ROLE OF CT SCAN EXAMINATION ON COVID-19

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ABSTRACT

Coronavirus disease 2019 (COVID-19) is a disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The role of radiology has a very important role in diagnosis and evaluation. CT scan has a potential role in diagnosing and complications of COVID-19, such as acute respiratory distress syndrome, pulmonary embolism, and heart failure, while its role in determining prognostics requires further investigation. The images on a COVID-19 CT scan generally show ground glass opacities, consolidation, air bronchogram and poving stone. CT scan examination can be used in the use of triage in the hospital in enforcing COVID-19 patients who need immediate treatment. The use of radiological examinations in combination with RT-PCR can help diagnose and manage COVID-19.

Keywords: COVID-19; CT scan; Radiology

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Kwee & Kwee, 2020). This disease is transmitted from human to human and can cause pneumonia disease COVID-19 (Meng Li, 2020). Since being discovered in China in early January 2020, this virus has spread aggressively and globally. On March 2, 2020, the first case of COVID-19 in Indonesia (Depok, West Java) was announced by the President of the Republic of Indonesia. Since then, COVID-19 has spread rapidly throughout Indonesia (Tenda et al., 2020). The reference standard for confirming COVID-19 relies on microbiological tests such as reverse-transcriptase polymerase chain reaction (RT-PCR) or sequencing. However, this test may not be available in an emergency and may take some time to produce results. RT-PCR can be completely negative if the viral load is insufficient. In addition, RT-PCR also cannot detect viruses that have invaded the lower respiratory tract where there is
no active virus in the throat. Computed tomography (CT) scan has been used as a complement to RT-PCR examination in diagnosing COVID-19 pneumonia in the context of the current epidemic, due to its speed, high availability, and high sensitivity for the diagnosis of COVID-19 pneumonia (Guillo et al., 2020). Meanwhile, CT scan examination can be used for the diagnosis of COVID-19 with several advantages. Health workers can decide to use CT scans as an evaluation of the condition of the COVID-19 patient in addition to using RT-PCR. CT scanning also has a potential role as a diagnostic troubleshooting tool in patients whose RT-PCR test remains negative, even though the patient has clinical suspicions that suggest COVID-19 disease. In addition, CT scans performed as part of standard clinical care can reveal lung abnormalities that could lead to a diagnosis of COVID-19 that presents without symptoms (Adams, Kwee, Yakar, Hope, & Kwee, 2020).

**CT scan of the thorax in COVID-19 infection**

Initial reports of RT-PCR sensitivity vary widely, ranging from 42% to 71% and initially negative RT-PCR may take up to 4 days to become positive in patients with COVID-19 (Simpson et al., 2020). However, CT scans can compensate for the above deficiencies and play an important additional role in the diagnosis and management of COVID-19 patients. The sensitivity and specificity of CT scans used for the examination of COVID-19 vary widely, which has a sensitivity of 88% - 98%, specificity of 25% - 53%, positive and negative predictive values for COVID-19 are estimated at 92% and 42% (Simpson et al., 2020). CT scans can reduce the possibility of false negative results in RT-PCR examinations because CT scans are more sensitive than RT-PCR, namely CT scans have a sensitivity of 88% - 98% (Meng Li, 2020). When compared with the use of x-rays for the examination of COVID-19, x-ray examination alone has a sensitivity of 69% and specificity of 60% in the examination of COVID-19 (Fechner et al., 2020).

**RESULT AND DISCUSSION**

Imaging overview
1. Ground glass opacity

Ground glass opacities (GGO) are blurry images with slightly higher density in the lung parenchyma on CT scan. This occurs due to a decrease in air content or thinning of the alveolar walls due to exudate in the alveolar space. The distribution pattern of GGO usually occurs in pneumonia (Bajaj & Tombach, 2017; Chen, Ai, Lu, & Li, 2020) (Gambar 1).
2. Consolidation and air bronchogram

Consolidation is the most common and easy to interpret CT scan finding. Consolidation occurs due to cloudiness of the air space by exudate of bacterial origin. Bronchioles in the lungs are visualized as thickening and swelling of the bronchial walls when there is consolidation around them which is known as the “air bronchogram” sign (Bajaj & Tombach, 2017; Chen et al., 2020) (Figure 2).

3. Paving stone

The “paving stone” sign is an important sign of coronavirus infection, indicating that the virus infects the interlobular septum which usually occurs in the presentation of viral pneumonia (Chen et al., 2020; Wu et al., 2020) (Gambar 2).
4. fibrotic lesions

Fibrous lesions may form during healing of chronic pulmonary inflammation or proliferative disease with gradual replacement of cellular components by scar tissue. Currently, the relationship between fibrosis and patient prognosis is still debated. Some researchers argue that the presence of fibrosis indicates a good prognosis for COVID-19 patients with stable disease status. However, other opinions suggest that fibrosis may indicate a poor outcome of COVID-19. There are reports that the condition can progress to a peak stage or result in pulmonary interstitial fibrosis disease. (Chen et al., 2020; Ye, Zhang, Wang, Huang, & Song, 2020) (Figure 3).

Figure 3. Overview of fibrotic lesions (white arrows). (Ye, Zhang, Wang, Huang, & Song, 2020)

5. Thickening of blood vessels

Thickened blood vessels may appear in the inflamed lesion. Inflammation can lead to increased vascular permeability, telangiectasia, and pulmonary artery thickening. (Chen et al., 2020; Wu et al., 2020) (Gambar 1)

6. Hello sign

The halo sign is a CT scan sign that usually occurs in fever with neutropenia. The halo sign appears because the virus replicates in epithelial cells, resulting in a halo image. Halo sign is a good prognostic predictor of response to therapy (Bajaj & Tombach, 2017; Chen et al., 2020) (Gambar 4).
Some examples of cases of CT scan images of COVID-19 patients

Figure 5. Male 60 years with complaints of fever and cough for 7 days due to COVID-19. (a) AP radiograph shows indistinct opacification in the lateral aspect of the right lung (arrow). (b) Axial non-contrast chest CT scan showing GGO with a peripheral distribution in both upper lobes (arrows). There is thickening of the interlobular and intralobular septum (crazy paving pattern). (c) Coronal-sectional chest CT image showing bilateral multifocal ground glass opacity corresponding to a peripheral distribution (arrows) (El Homsi et al., 2020).
Figure 6. A 74-year-old man with fever and cough, diagnosed with COVID-19. (a) Axial and (b) coronal CT scan of the chest showing bilateral multifocal ground glass opacity (white arrows) and consolidation (black arrows). (El Homsi et al., 2020).

CT scan time
A CT scan is indicated in patients with moderate to severe respiratory symptoms. The symptoms were the presence of significant pulmonary dysfunction, clinical suspicion of ongoing COVID-19 infection but negative RT-PCR tests, and in any patient for whom RT-PCR tests could not be performed or were not available. CT scan speed can support the rapid triage desired in resource-limited environments (e.g., limited access to personnel, PPE, RT-PCR testing capabilities, hospital beds, or ventilators and the urgent need for patient triage) (Kwee & Kwee, 2020). Chest imaging can also help suggest alternative diagnoses to explain the patient's clinical picture or can show features of COVID-19 infection. If no alternative diagnosis is specified or if the images show features of COVID-19 infection, then further clinical evaluation will depend on the availability of the RT-PCR test (Fechner et al., 2020).

Advantages, disadvantages and limitations
Advantages:
CT scan has high potential in diagnosis and management, especially if RT-PCR is not available in a health facility. In addition, CT scans have other advantages, namely the majority of them are in hospitals, fast examinations, have stronger sensitivity than RT-PCR tests and the results are almost always positive regardless of the condition of the COVID-19 patient. In addition, the advantages of CT scans can allow for more patient care to ensure appropriate safety requirements to prevent the spread of COVID-19 to hospital staff or to other patients (Taylor et al., 2020).
Deficiency:

The drawback of a CT scan for COVID-19 is that it requires disinfection after scanning every patient with suspected or confirmed COVID-19, which can take time for disinfection, especially in hospitals with a high number of cases. This problem can be overcome by providing a special CT room for COVID examinations. In hospitals with only one CT scanner, a CT scan for all suspected or confirmed cases of COVID-19 can be performed by disinfection. Another disadvantage of a CT scan is that the patient is exposed to radiation. Radiation levels in CT scans have been found to produce an estimated risk of death from cancer of 0.08% in adults aged 45 years (Taylor et al., 2020; Vermani, Kaushal, & Kaushal, 2020).

Limitations:

A limitation of the CT scan is that it diagnoses cases with mixed findings, i.e. cases that have both typical and atypical signs for COVID-19. The radiologist must determine whether these findings are part of the same process or are unrelated. For example, hospitalized patients undergoing CT scanning for fever may have lower lobe opacities as well as peripheral GGO, which may reflect aspiration pneumonia superimposed on features of viral pneumonia. It is also possible that atypical signs such as lobar consolidation may reflect secondary bacterial pneumonia even in patients who test positive for COVID-19 (Simpson et al., 2020).

CONCLUSION

COVID-19 is a highly contagious disease and humans are generally susceptible to infection. Heterogeneous clinical symptoms and laboratory results of COVID-19 are challenges in establishing a diagnosis. CT scan examinations in patients with suspected or confirmed COVID-19 can assist in the diagnosis of COVID-19. A comprehensive analysis of the patient's epidemiological history, laboratory test results, clinical symptoms and the results of supporting examinations is needed to carry out prevention, early detection, diagnosis, and treatment of COVID-19 itself.
REFERENCE


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