

Home mobile radiography service in the COVID-19 era

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Abstract. – Demographic changes in the Western world linked to the increase in the elderly population, life expectancy and above all cancer patients and chronically ill patients, often entrusted to home care or in healthcare residences, highlight an exponential increase in requests for diagnostic tests at home. Conventional radiographic examinations, such as thoracic, musculoskeletal and abdominal images are the most requested and are important first level diagnostic tests. To date and, in particular, in times of COVID-19 emergency, these patients need to be transferred to the hospital to perform radiological examinations which involve an increase in costs for the health system and an increased risk for the health of these patients, already often debilitated and immunocompromised. This article discussed the benefits of taking conventional chest x-rays directly at the patient's home.

Key Words:

Home mobile radiography, COVID-19, Oncology.

Introduction

A large outbreak of a novel coronavirus infection occurred in Wuhan, Hubei Province, China, last December 2019^{1,2}. The disease caused by the virus, called coronavirus disease (COVID-19) by the World Health Organization, can be spread through human-to-human contact.

The COVID-19 diagnosis is made by the Reverse Transcription Real-Time Fluorescence Polymerase Chain Reaction (RT-PCR) test. The RT-PCR test can be executed on nasopharyngeal and/or oropharyngeal swabs, sputum, blood samples, body fluids, stool samples, and broncho-alveolar lavage fluid using qualitative and quantitative approaches³.

In the recent literature^{4,5}, it is demonstrated that qualitative RT-PCR test has low sensitivity

due to the high false negatives number (about 20%). Moreover, Ferrari et al⁵ have reported a high false positive rate of RT-PCR test with a sensitivity of 60-70%. In any case, the RT-PCR test is the most reliable test for COVID-19 infection diagnosis⁶.

Several researchers⁷⁻¹⁰ in literature have demonstrated the efficiency of imaging methods, including chest X-ray and chest computed tomography (CT), in the management of COVID-19 disease. Chest X-ray and CT imaging could be used to evaluate the pulmonary involvement by an abnormality (ground glass, consolidations, etc.) connected to the COVID-19 infection but also to another pulmonary infections¹¹⁻¹⁵. Chest X-ray scan, although not offering highly specific findings, gives a first patients overview and could be useful to perform the differential diagnosis respect to other pulmonary^{16,17}. Typical radiological findings on chest X-ray was patchy or diffuse asymmetric airspace opacities^{16,17}. Bandirali et al¹⁶ demonstrated that in 100/170 chest X-ray there were pulmonary abnormalities highly suspicious for COVID-19 pneumonia. Therefore, chest X-ray could be used as a first radiological modality to assess parenchymal pulmonary involvement in suspected patients for COVID-19.

However, in a pandemic scenario should be considered the need to reduce, as much as possible, hospital patient's admission with suspected or confirmed COVID-19 infection when they could receive care at home.

The use of mobile X-ray equipment could represent a safe approach, enabling imaging of suspected or confirmed COVID-19 patients, performing chest X-ray examinations in their house reducing social contacts¹⁷.

Zanardo et al¹⁸ reported a potential sequence of events going to patient's home to chest X-ray, nasopharyngeal swab (and, if needed, also a

blood sample), with fast radiologist tele-reporting, and resulting patient management approach. The management approach consist of the following steps:

1. Suspected COVID-19 patient is detected by any telephone service or doctor requested of a visit in the presence of symptoms or contact with a confirmed COVID-19 case.
2. A team composed by a radiographer and a nurse go to patient's home to perform chest X-ray using a mobile equipment, nasopharyngeal swab (and, if needed, also a blood sample).
3. Clinical information and chest X-ray images are sent to a radiology department by means of a protected web-based tool.
4. A radiologist reports the examination.
5. The report is sent to the general practitioner or any other clinician for the best decision-making.
6. The team, being still at patient's home, can explain to patients and their family what to do and, if necessary, to start applying home isolation.

Zanardo et al¹⁸ concluded that their approach brings healthcare to patient's home, reducing the risk of infected subjects referring to family doctors' office or emergency departments¹⁸.

The purpose of this work is to report our experience of the Home Oncology X-ray Unit Group in the COVID-19 pandemic era. Home Oncology X-ray Unit Group strategies included reviewing of procedural indications, development of tactics to minimize cross contamination, appropriate usage of personal protection equipment according to the type of procedure.

Our Experience

During the COVID-19 pandemic era, the main requested diagnostic test is chest X-ray for the onset of acute diseases, such as infections, respiratory diseases, cardiovascular accidents, control of devices or follow-up.

The worker should wear a N95 mask or higher, disposable fluid-resistant gown, a pair of disposable gloves, goggles or visor for eye-protection. Our worker wore PPE, disposable fluid-resistant gown, a pair of disposable gloves, goggles or visor for eye-protection. World Health Organization gives the guidelines for appropriate use of PPE ensuring that local policy is followed.

Patients (regardless of symptoms) wore level 1 (low fluid resistance) surgical masks (not N95). The surgical masks allow human protection from

respiratory droplets and saliva, which are known to be the chief mechanisms of infectivity for COVID-19.

Chest X-ray (CXR) was performed using a light, portable and high frequency X-ray tube, digital cassettes and a mobile radiography station (Computed Radiography POC 260; Carestream Health, Rochester, New York) with remote viewing and real-time processing of the acquired images. The equipment was transported in a small, homologated van. Chest X-ray was acquired considering standard protocol with 80/82 kVp and 12/14 mAs.

The portable X-ray unit was brought into the patient's room. The technologist positioned the patient and then placed the detector (within a disposable plastic bag) behind the patient's chest. The distance from the detector to the tube is approximately 50 inches. The technologist then stood 6 feet away when acquired the image. The technologist removed the detector from the bag, doffs the PPE following standard procedure, and sterilized the detector and the portable machine with approved disinfectant wipes.

Chest X-ray machine was covered with plastic sheeting to facilitate disinfection. After acquisition, CXR machine was disinfected with low-level or intermediate-level disinfectant, disposables properly disposed, and workers washed their hands.

Following the procedure, cleaning and disinfecting of all imaging equipment, including mobile X-ray machine and detectors was performed quietly and carefully.

Clinical information and chest X-ray images were sent to a radiology department and a radiologist reported the examination.

From February 2020 to January 2021, we performed 40 Chest X-ray at patient home.

The first five radiographs obtained with the mobile Chest X-ray were assessed for diagnostic quality immediately after acquisition by the interpreting radiologist to ensure the images were adequate.

In the Figure 1 two Chest X-ray of the same patient were reported: in a) the X-ray was performed in Institute and in b) at patient home. The quality of the X-ray was comparable.

From our experience there were not significant differences in the quality of chest X-ray taken at home or in hospital. We found a reduction in hospitalization rates with a better and timely assistance at home associated to a better patient's compliance and a reduction in transport costs.

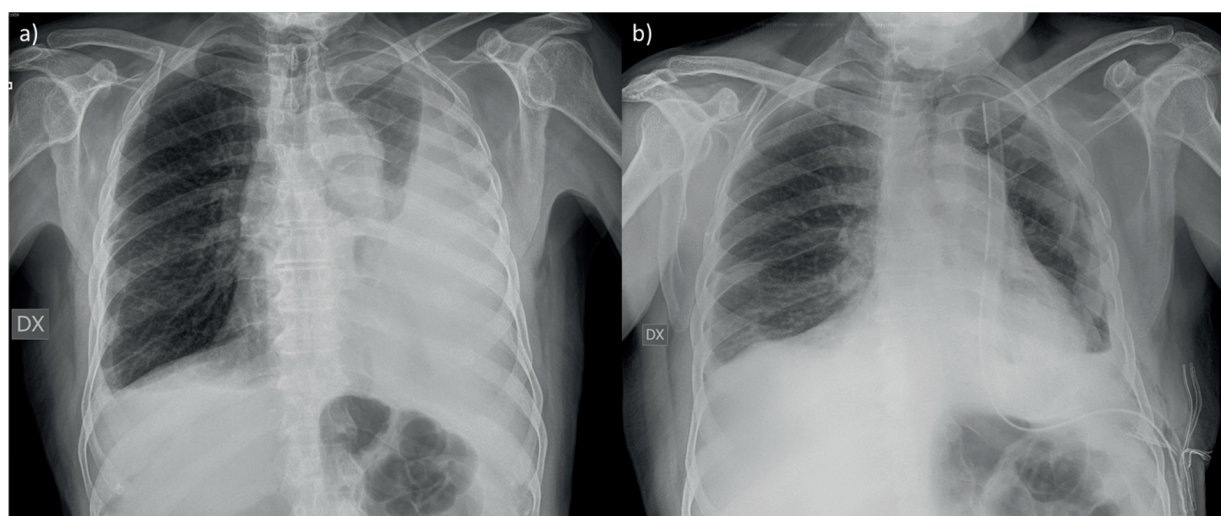


Figure 1. Chest X-ray of the same patient: in a) the chest X-ray was performed in Institute for the placement of a drainage pipe and in b) at patient home for a control.

Moreover, using the home mobile X-ray service was possible to reduce the risk of COVID-19 contagious.

Therefore, the home mobile radiography service could have many advantages both in terms of cost-benefits for the health system and increasing the fragile patient's quality of life by protecting physical and psychological health.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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