COVID-19 in the Computed Tomography (CT) Department

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Introduction:

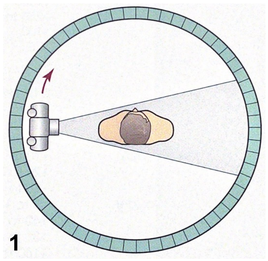
Coronavirus (COVID-19) has severely impacted the world since the original outbreak in December of 2019 in the city of Wuhan, China (Pontone et al., 2020). The virus created a pandemic that has ruthlessly affected the lungs of patient's confirmed with COVID-19. Chest computed tomography (CT) scans are used to aid in the diagnosis, progression, and monitoring of patients confirmed with COVID-19 (Kwee and Kwee, 2020).

What is Computed Tomography?

Computed Tomography (CT) is process of creating cross-sectional images by the x-ray tube rotating around the patient's body and relaying the information to the computer.

- Images are constructed of the body part scanned and the computer renders 3D axial, coronal, and sagittal planes.
- The three different imaging planes provide in-depth detail of patient anatomy.

(Long, Rollins, and Smith, 2016)



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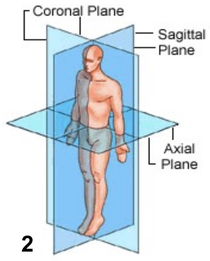

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Image 1: Diagram of how the x-ray tube rotates around the patient to create cross sectional images (Long, Rollins, and Smith, 2016, pg. 307).

Image 2: Diagram demonstrates the coronal, sagittal, and axial planes of the body. (Colorado Comprehensive Spine Institute, 2016).

What is COVID-19?

- COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and is classified as an infectious disease (Kwee and Kwee, 2020).
- The virus is spread by respiratory droplets from person to person by being in close contact of 6 feet or less (Mayo Clinic, 2021).
- The World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020, due to the the virus spreading to 6 continents (Ojha, Mani, Pandey, Sharma, and Kumar, 2020).

Symptoms of COVID-19:

People may experience one or more the following symptoms as moderate to severe:

- Fever
- Body aches
- Difficulty breathing or shortness of breath
- Headache
- Vomiting
- Nausea
- New loss of taste and smell
- Tiredness

(Mayo Clinic, 2021)

How is COVID-19 Diagnosed?

The primary tool to confirm COVID-19 is done by a reverse transcription polymerase chain reaction (RT-PCR) test. The RT-PCR laboratory test can be collected from swabbing the upper respiratory tract or nasopharyngeal area (Kwee & Kwee, 2020).

- X-ray is the use of ionizing radiation that passes through the patient's body and creates a radiographic image (Kwee & Kwee, 2020) .
- The first imaging modality chosen is a chest x-ray for the early detection of COVID-19 (Kwee & Kwee, 2020).
- Chest CT scans are used routinely for fast diagnosis and aid in the diagnosis of COVID-19 (Ai et al., 2020).

COVID-19 Precautions Within the CT Department:

Patient's suspected or confirmed with COVID-19 require strict precautions to limit exposure. Prior to the patient entering the department:

- The CT technologist(s) must wear personal protective equipment (PPE) such as an N-95 mask, goggles or face shield, gloves, and gown.
- All unneeded equipment should be removed from the CT scanner room to limit exposure from the patient.

After the patient leaves the department:

- The CT technologist properly disposes all used PPE in the appropriate waste container.
- The room is then deep cleaned by disinfecting to help prevent the spread of the virus to the next patient entering the department.
- The CT scanner room has a downtime of 30 minutes to one hour for decontamination.

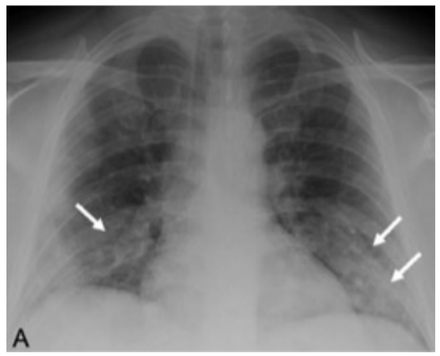
(Kwee & Kwee, 2020)

Pathologies Seen on Positive COVID-19 Chest X-rays & CT:

- Ground glass opacities (GGO) are seen in areas of the lungs that have an increased attenuation on x-rays and CT scans of the chest.
- Consolidation of the lung tissue are areas that are limiting air passing through to inflate the lungs.
- Vascular enlargement is the vasculature around and within the lungs are increased in size.
- Interlobular septal thickening is the increased densities in-between the five lobes of the lungs.

(Li and Xia, 2020)

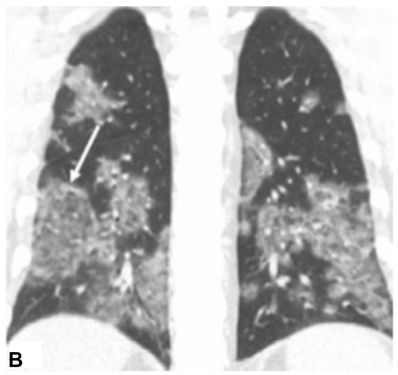
Chest X-ray of a COVID-19 Positive Patient:



A

Image A: Chest x-ray on day 1 of COVID-19 diagnosis with arrows pointing to opacities seen bilaterally in the lower lobes (Bhat et al., 2020, p. 299).

Chest CT of a COVID-19 Positive Patient:



B

Image B: Chest CT in the coronal plane demonstrating with the white arrow the ground glass opacites (GGO) and septal thickening (Bhat et al., 2020, p. 299).

Findings from Research:

A study conducted by Li and Xia (2020) included 53 patients (24 women and 29 males) in the age range of 26 to 83 years old. The results of study are as follows:

- All patients were tested for COVID-19 using the RT-PCR swab and 51 were positive.
- Chest CT scans were performed on all patients shortly after testing positive and the findings were documented.
- Patients who tested positive also had viral pneumonia present. All five lobes of the lungs were impacted in 38 of the 51 patients (74.5%).
- The most documented pathologies were GGO and consolidation which were diagnosed in 49 patients (96.1%).
- Vascular enlargement was present in 42 patients (82.4%).
- Interlobular septal thickening was present in 36 patients (70.6%).
- The chest CT scans of the 51 patients with COVID-19 demonstrated the main findings that were present and coincided with the diagnosis.

Statistics:

The current statistics as of 04/22/2021 @7:20am from the COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at John Hopkins University (JHU) include data from 192 countries/regions:

- Global cases of COVID-19: 143,962,157
- Global deaths of COVID-19: 3,061,478 people

COVID-19 in the United States:

- COVID-19 cases: 31,862,987
- COVID-19 deaths: 569,404 people
- RT-PCR tests administered: 421,219,495

(Dong, Du, and Gardner, 2021)

Conclusion:

The virus has heavily impacted people diagnosed with COVID-19, the healthcare system, and the world as a whole. The RT-PCR tests and chest CT scans are a vital part of diagnosing patients in combination with progression of the virus. The COVID-19 vaccines have become available to help aid in the prevention of contracting the virus (Mayo Clinic, 2021).

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