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RELEVANCE OF CHEST X-RAY IN COVID-19 DIAGNOSIS

Pulmonary Medicine

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ABSTRACT

Background: Radiological imaging also plays an important role in diagnosing and severity assessment of the disease. British Society of Thoracic Imaging released guidance for reporting computed tomography as well as chest radiographs. We conducted this study to assess the sensitivity and specificity of chest radiograph for COVID-19 patients attending a COVID Hospital in India.

Material And Methods: This was a retrospective study in which suspected COVID-19 patients attending HNB Base Hospital, Srinagar, Uttarakhand from April 2021 to June 2021 who underwent RTPCR and chest radiographs were taken. Chest X-rays were classified according to the BSTI chest X-ray report Performa. This Performa was then compared with the RTPCR reports of the patients to calculate the sensitivity and specificity.

Results: Comparison of the four chest X-ray groups according to the BSTI guidance with RT-PCR status was done. It revealed that almost 85.48% of the normal chest X-ray group were RT-PCR positive and 30.68% of the chest X-rays that had classic or probable COVID-19 features came out to be RT-PCR negative. 75% of patients who were grouped in Non-COVID-19 in accordance with their chest x-ray features were RT-PCR positive.

Discussion And Conclusion: The specificity (40.66%) and sensitivity (50.62%) of the BSTI guidance for chest x-ray are low as shown in our study. The main drawback of this study is that we have kept RT-PCR as the gold standard.

KEYWORDS

Chest X-ray, Screening, COVID-19, BSTI, Sensitivity, Specificity

INTRODUCTION:

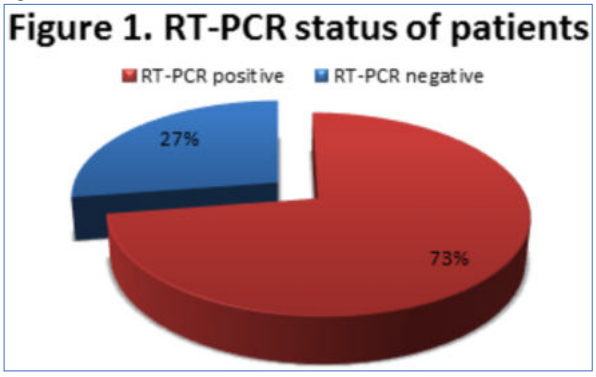
Wuhan Municipal Health Commission, China, reported a cluster of cases of pneumonia in Wuhan, Hubei Province on 31st December 2019. A novel coronavirus was eventually identified. On 11th March 2020 WHO made the assessment that COVID-19 can be characterized as a pandemic[1]. COVID-19 infection is confirmed in majority of the nations by Reverse Transcription Polymerase Chain Reaction (RT-PCR) on nasopharyngeal and throat swabs, with a positivity rate of 30–70%[2,3]. Radiological imaging also plays an important role in diagnosing and severity assessment of the disease. In the near future, COVID-19 will probably remain an important differential diagnosis in a patient presenting with flu-like symptoms, lymphopenia in routine laboratory investigations and/or loss of normal sense of smell (anosmia) or taste[4,5]. Majority of the times, COVID-19 does not progress to pneumonia[6]. In case, if COVID-19 progresses to pneumonia, chest radiographs may help in identifying the pneumonia, especially in seriously ill patients with respiratory symptoms[7]. Although Chest x-rays were found to have limited value in the initial diagnosis of COVID-19 with a sensitivity of approximate 69%[8,9]. Chest radiographs also correlate well with the clinical severity of COVID-19 patient[10]. On March, 2020 British Society of Thoracic Imaging released a guidance for reporting computed tomography as well as chest radiographs[11]. According to the Performa, the chest radiographs are grouped as normal, classic/probable COVID-19, indeterminate for COVID-19 and non-COVID-19. We conducted this study to assess the sensitivity and specificity of chest radiograph for COVID-19 patients attending a COVID Hospital in India.

MATERIAL & METHODS:

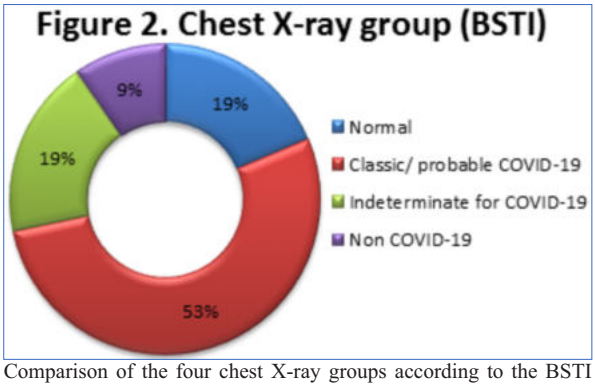
This was a retrospective study in which suspected COVID-19 patients attending HNB Base Hospital, Srinagar, Uttarakhand from April 2021 to June 2021 who underwent RTPCR and chest radiographs were taken. A total of 332 patients were found in whom both RTPCR and chest X-ray was done on the same day. Chest X-rays were classified according to the BSTI chest X-ray report Performa[11]. According to the Performa, the chest radiographs were grouped as normal, classic/probable COVID-19, indeterminate for COVID-19 and non-COVID-19. In normal group, clinical correlation is required. In classic/probable COVID-19, lower lobe and peripheral predominant multiple opacities were visualised which were mostly bilateral. Indeterminate for COVID-19 were those chest X-rays that did not fit in normal or classic COVID-19 descriptors. Similarly, non-COVID-19 chest radiographs had features such as pneumothorax, lobar pneumonia, pleural effusion, pulmonary oedema etc. This Performa was then compared with the RTPCR reports of the patients to calculate the sensitivity and specificity of chest radiography in COVID-19. RT-PCR was taken as gold standard for diagnosing COVID-19.

RESULTS:

A total of 332 patients were found in whom both RTPCR and chest X-ray was done on the same day. Out of 332 patients, 241 (72.59%) were RT-PCR positive and 91 (27.41%) were RT-PCR negative as shown in figure 1.



Chest X ray of the patients were classified in four groups according to BSTI. Normal chest X-rays were found in 62 patients (18.67%). Classic or probable COVID-19 was seen in 176 patients (53.01%). Chest X-rays indeterminate for COVID-19 were seen in 62 patients (18.67%) and there were 32 patients (9.64%) in whom chest radiographs were classified as non-COVID-19. These are depicted in figure 2.

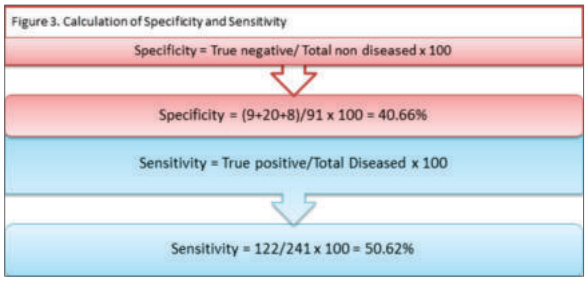


Comparison of the four chest X-ray groups according to the BSTI guidance with RT-PCR status was done. It revealed that almost 85.48% of the normal chest X-ray group were RT-PCR positive and 30.68% of the chest X-rays that had classic or probable COVID-19 features came out to be RT-PCR negative. 75% of patients who were grouped in Non-COVID-19 in accordance with their chest x-ray features were RT-PCR positive. These results are detailed in Table 1.

Table 1. Comparison of BSTI and RT-PCR status of suspect COVID patients

RT-PCR status	BSTI Group	No. Of patients (percentage of BSTI group)	
RT-PCR Positive	Normal	53 (85.48)	62 (100)
RT-PCR Negative	Normal	9 (14.52)	
RT-PCR Positive	Classic or Probable COVID-19	122 (69.32)	176 (100)
RT-PCR Negative	Classic or Probable COVID-19	54 (30.68)	
RT-PCR Positive	Indeterminate for COVID-19	42 (67.74)	62 (100)
RT-PCR Negative	Indeterminate for COVID-19	20 (32.26)	
RT-PCR Positive	Non-COVID-19	24 (75)	32 (100)
RT-PCR Negative	Non-COVID-19	8 (25)	

Since, to calculate specificity we need to divide true negative from the total non diseased individuals. Here true negatives will include BSTI groups other than classic or probable COVID-19 who are RT-PCR negative (9+20+8). Total non diseased individuals are taken as all patients who came negative on RT-PCR (91). Similarly, to find sensitivity of a diagnostic test, we need to divide true positive from total diseased individuals. Here true positive will include patients with classic or probable COVID-19 on chest x-ray that were positive on RT-PCR (122). Total diseased individuals would be all patients that were RT-PCR positive (241). Sensitivity and specificity calculations are elaborated in Figure 3.



DISCUSSION:

This study revealed that almost 85.48% of the normal chest X-ray group were RT-PCR positive. In other words, chest X-rays may be normal even if the individual is suffering from COVID-19. Hence, normal chest x-ray does not rule out COVID disease. 75% of patients who were grouped in Non-COVID-19 in accordance with their chest x-ray features were RT-PCR positive, while 30.68% of the chest X-rays that had classic or probable COVID-19 features came out to be RT-PCR negative. This clearly shows that typical chest X-ray lesions associated with COVID-19 such as peripheral distribution of opacities and lower zone predominance are not specific for the disease. It also shows that lesions such as pleural effusion, pneumothorax, lobar pneumonia which were thought to be not associated with COVID-19 are now increasingly being found in COVID-19, especially in second wave[12].

The specificity of chest X ray according to BSTI guidance was only 40.66% and sensitivity of 50.62%. In a similar study conducted in Hong Kong in early 2020, chest x-ray sensitivity was found to be 69%[13]. The decrease in sensitivity may be attributed to the emergence of new variants of the coronavirus, leading to emergence of parenchymal lesions or abnormalities that are not normally attributed to COVID-19[12]. Even COVID vaccination may lead to atypical radiological lesions that are not normally associated with COVID-19[14]. Specificity and sensitivity of chest x-ray according to BSTI guidance is very low and hence, cannot be used for screening or diagnostic purposes for COVID-19. A new guidance or classification system needs to be made or further modification of the existing guidance system should be done to help in diagnosis of COVID-19.

CONCLUSION:

The specificity and sensitivity of the BSTI guidance for chest x-ray are low as shown in our study. The main drawback of this study is that we have kept RT-PCR as the gold standard and compared chest x-ray with RT-PCR. RT-PCR itself can be sometimes false positive or false negative. Further studies are required to evaluate the utility of this guidance system for chest radiographs.

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