 sciendo

Description of Thorax X-ray and Brixia Score in Pregnancy with COVID-19 Infection

A. A. N. Jaya Kusuma*

Department of Obstetrics and Gynecology, Division of Fetomaternal, Sanglah General Hospital, Denpasar, Indonesia

Abstract

BACKGROUND: Based on data until December 31, 2020, confirmed cases of coronavirus disease 2019 (COVID-19) have been reached nearly 750,000 cases, COVID-19 can infect pregnant women because a reduction in the immune receptor and increase in another pro-inflammatory factor. Complications include fetal distress, premature rupture of membranes, fetal death, chorioamnionitis, preeclampsia, sepsis, renal failure, and disseminated intravascular coagulation. A serial chest X-ray is used as a basis for assessing COVID-19 progression. An experimental study in Italy proposed a scoring system known as the Brixia score divides the chest X-ray image posteroanterior or anteroposterior into 3 zones, namely, the upper, middle, and lower zones labeled as A to F, then assess the abnormalities that exist in each area with a score of 0–3, a score of ranges from 0 to 18. This score can be used to assess the severity of symptoms suffered by confirmed patients and determine the patient's prognosis.

AIM: This study aims to determine the characteristics of the chest X-ray and Brixia score in pregnancy with COVID-19 infection.

METHODS: This descriptive research aims to describe the characteristics of the chest X-ray and the Brixia score in pregnancy with COVID-19 infection in pregnancy at the Department/KSM Obstetrics and Gynecology FK Udayana/Sanglah Hospital, Denpasar. This research carried out from April 2020 to March 2021. The sample of this study was all pregnant women with confirmed COVID-19 at Sanglah Hospital Denpasar during the period April 2020–March 2021. Data collected are all pregnant women who are confirmed to have COVID-19 and met the inclusion and exclusion criteria of the study. Data recorded and data tabulation is carried out according to characteristics that have been determined, then data processing is carried out descriptive.

RESULTS: In pregnant patients with confirmed COVID-19 in the period from April 2020 to March 2021, there were 95 people. The highest proportion of mothers pregnant with COVID-19 infection performs antenatal care checks at midwives and Obstetric Gynecologist (47.4%) with age 20–35 years (86.3%), primipara (41.1%), age term pregnancy (74.7%), and using the abdominal method for delivery (87.4%). X-ray results that it was found that from 95 pregnant women, there were 56 pregnant women with thorax abnormal and 39 with normal conditions. The highest proportion of the X-ray results was obtained pregnant with COVID-19 infection with abnormal thorax consolidation lesions found (94.6%) and the distribution of the lesions on the right lung side (39.3%). Based on the cross-tabulated analysis, it can be seen that the consolidation lesion is found in all Brixia scores with the highest proportion in the 0–5 category, which is 80.3%. Results chest X-ray of pregnant women with COVID-19 infection with Brixia score 0–5 had the same values including pleural effusion lesions 1.8%, pulmonary edema 1.8%, and fibrotic by 1.8%.

CONCLUSION: Following conclusions can be drawn: Overview of the characteristics of pregnant women with the most COVID-19 infections is at the age of 20–35 years with a primiparous pregnancy. Gestational age term gave birth by the abdominal method; abnormal chest X-ray images are more often found in patients with COVID-19 in pregnancy with consolidated lesions as well as diffuse distribution mostly on the right side of the lung; Brixia score in pregnancy with COVID-19 infection with proportion the highest is in parameter 0–5 as much as 85.7%.

Introduction

Coronavirus is an RNA virus with a 120160 nm particle size. The virus primarily infects animals, including bats and camels. Coronavirus disease 2019 (COVID-19) first appeared in Wuhan and continues to increase every day. The peak of COVID-19 cases occurred from the end of January to early February 2020. The total number of sufferers COVID-19 until April 2021 reached 147,893,321 people and the death toll reached 3,124,774 people.

The first case of COVID-19 in Indonesia was reported on March 2, 2020, as many as two cases and there has been an explosion of cases to date. Based on data until December 31, 2020, confirmed cases of COVID-19 have been reached nearly 750,000 cases, of which 22,000 people died. This virus is transmitted through droplet obtained from an infected persona aerosol even fecal-oral transmission has been reported [1]. COVID-19 can be infected by anyone, especially pregnant women because changes in the immune system are characterized by a reduction in lymphocytes, increased angiotensin-converting enzyme 2 (ACE2), increased NKG2A receptors, and also followed by an increase in other pro-inflammatory factors such as interleukin 8 (IL-8), interleukin 10 (IL-10), and induced protein 10 (IP-10). Complications to watch out for include fetal

distress, premature rupture of membranes, fetal death, chorioamnionitis, preeclampsia, sepsis, renal failure, and disseminated intravascular coagulation (DIC) [2]. The study too found that there is a possibility that transmission occurs vertically from the mother which confirmed to baby, although still inconclusive in the proof [3].

Symptoms that are often present in pregnant women are fever, cough, and shortness of breath, the same as in other people in general. An infected pregnant woman COVID-19 has become an indication for the delivery method Sectio Cesarea because it is suspected that there is a vertical transmission and can reduce pressure intra-abdominal for better breathing [1]. A randomized trial controlled studies show that in addition to COVID-19 infection, pregnant women are often accompanied by other complications such as fetal distress, premature rupture of membranes, history of fetal death, chorioamnionitis, or preeclampsia [1]. Complications that are feared from pregnant women infected with COVID-19 include sepsis, acute renal failure, and DIC. The literature states that pregnant women are more at risk infected with COVID-19 due to changes in their immune system, characterized by a reduced number of lymphocytes, increased ACE2, increased receptors NKG2A, increased proinflammatory factors such as IL-8, IL-10, and IP-10 which is a risk factor for COVID-19 infection [2].

A serial chest X-ray is used as a basis for assessing COVID-19 progression. Diagnostic modalities that are the gold standard for COVID-19 are the reverse transcription-polymerase chain reaction (RT-PCR) examination obtained from the nasopharyngeal/oropharynx swab. RT check PCR had a sensitivity of ±94% and a specificity of 100%. Even though inspection chest X-rays are often considered insensitive to assess changes in the lungs in the early stages of the disease, computed tomography scan thorax is good for assessing changes in the lungs [4].

An experimental study in Italy proposed a scoring system known as the Brixia score, this scoring divides the chest X-ray image posteroanterior or anteroposterior into 3 zones (each zone is divided into two areas), namely, the upper, middle, and lower zones labeled as A to F, then assess the abnormalities that exist in each area with a score of 0–3, a score of ranges from 0 to 18. This score can be used to assess the severity of symptoms suffered by confirmed patients and determine the patient's prognosis. This score can help assess the severity of the disease in children COVID-19 patients, especially in this study in pregnant women [5]. Given that pregnancy infected with the severe acute respiratory syndrome coronavirus 2 virus is a case of pregnancy with high risk and based on the background of the problem described above, the author is interested in doing a descriptive study to determine the characteristics of the chest X-ray and Brixia score in pregnancy with COVID-19 infection at Sanglah Hospital Denpasar in the period April 2020–March 2021.

Methods

This research is descriptive research, namely, research that aims to describe the characteristics of the chest X-ray and the Brixia score in pregnancy with COVID-19 infection in pregnancy at Sanglah Hospital Denpasar. This research took place at the Department/ KSM Obstetrics and Gynecology FK Udayana/Sanglah Hospital, Denpasar. From April 2020 to March 2021. The sample of this study was all pregnant women with confirmed COVID-19 at Sanglah Hospital Denpasar during the period April 2020–March 2021.

The initial stage of this study was to collect data on pregnant patients who confirmed COVID-19 at Sanglah Hospital in the form of medical record data. Data that collected are all pregnant women who are confirmed to have COVID-19 at the RSUP Sanglah Denpasar and met the inclusion and exclusion criteria of the study. Then, recorded and collected data both from the patient's identity and other basic characteristics. After that, the data tabulation is carried out according to characteristics that have been determined, then data processing is carried out descriptive. The final stage is writing a research report.

Results

In pregnant patients with confirmed COVID-19 in the period from April 2020 to March 2021, there were 95 people. Patients who had no confirmed COVID-19, abortion cases, or postpartum cases were excluded from this data. Demographic data of respondents taken include antenatal care (ANC), age, parity, gestational age, and method of delivery. The distribution of demographic data for all respondents is presented in Table 1.

Table 1: Frequency distribution of demographic data of pregnant women with infection COVID-19

Characteristic	Pregnant women with COVID-19 infection	
	n = 95	%
Antenatal care		
Obstetricians	49	51.6
Midwives	1	1.1
Midwives and obstetricians	45	47.4
Age (years)		
<20	1	1.1
20–35	82	86.3
>35	12	12.6
Parity		
Multipara	33	34.7
Primipara	39	41.1
Multipara	23	24.2
Gestational age		
Pre-term	24	25.3
Aterm	71	74.7
Post-term	0	0
Delivery method		
Vaginal	12	12.6
Abdominal	83	87.4

Based on the data in the table above, the highest proportion of mothers pregnant with COVID-19 infection performs ANC checks at midwives and

Table 2: Distribution of characteristics of thorax X-ray in pregnancy with COVID-19 infection

X-ray thorax	Pregnant women with COVID-19 infection	
	n = 95	%
Thorax		
Normal	39	41.1
Abnormal	56	58.9

obstetric gynecologist (47.4%) with age 20–35 years (86.3%), primipara (41.1%), age term pregnancy (74.7%), and using the abdominal method for delivery (87.4%).

One of the parameters assessed in this descriptive study is chest X-ray pictures in pregnant women with COVID-19 infection. X-ray results that it was found that from 95 pregnant women, there were 56 pregnant women with thorax abnormal and 39 with normal conditions (Table 2).

Table 3: Distribution of characteristics of abnormal thorax X-rays in pregnancy with COVID-19 infection

X-ray thorax abnormal	Pregnant women with COVID-19 infection	
	n = 56	%
Lesi		
Consolidation	53	94.6
Pleural effusion	1	1.8
Edema pulmonum	1	1.8
Fibrotic	1	1.8
Distribution		
Right	22	39.3
Left	18	32.1
Bilateral	16	28.6

Furthermore, 56 pregnant women infected with COVID-19 with abnormal thorax X-rays were performed to see the lesions found and the distribution of the lesions on the chest X-ray (Table 3).

Based on the results of the analysis, the highest proportion of the X-ray results was obtained pregnant with COVID-19 infection with abnormal thorax consolidation lesions found (94.6%) and the distribution of the lesions on the right lung side (39.3%).

Brixia score is one of the parameters that are also assessed in this study, this scoring system was used to assess the severity damage that occurs on abnormal chest X-ray images of COVID-19 patients which were coined in Italy. The results of the study are presented in Table 4 below.

Table 4: Distribution of Brixia score in pregnancies with COVID-19 infection

Brixia score	Pregnant women with COVID-19 infection	
	n = 56	%
0–5	48	85.7
6–10	6	10.7
11–15	2	3.6
>15	0	0

Brixia score results in pregnancy with COVID-19 infection with the highest proportion were in parameter 0–5 as many as 48 patients (85.7%). While the lowest score is in the >15 category, which is 0.

Based on the cross-tabulated analysis, it can be seen that the consolidation lesion is found in all Brixia scores with the highest proportion in the 0–5 category, which is 80.3%. Results chest X-ray of pregnant women

with COVID-19 infection with Brixia score 0–5 had the same values including pleural effusion lesions 1.8%, pulmonary edema 1.8%, and fibrotic by 1.8%.

Discussion

Characteristics of pregnant women with COVID-19 infection

This research was conducted over 11 months from April 2020 to March 2021, there were 95 pregnant women research subjects with infection COVID-19. Characteristics of pregnant women with COVID-19 infection show that as many as 82 people (86.3%) have an age range of 20–35 years, while 12 people (12.6%) were over 35 years old and only 1 subject (1.1%) were <20-years-old. Based on parity, the majority of subjects were primiparas as many as 39 people (41.1%), while nullipara as many as 33 people (34.7%) and followed by multipara as many as 23 people (24.2%). Judging from the age range of patients in this study, the majority of the pregnant women ranges from 20 to 35 years, which is in line with research in Italy by Ferrazzi et al. in 2020 [6], where the age range of the patients there ranged from between 21 and 40 years. In this study, it was also found that 15 patients were pregnant women with nulliparous parity status of around 35.7%, this is in line with findings in our study, where primiparous (41.1%) or multipara (24.2%) had a higher proportion than cases in mothers with nulliparous status (34.7%) [6].

ANC data show the proportion of pregnant women who have ANC in Obstetric Gynecologist and ANC in midwives and obstetric.

Gynecologist has almost the same proportion as many as 49 people (51.6%) and 45 people (47.4%), while the proportion the smallest number of pregnant women who perform ANC to midwives is 1 person (1.1%). In terms of gestational age, the majority of pregnant women who are confirmed the number of COVID-19 that came to Sanglah Hospital was 71 people (74.7%) followed by preterm gestational age as many as 24 people (25.3%), there were no confirmed pregnant patients with COVID-19 aged post-term pregnancies in the study period. Findings in this study in line with the research in Wuhan, China in 2020 by Chen et al. were found the proportion of preterm deliveries as much as 21%, wherein, in this study, it was found that 25.3% of the total cases were where the gestational age is preterm [7]. Reviewing the method of delivery performed on pregnant patients confirmed COVID-19 at Sanglah Hospital during this study period, it was found that as many as 83 people (87.4%) had an abdominal method of delivery or Sectio Cesarea and as many as 12 other people (12.6%) experienced parturition spontaneous/vaginal. Regarding the method of delivery,

according to the recommendations of American Journal of Obstetrics and Gynecology [8], the delivery method must be adjusted according to obstetric indications and does not have to be done with section Cesarea. However, even so, case reports in China too found that 89% of cases of COVID-19 in pregnancy were carried out by cesarean section [8]. Recommendations from Perkumpulan Obstetrics and Gynecology Indonesia (POGI) also stated the same thing that method of delivery should be determined on a case-by-case basis, beforehand family counseling is important, except for pregnant patients who experience respiratory distress requiring immediate delivery. The above results are supported by similar results in the reviewed studies by Ryan *et al*. in 2020 regarding the method of delivery, where it was found abdominal delivery methods ranged from 42.9% to 91–92% in cases of COVID-19 in pregnancy. The selection of this abdominal delivery method is considered because there is consideration of the possibility of interference in the patient's respiratory system. In contrast to the Italian study by Ferrazzi *et al*., in 2020 [6], where 57.1% of COVID-19 cases were found in pregnancy delivery by vaginal delivery method. Even though, recommendations from POGI have not found any strong evidence between any of the following: A delivery method that has a better outcome. Preferably, every case is individually reviewed and decision-making is taken in various ways consideration by the physician treating the patient [6], [9], [10].

Characteristics of thorax X-ray in pregnancy with COVID-19 infection

Based on chest X-ray findings in pregnancy with infection COVID-19 in this study period, it was found that as many as 56 people (58.9%) had an abnormal chest X-ray, whereas as many as 39 people (41.1%) had normal chest X-rays. This finding is contrary to the study conducted by Cozzi *et al*. in 2020 regarding the findings of a chest X-ray in a COVID-19 patient, where it was found that 94.4% of cases in the study found abnormal X-rays, whereas, in this study, abnormal X-ray images had ratio 3:2 with normal X-ray images (58.9% and 41.1%) [11]. The most common lesions found on the patient's chest X-ray COVID-19 in pregnancy were a consolidation of 53 patients (94.6%), followed by pleural effusion, pulmonary edema, and fibrotic tissue (each proportion 1.8%). Judging from the distribution of abnormal lesions on the X-ray picture thorax, it was found that the majority of the lesions occurred on the right side of the lung, as many as 22 patients (39.3%), the left lung as many as 18 patients (32.1%), and bilateral as many as 16 patients (28.6%). The findings in this study found lesions that were dominated by consolidated and do not describe a picture of nodular reticular opacities, ground-glass opacities, vascular congestion, and nodules. Whereas in the study conducted by Cozzi *et al*. in 2020 [11], the majority of X-rays are dominated by images of ground-glass opacity and followed by features of consolidation, vascular congestion, and pulmonary nodules, while in this study we found that the majority of the lesions were consolidated (94%). Based on the findings in this study, the distribution of the lesions on the right side of the lung was more with a proportion of 39.3%, followed by the left side of the lung as much as 32.1% and bilaterally as much as 28.6%, this finding is in line with the findings in the study by Yoon *et al*., in 2020, which found the proportion of the distribution of lesions on both lung sides right and left are comparable, namely, 1:1 [11], [12].

Distribution of Brixia score in pregnancy with COVID-19 infection

Judging from the distribution of the Brixia score on a chest X-ray abnormality in pregnancies with COVID-19 infection in this study, we found a minimum score of 1 and a maximum score of 13, with an average score of 3.45. For the majority of Brixia score proportions in the 0–5 group there are as many as 48 patients (85.1%), followed by 6–10 group with 6 patients (11.4%) and group 11–15 as many as 2 patients (3.5%). No chest X-ray was found scored >15 in this research period. No comparative studies have been found to compare the results of Brixia score in pregnant women infected with COVID-19, but there are studies on Brixia score comparing outcomes between sex and age groups, in a study by Borghesi *et al*. in 2020 found that in the group aged 20–29 years, 60% of the subjects were women and had a score of Brixia with a range of 1–3 and in the age group of 30–39 years, 38% of subjects were women and found scores ranging from 0 to 6. This finding is in line with our research where the majority of the subjects scored 0–5 which is as much as 80%. In conclusion, the Brixia scoring is a semi-quantitative assessment that can assess the severity or progression of damage to the lung in patients being treated with COVID-19. This scoring is very easy to do and had a comparable clinical association, with the higher the Brixia score, then the more severe the severity of the disease suffered by the patient [5], [13].

Conclusion

From the results of the study, the following conclusions can be drawn: (1) overview of the characteristics of pregnant women with the most COVID-19 infections is at the age of 2035 years with a primiparous pregnancy.

Gestational age term gave birth by the abdominal method. (2) Abnormal chest X-ray images are more often found in patients with COVID-19 in pregnancy with consolidated lesions as well as diffuse distribution mostly on the right side of the lung. (3)

Brixia score in pregnancy with COVID-19 infection with proportion the highest is in parameter 0–5 as much as 85.7%.

Suggestion

From the research results, the following suggestions can be given: (1) A more detailed description of the lesions found in cases of pregnant women infected with COVID-19 such as ground-glass opacity, reticular-nodular opacities, nodules, and vascular congestion so data can be used as research material and as a source science. (2) So that in the future application of use of the Brixia score can be used as data for prognostic studies of COVID-19 cases, especially in COVID-19 cases in pregnancy. (3) As a basis for further researchers to be able to develop research on cases of COVID-19, especially in pregnant women with infection COVID-19 especially on use Brixia scores.

Ethical Approval

All data is based on medical record data. Ethical clearance was not given as there is no intervention or conflicts of interest to the subject within.

References

1. Ashraf MA, Keshavarz P, Hosseinpour P, Erfani A, Roshanshad A, Pourdast A, *et al*. Coronavirus disease 2019 (COVID-19): A systematic review of pregnancy and the possibility of vertical transmission. J Reprod Infertil. 2020;21(3):157-68.
    PMid:32685412

2. Phoswa WN, Khaliq OP. Is pregnancy a risk factor for COVID-19? Eur J Obstet Gynecol Reprod Biol. 2020;252:605-9. https://doi.org/10.1016/j.ejogrb.2020.06.058
    PMid:32620513

3. Chen H, Guo J, Wang C, Luo F, Yu X, Zhang W, *et al*. Clinical characteristics and intrauterine vertical transmission potential of COVID19 infection in nine pregnant women: A retrospective review of medical records. Lancet. 2020;395(10226):809-15. https://doi.org/10.1016/S0140-6736(20)30360-3
    PMid:32151335

4. Mahase E. Covid-19: Point of care test reports 94% sensitivity and 100% specificity compared with a laboratory test. BMJ. 2020;370:m3682. https://doi.org/10.1136/bmj.m3682
    PMid:32948516

5. Borghesi A, Maroldi R. COVID-19 outbreak in Italy: Experimental chest X-ray scoring system for quantifying and monitoring disease progression. Radiol Med. 2020;125(5):509-13. https://doi.org/10.1007/s11547-020-01200-3
    PMid:32358689

6. Ferrazzi E, Frigerio L, Savasi V, Vergani P, Prefumo F, Barresi S, *et al*. Vaginal delivery in SARS-CoV-2-infected pregnant women in Northern Italy: A retrospective analysis. BJOG. 2020;127(9):1116-21. https://doi.org/10.1111/1471-0528.16278
    PMid:32339382

7. Chen L, Li Q, Zheng D, Jiang H, Wei Y, Zou L, *et al*. Clinical characteristics of pregnant women with covid-19 in Wuhan, China. N Engl J Med. 2020;382(25):e100. https://doi.org/10.1056/NEJMc20092
    PMid:3230207

8. Boelig RC, Manuck T, Oliver EA, Di Mascio D, Saccone G, Bellussi F, *et al*. Labor and delivery guidance for COVID-19. Am J Obstet Gynecol MFM. 2020;2(2):100110. https://doi.org/10.1016/j.ajogmf.2020.100110
    PMid:32518901

9. Ratnapalan S, Bentur Y, Koren G. Doctor, will that x-ray harm my unborn child? CMAJ. 2008;179(12):1293-6. https://doi.org/10.1503/cmaj.080247
    PMid:19047611

10. Ryan GA, Purandare NC, McAuliffe FM, Hod M, Purandare CN. Clinical update on COVID-19 in pregnancy: A review article. J Obstet Gynaecol Res. 2020;46(8):1235-45. https://doi.org/10.1111/jog.14321
    PMid:32500549

11. Cozzi D, Albanesi M, Cavigli E, Moroni C, Bindi A, Luvarà S, *et al*. Chest X-ray in new Coronavirus Disease 2019 (COVID-19) infection: Findings and correlation with clinical outcome. Radiol Med. 2020;125(8):730-7. https://doi.org/10.1007/s11547-02001232-9
    PMid:32519256

12. Yoon SH, Lee KH, Kim JY, Lee YK, Ko H, Kim KH, *et al*. Chest radiographic and CT findings of the 2019 novel coronavirus disease (COVID-19): Analysis of nine patients treated in Korea. Korean J Radiol. 2020;21(4):494-500. https://doi.org/10.3348/kjr.2020.0132
    PMid:32100485

13. Borghesi A, Zigliani A, Masciullo R, Golemi S, Maculotti P, Farina D, *et al*. Radiographic severity index in COVID-19 pneumonia: Relationship to age and sex in 783 Italian patients. Radiol Med. 2020;125(5):461-4. https://doi.org/10.1007/s11547-020-01202-1
    PMid: 32358691