

Original Research Article

Chest X-ray findings in COVID-19 patients: a descriptive study

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ABSTRACT

Background: Early suspicion and diagnosis remains the cornerstone for the better outcome of patients and to decrease cross infection in cases of COVID-19 pneumonia. In a country like Nepal X-ray facilities are readily available radiological tool in most of the centers and can be important screening tool. There is a lack of studies detailing the chest XR (C-XR) findings in these patients when compared to that dedicated to the CT features. Study aims to describe the patterns of the lung opacities in CXR in these patients.

Methods: This is retrospective descriptive study conducted at NMCTH in COVID-19 patients from 12 September to 17 October 2020. Demographic characteristics, symptoms, co-morbidities and C-XR findings were studied. CXR findings were categorized according to BSTI classification.

Results: Among 111 COVID-19 RT-PCR positive cases admitted 102 (91.9%) belonged to age group 18-65 years, 89 (80.2%) were males. Cough and fever were the commonest symptoms present in 109 (98.2%) patients. Ischemic heart disease and hypertension in 32 (28.8%) patients were the commonest co morbidities. According to British society of thoracic imaging (BSTI) COVID-19 CXR classification, six patients (5.4%) had normal chest X-rays. Classic/probable COVID-19 picture was present in 79 (71.17%) patients while (7.2%) had intermediate for COVID-19 X-ray findings. Among 79 patients with classic/probable COVID-19 CXR findings 71 (89.8%) had bilateral consolidation/ground glass haze, 72 (91.1%) had peripheral lung involvement while 66 (83.5%) had middle and lower zone involvement.

Conclusions: Ground glass opacities/consolidations with bilateral location, peripheral distribution and middle- lower zone predominance were the commonest X-ray findings in our study.

Keywords: COVID-19, CXR, Lungs, Co-morbidities, BSTI

INTRODUCTION

COVID-19 is an abbreviation for Corona virus disease 2019 which is caused by a severe acute respiratory syndrome corona virus 2 (SARS-CoV2). This virus belongs to family called corona virus and is responsible for the COVID-19 pandemic.¹ In the month of December 2019, there was an outbreak of pneumonia of unknown cause in Wuhan, Hubei province in China, with an epidemiological link to the Huanan seafood wholesale

market in the month of December 2019. Chinese health authorities notified world health organization (WHO) about the disease on 31 Dec 2019. A novel Corona virus was identified by the center for disease control and prevention (CDC) on January 7, 2020 from the throat swab sample of a patient, and was subsequently named 2019-nCoV by WHO. WHO declared it a public health emergency of international concern on January 30, despite these efforts, the virus continued to spread and WHO declared it as pandemic on 11 March 2020.² In Nepal, the

first case of COVID-19 was tested positive by real-time RT-PCR assay on 23 January 2020.³

Clinical features of COVID-19 can be mild like fatigue, myalgia, fever, dry cough, and dyspnea. It can also have severe manifestations like acute respiratory distress syndrome (ARDS), septic shock, disseminated intravascular coagulation (DIC), and acute renal failure. Severe manifestations of the disease are usually seen in elderly adult males with chronic co morbidities like chronic lung diseases, obesity (body mass index >40), liver disease, chronic kidney disease, diabetes mellitus, under immunosuppressant drugs which can weaken the immune functions of these patients.^{4,5}

Nepal has concluded its first phase of COVID-19 vaccination drive. A total of 184,857 person received the vaccine during the drive.⁶

The BSTI developed a simple and easy CXR reporting template which is, internationally recognized.⁷ This template has been incorporated into an NHS England (NHSE) endorsed radiology decision tool for suspected COVID-19.^{7,8} Delay in the results of COVID-19 RT-PCR results and likely initial false negative results have made CXR an important tool in proposed infection control management strategies of in patients.^{7,9}

The purpose of this study was to describe the morphological and distributional patterns of the lung opacities in CXR in COVID-19 patients and to classify the spectrum of essential features on portable AP chest radiographs according to BSTI classification. Study also intended to explore demographic pattern, co morbidities associated and symptoms at time of presentation in those patients.

METHODS

This is a retrospective descriptive study conducted at national medical college COVID-19 hospital, Birgunj Nepal. Those patients who were admitted after RT-PCR for COVID-19 positive reports from 12 September 2020 to 17 October 2020 were included in the study. A structured form was used to extract the data. Data collected included demographic characteristics, presenting symptoms, co-morbidities present among these patients and chest radiographic findings. Chest radiographic findings were further categorized according to BSTI classification.¹⁰ BSTI has classified COVID-19 chest X-rays as normal co related with RT-PCR, classical, having multiple bilateral, peripheral basal opacities more bilateral than unilateral, indeterminate that does not fit into classical or non-COVID descriptors and non-COVID-19 X-rays having pneumothorax, pleural effusion and pulmonary edema.¹⁰ Radiological findings were described according to Fleischner society glossary of terms for thoracic imaging.¹¹ Ground glass opacities were defined as increased opacification of lung parenchyma not obscuring blood vessels and bronchi. Consolidation was described as

homogenous opacification of lung parenchyma obscuring blood vessels and bronchi.

Data analysis

Microsoft excel was used for data entry. Descriptive statistics was calculated to describe the characteristics of the sample. Categorical data were described using frequencies and percentages.

RESULTS

Total of 111 COVID-19 RT-PCR positive cases admitted were included in the study. One hundred and two (91.9%) belonged to age group 18-65 years. There were 89 (80.2%) males and 22 (19.8%) females. Male predominance was noted. Cough along with fever was the most common symptom present in 109 (98.2%) patients, followed by shortness of breath in 108 (97.3%), sore throat in 91 (82%), loss of sense of smell and taste in 76 (68.5%), headache in 34 (30.6%), myalgia or arthralgia 31 (27.9%), nasal congestion in eight (7.2%), conjunctival congestion in 4 (3.6%), nausea and vomiting in 4 (3.6%) and diarrhea in 2 (1.8%) patients.

Among total patients 70 (63.1%) had no co morbidities. Ischemic heart disease and hypertension were present in 32 (28.8%) patients, diabetes was present in 14 (12.6%) patients while 13 (11.7%) had renal complaints in Table 1.

Table 1: Demographic characteristics, symptoms and co-morbidities (n=111).

Variables	Findings	N (%)
Age (year)	<18	4 (3.6)
	18-65	102 (91.9)
	>65	5 (4.5)
Gender	Male	89 (80.2)
	Female	22 (19.8)
Symptoms	Cough	109 (98.2)
	Fever	109 (98.2)
	Shortness of breath	108 (97.3)
	Sore throat	91 (82)
	Loss of sense of taste and smell	76 (68.5)
	Headache	34 (30.6)
	Myalgia or arthralgia	31 (27.9)
	Nasal congestion	8 (7.2)
	Conjunctival congestion	4 (3.6)
	Nausea and vomiting	4 (3.6)
	Diarrhea	2 (1.8)
Co-morbidity	No co-morbid	70 (63.1)
	IHD and hypertension	32 (28.8)
	Diabetes mellitus	14 (12.6)
	Renal complaints	13 (11.7)
	Smoker	11 (9.9)
	Arthritis	4 (3.6)

Table 2: Chest X-ray finding in COVID-19 patients (n=111).

Findings	N (%)
Normal correlated with RT-PCR	6 (5.4)
Classic/probable COVID-19, consolidation /ground glass haze	79 (71.17)
Indeterminate for COVID-19 (Does not fit classic or non-COVID-19 descriptions)	18 (16.2)
Non COVID-19	8 (7.2)

Table 3: Characteristics of consolidations/ground glass haze among X-rays with classic/probable COVID-19 findings (n=79).

Classic/Probable COVID-19 X-ray findings		N (%)
Consolidation/ground glass haze, based on-Location	Unilateral	8 (7.2)
	Bilateral	71 (89.8)
Consolidation/ground glass haze, based on-Distribution	Diffuse lung involvement	7 (10.1)
	Peripheral lung involvement	72 (91.1)
Consolidation/ground glass haze, based on-Zonal predominance	Middle and lower zones	66 (83.5)
	Middle zone	13 (16.5)

Table 4: Non COVID-19 X-ray findings (n=8).

Non COVID-19 X-ray findings	N (%)
Pleural effusion	6 (75)
Lobar pneumonia	2 (25)
Pneumothorax	(0.0)
Pulmonary edema	(0.0)

Chest X-rays of all the patients were classified according to British society of thoracic imaging (BSTI) COVID-19 CXR classification. Six patients (5.4%) had normal chest X-rays. Classic/probable COVID 19 pictures were present in 79 (71.17%) patients. Eight patients (7.2%) had intermediate for COVID-19 X-ray findings. Among 79 patients with Classic/probable COVID-19 X-ray findings 71 (89.8%) had bilateral consolidation/ground glass haze, 72 (91.1%) had peripheral lung involvement while 66 (83.5%) had the middle and lower zone involvement. Hence bilateral location with the peripheral distribution and middle and lower zone predominance were the commonest X-ray findings in our COVID-19 RTPCR positive patients.

DISCUSSION

COVID-19 is caused by a severe acute respiratory syndrome corona virus 2 (SARS-CoV2) belonging to family called corona virus which is responsible for the COVID-19 pandemic.^{1,2} even after one year of outbreak COVID-19 is a major threat to mankind. Availability of

vaccines against the virus are proving to be a transient relief factor as recurrent waves of disease are hitting at various places. New strains are posing potential difficulties. In a small and economically weak country like Nepal a cheap and easily available screening tool is very necessary. Hence portable X-ray could be an important tool.

Total of 111 COVID-19 RT-PCR positive cases admitted were included in the study. One hundred and two (91.9%) belonged to age group 18-65 years. There were 89 (80.2%) males and 22 (19.8%) females. Male predominance was noted. Our finding is similar to that of a study done in Pakistan.¹² In our study cough along with fever was the most common symptom present in 109 (98.2%) patients. This finding was in accordance with study done in Kathmandu.¹³ Other presenting symptoms in our study were shortness of breath in 108 (97.3%), sore throat in 91 (82%), loss of sense of smell and taste in 76 (68.5%), headache in 34(30.6%), myalgia or arthralgia 31 (27.9%), nasal congestion in eight (7.2%), conjunctival congestion in 4 (3.6%), nausea and vomiting in 4 (3.6%) and diarrhea in 2 (1.8%) patients.

In our study 70 (63.1%) had no co morbidities. Ischemic heart disease and hypertension were commonest co-morbidities present in 32 (28.8%) patients; diabetes was present in 14 (12.6%) patients while 13 (11.7%) had renal complaints. Similarly, hypertension was commonest co morbidity followed by diabetes among COVID-19 patients according to a study done in New York.¹⁴

In our study chest X-rays of all the patients were classified according to British society of thoracic imaging COVID-19 CXR classification. Six patients (5.4%) had normal chest X-rays and 105 patients (94.6%) had abnormal chest X-rays. In a study done in Jordan, (45.5%) of COVID 19 patients had abnormal chest X-ray findings which were comparatively low compared to our study.¹⁵ Classic/probable COVID-19 pictures was present in 79 (71.17%) patients. Eight patients (7.2%) had intermediate for COVID-19 X-ray findings. Among 79 patients with classic/probable COVID-19 X-ray findings 71 (89.8%) had bilateral consolidation/ground glass haze, 72 (91.1%) had peripheral lung involvement while 66 (83.5%) had middle and lower zone involvement. Hence bilateral location with peripheral distribution and middle and lower zone predominance were the commonest X-ray findings in our COVID-19 RTPCR positive patients. Our findings were in accordance with many international studies where bilateral, peripheral lower zone consolidation/ground glass opacities were most frequent X-ray findings in COVID-19 patients.¹⁵⁻¹⁷

Limitations

Being a single centered study with a small sample size of just one hundred and eleven is a major limitation of this study. First chest X-ray taken after the diagnosis of COVID-19 was taken into consideration irrespective of

duration and severity of the disease. No comparison was made with subsequent chest X-rays.

CONCLUSION

Ground glass opacities/consolidations with bilateral location, peripheral distribution and middle-lower zone predominance were the commonest X-ray findings in our COVID-19 RTPCR positive patients. These characteristic patterns and distributions should help clinicians to suspect COVID-19 as a possible diagnosis in cases of pneumonia and help them to manage the cases promptly with minimal risk of cross contamination and infection.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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