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Use of Chest X-Ray (CXR) in Covid-19 Screening as A Modalities

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ABSTRACT

Background: As of March 11, 2020, the number of confirmed cases in China had reached 80,955 with the death toll reaching 3,162. So far, Covid-19 tends to infect people who have comorbid diseases such as heart disease, diabetes mellitus, cancer and chronic respiratory diseases as well as people over 60 years of age. Several cases of Covid-19 have also been reported in pregnant women.
Method: Radiographic technologies and tools including chest X-Ray and Computed Tomography (CT) are applied for initial screening and the follow-up because they provide detailed diagnoses with specific pathological features for staging and treatment settings. Not infrequently cases of Covid-19 are found in pregnant women because during pregnancy women's condition becomes very vulnerable to infection with pneumonia pathogens due to physiological changes during pregnancy that result in a decrease in the immune system. Although the clinical symptoms are the same as for non-pregnant women and there are no aggravating factors, pregnant women are prone to hypoxia.
Results: Chest x-ray (CXR) is a radiographic projection tool that can help diagnose conditions or abnormalities in the thoracic cavity. Due to the spread of Covid-19, it is important to recognize the common Covid-19 imaging findings and the abnormal pneumonia that occurs over time on CXR results. CXR can be used to diagnose patients with acute respiratory distress as the first line of evaluation for Covid-19 patients 19.
Conclusion: CXR can be a screening modality in Covid-19 patients including pregnant women. However, it is necessary to keep in mind that the CXR examination can have an impact on the fetus. Even though the risk is small, pregnant women who will undergo a Covid-19 examination or evaluation need special attention. In addition, it is necessary to consider other examinations that can be carried out especially on pregnant women, which do not have the effect of radiation.

Keywords *CXR Screening Modalities, Covid-19, Pregnant*

INTRODUCTION

The world was shaken by the news delivered by the WHO (World Health Organization) regarding the spread of pneumonia with no known cause in the city of Wuhan, China. This case first appeared at the end of December 2019 and its spread continued to the surrounding cities. After research was conducted, the disease was identified as being caused by a new type of corona virus which was isolated on January 7, 2020. (1)

As of March 11, 2020, the number of confirmed cases in China had reached 80,955 with the death toll reaching 3,162. So far, Covid-19 tends to infect people who have comorbid diseases such as heart disease, diabetes mellitus, cancer and chronic respiratory diseases as well as people over 60 years of age. (1) Several cases of Covid-19 have also been reported in pregnant women.

Early detection of COVID-19 cases needs to be carried out as quickly and accurately as possible so that appropriate treatment is obtained. Radiographic technologies and tools including chest X-Ray and Computed Tomography (CT) are applied for initial screening and the follow-up because they provide detailed diagnoses with specific pathological features for staging and treatment settings.(2) Not infrequently cases of Covid-19 are found in pregnant women because during pregnancy women's condition becomes very vulnerable to infection with pneumonia pathogens due to physiological changes during pregnancy that result in a decrease in the immune system. Although the clinical symptoms are the same as for non-pregnant women and there are no aggravating factors, pregnant women are prone to hypoxia. (3,4)

Radiographic tools are an excellent predictor for assessing the course of COVID-19 and can be used to monitor long-term consequences. (5) Radiologists need to understand the advantages and disadvantages of imaging media in evaluating Covid-19 in pregnant women. This is why Covid-19 cases in pregnant women need further review.

Chest X-Ray

Chest x-ray (CXR) is a radiographic projection tool that can help diagnose conditions or abnormalities in the thoracic cavity. Due to the spread of Covid-19, it is important to recognize the common Covid-19 imaging findings and the abnormal pneumonia that occurs over time on CXR results. (6) CXR can be used to diagnose patients with acute respiratory distress as the first line of evaluation for Covid-19 patients 19.(6.7) CXR has a substantial level of sensitivity (68.1%) with a fairly high variability between 69 and 90% (8) so it can be used to assess abnormal changes that occur in the chest cavity.

Chest X-Ray for Pregnant Women

Chest radiography or CXR is one of the conventional examinations that can be used as an initial screening in detecting Covid-19, including in pregnant women. CXR can be performed on pregnant women to evaluate Covid-19 by providing a minimum radiation dose of 50 mGy, but it is also necessary to consider the use of other imaging tools that do not have a radiation effect. CXR can be performed in the first and second trimesters of pregnancy with decreased exposure doses. In the third trimester it is necessary to place a lead shield that on the patient's upper abdomen to reduce the level of radiation exposure to the fetus and collimation techniques to narrow the X-ray waves. (9) Therefore, CXR is recommended to be used as a follow-up examination in clinical practice if the clinical condition the patient confirmed to be infected with Covid-19 worsened. (10)

Chest X-Ray for Fetus

In general, the minimum radiation dose that can be given to pregnant women is 50 mGy, although the literature describing the risk of radiation to the fetus is still diverse. However, there was no increased risk of radiation exposure to the fetus such as stunted growth, fetal malformations or miscarriage. Radiation generated from CXR is ionizing radiation that can cause genetic mutations or carcinogenesis due to cell death, DNA changes and morphological influences. However, the effect of this radiation also depends on gestational age and the dose used when the chest x-ray is taken. There is strong evidence that supports an increased risk of cancer in children due to radiation to the fetus in the womb. However, many aspects of radiation-induced child cancer are still controversial. (11)

Advantages of CXR Examination

Rapid and precise identification is the main factor in overcoming and preventing the spread of Covid-19. As is known, conventional examinations such as CXR have several advantages in the evaluation of Covid-19 cases. CXR can be used easily, imaging modalities do not require high costs, the method can be carried out quickly, and it can provide a good clinical picture and evaluation of Covid-19 cases (12)

In addition, several studies have also revealed that CXR has a sensitivity level of 61% and a specificity of 76% in the diagnosis of Covid-19, making it easier for medical personnel to identify and treat Covid-19 cases (13)

Table 1. Effect of Gestational Age and Radiation Dose on Radiation-Induced Teratogenesis

Pregnancy Period	Effect	Estimated Dose Limit*
Before implantation (0-2 weeks after conception)	Embryo death or no consequences (all or none)	50-100mGy
Organogenesis (2-8 weeks after conception)	Congenital abnormalities (skeleton, eyes, sex)	200 mGy
	Stunted growth	200-250 mGy
Fetal Period	Effect	Estimated Dose Limit*
8-15 weeks	Severe mental retardation (High risk)[+]	60-310 mGy
	Intellectual deficit	25 IQ-point loss per 1,000 mGy
	Microcephaly	200 mGy
16-25 weeks	Severe mental retardation (Low risk)	250-280 mGy*

*Data is based on the results of animal studies, epidemiological studies of atomic bomb victims in Japan, and studies of groups exposed to radiation for medical reasons (e.g. radiation therapy for uterine carcinoma)
+Because this is a period of rapid development and migration of neurons.(11)

Disadvantages of CXR Examination

Although CXR is widely recommended as the first line in the Covid-19 diagnose and evaluation, many do not recommend CXR as an initial modality due to some of the effects it can cause. As is known exposure to ionizing radiation resulting from CXR has a bad risk to the body and also the fetus.

Conclusion

CXR can be a screening modality in Covid-19 patients including pregnant women. However, it is necessary to keep in mind that the CXR examination can have an impact on the fetus. Even though the risk is small, pregnant women who will undergo a Covid-19 examination or evaluation need special attention. In addition, it is necessary to consider other examinations that can be carried out especially on pregnant women, which do not have the effect of radiation.

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