

DIAGNOSTIC POINTS IN RADIOLOGY FOR PREGNANT AND NON-PREGNANT PATIENTS WITH COVID-19

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Considering the importance of Reverse Transcription-Polymerase Chain Reaction (RT-PCR) as a reference to detect COVID-19, computed tomography (CT) has some advantage to help diagnosing this disease during COVID-19 pandemic. In this study, we reviewed the diagnostic points in radiology for patients with COVID-19. The use of RT-PCR and chest CT is beneficial and reliable to diagnose COVID-19 patients with suspected signs and symptoms. Not only radiological finding using RT-PCR and CT can help physician in the detection and diagnosis but also for monitoring of the COVID-19 stages. COVID-19 pneumonia shows more GGO, consolidation and crazy-paving especially in lower zones through CT scan. Pregnant women with COVID-19 mostly develop bilateral pleural effusion and consolidation, so CT scans can play an important role for detecting cases of pregnant women with COVID-19 but totally, radiological findings in pregnant involved with COVID-19 is not different with those of non-pregnant cases with COVID-19.

Keywords: SARS-Cov-2, COVID-19, Diagnosis, Radiology, Imaging.

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For citation: Forouzesh M., Dadashzadeh N., Farshid S., Hassanlouei B., Vazifekhah S., Valizadeh R. Diagnostic points in radiology for pregnant and non-pregnant patients with COVID-19. REJR 2021; 11(4):20-24. DOI: 10.21569/2222-7415-2021-11-4-20-24.

Received: 03.11.21

Accepted: 25.11.21

COVID-19 У БЕРЕМЕННЫХ: ДИАГНОСТИЧЕСКИЕ ОРИЕНТИРЫ В ЛУЧЕВОЙ ДИАГНОСТИКЕ

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Учитывая важность полимеразной цепной реакции с обратной транскрипцией (ОТ-ПЦР) в качестве эталона для выявления COVID-19, компьютерная томография (КТ) также имеет некоторые преимущества для диагностики данного заболевания в период пандемии. В этом исследовании мы рассмотрели диагностические ориентиры в лучевой диагностике для пациентов с COVID-19. Использование ОТ-ПЦР и КТ грудной клетки информативно и надежно для диагностики COVID-19 у пациентов с соответствующими признаками и симптомами. Обследование с использованием ОТ-ПЦР и КТ может помочь врачу как в выявлении и диагностике, так и в мониторинге стадий COVID-19. Пневмония COVID-19 преимущественно проявляется на КТ участками уплотнения по типу «матового стекла», зон консолидации и симптомом «crazy-paving», особенно в базальных отделах легких, при проведении компьютерной томографии. У беременных женщин с COVID-19 в основном развивается двусторонний плевральный выпот и зоны консолидации, поэтому компьютерная томография может сыграть важную роль в выявлении случаев COVID-19 у беременных женщин, но в целом результаты рентгенологических исследований у беременных с COVID-19 не отличаются от таковых у небеременных с COVID-19..

Ключевые слова: SARS-Cov-2, COVID-19, диагностика, рентгенология, визуализация.

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Для цитирования: Форузеш М., Дадашзаде Н., Фаршид С., Хассанлуэй Б., Вазифехах С., Вализаде Р. COVID-19 у беременных: диагностические ориентиры в лучевой диагностике. REJR 2021; 11(4):20-24. DOI: 10.21569/2222-7415-2021-11-4-20-24.

Статья получена: 03.11.2021

Статья принята: 25.11.21

Introduction.

In December 2019, a new disease caused by coronavirus so-called COVID-19 was reported in China and announced as pandemic situation by the World Health Organization (WHO) On March 11, 2020 [1]. Patients who developed COVID-19 most commonly reported symptoms like cough, fever, fatigue, and headache [1]. The diagnosis tools are based on human antibody detection, viral gene and antigen detection, and clinical finding in examination [2]. Use of computed tomography (CT) scan plays fundamental role in the early diagnosis for COVID-19 with lung involvement. In resource-limited places without easy accessibility to polymerase chain reaction (PCR) kits, CT along with clinical signs and symptoms are useful to discriminate COVID-19 patients but it is of great deal to know radiological finding in COVID-19 patients to accurate diagnosis [3]. This paper was done to review the diagnostic points in radiology for patients with COVID-19.

Methods.

In this mini-review, PubMed, Scopus, and Science direct were considered for search of English articles from 1 January 2020 to 10 August 2021. All types of articles related to the subject of this review in English and performed on human were selected. Keywords were COVID-19, corona-

virus disease 2019, radiology, Computed tomography, CT scan, novel coronavirus, ground-glass opacities, GGO, COVID-19 pneumonia, consolidation, Positron emission tomography and PET, Crazy-paving. All references imported to Endnote software and removed duplicate articles.

Role of ground-glass opacities and radiology in COVID-19 infection.

Some key points are necessary to use CT for accurate diagnosis. SARS-CoV-2 infection involves multifocal, multilobar, and peripherally dominant ground-glass opacities (GGO) especially in the posterior and basal segments and halo sign, reversed halo sign, and crazy-paving pattern in CT [4]. According to the report by radiological society of North America expert consensus statement on reporting chest CT findings, typical peripherally located GGO, GGO with halo sign, GGO in peribronchovascular locations, isolated consolidation without air-bronchogram sign, GGO in subpleural part of right lower lobe, bi-basilar consolidations, consolidations with an irregular border and subpleural bands are observed in patients with positive PCR tests and respiratory symptoms [4]. It should be mentioned that GGO is defined as hazy increased lung opacity; consolidation is defined as homogeneous increase in pulmonary parenchymal with obscured margins of vessels and airway

walls; halo sign is the same GGO surrounding a nodule or mass; Reversed Halo sign is defined as focal round area of ground-glass density surrounded by a rim of consolidation and crazy-paving pattern is defined as thickening of interlobular septa superimposed [5]. Generally, COVID-19 pneumonia typically presents with bilateral or subpleural areas of GGO with or without consolidations [6]. Regarding specificity and sensitivity of CT to discriminate COVID-19 pneumonia, it should be said that its sensitivity is 90% but its specificity is between 25 and 33% [6].

polymerase chain reaction (RT-PCR) with a specificity of approximately 95% and the sensitivity of 60–71% [11]. Due to low sensitivity and need for rapid diagnosis during this pandemic, CT scan can be used. Additionally we encounter with several cases with negative RT-PCR results, then given the high sensitivity of CT for diagnosis, CT scan is fundamental tool to detect COVID-19 during COVID-19 pandemic [7, 12, 13].

Frequent radiological findings in COVID-19.

CT findings based on COVID-19 pneumo-

Table №1. Differences in radiological findings across COVID-19 pneumonia, non-COVID viral pneumonia and bacterial pneumonia.

CT finding	Bacterial pneumonia	Non-COVID viral pneumonia	COVID-19 pneumonia
GGO	+	++	+++
Crazy-paving	+	++	++
Consolidation	+++	++	++
Centrilobular nodular opacities	++	++	---
Pleural effusion	++	+	--
Lesion distribution			
Lymphadenopathy	++	+	--
Lowerzone	+	++	+++
Cavitation	+	-	---
Rounded morphology	+	+	+++
Peripheral	+	++	+++

Why CT scan is essential to detect COVID-19.

Evidence shows 54% of COVID-19 cases with false-negative RT-PCR which approves low certainty [7], therefore chest CT is especially crucial to determine the COVID-19 cases and severity of the disease as well as to predict the need to mechanical ventilation in the intensive care unit [4, 8]. The signs of COVID-19 is not limited to geography in which in a study by Akçay et al in Turkey chest CT results were the same and reported similar findings consisting of air bronchogram sign, crazy paving pattern, reversed halo sign and subsegmental vascular enlargement inside or surrounding the lesion [9]. The diagnosis of COVID-19 pneumonia is challenging because it is the great radiological mimicker [10]. We believe that the reference diagnostic test for detecting COVID-19 pneumonia is real-time reverse transcription-

polymerase chain reaction (RT-PCR) and non-COVID viral pneumonia is summarized in Table 1 taken from a study done by Duzgunet al showing COVID-19 pneumonia as great radiological mimicker [10].

Positron emission tomography.

Also, Positron emission tomography [8]-CT may facilitate diagnosis and help selecting the treatment in these patients. Jin et al in a review study revealed that PET-related cases and research over the COVID-19 pandemic time focus on the ability of PET in the management of COVID-19 patients [14]. PET used for the diagnosis of COVID-19 respiratory syndrome in asymptomatic left ventricular assist device (LVAD) recipients [15]. Radiological findings from 81 patients showed that both CT and PET remain sensitive to find COVID-19 involving lung in asymptomatic cases or in patients with less symptoms [11, 16, 17].

Radiology room for medical imaging.

It is of great importance that after each patient imaging to prevent cross-contamination, all equipment be disinfected using an appropriate disinfectant as well as it is helpful to protect radiology department staff from COVID-19. It is strongly suggested to employ one week work and two weeks off shifts of fixed teams. Ventilation in radiology room can help to protect staff and patients from cross-contamination [18]. Additionally, an isolated imaging room can be dedicated for suspected or confirmed COVID-19 cases for further consideration[19].

Radiology in pregnant women with COVID-19.

Pregnant women with COVID-19 can develop bilateral pleural effusion, GGO and consolidation, so CT scans can play an important role for detecting cases of pregnant women with COVID-19 [20]. In a study by Gong et al, 100% of the pregnant women with COVID-19 showed lower lobe involvement while upper and middle lobes involved in 70%, 90% of the patients, respectively and 80% of the patients showed bilateral lung involvement. GGO was observed in 100% of the pregnant patients with COVID-19. Also, lymphadenopathy was not reported in this study [20]. In pregnant women suspected or confirmed COVID-19, CT scan can be used for detecting COVID-19 because according to the American Radiological Association the fetal radiation dose in pregnant women in single CT scan is 0.0005 to 0.01 mGy[21]. The family of SARS-Cov (SARS) and SARS-Cov-2 (COVID-19) is the same, therefore when the mortality rate of SARS in general people was 10%, it was 25% in the pregnant women as well as it was 37% for Middle East respiratory syndrome coronavirus (MERS-CoV)[22] showing that COVID-19 can be lethal for pregnant women as well. In a case report study, Vasilev et al. used magnetic resonance imaging (MRI) to detect COVID-19 in a pregnant woman and chest MRI showed bilateral lesions in basal segments [23]. Totally, radiological findings in pregnant with COVID-19 is similar to those of non-pregnant cases with COVID-19 [24]. Regarding most common CT scan findings in pregnant women with COVID-19, a

study by Oshay et al 427 pregnant patients revealed a higher prevalence of consolidation and pleural effusion on compared to the general adult population as well as vertical transmission of COVID-19 infection in pregnant women is not approved yet [25].

Further key points.

It is feasible to find up to 50% of COVID-19 patients with normal CT scans by 2 days after onset of flu-like symptoms due to COVID-19. Due to low sensitivity of RT-PCR, COVID-19 patients may show negative RT-PCR results but with lung abnormalities on chest CT in a such way that mostly are presented as peripheral focal or multifocal GGO affecting both lungs in at least 50% of the patients. In severe COVID-19 patients, consolidation and crazy paving is the dominant CT findings [26]. Important key is to avoid children and pregnant women to exposure radiation as much as possible[27].

Conclusion.

Finally, the use of chest CT accompanied by Reverse Transcription-Polymerase Chain Reaction (RT-PCR) is beneficial and reliable to diagnose COVID-19 patients with clinical suspicion. Not only radiological finding using RT-PCR and CT can help physician in the detection and diagnosis but also for monitoring of the COVID-19 stages. COVID-19 pneumonia shows more GGO, consolidation and crazy-paving especially in lower zones through CT scan. Pregnant women with COVID-19 mostly develop bilateral pleural effusion and consolidation, so CT scans can play an important role for detecting cases of pregnant women with COVID-19 but totally, radiological findings in pregnant with COVID-19 is similar to those of non-pregnant cases with COVID-19.

Authors' contribution.

Primary draft was prepared by MF, ND, RV and SF. SK, MB and TS edited, completed and revised the paper. All authors read and signed the final paper.

Conflicts of interest.

The authors report no conflict of interests.

Funding/Support.

There was no financial support.

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