RADIOLOGICAL FEATURES OF COVID-19 PATIENTS AT RSUP DR. MOHAMMAD HOESIN

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Abstract

Radiological Features of COVID-19 patients at RSUP dr. Mohammad Hoesin. Chest x-ray and chest CT are radiological examinations that play an important role in assessing COVID-19. This examinations can also useful in screening and follow-up therapy. This study aims to find out the radiological features of chest x-ray in COVID-19 patients at RSUP Dr. Mohammad Hoesin. The research is an observational descriptive with cross sectional design. The data is gathered from medical records at RSUP Dr. Mohammad Hoesin Palembang. The sample of this research is 199 Covid-19 patients at RSUP Dr. Mohammad Hoesin. Descriptive analysis is performed to determine the proportion of sociodemographic characteristics (age, sex, hypertension, diabetes mellitus) and radiological chest X-ray images. The results of the analysis showed that 18-60 years is the highest age range in 163 (81,9%), female in 108 (54.3%). Comorbidities are diabetes mellitus in 15 (7, 5%) and hypertension in 14 (7.0%). Patchy opacity lesions are the most common lesions found on chest X-ray (19.1%), followed by consolidation (16.6%). The uncommon lesions are lung nodule (1%) and pleural effusion (1%). There are also abnormality with more than one type of lesion, such as lung consolidation with pleural effusion (4 cases). Chest X-ray lesions in this study are mostly found in parahillar/paracardial (31.7%) and in both lungs (34.2%).

Keywords: Chest X-ray, COVID-19

1. Introduction

At the beginning of 2020, a new pneumonia disease is found in many countries of the world. This case started in Wuhan, at Hebei province in China at the end of 2019, then spread fast unto almost 200 countries worldwide[1]. WHO called this *Coronavirus Disease* (COVID-19), caused by *Severe Acute Respiratory Syndrome Coronavirus-2* virus. This virus spreads very fast and the death rate keeps on increasing, causing WHO declare as pandemic status in March 2020[2]. In Indonesia, COVID-19, there are two cases are reported for the first time in March 2nd, 2020[3,4].

Patient with cardiovascular disease, hypertension, diabetes and active smoker are the risk factors for COVID-19 infection and have poor prognosis[5]. Patient with hypertension, diabetes meliitus (DM) or active smoker, there are suspected elevating of ACE2 receptor expression[6,7]. Cancer patient and chronic liver disease are also more vulnerable to this virus infection[8,9]. Cancer is related with immunosuppressive reaction, excessive level of cytokines, proinflammation induction agent suppression and dendritic cell maturation disorder[10]. Patient with liver cirrhosis also have a weaker immune response, making them easily infected with COVID-19[11].

SARS-COV-2 diagnostic examination includes antigen examination, antibody and virology examination. The preferred method for virus detection is nucleic acid amplication with *real-time reversetranscription polymerase chain reaction* (RT-PCR) and sequencing[12]. The PCR test is reported to be a specific examination with 60-70% sensitivity rate[13,14]. This test also need their own adequate time to reach the result.

The supporting examination that plays an important role in COVID-19 cases are chest X-ray and CT Scan, which can detect the early symptoms and evaluate the progressivity of disease, therapy response and the complication. Chest X-Ray examination are considered to be easy, quick, cheap and can be done in inpatient ward/isolation ward with portable X-ray. This examination are also already widely used everywhere. Chest CT is expensive, not portable tool and only available in hospitals[15]. Radiological features of COVID-19 diagnosis is ground glass appearance, consolidation, multifocal, bilateral, in the peripheral and usually found in the lower lobe of the lung[16].

There are a lot of researches that focusing in chest CT findings for COVID-19 cases[17]. There are also research who reports that chest X-ray is less sensitive than CT scan, because in almost 40% cases there are no radiological pathology in chest X-ray[12]. Nevertheless, in some places, chest X-ray are still the chosen diagnostic modality because of their availability and efficiency than chest CT.[13].

2. Research Methods

This research is a descriptive observational with a cross-sectional design. We collect the data from RSUP dr. Mohammad Hoesin patient's medical record. This research is conducted in RSUP dr. Mohammad Hoesin, Palembang by overviewing COVID-19 patient's medical record.

This research is held on May – December 2020. The sample in this study were some of the COVID-19 patients at Dr. Mohammad Hoesin as many as 199 samples. The analysis was descriptively, to determine the number and percentage of each research variable, including sociodemographic characteristics (age, gender, hypertension, diabetes mellitus) and radiological chest X-ray findings.

3. Research Result

3.1 Distribution based on sociodemographic characteristic and chest X-ray images

The research sample was obtained from medical records at Medical Records Department and chest X-ray from PACS (Picture Achiving and Communication System) at Radiology Department in RSUP Dr. Mohammad Hoesin. Based on the data obtained, the sample data from the recapitulation of COVID-19 patients at the Medical Record Department, there are 633 cases until mid-October. In this study, the samples were 199 samples with a random sampling technique.

Frequency distribution based on sociodemographic factors.

Table 1. Frequency distribution based on sociodemographic factors

Characteristic	Quantity	Percentage (%)
Age (Year)		
18-60 year	163	81,9
>60 year	36	18,1
Gender		
Male	91	45,7
Female	108	54,3
Comorbid		
Hypertension	14	7,0
:(+)	185	93,0
	15	7,5
(-)	184	92,5
DM : (+)		
: (-)		

The results of the distribution analysis based on age, showed that the most age range was 18-60 years as many as 163 cases (81.9%) with 65 males and 98 females. Patients aged > 60 years were 36 cases (18.1%) with 26 males and 10 females.

Based on gender, it was found that the highest number of patients was female as many as 108 cases (54.3%) while male gender was 91 cases (45.7%). In this study, there are COVID-19 patients who have comorbid factors of hypertension and diabetes mellitus. The number of samples with comorbid factors of diabetes mellitus was 15 (7.5%) and hypertension was 14 (7.0%).

Frequency distribution based on pathological lesion on chest X-ray

Table 2. Frequency distribution based on pathological lesion on chest X-ray

Type of lesion	Quantity	Percentage (%)
Patchy opacities lesion	38	19,1
Ground-glass opacity (GGO)	21	10,6
Consolidation	33	16,6
Nodule	2	1,0
Pleural effusion	2	1,0
Combination	6	3,0
Normal	97	48,7

Patchy opacities lesion was the type of lesion that was mostly found on chest X-ray (19.1%), followed by consolidation (16.6%). The least visible lesions were pleural nodules and effusions, 1.0% each. In addition, there were also abnormalities that had more than 1 type of lesion / combination (3.0%), namely 4 cases found consolidation with pleural effusion, 1

case found ground glass opacity with pleural effusion dan 1 case found patchy opacity lesion with nodule.

Frequency distribution based on the distribution of the lesion on chest X-ray

Table 3. Frequency distribution based on the distribution of the lesions on the chest X-ray

Location	Quantity	Percentage (%)
Peripheral	31	15,6
Parahillar/paracardial	63	31,7
Perifer and parahillar / paracardial	6	3,0
Extrapulmonal	2	1,0
Normal	97	48,7

Chest X-ray lesions in this study were found mostly in parahillar / paracardial as many as 63 cases (31.7%), while the least number was in two locations, namely peripheral and parahillar / paracardial as many as 6 cases (3.0%) and other locations in the pleural cavity there were 2 cases (1.0%).

Frequency distribution based on the location of the lesion on chest X-ray

Table 4. Frequency distribution based on the location of lesions on chest X-ray

Location	Amount	Percentage (%)
Unilateral	33	16,6
Bilateral	68	34,2
Extrapulmonal	1	0,5
Normal	97	48,7
Total	199	100,0

On the table, it can be seen that the lesions were mostly found in both lungs as many as 68 cases (34.2%).

3.2 Distribution of Socio-Demographic Characteristics based on Radiological Chest X-ray Images

Age frequency distribution based on radiological chest X-ray

Table 5. Age frequency distribution based on radiological chest X-ray

Radiological image	Age	
	18-60 y.o old n (%)	>60 y.o n(%)
Type of lesion:		
Patchy opacities		
lesion	29(14,6)	9(4,5)
Ground-glass	16(8,0)	5(2,5)
opacity	24(12,1)	9(4,5)
Consolidation	2(1,0)	0
Nodules	1(0,5)	1(0,5)
Pleural effusion	2(1,0)	4(2,0)
Combination	90(45,2)	7(3,5)
Normal		
Distribution of		
Lesions:	20(10,1)	11(5,5)
Peripheral	48(24,1)	15(7,5)
Perihilar /		
paracardial	5(2,5)	1(0,5)
Peripheral and	1 (0,5)	1(0,5)
Extrapulmonary	90(45,2)	7(3,5)
Parahillar /		
paracardial		
Normal		
Location of lesions:		
One lung (unilateral)	28(14,1)	5(2,5)
Both lungs	46(23,1)	22(11,1)
(bilateral)	0	1(0,5)
Extrapulmonal	90(45,2)	7(3,5)
Normal		

On the table above, it can be seen that the most common lung lesions are patchy opacity lesions and consolidation in both age groups of the study subjects. In the 18-60 years age group, all types of lesions were found on the chest X-ray with the least number of lesions being pleural effusions (0.5%). Whereas in the age group >60 years, no nodules were found. Lesions were most commonly seen in the parahillar / paracardial groups in both age groups, namely 24.1% in the 18-60 year age group and

7.5% in the >60 years age group. Both groups showed the same location of lesion on the chest X-ray, in both lungs.

Sex frequency distribution based on radiological chest X-ray

Table 6. Distribution of sex frequencies based on radiological chest X-ray

Radiological Images	Gender	
	Male n (%)	Female n(%)
Type Of Lesion :		
Patchy opacities lesion	18(9,0)	20(0,1)
Ground-glass opacity	12(6,0)	9(4,5)
Consolidation	20(10,1)	13(6,5)
Nodule	1(0,5)	1(0,5)
Pleural Effusion	0	2(1,0)
Combination	5(2,5)	1(0,5)
Normal	34(17,1)	63(31,7)
Distribution Of Lesions :		
Peripheral	19(9,5)	12(6,0)
Parahillar/paracardial	32 (16,1)	31(15,6)
Peripheral and parahillar / paracardial	4(2,0)	2(1,0)
Ekstrapulmonal	2(1,0)	0
Normal	34 (17,1)	63(31,7)
Location Of The Lesion:		
One lung (unilateral)	20(10,1)	13(6,5)
Both lung(bilateral)	36(18,1)	32(16,1)
Ekstrapulmonal	1(0,5)	0
Normal	34(17,1)	63(31,7)

Male patients were found to have consolidated lesions as much as 20 (10.1%) and patchy opacity lesions were mostly found in women as many as 19 (9.5%). The most common lesion distribution and location were found in parahillar/paracardial (male 16,1%, female 15,6%) and in both lungs (male 18,1%, female 16,1%).

Frequency distribution of DM patients based on radiological chest X-ray

Table 7. Frequency distribution of DM patients based on radiological chest X-ray

Radiological Images	Diabetes Mellitus (DM)	
	DM (+) n (%)	DM (-) n(%)
Type Of Lesion :		
Patchy opacities	4(2,0)	34(17,1)
lesion	2(1,0)	19(9,5)
Ground-glass opacity	5(2,5)	28(14,1)
Consolidation	0	2(1,0)
Nodule	1(0,5)	1(0,5)
Pleural Effusion	0	6(3,0)
Combination	3(1,5)	94(47,2)
Normal		
Distribution Of Lesions :		
Peripheral	4(2,0)	27(13,6)
Parahillar/parakardial	7(3,5)	56(28,1)
Peripheral and parahillar/parakardial	0	6(3,0)
Ekstrapulmonal	1(0,5)	1(0,5)
Normal	3(1,5)	94(47,2)
Location Of The Lesion :		
One lung (unilateral)	4(2,0)	29(14,6)
Both lung (bilateral)	7(3,5)	61(30,7)
Ekstrapulmonal	1(0,5)	0
Normal	3(1,5)	94(47,2)

COVID-19 patients with comorbid DM found lung abnormalities in the form of consolidation (2.5%) and patchy opacity lesions (2%), with the distribution of the lesions often seen in the parahillar / paracardial stage (3.5%) and the location of the lesions mostly in bilateral lungs. (3.5%).

Frequency distribution of hypertensive patients based on radiological chest X-ray

Table 8. Frequency distribution of hypertension patients based on radiological chest X-ray

Radiological Images	Hypertension	
	Hypertension (+) n (%)	Hypertension (-) n(%)
Type Of Lesion :		
Patchy opacities	5(2,5)	33(16,6)

lesion	1(0,5%)	20(10,1)
Ground-glass opacity	4(2,0)	29(14,6)
Consolidation	0	2(1,0)
Nodule	0	2(1,0)
Pleural Effusion	1(0,5)	5(2,5)
Combination	3(1,5)	94(47,2)
Normal		
Distribution Of Lesions :	3(1,5)	28(14,1)
Peripheral	7(3,5)	56(28,1)
Parahillar/parakardial		
Peripheral dan	1(0,5)	5(2,5)
parahillar/parakardial	0	2(1,0)
Ekstrapulmonal	3(1,5)	94(47,2)
Normal		
Location Of The lesion :	4(2,0)	29(14,6)
One lung(unilateral)	7(3,5)	61(30,7)
Both lung (bilateral)	0	1(0,5)
Ekstrapulmonal	3(1,5)	94(47,2)
Normal		

Based on the table above, patchy opacity lesions were found in 5 patients (2.5%), which were the most common lesions in COVID-19 sufferers with comorbid hypertension, followed by consolidated lesions in 4 patients (2%).

3. Discussion

COVID-19 is a contagious disease that threatens the world and has spread to various continents. All age groups and sexes can be infected by this SAR-CoV-2 virus. In this study, it was found that the number of COVID-19 research subjects was more women (108 people) than men (91 people). Although there is a theory that states that men suffer more COVID-19 related to smoking habits, but there are several studies that show the opposite results, there is even literature that does not support the theory that smoking predisposes to COVID-19.[6] The Global Health 50/50 research initiative provides an overview of data from around the world about frequency distribution of sexes suffering from COVID-19. The results show that the ratio of male and female sufferers is almost the same, but the severity of the disease is increasing in men.[1] A study by The Joint Research Center (JRC) in Europe, found that the proportion of patients diagnosed with COVID-19 was higher in women under 50 years of age.[18] This study also showed similar results. Despite the women is greater in number, the difference is not significant.

Most of the COVID-19 patients at RSUP Dr. Mohammad Hoesin are in the group of 18-60 year old, namely 163 people. There are 36 peoples over 60 years old with the largest number of them being male as many as 26 people. Studies in the United States argue that the age group under 60 years is more susceptible to contracting the virus because they are still productive, have a lot of activities outside the home that allow contact with other people.[19] The Faculty of Medicine, University of Indonesia together with Cipto Mangunkusumo General Hospital conducted a study on elderly COVID-19 patients. The study shows a 23% mortality rate for those over 60. This is because the symptoms in this age group are often atypical, leading to delays in diagnosis and treatment. Even in this study, it was found that 90% of the patients who died were male. Men with COVID-19 are more prone to experiencing bad outcomes, one of which is because the decrease in the number of B and T cells in elderly men is greater than in women. Furthermore, the testosterone hormon actually affects the expression of transmembrane serine protease (TMPRSS2) which plays a role in the entry of the SARS-Co-V-2 virus into the body's cells.[20] This is also consistent with case reports in China at the start

of the pandemic, which found the mortality rate for male patients was 2.8% compared to 1.7% for female.[6,10]

There are various kinds of radiological abnormalities found on chest X-rays in cases of COVID-19. Abnormalities that can be found on chest X-ray include consolidation, GGO, nodules, patchy opacity infiltrate, pleural effusion, and lymphadenopathy. Pleural effusion, lymphadenopathy and cavity are rare radiological features. The typical characteristic of COVID-19 on chest X-ray is GGO or consolidation that is multifocal, lying peripheral or subpleural, with a distribution in the lower lobe and in both lungs. In this study, the most common lesion type found was patchy opacity lesion (38), followed by consolidation (33), followed by GGO (21). The distribution of lesions was greatest in parahillar / paracardial (63 cases), then 31 cases in peripheral, involving both lungs (68 cases). The few lesions found were nodules and pleural effusions, only 2 cases.

Research conducted by Soon et all in Korea on 9 COVID-19 patients also found various abnormalities including GGO, focal atelectasis, single nodular opacity and patchy opacities on chest X-rays.[21] Research in Hong Kong by Ho Yuen et al found consolidation, GGO , and pleural effusions in 64 COVID-19 patients. Apart from the type of lesion, Ho Yuen also assessed the distribution of the lesions on the chest X-ray. The results showed that the most common type of lesion was consolidation (47%) followed by GGO (33%) with the location of the most lesions in the lower lung field (50%) then in the peripheral lung (41%) involving both lungs (50%). Pleural effusion is only 3% .[17]

Another study was conducted in Pakistan by Durrani on 30 COVID-19 patients, with a scoring system similar to that of Ho Yuen et al. Seven patients showed peripheral consolidation of both lungs and 2 patients were normal. Of the remaining 21 patients, only 1 had lesions in one lung, while the rest involved both lungs, with diffuse visible lesions in both lungs in 3 patients and peripheral lesions in 18 patients. Four patients had pleural effusions and 1 patient had calcific granuloma nodules.[22]

Based on the patient's age group, the results of this study found that the most lesions in the lung were patchy opacity lesions in both age groups of the study subjects, with 135 (67.8%) patients in the 18-60 year age group and 26 (13.1%) patients in the 18-60 year age group. Age group over 60 years. The most common lesions seen were parahillar / paracardial in both age groups, namely 48 (24.1%) patients from 18-60 years age group and 15 (7.5%) patients over 60 years old, with the same lesion location, namely in both lungs. Based on gender, the most common lesions found in men were consolidation (10.1%) and patchy opacity lesions were mostly found in women (10.1%). The location of lesions in males and females were both seen most frequently in the parahillar/paracardial areas and the second most in the periphery of the lung, in both lungs. Russel et al conducted a study of 636 COVID-19 patients regarding radiological findings on chest X-rays and their relationship to patient age and sex. His research divided the ages into 3 groups (18-40 years, 41-63 years and 64-90 years). The most common lesion found in all age groups was interstitial infiltrates followed by GGO, with the location of the lesion in the lower lobe and the

distribution of the lesions peripherally. For sex category (males 363, females 273), the same lesions namely interstitial infiltrates and GGO were also the most common lesions found in both sexes, with distribution in the periphery and in the lower lobes. But in the end, the results of his research stated that age and gender had no influence / effect on the variation in the radiological image of the chest X-ray of the COVID-19 patient.[23] Another study conducted by Borghesi et al on 783 patients stated that the severity of chest X-ray abnormalities had a correlation. with increasing age. Men tend to be at more severe risk than women, especially at the age of 50-79 years. There was no specific explanation for whether there was a correlation between radiological abnormalities and age and sex. [24]

There were 15 COVID-19 patients who had comorbid DM in this study. The most common abnormality was consolidation (5 cases) followed by patchy opacity lesions (4 cases), with the largest distribution of lesions in parahillar / paracardial cells (7 cases). There are still very few studies that specifically study thoracic radiological abnormalities in COVID-19 patients with DM. In Iran, Raoufi et al studied 117 COVID-19 patients with DM who were divided into 2 groups into controlled DM (24 patients) and uncontrolled DM (93 patients). This study wanted to assess whether there were differences in the chest CT scan between the two groups. Of the two groups, the most common lesion found was GGO (51.3%) followed by consolidation (35%) with the lesion location in the lower lobe and 85.5% of the lesions were peripheral. However, in the uncontrolled DM group, linear opacities were often found on chest CT scans. Of all the patients, no perihilar distribution was found. Ten patients were found to have pleural effusions in their thorax.[25] In addition, there were two case reports, in Adam Malik General Hospital, Medan and at Union Hospital, China, each of which reported young COVID-19 patients suffering from DM. In Medan, a 26 year old patient came with respiratory problems and had a chest photograph. Based on the chest X-ray, paracardial infiltrates were found suggestive of bronchopneumonia.[26] Another case, at Union Hospital, a 23 year old patient complained of cough and fever, then a chest CT scan was performed. Chest CT scan results show consolidation and GGO especially in the posterior aspect of both lungs and in the lower lobe. Following follow-up imaging, the patient was given a chest X-ray, which showed consolidation and GGO in both lungs was still as extensive as before.[27]

In this study, there were 14 COVID-19 patients with hypertension. The results showed that the most lung lesions found were patchy opacity lesions in 7 patients (2.5%), followed by consolidation in 4 patients (2%). The greatest distribution of lesions was found in parahillar / paracardial in 7 patients (3.5%) with the most frequent location of lesions in both lungs in 7 patients (3.5%). As with DM, there are still very few studies of COVID-19 cases in hypertensive patients. Chao et al reported a case of a young patient who experienced COVID-19 with hypertension comorbid factors. His chest X-ray shows lesions in the form of patchy and confluent airspace opacities that are dominant in the upper lobes of both lungs.[28] Another study by Wenjun Yu et al who studied 15 COVID-19 patients with

hypertension based on chest CT scans, found the most common radiological image was GGO (13 patients), multiple, involving 4-5 lobes with a distribution in the subpleural parts of both lungs. Other radiological features include consolidation, interlobular septal thickening, and solid nodules.[29]

4. Conclusion

The results of the study of 199 samples based on sociodemographic factors showed that the age of COVID-19 patients was mostly found in the 18 -60 year age group (163) with the largest gender being women (108). Based on the comorbid diseases, 15 cases of COVID-19 have diabetes mellitus and 14 hypertension cases. Patchy opacity lesions are the most common type of lesion found on chest X-ray (38) followed by consolidation (33). The fewest lesions were nodules and pleural effusions (2 cases, respectively). In addition, there were also disorders that had more than one type of lesion, most of which was consolidation with pleural effusion (4 cases).

The greatest distribution of lesions was found in the parahillar / paracardial (63) with the most commonly location in both lungs (68). At 18–60 years of age, the most common lesions were patchy opacity lesions (29) with a distribution in the parahillar / paracardial (48) and in both lungs (46). Over the age of 60 years, there were 26 cases with patchy opacity lesions, 15 cases in parahillar / paracardial lesions and bilateral lung lesions (22).

Based on the sex of the study subjects from chest x-ray in COVID-19 patients, the most common type of lesion in women was patchy opacity lesions, including 20 cases, with the most frequent distribution in the parahillar / paracardial (31) and both lungs (32). In males there were 20 consolidation with the largest distribution of lesions found in the parahillar / paracardial (32) and in both lungs (36). Based on the comorbid diabetes mellitus from chest X-ray in COVID-19 patients, the most common type of lesion found was consolidation in 5 cases. Most of the distribution and location of the lesions were found in the parahillar / paracardial (7) and in both lungs (7). The most common type of lesion found in patients with comorbid hypertension is patchy opacity lesions (5), with the greatest distribution of lesions in the parahillar / paracardial (7) and in the bilateral lung (7).

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