Contents lists available at IOCScience

Science Midwifery

journal homepage: www.midwifery.iocspublisher.org

Chest X-Ray Description Of Vaccinated And Unvaccinated Covid-19 Patients: Case Study

Mustika Fatimah[1], Erna Widiarti[2], Tri Hastuti[3], Muslimah Putri Utami[4], Rima Ernia[5], Rina E. Sitindaon[6], Devi Susanti[7], Rizka Muliani[8]

[1478]X-Ray Engineering Department, Faculty of Health, Kader Bangsa University, Jl.Mayjend Ryacudu No.88 Palembang, 3000, South Sumatra, Indonesia; LKC Clinic, Jl. KH.Azhari 7 Ulu Palembang, South Sumatra, Indonesia; Ar Rasyid Hospital, Jl. HM. Saleh Km.7, Palembang, South Sumatra, Indonesia
[2]dr.Mohammad Hoesin Central General Hospital, Palembang, 30126, South Sumatra, Indonesia
[3]Bari Regional General Hospital, Palembang, 30254, South Sumatra, Indonesia
[5,6]Medical Laboratory Technology Department, Faculty of Health, Kader Bangsa University, Jl.Mayjend Ryacudu No.88 Palembang, 3000, South Sumatra, Indonesia

A R T I C L E I N F O

Keywords:

Chest X-Ray Descriptions;
Unvaccinated Covid-19 Patient;
Vaccinated Covid-19 Patient

ABSTRACT

As Covid-19 cases increase and transmission accelerates, it is more likely that new more contagious variants emerge, may spread more easily. Chest X-Rays examination performed during the Covid-19 pandemic is highly suggestive for severe infection and could be used to determine the diagnosis. The chest X-ray image of unvaccinated Covid-19 patients, at the initial onset appeared normal and could find infiltrates paracardial bilaterally. While chest X-ray image of 5-6 months vaccinated Covid-19 patients, in the first days paracardial and bilateral infiltrates were found as well as bilateral parahillar ground-glass opacity, but in late onset, the infiltrates and ground glass opacity became more widespread and bilateral consolidation was also found.

E-mail:

fatimahmustika271214@gmail.com

1. Introduction

Coronavirus Disease 2019 (Covid-19) is endemic globally affecting almost all countries in the world (El-Sayed, Aleya, & Kamel, 2021). Indonesia has become part of the pandemic and there has been an increase in cases per day since the end of August 2020 (Nugraha, Wahyuni, Laswati, Kusumastuti, Tulaar, & Gutenbrunner, 2020). This disease not only affects the health system of a country (Kaye, et al., 2020), but also has had a wide impact on the economic, social, educational, cultural sectors (Nicola, et al., 2020). Governments in various countries around the world have tried to implement national and regional quarantines in their respective countries (Asahi, Undurraga, Valdés, & Wagner, 2021). However, due to the complexity of the strategy implemented, it has had an impact on the social and economic conditions of the community, so that finally some countries have begun to open mobility restrictions (Zakig, et al., 2020).

Vaccines are one of the efforts chosen with great hopes that they will become one of the main weapons in controlling Covid-19. Vaccination as a method of eradicating infectious diseases is nothing new. With good smallpox surveillance and vaccination programs the world was declared free of smallpox in 1979 which was announced in 1980 through a WHO resolution (WHO, 2021). Specifically for the Covid-19 vaccine, the Food and Drug Administration (FDA) recommends that to issue an Emergency Use Authorization (EUA), data from phase 3 clinical trials are needed (Krause & Gruber, 2020). Various studies on the effectiveness of the Covid-19 vaccine have been also carried out. The effectiveness of the vaccine was assessed in various vaccines and in a number of different subjects with the standard test to date for diagnosing Covid-19 still through the RT-PCR

(Reverse Transcription-Polymerase Chain Reaction) examination. However, while vaccines can provide protection for most people against hospitalization and death, even during delta waves, they are less effective at protecting the elderly, especially those with underlying medical conditions (Sun & Achencbach, 2021).

As cases increase and transmission accelerates, it is more likely that new, more dangerous and more contagious variants emerge, may spread more easily or cause more severe disease (WHO, 2021). Plus the clinical spectrum of Covid-19 disease varies from asymptomatic or mild upper respiratory tract disease to severe pneumonia with respiratory failure and death (Parekh, Donuru, Balasubramanya, & Kapur, 2020). Similarly, an increased risk of severity has been reported in patients with comorbidities such as cardiovascular disease, chronic lung disease, chronic kidney disease, diabetes mellitus, cancer, and obesity (Chamorroa, Tascón, Sanz, Vélez, & Nacenta, 2021). For this reason, there needs to be other tests carried out, especially when RT-PCR is difficult, results are delayed, or gives false negative results, such as chest X-ray examination, which plays an important role in supporting the diagnosis, assessing the severity, detect complications, guide treatment, and assess outcome of treatment (Chamorroa, Tascón, Sanz, Vélez, & Nacenta, 2021); (WHO, 2020).

In a study conducted by Jeffrey P. Kanne et al in 2021, the findings on chest X-rays of Covid-19 patients varied, from normal at the onset of the disease to unilateral or bilateral pulmonary opacities, sometimes a striking and basic peripheral distribution was also seen, early studies reported that the sensitivity is relatively low (69%) for the diagnosis of Covid-19 (Kanne, et al., 2021). However, WHO states that chest X-rays with lower radiation doses have high specificity, are easier to repeat to monitor disease progression, and can be performed with portable equipment which reduces the risk of cross-infection (WHO, 2020).

In a study conducted by Ming Yeng et al in 2020, regarding photo profiles of Covid-19 infection accompanied by a literature review, the dominant imaging pattern was ground-glass opacity with consolidation at the periphery. Pleural effusion and lymphadenopathy were not found in all cases. The patient demonstrates the evolution of ground-glass opacity to consolidation and subsequent resolution of airspace changes. Ground-glass opacity and consolidation seen on CT are sometimes not detectable on chest X-ray. The literature review identified four other studies that confirmed bilateral and peripheral ground-glass opacity with or without consolidation as the main findings on chest CT examination (Yeng, et al., 2020). Likewise, in the research conducted by David et al in 2020 regarding the usefulness of chest X-ray in assisting clinical diagnosis of Covid-19 disease using RT-PCR, from 376 chest X-ray examinations, 37 (10%) showed a typical Covid-19 appearance; 215 (57%) showed a non-specific appearance; and 124 (33%) were negative for abnormalities, so it was concluded that the presence of ground-glass opacity or consolidation in the distribution of peripheral and lower middle lung zones on chest X-rays obtained during the Covid-19 pandemic is highly suggestive for severe infection and could be used to determine the diagnosis (David L, Grenier, Batte, & Spieler, 2020).

2. Method

This case study was conducted in Palembang on September-October 2021. The data taken in the form of secondary data in the form of chest X-ray results and medical records with information on the vaccination of the patient concerned. The data were analyzed by referring to the results of expert testimony (radiology specialists) then the results of the expertise were presented in a narrative form and linked to previous related research. This study was declared ethically worthy by the Health Research Ethics Commission, Faculty of Health, Kader Bangsa University (No: 329/KEPK/UKB-FKES/VIII/2021 on August 24, 2021) in accordance with the seven 2011 WHO standards.

3. Results and Discussion

3.1 Chest X-Ray of First Patient

The first Chest X-ray of a 55-year-old male patient with a positive RT-PCR for Covid-19 and who had not received a vaccine injection, based on the results of the radiology specialist's expertise, found right and left paracardial infiltrates with the impression of pneumonia.

Contents lists available at IOCScience

Science Midwifery

journal homepage: www.midwifery.iocspublisher.org

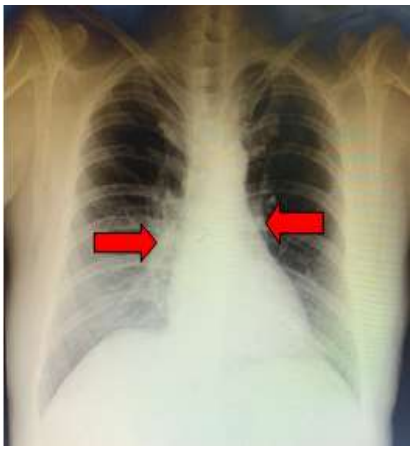

Figure 1. Chest X-ray of a 55-year-old male patient with positive RT-PCR for Covid-19 and had not received a vaccine injection.

3.2 Radiology Expertise Results:

On a Chest X-ray, normal lungs looked dark due to lower density of air. When air was replaced by another component (for example, fluid), causing the surrounding tissue to look lighter (Herring, 2021). On a chest X-ray, this term referred to more opaque or cloudy (Abbott, 2019).

Covid-19 pneumonia causes increase of lung density depending on the severity of the pneumonia. When the pulmonary markings are partially blurred by increased whitish, a white margin, band, horizontal, rough, or reticular change that can be seen in association with ground-glass opacity (Cleverley, Piper, & Jones, 2020). Distribution is usually in both areas and periphery, with a predominance in the lower plane. Between the first weeks of the onset of symptoms, these characteristic X-ray findings may progress and it is associated with advanced clinical hypoxemia (Chamorroa, Tascón, Sanz, Vélez, & Nacenta, 2021).

A quantitative meta-analysis that included 2847 patients in China and Australia, and a multinational descriptive analysis of 39 case report articles that included 127 patients, found that changes in Covid-19 pneumonia were on chest X-ray mostly bilateral (72.9%). A retrospective case series of 64 hospitalized patients with Covid-19 infection in Hong Kong found that changes of chest X-ray image frequently occurred in the peripheral (41%) and lower sections (50%) (Cleverley, Piper, & Jones, 2020).

The first patient lead a Chest X-ray examination in the first days onset. This was in accordance with a study conducted by Chamorroa, Tascón, Sanz, Vélez, and Nacenta (2021) where there was a relationship between chest X-ray image and symptom onset; consolidation was more typical in late onset while in the first days, the infiltrate and the ground-glass pattern was more dominant. In accordance with research conducted by B. Shen et al on 2021 that early Chest X-Rays could help recognize high risk patients and carried out Covid-19 patients (Shen, et al., 2021).

Likewise, in the research conducted by David, Grenier, Batte, and Spieler on 2020 regarding the usefulness of Chest X-ray in assisting clinical diagnosis of Covid-19 disease using RT-PCR, from 376 chest X-ray examinations, 37 (10%) showed a typical Covid-19 appearance; 215 (57%) showed a non-specific appearance; and 124 (33%) were negative for abnormalities, so it was concluded that the presence of ground-glass opacity or consolidation in the distribution of peripheral and lower middle lung zones on chest X-rays obtained during the Covid-19 pandemic is highly suggestive for severe infection and could be used to determine the diagnosis (David L, Grenier, Batte, & Spieler, 2020).

This patient's unvaccinated history did not prevent the patient from being confirmed RT-PCR positive. Likewise, this was in line with research conducted by Heather M. Scobie et al (2021) which showed that vaccines were effective in preventing someone exposed to Covid-19 from being hospitalized and reducing mortality (Scobie, et al., 2021). The history of unvaccinated in this patient did not prevent the patient from being hospitalized. This sholud also be influenced by the age of the patient and the presence of comorbidities.

3.3 Chest X-Ray of Second Patient

The second Chest X-ray of a 25-year-old male patient with positive RT-PCR for Covid-19 and had not received a vaccine injection, based on the results of the expertise of a radiology specialist, there were no infiltrates with the impression of no abnormalities.

Figure 2. Chest X-ray of a 25-year-old male patient with positive RT-PCR Covid-19 and had not received a vaccine injection.

a. Radiology Expertise Results**:**
   1) Cast seems normal
   2) Normal bronchovascular pattern
   3) No visible infiltrate
   4) Trachea in the middle
   5) Superior mediastinum not dilated
   6) The two hilums are not thickened
   7) Smooth diaphragm
   8) Acute costophrenic angle
   9) Good bones and soft tissue

b. Impression:
   1) No abnormalities

A Chest X-ray image should be normal in mild or in early-stage disease, but patients with moderate to severe symptoms were improbable to have a normal image. Abnormalities on Chest X-ray were found in patients requiring hospitalization and at onset 10-12 days after symptom onset (Chamorroa, Tascón, Sanz, Vélez, & Nacenta, 2021); (Daniel, 2021); (Cleverley, Piper, & Jones, 2020). A normal Chest X-ray was generally seen early in Covid-19 disease (about the first two days after symptoms appear), so a normal X-ray didn't really show infection (WHO, 2020); (Cleverley, Piper, & Jones, 2020).

A retrospective case series of 64 hospitalized patients with Covid-19 infection in Hong Kong found that 31% on admission had normal Chest X-Rays. Of these patients, 35% had alteration on follow-up radiographs. On the basis of this study, the Fleischner Society states that Chest X-Rays were not sensitive in mild cases or early stage Covid-19 infection. In a series of 1099 hospitalized patients with laboratory confirmed Covid-19 from across China, of the 274 patients who lead Chest X-ray on admission, 59.1% showed abnormalities, most commonly "bilateral patchy shadowing" (36.5%). Of the 1099 patients, 88.7% had unclear characteristics and how many of the Chest X-Rays were false negative for Covid-19 pneumonia (Cleverley, Piper, & Jones, 2020).

In a study conducted by Ming Yeng et al (2020), regarding photo profiles of Covid-19 infection accompanied by a literature review, five patients underwent X-rays along with a Chest CT examination. Of these, two patients had normal Chest X-ray findings, although a CT examination performed on the same day showed ground-glass opacity. Similarly, in a study conducted by Jeffrey P. Kanne et al (2021), findings on Chest X-Rays of Covid-19 patients varied, from normal at the onset of the disease to unilateral or bilateral pulmonary opacities, sometimes a striking and basic peripheral distribution was also seen.

The second patient had not received the vaccine injection and was confirmed positive. The

Contents lists available at IOCScience

Science Midwifery

journal homepage: www.midwifery.iocspublisher.org

history of not receiving the vaccine in this patient did not necessarily mean that this patient was hospitalized. This should be due to the young age and the absence of comorbidities.

3.4 Chest X-Ray of Third Patient

The third Chest X-ray of a 56-year-old male patient with RT-PCR Positive for Covid-19 and had received a vaccine injection 6 months earlier, based on the results of the radiology specialist's expertise, in the first days of symptom onset, infiltrates were seen in the left lung and right paracardial and bilateral parahillar ground-glass opacity with pneumonia was seen. However, 14 days later, the appearance of worsening with infiltrates and ground-glass opacity was found in both lung fields with the impression of progressive bilateral pneumonia. On the same day the patient was declared dead.

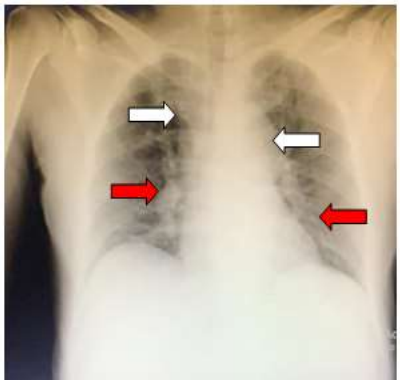

Figure 3. Chest X-ray of a 56-year-old male patient with positive RT PCR for Covid-19 and had received a vaccine injection 6 months earlier (first days).

a. Radiology Expertise Results (first days):

1) Cast seems normal
2) Visible infiltrates in the left lung and right paracardial
3) Bilateral parahillar Ground Glass Opacity view
4) Trachea in the middle
5) Superior mediastinum not dilated
6) The two hilums are not thickened
7) Smooth diaphragm
8) Acute costophrenic angle
9) Good bones and soft tissue

b. Impression:

1) Pneumonia

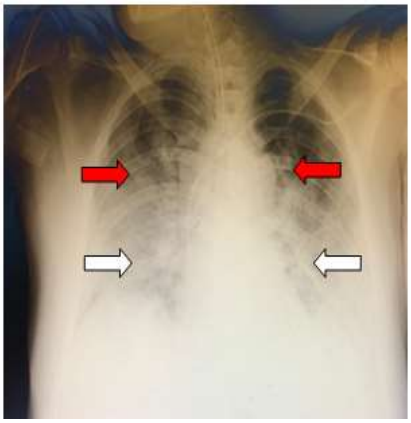

Figure 4. Chest X-ray of a 56-year-old male patient (same patient) with positive RT PCR for Covid-19 and had received a vaccine injection 6 months earlier (14 days later). Patient died. Note: red arrow: infiltrates; white arrow: ground-glass opacity.

a. Radiology Expertise Results (14 days later):

1) Cast seems normal
2) Increased bronchovascular pattern
3) Infiltrates are seen in both lung fields
4) Ground Glass Opacity is seen in both lung fields
5) Superior mediastinum not dilated
6) The two hilums are not thickened
7) Smooth diaphragm
8) Acute costophrenic angle
9) Good bones and soft tissue

b. Impression:

1) Progressive bilateral pneumonia
2) No improvement yet
3) ETT and CVC positions are good

3.5 Chest X-Ray of Fourth Patient

The fourth Chest X-ray of a 56-year-old male patient with RT-PCR Positive for Covid-19 and had received a vaccine injection 5 months earlier, based on the results of a radiology specialist, showed infiltrate, consolidation with ground-glass opacity in both lung fields with the impression of pneumonia. Four days later the patient was declared dead.

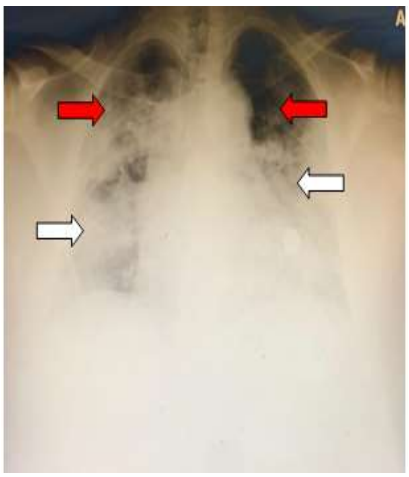

Figure 5. Chest X-ray of a 56-year-old male patient with positive RT-PCR for Covid-19 and had received a vaccine injection 5 months earlier. Four days later the patient died.
Note: red arrow: infiltrates; white arrow: ground-glass opacity and consolidation.

a. Radiology Expertise Results:

1) Cast seems normal
2) Increased bronchovascular pattern
3) Visible infiltrates with consolidation in the right and left lung
4) Ground Glass Opacity is seen in both lung fields
5) Trachea in the middle
6) Superior mediastinum not dilated
7) The two hilums are not thickened
8) Smooth diaphragm
9) Acute costophrenic angle
10) Good bones and soft tissue

b. Impression:

1) Pneumonia

Abnormalities on Chest X-ray were found in patients requiring hospitalization and at onset 10-12 days after symptom onset ((Chamorroa, Tascón, Sanz, Vélez, & Nacenta, 2021); (Cleverley,

Contents lists available at IOCScience

Science Midwifery

journal homepage: www.midwifery.iocspublisher.org

Piper, & Jones, 2020). On a Chest X-ray, this term referred to one or more areas where the lungs that normally appear darker (filled with air) appear more opaque or cloudy. Ground-glass opacity could be used to characterize focal and diffuse areas of increasing density (CM & JH, 2019). Ground-glass opacity had a broad aetiology: normal expiration, partial collapse of the alveoli, partial filling of air spaces, fibrosis, inflammation, and proliferation due to neoplasms (Shivanada, 2021).

These patients lead a Chest X-ray examination in the first days of complaints and was finally declared dead four days later due to the rapid development of the disease. This is in accordance with a study conducted by Chamorroa, Tascón, Sanz, Vélez, and Nacenta (2021) where there was an association between chest X-ray image and symptom onset; consolidation was more typical in late onset while in the first days, the infiltrate and the ground-glass pattern was more dominant. Also included are reticular patterns and ground-glass opacity with multifocal distribution. The consolidation was found to originate from the ground-glass opacity becoming whiter with all loss of lung markings with areas of consolidation feasible to have developed from the ground-glass opacity area. Distribution was usually in both areas and periphery, with a predominance in the lower plane (Cleverley, Piper, & Jones, 2020).

In a study conducted by Ming Yeng et al in 2020, regarding photo profiles of Covid-19 infection accompanied by a literature review, five patients lead X-rays along with a Chest CT examination. Of these, three chest X-ray examinations showed consolidation. One Chest X-ray showed a predominance of the lower zone. A quantitative meta-analysis on 2847 patients in China and Australia, and a descriptive analysis of 39 case report articles (127 patients), found that changes in Covid-19 pneumonia on Chest X-ray were mostly bilateral (72.9%) and had a ground -glass opacity (68.5%). This review also shows that the rough linear opacities associated usually appear at the periphery of the lungs. A small case series in Korea showed that 80% of radiographic changes were found in the periphery (Cleverley, Piper, & Jones, 2020). Between the first weeks of the onset of symptoms, these characteristic X-ray findings should progress and it was associated with advanced clinical hypoxemia (Chamorroa, Tascón, Sanz, Vélez, & Nacenta, 2021); (Daniel, 2021).

The third and fourth patient underwent a Chest X-ray examination on the first days of complaints, then a further Chest X-ray examination was performed on the 14th day and was finally declared dead due to the development of the disease. This was in accordance with a study conducted by Chamorroa, Tascón, Sanz, Vélez, and Nacenta (2021) where there was an association between chest X-ray image and symptom onset; consolidation was more typical in late onset while in the first days, the infiltrate and the ground-glass pattern was more dominant. Also included were reticular patterns and ground-glass opacity with multifocal distribution. Distribution was usually in both areas and periphery, with a predominance in the lower plane. Between the first weeks of the onset of symptoms, these characteristic X-ray findings should progress and it was associated with advanced clinical hypoxemia (Daniel, 2021).

Regarding the patient's vaccine history five or six months earlier, it turned out that the vaccine that had been obtained did not prevent the patient from being confirmed positive and did not prevent the patient from worsening to death. However, it could be explained that while vaccines can provide protection for most people against hospitalization and death, they were less effective in protecting the elderly, especially those with underlying medical conditions (Sun & Achencbach, 2021).

Five or six months after receiving the vaccine from this patient, as cases increased and transmission accelerated, it was more likely that new, more dangerous and more contagious variants emerge, may spread more easily or cause more severe disease (WHO, 2021). Similarly, an increased risk of severity had been reported in patients with comorbidities such as cardiovascular disease, chronic lung disease, chronic kidney disease, diabetes mellitus, cancer, and obesity (Chamorroa, Tascón, Sanz, Vélez, & Nacenta, 2021), although the history of comorbidities in third patient was unknown but obesity is history of comorbidities in fourth patient.

The history of five or six months after receiving the vaccine (CoronaVac) was also related to the duration of the vaccine's effectiveness. One study of 185 healthcare workers in Thailand found that of patients who received a second dose of CoronaVac, 60% had high levels of neutralizing antibody one month afterward. Co-author Opass Putcharoen, an infectious disease specialist at the Thai Red Cross Infectious Diseases Clinical Center in Bangkok, also found that three months after

receiving the second CoronaVac injection, antibody levels fell to just 12%. The results of this study in Chile and Thailand which showed that the optimal limit of effectiveness of the CoronaVac vaccine was three months related to the six-month post-vaccine history of this patient where within six months, the effectiveness of the acquired vaccine (CoronaVac) had greatly decreased (Mallaphaty, 2021).

4. Conclusion

There was an association between chest X-ray image and symptom onset; consolidation was more typical in late onset while in the first days, the infiltrate and the ground-glass pattern was more dominant. The distribution of abnormalities was paracardial, parahillar, and bilateral. The chest X-ray image of unvaccinated Covid-19 patients, at the initial onset appeared normal and could find infiltrates paracardial bilaterally. While chest X-ray image of vaccinated for 5-6 months Covid-19 patients, in the first days paracardial and bilateral infiltrates were found as well as bilateral parahillar ground-glass opacity, but in late onset, the infiltrates and ground glass opacity became more widespread and bilateral consolidation was also found.

A history of not receiving a vaccine in a patient did not prevent the patient from being confirmed positive for RT-PCR. The patient's history of not getting vaccinated did not prevent the patient from being hospitalized. This should also be influenced by the age of the patient and the presence of comorbidities. Regarding the patient's vaccine history five or six months earlier, it turned out that the vaccine that had been obtained did not prevent the patient from being confirmed positive and did not prevent the patient from worsening to death.

References

Abbott, S. A. (2019). Thoracic Imaging (3 ed.). Philadelpia: Elsevier.

Asahi, K., Undurraga, E. A., Valdés, R., & Wagner, R. (2021). The effect of COVID-19 on the economy: Evidence from an early adopter of localized lockdowns. J Glob Health, 11. doi: 10.7189/jogh.10.05002.

Chamorroa, E. M., Tascón, A. D., Sanz, L. I., Vélez, S. O., & Nacenta, S. B. (2021). Radiologic diagnosis of patients with COVID-19. Radiologia, 63(1), 56-73. doi:10.1016/j.rxeng.2020.11.001.

Cleverley, J., Piper, J., & Jones, M. M. (2020). The role of chest radiography in confirming covid-19 pneumonia. BMJ. doi:https://doi.org/10.1136/bmj.m2426.

CM, W., & JH, C. (2019). Muller's Imaging of The Chest (2 ed.). Philadelpia: Elsevier.

Daniel, J. B. (2021). Covid 19. Retrieved from Radiopaedia: https://radiopaedia.org/articles/covid-19-4.

David L, S., Grenier, J. P., Batte, C., & Spieler, B. (2020). A Characteristic Chest Radiographic Pattern in the Setting of the COVID-19 Pandemic. Radiology, 2(5). doi:https://doi.org/10.1148/ryct.2020200280.

El-Sayed, A., Aleya, L., & Kamel, M. (2021). COVID-19: a new emerging respiratory disease from the neurological perspective. PMC Article, 28(30), 40445–40459. doi:10.1007/s11356-021-12969-9.

Herring, W. (2021). Learning Radiology: Recognizing The Basics (Vol. 4). Philadelpia: Elsevier. Retrieved from https://www.us.elsevierhealth.com/learning-radiology-9780323567299.html.

Kanne, J. P., Bai, H., Bernheim, A., Chung, M., Haramati, L. B., Kallmes, D. F., . . . Sverzellati, N. (2021). COVID-19 Imaging: What We Know Now and What. Radiology, 299(3). doi:https://doi.org/10.1148/radiol.2021204522.

Kaye, A. D., Okeagu, C. N., Pham, A. D., Silva, R. A., Hurley, J. J., Arron, B. L., . . . Cornett, E. M. (2020). Economic impact of COVID-19 pandemic on healthcare facilities and systems: International perspectives. Best Practice and Research: Clinical Anaesthesiology, 35(3), 293-306. doi: 10.1016/j.bpa.2020.11.009.

Krause, P. R., & Gruber, M. F. (2020). Emergency Use Authorization of Covid Vaccines — Safety and Efficacy Follow-up Considerations. The New England Journal of Medicine, 383(19), e107. doi:0.1056/NEJMp2031373.

Mallaphaty, S. (2021, October 14). China's COVID vaccines have been crucial — now immunity is waning. Nature, 598(7881), 398-399. doi:https://doi.org/10.1038/d41586-021-02796-w.

Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., . . . Aghaf, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. Int J Surg, 78, 185-193. doi:10.1016/j.ijsu.2020.04.018.

Nugraha, B., Wahyuni, L. K., Laswati, H., Kusumastuti, P., Tulaar, A. B., & Gutenbrunner, C. (2020). COVID-19 pandemic in Indonesia: Situation and challenges of rehabilitation medicine in Indonesia. Acta Med Indones, 52(3), 299-305.

Parekh, M., Donuru, A., Balasubramanya, R., & Kapur, S. (2020). Review of the Chest CT Differential Diagnosis of Ground-Glass Opacities in the COVID Era. Radiology, 297(3). E289-E302

Contents lists available at IOCScience

Science Midwifery

journal homepage: www.midwifery.iocspublisher.org

doi:https://doi.org/10.1148/radiol.2020202504.

Scobie, H. M., Johnson, A. G., Suthar, A. B., Severson, R., Alden, N. B., Balter, S., . . . Brady, S. (2021). Monitoring Incidence of COVID-19 Cases, Hospitalizations, and Deaths, by Vaccination Status — 13 U.S. Jurisdictions, April 4–July 17, 2021. MMWR, 70(21), 1284–1290. Retrieved from https://www.cdc.gov/.

Shen, B., Hoshmand-Kochi, M., Abbasi, A., Glass, S., Jiang, Z., Singer, A., . . . Duong, T. (2021). Initial chest radiograph scores inform COVID-19 status, intensive care unit admission and need for mechanical ventilation. Clinical Radiology, 76(6), 473.e1-473.e7. doi:https://doi.org/10.1016/j.crad.2021.02.005.

Shivanada, A. (2021). Ground-glass Opacification. Retrieved from Radiopaedia: https://radiopaedia.org/articles/ground-glass-opacification-3.

Sun, L. H., & Achencbach, J. (2021). Unvaccinated people were 11 times more likely to die of covid-19, CDC report finds. Retrieved from Washington Post: https://www.washingtonpost.com/health/2021/09/10/moderna-most-effective-covid-vaccine-studies/.

WHO. (2020). Use of Chest Imaging in Covid-19-A Rapid Advice Guide. Retrieved from Clinical Radiology: WHO/2019-nCoV/Clinical/Radiology_imaging/2020.1.

WHO. (2021). Modul 1: Introduksi Keamanan Vaksin dalam Dasar-dasar Keamanan Vaksin. Retrieved from in.vaccine-safety-training.org: https://in.vaccine-safety-training.org/pre-licensure-vaccine-safety.html.

WHO. (2021). Vaccine efficacy, effectiveness and protection. Retrieved from who.int: https://www.who.int/news-room/feature-stories/detail/vaccine-efficacy-effectiveness-and-protection.

Yeng, M., Lee, E., Yang, J., Yang, F., Li, X., Wang, H. X., & Lui, M. M.-s. (2020). Imaging Profile of the COVID-19 Infection: Radiologic Findings and Literature Review. Radiology, 2(1), e200034. doi:https://doi.org/10.1148/ryct.2020200034.

Zakig, A., Haquea, U., Shresthaa, N., Yousaf, M., Osman, S., Modasser, U., & Rafdzah, H. K.-M.-S. (2020). The impact of COVID-19 on globalization. Journal Of One Health. doi:https://doi.org/10.1016/j.onehlt.2020.100180.