

Short Report

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Chest radiography as a predictor of prognosis in COVID-19

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Abbreviations: CXR: Chest radiography; CPAP: Continuous Positive Airway pressure; RT-PCR: Reverse Transcription-Polymerase Chain Reaction; ITU: Intensive Therapy Unit.

Introduction

Chest Radiography (CXR) is typically the first-line imaging modality used for patients with suspected respiratory tract infections, including COVID-19. CXRs may be normal in early or mild disease. Of patients with COVID-19 requiring hospitalization one study has demonstrated that 69% had an abnormal CXR at the initial time of admission, and 80% had radiographic abnormalities sometime during hospitalization [1]. Chest CT findings have been linked to disease severity and prognosis [2], however the prognostic implications of normal vs abnormal CXR findings on presentation to hospital with COVID-19 symptoms is less clear. This retrospective study was conducted to investigate CXR findings at admission and the predictive value in terms of subsequent diagnosis and outcomes in such patients.

Methods

595 patients were admitted with symptoms suggestive of COVID-19 between 15/3/2020-30/4/2020 to a large district general hospital in the United Kingdom. Data were retrospectively analysed to ascertain the rate of CXR abnormality suggestive of COVID-19 at admission and the correlation with Intensive Therapy Unit (ITU) admission, Continuous Positive Airway Pressure (CPAP) use, Reverse Transcription-Polymerase Chain Reaction (RT-PCR) swab positivity, and mortality.

Results

Of the 595 patients, 8 not had a CXR undertaken on admission, so were not included in the analysis. Abnormal CXR (compared to normal admission CXR) were more common than normal CXR in those who died, required CPAP treatment, or required ITU treatment (Table 1).

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Table 1: Numbers of patients receiving ward based care, ITU treatment, or CPAP; mortality in each group; and proportions with a normal or abnormal CXR on admission.

	Total no.	Normal CXR	Abnormal CXR
Did not receive ITU/CPAP treatment	491	133 (27.1)	358 (72.9%)
Mortality in those not receiving ITU/CPAP	115 (23.4%)	14 (12.2%)	101 (88.8%)
Received CPAP treatment	44	3 (6.8%)	41 (93.2%)
Mortality after CPAP	19 (43.2%)	1 (5.3%)	18 (94.7%)
Received ITU treatment	52	0 (0%)	52 (100%)
Mortality after ITU	42 (80.8%)	0 (0%)	42 (100%)

Normal CXR as a negative predictor for ITU admission, CPAP use, mortality, and RT-PCR positivity were all statistically significant (Table 2). All patients with a normal admission CXR who died were not for escalation to ITU treatment, thus co-morbidities and frailty may have been significant contributory factors in these cases.

Table 2: Proportion of patients with a normal CXR or abnormal CXR who had a positive RT PCR swab, required ITU/CPAP, or died.

	Normal CXR	Abnormal CXR
RT PCR swab positivity	25.7%	56.8% (P<0.05)
ITU/CPAP	2.2%	20.6% (P<0.05)
Mortality	11.0%	35.7% (P<0.05)

In the group with a normal CXR on admission there was a significantly lower RT PCR test positivity rate compared to those with an abnormal CXR. However this does not simply reflect low rates of infection in this group as RT PCR sensitivity at the time was a low as 71% [3], and the hospital was using CT scanning on admission to augment CXR and RT PCR in the cohorting of patients [4]. In those patients who had a negative RT PCR swab and a normal CXR on admission, and had a CT chest undertaken in the first 24 hours of admission, 22.2% had changes consistent with COVID-19 infection.

Discussion

In those hospitalised with COVID-19, a normal CXR on arrival serves as a particularly good predictor of an uncomplicated admission (without the need for CPAP or ITU); and is associated with significantly reduced risk of mortality. Interestingly, CXR findings have found to be not useful in the prediction of long term post discharge outcomes [5], but this study does demonstrate the utility of CXR appearance for acute prognosis during admission. No patients admitted with COVID-19, in the group deemed for escalation of treatment, who had a normal CXR on admission, died or required ITU treatment; thus a normal CXR in such patients may help in the process of safe triage to out-patient management.

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