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Research

Investigating the initial effect of COVID-19 on the functioning of outpatient diagnostic imaging facilities

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ABSTRACT

Introduction: As a result of the COVID-19 pandemic, outpatient diagnostic imaging (DI) facilities experienced decreased operations and even unprecedented closures. The purpose of this study was to examine the impact of COVID-19 on the practices of DI clinics, and investigate the reasons for the change in their operations during the initial period of the pandemic starting in mid-March 2020.

Materials and methods: A questionnaire was created and distributed to the managers of eighteen outpatient DI clinics in London, Hamilton, and Halton, Ontario, Canada. The managers indicated whether their clinics had closed or decreased operations, the reasons for closure, and the types of imaging examinations conducted in the initial period of the COVID-19 pandemic.

Results: Fifty percent of the DI clinics surveyed (9/18) closed as a result of COVID-19, and those that remained open had decreased hours of operation. The clinics that closed indicated decreased referrals as the primary reason for closure, followed by staff shortage, concerns for safety, and suspension of elective imaging. Chest radiography and obstetric ultrasound were the most commonly conducted examinations. Clinics that were in close geographical proximity were able to redistribute imaging examinations amongst themselves. All DI clinics had suspended BMD examinations and elective breast screening, and some transitioned to booked appointments only.

Conclusion: Many DI clinics needed to close or decrease operations as a result of COVID-19, a phenomenon that is unprecedented in radiological practice. The results of this study can assist outpatient DI clinics in preparing for subsequent waves of COVID-19, future pandemics, and other periods of crisis.

RÉSUMÉ

Introduction : En raison de la pandémie de COVID-19, les installations d'imagerie diagnostique pour les patients ambulatoires sont confrontées à une baisse de leurs activités et même à des fermetures. Cette étude vise à examiner l'impact de la COVID-19 sur la pratique des cliniques d'ID, et à examiner les raisons du changement dans leurs activités durant la période initiale de la pandémie, qui a débuté à la mi-mars 2020.

Matériel et méthodologie : un questionnaire a été créé et envoyé aux gestionnaires de 18 cliniques d'imagerie de London, Hamilton et Halton, en Ontario, au Canada. Les gestionnaires ont indiqué si leur clinique avait fermé ses portes ou réduit ses activités, les motifs de la fermeture, et le type d'examens d'imagerie effectués durant la période initiale de la pandémie de COVID-19.

Résultats : Cinquante pour cent des cliniques d'imagerie sondées (9/18) ont fermé leurs portes en raison de la COVID-19, et celles qui sont restées ouvertes ont réduit leurs heures d'ouverture. Les cliniques qui ont fermé donnent la diminution des aiguillages comme principale motif de fermeture, suivi par le manque de personnel, les préoccupations relatives à la sécurité et la suspension de l'imagerie élective. Les radiographies de la poitrine et les échographies obstétriques ont été les deux types d'examens les plus fréquemment effectués. Les cliniques en étroite proximité géographique ont pu se partager les examens d'imagerie. Toutes les cliniques d'imagerie ont suspendu les examens de DMO et de mammographie de dépistage élective, et certaines sont passés à une formule sur rendez-vous seulement.

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Ethical approval: The study was reviewed by the university research ethics board in May 2020 with oversight waived for this project.

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Conclusion : Plusieurs cliniques d'imagerie diagnostique ont dû fermer ou diminuer leurs activités en raison de la COVID-19, un phénomène sans précédent dans la pratique radiologique. Les résultats de cette étude peuvent aider les cliniques de radiologie pour patients ambulatoires à se préparer aux prochaines vagues de COVID-19, aux pandémies futures et à d'autres périodes de crise.

Keywords: COVID-19; Diagnostic imaging; Impact

Introduction

The COVID-19 pandemic, which began in mid-March 2020, impacted the operations of many healthcare institutions. Decreased patient volumes were reported across ambulatory practices,[1] many non-urgent consultations were rescheduled,[2–5] and numerous physician practices transitioned to conducting online telemedicine consultations to prevent the spread of COVID-19.[6] Patient imaging was also impacted, as there was a significant decrease in imaging volumes due to factors such as governmental quarantine orders, rescheduling of elective imaging, and patient hesitancy in visiting healthcare settings due to fear of exposure to COVID-19.[3–5,7] Naiditch et al. examined the effect of the pandemic on various imaging modalities and found that the greatest decline in imaging volume was for mammography examinations (94% decrease), and the least decrease for radiography imaging (22%).[3]

Outpatient diagnostic imaging (DI) settings were particularly affected by the pandemic in comparison to other imaging locations, experiencing as much as approximately an 88% decrease in imaging volumes relative to 2019.[3] As examined in this study, many outpatient DI clinics decreased operations or closed down entirely as a result of the pandemic.

While previous literature examines the decreased patient volumes and operations of hospitals during prior disease outbreaks, such as SARS-CoV-1,[8–16] there is no recorded instance of DI clinics closing during the prior outbreaks, making this a potentially unprecedented phenomenon. Thus, the objective of this study was to investigate the initial impact of the COVID-19 pandemic, starting in mid-March 2020, on the functioning of outpatient DI clinics by examining the reasons for the change in their operations, including closures, and to gain insight into their practice during the initial period of the outbreak.

Materials and Methods

Eighteen public outpatient DI clinics in the metropolitan areas of London, Hamilton, and the Halton region in Ontario, Canada were examined. Five of the imaging clinics surveyed were in London, and 13 of the imaging clinics were in the Hamilton and Halton areas. DI clinics in the London area were associated with one imaging company (these clinics are henceforth referred to as Group A), while clinics in the Halton and Hamilton areas were associated with another company (these clinics are henceforth referred to as Group B). The surveyed DI clinics performed radiography, ultrasound (US), mammography, and Bone Mineral Density (BMD) imaging examinations, which is standard practice for public outpatient DI clinics in Canada. The study was reviewed by the university research ethics board in May 2020 with oversight waived for this project.

A questionnaire was created and sent to DI clinic managers in the London, Halton, and Hamilton areas in May 2020 (Fig. 1). The respondents were required to indicate:

- Whether a DI clinic was currently open in May 2020
- Whether the clinic had decreased its hours of operation or shut down entirely since mid-March 2020
- If a clinic had closed, which factors influenced the decision to close it (staff shortage, decreased number of referrals, concerns regarding a safe working environment, PPE shortage, or other reasons)
- Which imaging modality was being used most frequently for cases in the clinic from mid-March to the end of April (X-ray, US, or BMD)
- The most common case being imaged in the clinic from mid-March to the end of April

	Question	Yes	No	Cannot answer
1	Is your clinic currently open and functioning (in May 2020)?			
2	Has your clinic **closed** as a result of COVID-19 in March 2020?			
OR	Has your clinic **decreased its hours or days** of operation as a result of COVID-19 in March 2020?			
3	If your clinic has **closed**, which of the following factors influenced your decision to close the clinic?			
	Staff shortage			
	Decreased number of referrals			
	Concerns regarding safe working environment			
	PPE shortage			
	Other reasons:			
4	Which imaging modality was being used **most frequently** for cases in your clinic in mid-March - April? (Please select one)			
	X-ray			
	US			
	BMD			
5	What was the most common case being imaged in your clinic in mid-March - April? (please specify)			

Fig. 1. Questionnaire for investigating the initial effect of the COVID-19 pandemic on the functioning of diagnostic imaging facilities.

Table 1
Summary of questionnaire responses by DI clinic managers in London, Hamilton, and Halton, Ontario.

	Clinics in Group A (N = 5)	Clinics in Group B (N = 13)	Total Clinics
Open and functioning in May 2020	4	5	9
Closed as a result of COVID-19 in March 2020	1	8	9
Decreased hours or days of operation as a result of COVID-19 in March 2020	4	5	9
Closed due to:			
Staff shortage	0	8	8
Decreased number of referrals	1	8	9
Concerns regarding safe working environment	0	8	8
PPE shortage	0	0	0
Other reasons[a]	1	0	1
Most frequently used imaging modality for cases in mid-March and April:			
X-ray[b]	3	0	3
US[c]	1	5	6

[a] Suspension of elective breast screening and BMD.
[b] Chest radiography was the most common X-ray examination across all locations.
[c] Obstetric US was the most common US examination across all locations.

The results of the questionnaires were analyzed to examine the relations between the clinics that had closed or remained open, and their operational hours, reasons for closure, and the imaging investigations conducted. Additionally, the locations of the clinics were identified and analyzed.

Results

The results of the completed questionnaires for the 18 DI clinics are summarized in Table 1. Of the 18 DI clinics fully operational before the COVID-19 pandemic, 9 clinics had remained open and 9 had closed in mid-March 2020 as a result of the pandemic. All DI clinics that had remained open had decreased hours of operation. Of the 5 DI clinics surveyed in Group A, 1 clinic had closed. Of the 13 DI clinics in Group B, 8 clinics had closed.

In Group A, the one DI clinic that had closed indicated that the closure was due to a decreased number of referrals, and the suspension of elective breast screening (OBSP in Ontario) and BMD examinations. The indicated causes of the closure of all 8 DI clinics in Group B were decreased referrals, concerns regarding a safe working environment, and staff shortage; issues with child care was indicated as a contributing factor to the staff shortage. Thus, all 9 DI clinics in Groups A and B that had closed indicated a decreased number of referrals as a reason for closure.

The clinic manager for Group A indicated that the 4 DI clinics which remained operational in Group A had redistributed their workload. One clinic suspended radiographic imaging and performed only ultrasound (US) examinations, with obstetric examinations being the most common. The other three DI clinics in Group A performed primarily radiographic examinations and minimal US examinations, with chest radiography being the most common examination in these clinics.

All 5 clinics which remained operational in Group B performed both radiographic and US examinations. US was the most frequently used imaging modality in these clinics, with obstetric US being the most common examination. Clinics in Group B also suspended elective breast screening and BMD examinations.

Discussion

While there are reports of reduced patient volumes for radiological imaging at hospitals during the SARS-CoV-1 outbreak,[17,18] there is limited literature on the effect of prior widespread diseases on outpatient DI facilities. During the COVID-19 pandemic, decreases in patient imaging volumes and the rescheduling of elective imaging in outpatient settings were reported[3,5,7]; however, at the time of the planning and execution of this study, there was no available literature detailing the unprecedented closure of outpatient DI clinics as a result of COVID-19. After our manuscript was submitted for publication and was in the process of acceptance, Lee et al. mentioned the closure of DI facilities and redistribution of workflow between outpatient clinics and hospitals as a result of COVID-19.[19] The initial effect of COVID-19 on the functioning of outpatient DI clinics was assessed in detail in our present study.

The COVID-19 pandemic was declared in mid-March 2020, resulting in half of the imaging clinics surveyed in this study to cease operations. All 9 clinics that closed indicated a decreased number of referrals as a reason for closure. This correlates to reports of decreased patient volumes for imaging examinations during the COVID-19 pandemic,[2–5,7] as imaging is not the standard screening or diagnostic tool for COVID-19[20] and many elective imaging examinations had been postponed.[2–5]

Eight of the clinics that had closed also indicated staff shortage as a reason for closure, citing issues with childcare as a contributing factor to the shortage. This was likely due to the closure of schools and child-care centres as a result of

the provincial Ontario shut-down, forcing parents to take time off work and stay at home to care for their children. The same eight clinics that closed additionally indicated concerns for safety as a reason for closure. While the exact concerns were not specified, it can be hypothesized that initially limited experience dealing with potential COVID-19 patients can be among the contributing factors to the concerns for safety, as many institutions (healthcare and otherwise) were required to rapidly change their methods of operation with little preparation as a result of the pandemic.

Interestingly, none of the clinics surveyed indicated a shortage of PPE as a reason for closure, despite the fact that many medical institutions were experiencing severe disruptions in PPE supply at the time.[21] It may be that closing some DI clinics allowed the managing companies to redistribute PPE resources to the clinics that did remain operational. Additionally, the closure of some clinics possibly allowed for the concentration of the remaining available staff resources in the clinics that had remained open.

All the imaging clinics that had remained open had decreased hours of operation. Open clinics in Group A all transitioned to booked appointments and cancelled walk-ins. The reduced clinic hours, combined with the increased time required for safety precautions such as disinfection between patient encounters,[20,22] suggest that even clinics which had remained operational faced decreased referrals as compared to the pre-pandemic period.

In the clinics which had remained operational, the most common examinations were chest radiography and obstetric ultrasound. The prevalence of chest radiography studies correlates with the reports that radiography examinations experienced the least decrease in patient imaging volume during COVID-19,[3] and this may be due to several reasons. The first is that chest radiography is one of the most commonly conducted examinations in regular DI clinic practice,[23] and it is possible that this remained the case during the pandemic. The second reason may be that many patients and referring physicians were concerned for COVID-19-related findings and wished to investigate them. The prevalence of obstetric US cases can likely be explained by the fact that, for the patients and referring physicians, the importance of tracking the course of pregnancy and its outcome outweighed the risks of the patient contracting COVID-19.

In Group A, most US examinations (primarily obstetric US) were conducted in one location, while all the other locations focused on conducting X-ray examinations. Upon examination of the distances between the clinics, it may be suggested that the close geographical proximity between the DI clinics allowed them to effectively redistribute referred cases (in Group A, the distance between most clinics was approximately 5-9 km).

The study is limited in that it only assessed clinics in a limited geographical area, and it is possible that investigating the operations of DI clinics over a greater area (i.e., the whole province of Ontario) would have provided different statistical results. The study also did not investigate the exact dates when DI clinics reopened following the start of the pandemic. Investigating the aforementioned aspects would have been beyond the scope of the study, which was intended to specifically assess the initial impact of the pandemic on the general everyday functioning of DI clinics and the possible reasons for their closure. Finally, the study relied on self-reported data from clinic managers, and the results may have been affected by the managers' ability to recall information; however, this is unlikely as the data on the operations of clinics was collected at a time very close to the period being investigated (within weeks).

Conclusion

The COVID-19 pandemic in March 2020 had an unprecedented impact on outpatient DI clinics. Multiple DI clinics that were examined in the London, Halton, and Hamilton in Ontario, Canada had closed as a result of COVID-19, citing decreased referrals as the primary cause, followed by staff shortage, concerns for safety, and suspension of elective imaging. All the clinics that remained open had decreased hours of operation and some transitioned solely to booked appointments. Some of the clinics that had remained open were able to redistribute their workload amongst themselves; this was likely assisted by their close geographic proximity to each other. Chest radiography and obstetric US constituted the most frequently imaged cases in the DI clinics. Ultimately, the results of this study provide a greater understanding of the impact of the COVID-19 pandemic on diagnostic imaging practices, and may assist outpatient DI clinics in preparing for potential subsequent waves of COVID-19, future pandemics, and other periods of crisis.

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