Original Research Article

Cross-sectional study of chest CT-scan findings in patients affected by SARS-CoV-2 in a tertiary care health centre in Guntur Andhra Pradesh

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ABSTRACT

Background and introduction : A new strain of corona virus emerged during the month of December 2019, in china particularly from the Wuhan city. Majority of the patients presented with atypical pneumonia in Wuhan city, which later contributed this atypical pneumonia is due to novel coronal virus and named it as SARS-CoV-2 virus. Chinese authorities later investigated that the virus was originated from whole sale food and meat market in Wuhan. Many of the initial patients were wet market sellers, stall owners and regular visitors of the market

Aims and objectives of the study: 1. To find out CO-RADS scoring of patients diagnosed as COVID-19 positive by RT-PCR. 2. To find out chest CT-scan findings in of patients diagnosed as COVID-19 positive.

Methodology : The present study was an Observational cross-sectional study of patients suffering from COVID -19 infected patients affected with corona virus (COVID-19) at Katuri Medical College and Hospital, Guntur, during the period of 6 months from April 15, 2020 to October 15, 2020.

Total of 567 patients included in the study based on the prevalence of COVID-19 infection in India. Inclusion criteria and exclusion criteria used to study the patients in the study.

Results : Among 567 patients included in the study, CO-RADS Scoring system patients were divided into 6 categories. Among them 17 (2.9%) patients belong to CO-RAD-1 group, 188 (33.1%) patients were diagnosed with RT-PCR as COVID-19 infection belonging to the score of 2-3, 310 (54.6%) patients with CO-RADS 4-5 and 7 patients with CO-RADS. 52 (9.1%) patients were categorized to CO-RADS-6.

The most common chest CT features of patients having COVID-19 infection is ground glass opacities which constitute 80.65 % (457/567), interlobular septal thickening found in 60.2% (341/567) patients. Linear opacities constitute 55.4% (314/567), consolidation which constitute 59.7 % (338/567). Crazy-paving pattern is seen in 29.3% (166/567) of the patients followed by honey-comb pastern of opacities found in 19.4% (109/567) patients

Left lower lobe is predominantly involved in 79.38% (450/567) patients followed by left upper lobe involvement in 73.5% (416/567) patients. On right lung, right upper lobe involvement present in 52.4%, right middle lobe in 56.7% and right Lower lobe is involved in 70.4% (399/467). Bilateral lung involvement is present in 75.39% (427/567)

Conclusions : Majority of the patients 310 (54.6%) belong to CO-RADS score of 4-5. Most of the patients were having lower lobe involvement on both sides of the lung when compared to the upper lobes and majority of the patient's showed ground glass opacities and consolidations with air bronchograms when compared to minority of the patients presenting as lymph node enlargement and pleural infections

1. Introduction

COVID-19 is most dangerous and transmittable infection caused by different variant of the severe acute respiratory

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syndrome virus namely SARS-CoV-2 which was originated from Wuhan city present in China. Genomic analysis of the virus shows it was a bat virus so probable bat might be probable primary reservoir. But the intermediate host is still not known. The spread among the human beings was confirmed.[1]

COVID-19 virus previously nominated as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)[2] which belong to the same family, later by its different strain and clinical properties it was named as 2019-nCoV.

COVID-19 infection presents from mild disease to life threatening conditions like ARDS (Acute respiratory disease syndrome), myocarditis, coronary artery diseases etc.

Mild COVID-19 manifest with no symptoms or grade 2 or grade 3 MMRC dyspnea scale. Diarrhea and fever may present in mild disease within a week of infection Severe COVID -19 manifest with severe dyspnea with more than half of the lung involved Critically life-threatening disease manifest as more than 90 % of lung involvement, With circulatory shock, multiple organ dysfunction syndrome (MODS). Some patients Present with sepsis and septic shock finally leading to death of the patient

CO-RADS scoring[1] is used to classify the severity of COVID-19 infection.CO-RADS[3] scoring is used as homogenous reporting classification for COVID-19 infection developed to assess the severity of the infection from mild to life threatening.

CO-RADS scoring was based on the CT findings, the degree COVID-19 infection is classified as very low or CO-RADS 1 to very severe infection or CO-RADS 5. CO-RADS 6 is used when RT-PCR is positive along with the lung infection. CORADS 5 is having highly predictive value of infection when compared to CO-RADS 1 CORADS stages 2, CORADS 3, CORADS 4 is having higher interobserver variability, so the diagnosis in these stages is done using clinical signs and symptoms along with biomarkers and RT-PCR values

2. Aims and objectives of the study

1. To find out CO-RADS scoring of patients diagnosed as COVID-19 positive by RT-PCR.
2. To find out chest CT-scan findings in of patients diagnosed as COVID-19 positive.

3. Materials and Methods

The present study included patients affected with corona virus (COVID-19) at Katuri Medical College and Hospital, Guntur, during the period of 6 months from April 15 2020 to October 15 2020. An ethical committee clearance was obtained.

Informed consent was taken before enrolment. Totally 567 patients enrolled in the study. The criteria for selection

of patients were as follows.

3.1. Inclusion criteria

Patients diagnosed as COVID -19 infection by the following inclusion criteria

1. Patients are diagnosed as COVID-19 infection by RT-PCR investigation
2. Patients diagnosed as COVID-19 infection based on CT-SCORING of corona

Infection based on CO-RADS SCORES.

Patients having CO-RADS score 4 and higher are included in the study, irrespective of the RT-PCR result.

3.2. Exclusion criteria

1. Patients with CO-RADS[4] score 3 with negative RT-PCT for CORONA infection. CO-RADS SCORE 3 defined as undetermined with unclear diagnosis of COVID-19 infection.
2. Children with age group of less than 14 years are excluded from the study.
3. Reinfected patients already diagnosed and treated and tested RT-PCR negative after treatment completion are excluded from the study.

The patients enrolled in the study were subjected to a complete isolation from rest of the family members and admitted to the special wars allotted to the corona patients. Clinical history was obtained from the attenders of patients and patient also. Family members are subjected to CORONA testing with RT-PCR investigation

The risk factor profile of each patient was evaluated mainly

1. Systemic Hypertension defined as a BP recording of >140/90 mmHg
2. Patient's history of heart diseases are evaluated with ECG and Echocardiography
3. Smoking history is evaluated based on smoking index and pack years
4. Diabetic patients were diagnosed as per the ADA association Guidelines OF 2020

3.3. Study design

Observational cross-sectional study of patients suffering from COVID -19 infection

3.4. Statistical analysis

Statistical analyses done using IBM SPSS Statistics V.24.0. Various risk factors like hypertension, Diabetes mellitus, smoking and other variables were reported using descriptive statistics. Age at onset was compared across gender using

Co-RADS score	Suspiciousness	CT- findings
CO-RADS 1	No infection	Normal or non-infectious aetiology
CO-RADS 2	Low doubt of infection	Findings similar to typical bronchiolitis with tree-in-bud and thickened bronchus walls, Bronchiectasis But no ground glass opacities.
CO-RADS 3	Intermediate	widespread bronchopneumonia, lobar pneumonia along with ground glass appearance
CO-RADS 4	High	Unilateral ground glass opacities, Multi-focal pneumonia with air bronchograms
CO-RADS 5	Very high	Bilateral ground glass opacities consolidation with air bronchograms, mainly in the basal regions of the lung. vascular wall thickening
CO-RADS 6	PCR+	Patient with positive PCR and bilateral ground glass opacities with halo sign

t-test and value of P<0.05 was considered statistically significant.

3.5. Sample size

In the present cross-sectional study. Sample size calculated using the following formula

$$N = \frac{(za)^2[p*q]}{d^2}$$

(where the symbol ^ means 'to the power of'; * means 'multiplied by')

Za; The value of z corresponding to this is 1.96 (from the standard normal variate tables

Finally

$$N = \frac{(1.96)^2[p*q]}{d^2}$$

(where the symbol ^ means 'to the power of'; * means 'multiplied by')

p: The prevalence of the condition/ health state.

q: When p is in percentage terms: (100-p)

d (or l): The precision of the estimate.

By using the above formula estimated sample size is 524 patients.

So, the present study of 567 patients was sufficient for the present observational cross- sectional study

Table 1: CT scan features of various patients presenting asCOVID infection

CT-Scan findings	Patients affected	Percentage
Ground Glass Opacities	457/ 567	80.65%
Linear opacities	314/ 567	55.4%
Consolidation	338/ 567	59.7%
Interlobular septal thickening	341/ 567	60.2 %
Crazy-paving patter	166/ 567	29.3%
Honey -comb sign	109 / 567	19.4%
Bronchial wall thickening	89 / 567	15.7%
Nodular opacities	30 / 567	05.4%
Reticular opacities	018 / 567	03.21%
Lymph node enlargements	030/ 567	05.34%
Pleural effusions	025/ 567	04.5%

Table 2: Lobar involvement of lung in covid-19 infection

Lobe Invoved	No of patients	Percentage
Right Upper Lobe	297/ 567	52.4%
Right Middle Lobe	321/ 567	56.7%
Right Lower Lobe Involvement	399/ 567	70.4%
Left Upper lobe Involvement	416/ 567	73.5%
Left Lower Lobe Involvement	450/ 567	79.38%
Bilateral Lung Involvement	427/ 567	75.39%

4. Results and Discussion

In our study patients are classified in 6 groups according to the CO-RADS scoring system. Therefore, according to this CO-RADS Scoring system patients were divided in to 6 categories. Among them 17 (2.9%) patients belong to CO-RAD-1 group, 188 (33.1%) patients were diagnosed with RT-PCR as COVID-19 infection belonging to the score of 2-3, 310 (54.6%) patients with CO-RADS 4-5 and 7 patients with CO-RADS. 52 (9.1%) patients were categorized to CO-RADS-6. All the 567 patients were diagnosed as COVID-19 + based on the RT-PCR report. In our study majority of the patients belong to CO-RADS 4-5. These study findings done in India was found conflicting to the study done by Borgstein[4].,which was done in Netherlands where there was only 3.1% patients belong to CO-RADS 4-5.

In the following study the most common chest CT features of patients having COVID-19 infection is ground glass opacities which constitute 80.65 % (457/567) of the whole patients.

Similar findings are reported in a study done by Salehi et al.,[2] where ground glass appearance (GGO) on CT-scan was 88.0%, a much higher value than our study.

2nd most common CT-scan finding is interlobular septal thickening found in 60.2% (341/567) patients. Even though this is non-specific found in many infectious diseases. But this finding is associated with ground glass opacities will increase the positive predictive value of the disease linear opacities constitute 55.4% (314/567) which is the 4th most CT scan finding in our study. 3rd most important CT-

scan finding in our study is consolidation which constitute 59.7% (338/567). This shows nearly 60% of the patients presented as consolidation, which shows higher percentage when compared by the study done by Salehi et al.,[2] where the reported incidence was 31.8% which shows significant number of patients present as consolidation in India when compared to other countries.

Crazy-paving pattern is seen in 29.3% (166/567) of the patients followed by honey-comb pastern of opacities found in 19.4% (109/567) patients Minor CT-SCAN finding include air way wall thickening which constitute 15.7% (89/567), nodular opacities in 5.4% (30/567) reticular opacities in 3.21%, lymph node enlargement in 5.34%, and few patients (4.5%) presented as pleural effusion.

When it comes to lobar involvement of the infection. Left lower lobe is predominantly involved in 79.38% (450/567) patients followed by left upper lobe involvement in 73.5% (416/567) patients.

On right lung, right upper lobe involvement present in 52.4%, right middle lobe in 56.7% and right Lower lobe is involved in 70.4% (399/467). Bilateral lung involvement is present in 75.39% (427/567) of the patients affected by COVID-19 infection. Similar finding are found in a study done by Kong.[5]

5. Conclusions

All the 567 patients were diagnosed as COVID-19 + based on the RT-PCR report. In our study majority of the patients belong to CO-RADS 4-5 most of the patients are having lower lobe involvement on both sides of the lung when compared to the upper lobes most of the patients shows ground glass opacities and consolidations with air bronchograms minority of the patients presented lymph node enlargement and pleural infections.

6. Acknowledgement

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7. Source of Funding

8. Conflict of Interest

The authors declare they have no conflict of interest.

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