg/mL Visipaque, and it was recommended by the American College of Radiology (ACR) Committee on Drugs and Contrast Policy to mitigate risks caused by the shortage through usage of alternative brand ICMs.[4] In order to maintain continuity of care, a decision was made to transition to the use of 320 mg/mL Visipaque. However, severe adverse reactions were observed in some patients almost immediately after the switch in contrast. This study is one example of the post-COVID-19 impact on disease progression and adverse outcomes which took place in a tertiary care hospital in West Texas.

Methods

A retrospective chart review was conducted on all patients with adverse reactions from interventional procedures performed after the new contrast was adopted in September 2022 and October 2022. Patient demographics, allergies, comorbidities, medications used (including sedation), adverse reactions, and type of contrast formulation were recorded and analyzed. Severity of reactions were defined at the study level using Brighton Collaboration criteria.[5] Severe reactions qualified as a level 2 or 3 classification while all other reactions classified as a level 1 were mild.

Case details

COVID-19 presented some clinical challenges in the catheterization lab. The following seven cases had severe contrast reactions to Iodine 320 mg/mL Visipaque, a contrast alternative used due to the shortage of the original Iodine 270 mg/mL Visipaque secondary to shortages from COVID-19 supply chain disruptions. Patients 3 and 6 were classified as severe reactions, while all other patients were classified as mild reactions.

Patient 1: A 63-year-old patient presented to the catheterization lab for peripheral angiography. The patient had a known peanut allergy but no adverse reaction to contrast during his past procedures. Peripheral angiography was performed with no complications. Thirty minutes after the procedure, he developed sudden hypertensive distress with a pulse rate of 141 beats per minute, a respiratory rate of 41 breaths per minute, and a blood pressure of 211/154 mmHg. In addition, he had extreme shivering unrelieved by warm blankets. The patient was monitored and treated with morphine, antihypertensive medications, and furosemide which led to rapid improvements in his blood pressure and heart rate.

Patient 2: A 58-year-old patient with no known history of allergies presented to the catheterization lab for a chest angiogram. Angiography was performed with no complications. Ten minutes after the procedure, the patient experienced hypertensive episodes along with extreme nausea and vomiting. The patient's blood pressure increased to 160/96 mmHg, and he had a pulse of 109 beats per minute and temperature of 102°F. After treatment with ondansetron (4 mg), promethazine (6.25 mg), and corticosteroids, the symptoms gradually subsided.

Patient 3: A 71-year-old patient with no known prior allergies presented with severe peripheral arterial disease for peripheral angiography. Peripheral angiography was performed with no complications. Less than 1-hour post procedure, the patient reported chills despite mild elevation in temperature. The patient progressed into a sudden hypertensive distress along with tachycardia and development of a fever. He had a blood pressure of 160/100 mmHg, a pulse rate of

110 beats per minute, and a temperature of 106.1°F. The patient was immediately treated with antihypertensive medications, methylprednisolone (125 mg), intravenous (IV) acetaminophen, diphenhydramine, and chilled IV saline. Two hours after the onset of symptoms and treatment, he began to stabilize.

Patient 4: A 61-year-old patient with no known allergies presented for a peripheral angiography that was performed with no complications. An hour post procedure, the patient started reporting shivering and nausea. In addition, he developed extreme hypertension episodes with blood pressure reaching as high as 176/102 mmHg and a mild fever of 99.8°F. Hydralazine, ondansetron (4 mg), and methylprednisolone (125 mg) were administered, and he was covered with blankets. The patient was stable and afebrile four hours after treatment.

Patient 5: A 57-year-old patient with a documented allergy to metoprolol but no prior reaction to contrast presented for left heart catheterization and a peripheral angiogram. These procedures were performed with no complications. While in the recovery unit, the patient began developing severe shivering associated with postoperative nausea and vomiting episodes. He was given warming blankets to reduce the shivering and 4 mg of ondansetron for his nausea. Two hours after the medical treatment, the patient's condition improved dramatically, and he was discharged home.

Patient 6: A 64-year-old patient with a known allergy to amitriptyline and no psychiatric history presented to our catheterization lab for a coronary angiography. Two hours post procedure, she became confused and combative in the cardiac anesthesia recovery unit. Ten mg of haloperidol with IV fluids was administered with no effect. Due to continued combative episodes, violent restraints were applied, and she was admitted for further evaluation. Overnight, the patient was given additional lorazepam (2 mg), methylprednisolone (180 mg), and olanzapine (10 mg). She was kept as an inpatient for an additional two nights for agitation and combative behavior, most likely induced by contrast-related delirium reaction. On the third morning, the patient was discharged in stable condition.

Patient 7: A 66-year-old patient with no known allergy presented for a peripheral angiogram. The procedure was performed with no complications, and the patient was discharged. Later the same evening, she presented to the emergency room with a high-grade fever of 102°F. The patient reported the onset of fever shortly after being discharged with associated chills, generalized fatigue, severe left lower extremity pain, and tenderness. Cultures were negative, she had no signs of infection, and she was treated with acetaminophen and evaluated for anaphylaxis associated with a contrast-induced reaction. Patient recovered the following day and was discharged home.

These seven cases are some of the examples of the challenges that COVID-19 created for the health care system due to its strict health care protocol restrictions and backlog of supply issues. These seven cases demonstrate the worsening progression of patients who could not have delayed their care and unfortunately endured adverse effects of contrast shortage imposed by COVID-19.

Discussion

Life is full of unexpected challenges, and COVID-19 proved to be one of the toughest stressors of the healthcare system. New policies, shutdowns, and shortages disrupted and sometimes halted crucial elements of this system and undoubtedly reduced needed care for patients. Health care professionals and the support staff needed to manage this complex system all had to develop new techniques and methods to adapt to the changes imposed in the COVID-19 era.

Shortages and new policies outlining what care could be given forced a departure from previous methods and adaptation to maintain the continuity of care. Some challenges that were imposed were a shortage of beds, medical devices, and contrast that was crucial for operations. Catheterization personnel improvised by practicing non-traditional operative methods that reduced the necessity for post procedure hospitalization. Unfortunately, contrast that was supplemented for the previously used contrast brought on unprecedented adverse reactions in a series of patients.

Table 1. Classification of Contrast Reactions

Mild	Moderate	Severe
Self-limited without any evidence of progression	Not immediately life-threatening, but requires treatment	Life-threatening
Nausea, vomiting, mild abdominal discomfort, itching and pruritus, cough, headache, sweat, rash, anxiety, chills, flushing	Tachycardia, bradycardia, hypertension, hypotension, dyspnea, pronounced cutaneous reaction, laryngeal edema, pulmonary edema	Convulsion, profound hypotension, severe or progressive laryngeal edema, arrhythmias, cardiopulmonary arrest

Adapted from the American College of Radiology (ACR) Manual on Contrast Media-Version 9, 2013.

The pandemic has taught that preparation for massive stressors on the health care system is crucial to ensure its resiliency and ability to perform. There must be a surplus of supplies in hospitals to outlast or at least substantially prolong operations in the face of severe shortages.

Table 1, adapted from the ACR Manual on Contrast Media, clearly shows the classification of contrast allergic reactions into mild, moderate and severe based on symptoms. The majority of our patients experienced mild and moderate allergic reactions involving chills, fever, nausea, vomiting, tachycardia and hypertension.

Conclusion

As the United States emerges from the COVID-19 pandemic, the health care system should reflect on and analyze responses to COVID-19 and the damages incurred from COVID-19. Restrictions placed during the pandemic, including physical distancing mandates and shelter-in place regulations, disrupted many supply chain manufacturing and distribution centers. One such supply disruption involved iodinated contrast media that led to alternatives that produced severe adverse reactions in some patients. It is without question that COVID-19 has illuminated glaring flaws in the health care system, and this study illustrates the importance of remaining mindful when using all alternative strategies.

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References

1. Shereen MA, Khan S, Kazmi A, et al. COVID-19 infection: Emergence, transmission, and characteristics of human coronaviruses. *Journal of Advanced Research* 2020;24:91–98. https://doi.org/10.1016/j.jare.2020.03.005.
2. Yan Z, Goh B, et al. Shanghai factories scramble to reopen as COVID-19 lockdown lingers. *Reuters*. Accessed November 2022. https://www.reuters.com/world/china/shanghai-factories-scramble-reopen-COVID-19-lockdown-linger s-2022-04-29/
3. Rowland C. COVID-19 shutdowns in China are delaying medical scans in the U.S. *Washington Post*. Accessed November 2022. https://www.washingtonpost.com/business/2022/05/11/medical-scans-dye-shortage/

4. American College of Radiology. Statement from the ACR Committee on Drugs and Contrast Media. *American College of Radiology Website*. Accessed November 2022. https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Contrast-Media-Shortage.

5. Rüggeberg JU, Gold MS, Bayas JM, et al. Brighton Collaboration Anaphylaxis Working Group. Anaphylaxis: case definition and guidelines for data collection, analysis, and presentation of immunization safety data. *Vaccine* 2007;25(31): 5675–5684. doi: 10.1016/j.vaccine.2007.02.064