

# Lung Involvement in COVID-19 Positive Pregnant Women and Their Outcomes – A Clinical and Imaging Based Retrospective Case Study

## Abstract

**Background and Aims:** COVID-19 has been a globally concerning pandemic affecting more than 20 million people worldwide. Due to physiological and anatomical changes, pregnant women are more susceptible to viral respiratory infections. Although the clinical and radiological features of COVID positive pregnant and non-pregnant women are comparable, literature pertaining to the clinical presentation and the outcomes in COVID positive pregnant women are being researched upon. **Aims and Objectives:** The main objective is to assess the lung involvement in COVID-19 positive pregnant women based on their clinical presentation and CT imaging features. The secondary aim is to study their clinical outcomes based on the above findings. **Methods:** This was a retrospective study carried out on COVID-19 positive pregnant women admitted to our hospital over 6 months (from May 2020 to October 2020). The collected data were analyzed with IBM.SPSS statistics software 23.0 Version. **Results:** There were a total of 480 COVID positive antenatal women detected. Out of 480 patients 75.8% (364) were asymptomatic, one hundred and two patients (21.3%) presented with mild symptoms such as fever, dry cough, runny nose, loss of taste/smell without any breathing difficulty. Fourteen patients (2.9%) were identified in the moderate to severe symptomatic category with lung involvement with a 95% Confidence Intervals between 1.41 and 4.42. Three patients sustained mortality, the overall Mortality rate being 0.6%. **Conclusion:** The majority of the COVID positive antenatal women are asymptomatic or present with mild symptoms as detected from this study. Only a small proportion (2.9%) were identified with respiratory compromise. Although their infectivity rate is quite high, 99.4% of the population were cured and discharged.

**Keywords:** COVID-19, CT chest, lung involvement, pregnancy

## Introduction

The management of COVID positive antenatal women can be extremely challenging as the virus is contagious causing life-threatening severe acute respiratory tract infection in 5% of the infected antenatal women.<sup>[1,2]</sup> The SARS-CoV-2 virus has the potential to cause varying degrees of illnesses ranging from common cold to pneumonia and acute respiratory distress in pregnant women.<sup>[3]</sup> The infectivity rate is higher in immunocompromised<sup>[4]</sup> and the patients' clinical characteristics can range from being asymptomatic or with mild symptoms of sore throat, loss of smell/taste up to the development of florid COVID pneumonia as opposed to the radiological patterns of ground glass opacities and focal consolidations which are the commonest of imaging patterns in COVID positive

antenatal women.<sup>[5]</sup> Also, they have a higher likelihood of progression to severe COVID pneumonia if not aggressively monitored and treated.

The physiological changes of pregnancy such as increased heart rate, stroke volume, oxygen consumption, decreased lung capacity, and edema of respiratory tract mucosa make these patients prone to respiratory pathogens and severe pneumonia.<sup>[6,7]</sup>

The diagnosis of COVID-19 is universally confirmed by reverse transcription polymerase chain reaction (RT-PCR) assay. Chest CT plays an important role in the evaluation, management, and follow-up of COVID-19 patients. Several studies have shown the sensitivity of chest CT to be superior to that of RT-PCR for early detection of COVID-19.<sup>[8]</sup> Chest CT without contrast is a very useful investigation to confirm or exclude viral pneumonia in symptomatic pregnant women, because

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radiation exposure to the fetus is very small. Therefore CT (with abdominal shielding) is the imaging tool of choice in pregnant women under moderate to severe risk category (i.e., those with respiratory compromise).<sup>[8,9]</sup> Therefore, this study focuses to detect lung involvement in COVID-19 positive pregnant women who were moderate to severely symptomatic.

### Methodology

This was a retrospective cross-sectional observational study and proper institutional ethics committee clearance was obtained on 19-1-2020 (ethical committee clearance number: 02012021).

All COVID-19 positive pregnant women admitted to our tertiary care hospital from May 2020 to October 2020 were included in the study.

### Exclusion criteria

1. All COVID negative Antenatal & postnatal women
2. Postnatal women diagnosed to be COVID positive
3. Post caesarean women diagnosed to be COVID positive.

The patients' clinical symptomatology was recorded based on which they were categorized as asymptomatic, mildly symptomatic, and moderate to severely affected. The mild symptomatic group presented with fever, cough, cold, loss of smell, taste without any breathing difficulty, or drop in oxygen saturation as recorded by the pulse oximeter. Patients who presented with breathing difficulty and/or had a drop in room air saturation <96% were grouped in the moderate to severe category. Patients of the moderate and severe categories were differentiated by the percentage of lung involvement in chest CT with more than 50% lung involvement being grouped under severe category. Only the patients in the moderate to severe category underwent chest X-ray and CT chest imaging with abdominal shield considering the need to avoid unnecessary radiation exposure in all antenatal women as per ACOG guidelines. Non-enhanced CT chest imaging was done in supine position end inspiration with one of the 64 section multi detector CT scanners. The X-ray and CT imaging were standardized for all the patients who required the imaging. The reporting of the findings was also standardized and the radiologist was blinded to the clinical picture of the patient. The

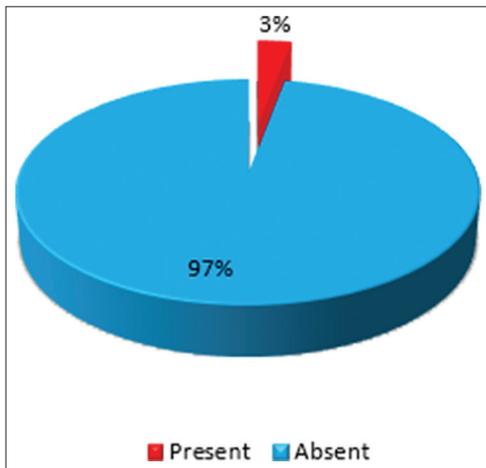


Figure 1: Lung involvement & ICU admissions

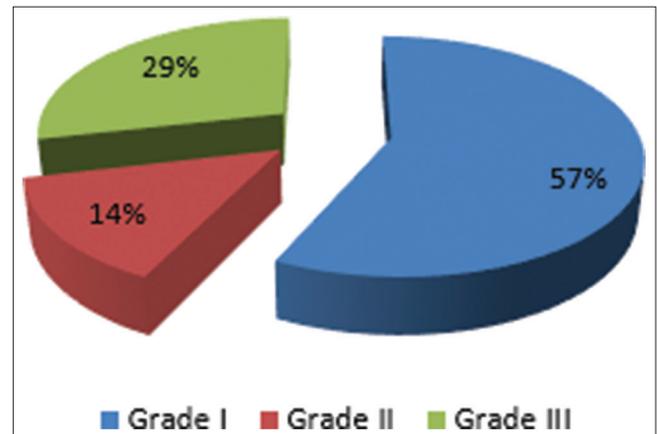


Figure 2: Grading of lung involvement by CT chest scoring

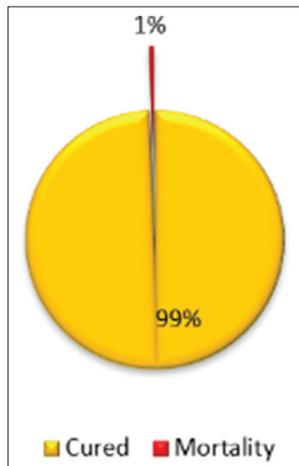


Figure 3: Overall outcome

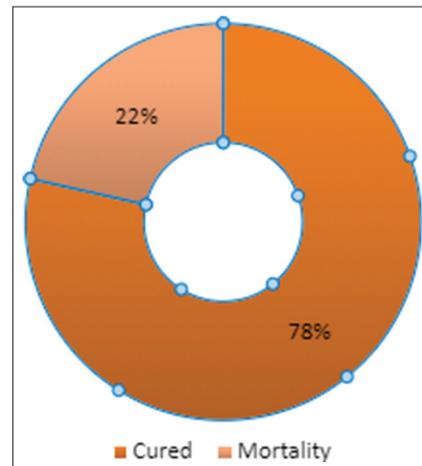


Figure 4: Outcome in lung involved group

**Table 1: Overall descriptive statistics**

	<i>n</i>	Minimum	Maximum	Mean	SD	95%CI
Age	480	18.0	46.0	26.348	4.5953	
Lung involvement	14	5.0	75.0	33.179	25.9256	1.41-4.42
Number of days taken for cure and discharge	477	4.0	38.0	8.761	4.0117	

**Table 2: Overall descriptive statistics**

	<i>n</i>	Minimum	Maximum	Mean	SD
Age	14	22.0	39.0	29.3	5.2
Number of days taken for cure and discharge	11	8.0	38.0	14.6	7.9

CT chest severity scoring out of 25 was graded into four as per the standard scoring system followed in our institution.

Grade 1 <25% lung involvement.

Grade 2 25 to 50% lung involvement.

Grade 3 50 to 75% lung involvement.

Grade 4 >75% lung involvement.

They were followed up during their course of treatment in the hospital, their outcomes were studied and classified as:

- Patients cured without respiratory complication
- Patients cured after being treated for respiratory complications
- Patients who died in the course of disease treatment.

The patients' data were analyzed with IBM.SPSS statistics software 23.0 version. To describe the data, descriptive statistics, frequency analysis, percentage analysis were used for categorical variables, and the mean and S.D were used for continuous variables.

## Results

There was a total of 480 COVID positive antenatal women detected in the study period out of which 14 were identified to have lung involvement. "Lung involvement" was defined as those COVID positive patients of the moderate and severe categories who presented with breathing difficulty/drop in oxygen saturation and also had corresponding typical features of COVID on CT chest. Although chest X-ray was also done, CT chest imaging, being a sensitive tool was considered in defining lung involvement. 14 patients out of 480 were identified to have lung involvement. Lung involvement & ICU admission rate is 2.9% (95% CI, 1.41 to 4.42) [Figure 1].

Amongst the 480 COVID positive antenatal women, 74.6% fall in the age group between 21 to 30 years. 20% of the study population was less than 20 years of age while 15.5% of the population was older than 30 years of age. In the lung involved group, 8 out of 14 patients were between 21 to 30 years of age and the remaining 6 patients were above 30 years. COVID positive population belonging to the third trimester were 80.2% (385) as opposed to 16.7% patients

in the second trimester and 3.1% patients in first trimester. In the lung involved patients, 11 patients belonged to the third trimester.

Out of 480 patients, 75.8% (364) of COVID positive antenatal women were asymptomatic developing no symptoms before and after admission including course of stay in hospital. Patients who presented with mild symptoms such as fever, dry cough, runny nose, loss of taste/smell without any breathing difficulty summed up to 21.3% (102). Out of 480 patients, 1.7% (8) presented under moderate category with minimal breathing difficulty/SpO<sub>2</sub> drop requiring only minimal oxygen support without the need for ventilatory support whereas 1.3% (6) patients presented under severe category requiring the need for invasive ventilatory support.

Out of the 14 patients, chest X-ray was found to be normal in 5 patients of moderate symptomatic category. Other 9 patients (3 in moderate + 6 in severe category) presented with chest X-ray findings such as air bronchograms, air space opacities & patchy consolidations.

Among the 14 patients, 8 of them (57.1%) had grade 1 COVID lung involvement of 25%. 2 patients (14.2%) had grade 2 lung involvement (25 to 50%) whereas 4 patients (28.5%) presented with grade 3 lung involvement with more than 50 percent of lungs involved [Figure 2].

Among the overall 480 COVID positives, three patients sustained mortality. 477 were cured and discharged (99.4%) [Figure 3]. In the lung involved group, 11 were cured out of 14 (78.5%) [Figure 4]. The average number of days taken for discharge in 477 COVID positive patients on the whole (excluding 3 mortalities) is 8 days [Mean (SD) 8.8 (4)] [Table 1] as opposed to 2 weeks [Mean (SD) 14.6 (7.9)] in patients with respiratory involvement [Table 2].

## Discussion

This study aimed to detect the total number of COVID positive antenatal women with lung involvement, the intensity of lung involvement, and the outcomes based on their clinical symptomatology & CT imaging features.

There were a total of 480 COVID positive antenatal women detected in the study period, out of which 75.8% (364) of COVID positive antenatal women were asymptomatic, 21.3% (102) of patients presented with mild symptoms without any breathing difficulty. This is in correlation with the study conducted by Yang *et al.*<sup>[10]</sup> who reported in his

study that 84.6% (majority) of antenatal women presented asymptomatic on admission. Only 15.4% developed mild symptoms during admission<sup>[11]</sup> commonest of which were fever & dry cough.<sup>[3]</sup>

Among the 480 patients, 14 patients were identified to have lung involvement as detected by clinical and corresponding radiological CT features. Pregnant women have been found to be more sensitive to radiation exposure.<sup>[11]</sup> Therefore only 14 of the 480 patients who presented under the moderate/severe category (in whom imaging was mandatory for the guidance of treatment) were taken up for chest X-ray & CT chest with an abdominal shield. In the asymptomatic & mildly symptomatic group, imaging was avoided considering the need to avoid unnecessary radiation exposure as dictated by ACOG guidelines which is also in accordance with studies conducted by Liu *et al.*<sup>[3]</sup> and Francis *et al.*<sup>[11]</sup>

CT chest has been found to have more diagnostic sensitivity than X-ray chest.<sup>[12]</sup> Zhao *et al.*<sup>[13]</sup> Panahi *et al.*<sup>[14]</sup> studied CT chest imaging features of 101 confirmed COVID positive antenatal women which revealed typical patterns such as ground-glass opacities (86.1%), consolidations with ground glass opacities (64.4%). They were more of peripheral distribution (87.1%), bilateral involvement (82.2%) & lower lung predominance (54.5%). In our study, 14 patients who were imaged for CT chest presented with typical COVID lung patterns such as bilateral ground-glass opacities of lower lobes with crazy paving pattern/pneumonic consolidation of lower lobes. Extreme consolidation & pleural effusion indicate a poor prognosis as pointed out by Liu *et al.*<sup>[15]</sup> In this study 28.5% of patients presented with extensive consolidation and severe lung involvement of more than 50% requiring ventilatory support.

14 patients in the moderate to severe category with identified lung involvement were admitted in COVID ICU while the rest were kept in COVID ward under observation. Amongst the 14 patients four required invasive ventilatory support, two were on CPAP, five were on non-rebreathing mask, two patients were on simple face mask with oxygen and one patient did not require any oxygen support (5% lung involvement). Three patients sustained mortality, the overall Mortality rate being as low as 0.6% out of the total 480 patients. Though other research studies report a mortality rate of less than 2%,<sup>[16]</sup> the maternal mortality risk has been shown to be 13.6-fold higher when compared with non-pregnant women, with increasing adverse outcomes in pregnant women with comorbidities.<sup>[17,18]</sup> This would prompt more studies to be conducted on a large population of antenatal women to identify COVID pneumonia as in the other comparable studies up till now, the total number of patients studied were smaller as opposed to our study carried out on 480 patients.

Among the overall 480 COVID positives, 477 were cured and discharged (99.4%). In patients with COVID pneumonia

average number of days taken for discharge ranged from 2 to 3 weeks as studied by wang *et al.*<sup>[19]</sup> In our study too average number of days taken for discharge in the COVID positive lung involved group of 11 patients (excluding 3 mortalities) is 14 days [Mean (SD) 14.6 (7.9)].

This was a retrospective cross-sectional observational study which serves to be a basic forerunner to describe the type of presentation & clinical features of COVID-19 infected pregnant women with severity assessed by CT chest scoring. Moreover, in this study, we had not correlated the specific laboratory parameters of COVID-19 upon the clinical presentation and its severity which prompts many directions for future research work around this topic. Also, the affliction of the disease on the mode of delivery and its effects on the newborn need to be researched in detail separately.<sup>[20,21]</sup>

The major limitation of this study is the inability to identify lung involvement if any, in the asymptomatic and mildly symptomatic COVID positive group as all antenatal COVID positive population could not be subjected to radiation exposure as per guidelines. The design of the study being a cross-sectional and an observational type also adds to the limitation. In this study, the clinical outcomes alone were studied but their obstetric related and neonatal outcomes were not evaluated which could provide future directions to identify the impact of severity of COVID-19 infection upon obstetric and neonatal outcomes.

## Conclusion

From this cross-sectional study, we conclude that majority of COVID-19 positive antenatal women have been identified to be either asymptomatic or presented with mild symptoms only. A small proportion of 2.9% (14/480) of the total population were having respiratory compromise with lung involvement as detected clinically and supported by CT chest imaging. The mortality rate has been detected to be as low as 0.6%. Despite the severity of affliction of the disease 99.4% were cured and discharged. The impact of the mutant variants of the second wave of pandemic infection and its effects on the infected pregnant population need to be researched separately.

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## Conflicts of interest

There are no conflicts of interest.

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