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Progression of CXR features on a COVID-19 survivor

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Title Page

•**Article category –** Brief report

•**Article title-** Progression of CXR features on a COVID-19 survivor

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Highlights

- Mortality from COVID-19 primarily results from respiratory failure
- CXR changes in COVID-19 are peripheral, basal, and multilobar
- CXR changes in COVID-19 range from subtle, mild, moderate, to severe
- Progression of CXR changes over 6 weeks has not been presented in published case reports

ABSTRACT

COVID-19 causes consolidations or ground glass opacities that are predominantly peripheral, basal, and bilateral on chest x-ray (CXR). There are no published case reports that present over ten serial CXRs on the same patient. We present a case report of a 68-year-old patient with confirmed COVID-19 and a prolonged course of admission, receiving nasal and humidified oxygen, non-invasive and then mechanical ventilation. She self-extubated, but remained stable on nasal oxygen only and was transferred for rehabilitation. We present 12 of her serial CXRs over six weeks, showing progression from subtle changes to overt widespread pneumonitis to slow resolution. She is also an example of a rare case of COVID-19 pneumonitis causing persistent hypoxia for over six weeks.

KEYWORDS

COVID-19; CXR; consolidation; hypoxia; radiological

INTRODUCTION

COVID-19 is a predominantly pulmonary pathogen that causes death primarily via respiratory failure (1). COVID-19 pneumonia is usually bilateral, peripheral or basal, and multilobar (2). Ground glass opacity (GGO) is seen in two thirds of patients, and acute respiratory distress syndrome (ARDS) in one third of patients requiring intensive care unit (ICU) admission (3). Like Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), cavitation and lymphadenopathy are not seen, and pneumothorax is rare (4). The British Society of Thoracic Imaging (BSTI) provided templates for reporting chest x-ray (CXR) changes in suspected COVID-19 patients (5). Normal CXR is labelled as CVCX0, and correlation with viral reverse transcriptase polymerase chain reaction (RT-PCR) is recommended. Lower lobe and peripheral predominant multiple opacities that are bilateral are classical or probable COVID-19 (CVCX1). Consolidation or opacities that do not fit with classical or non-COVID are classified as indeterminate (CVCX2), and other features such as lobar pneumonia, pleural effusion, pneumothorax and pulmonary edema, are regarded as non-COVID-19 (CVCX3). COVID-19 pneumonia is further quantified as mild, moderate, or severe. We use these standardized templates in our institution to aid in patients' triage. If CXR is normal or indeterminate and COVID-19 swab is negative, they are labelled as negative and moved to a

non-COVID ward. If CXR shows probable COVID-19 and swab is negative, they are still treated as clinical COVID-19 until a nasopharyngeal swab is repeated.

Despite the well-known literature on CXR features of COVID-19 pneumonia, there are not many reports to show the progression of these changes in the same patient. The first case of COVID-19 pneumonia in Taiwan shows four serial CXRs (6), but to our best knowledge there is no case report of over 10 serial CXR images. We present a case of COVID-19 pneumonia with a prolonged course from being asymptomatic with no oxygen (O_2) requirements, through progression to respiratory failure requiring non-invasive and then mechanical ventilation. She self-extubated and was slowly weaned off O_2. We present her serial CXRs to show the evolution from subtle pneumonia to widespread COVID-19 pneumonitis to gradual and slow resolution.

CASE DESCRIPTION

On March 22 2020, a 68-year-old woman was admitted with a suspected accidental overdose of diazepam and amitriptyline which she was taking for a right facial pain she had for a week. She denied any flu-like symptoms or contact with a COVID-19 patient. In the emergency department, she spiked a high temperature, so she was isolated on a COVID-19 ward and had a nasopharyngeal swab for viral RT-PCR which was positive. She had a history of mild chronic kidney disease and multi-organ failure from dental abscess many years back when she was intubated and ventilated.

Her initial and subsequent laboratory tests are shown in Table 1. Her initial CXR showed patchy air space change in both lower zones with left basal atelectasis, indeterminate for COVID-19 (CVCX2). Her oxygen (O_2) saturations on day one were 92% on room air. She was commenced on intravenous Ceftriaxone and Clarithromycin. 48 hours later her inflammatory markers worsened and CXR showed increased consolidation in both lungs, probable for COVID-19 (CVCX1). Over the following 72 hours her O_2 saturations dropped to low 80s on room air and she was treated with O_2, first via nasal cannula to a maximum of 4 litrers, and then humidified O_2 via Venturi mask which was titrated up to 98%. She remained hypoxic and on day seven was treated with 98% O_2 via AIRVO. She failed this and on day eight was transferred to ICU. Initially she was managed with continuous positive airway pressure (CPAP) alternating with high flow nasal cannula (HFNC), but within 24 hours she was intubated and ventilated and then remained on significant support for many days. She self-extubated after nine days, but remained unsupported and was successfully weaned down to nasal O_2 at 4 liters. She completed nine days of intravenous meropenem and linezolid. She was stepped down to a medical ward and remained confused for several days. Her C-reactive protein and lymphocytes normalized. Her CXR changes gradually and slowly resolved, but she remained O_2-dependent (at 1.5 liters) at day 47 of admission and was transferred for rehabilitation. Figure 1 shows her serial CXRs from admission to day 41.

DISCUSSION

This case is an example of survival from severe COVID-19 pneumonitis, despite a very long course of admission. Her CXR shows significant progression from subtle changes to overt COVID-19 pneumonitis to slow resolution. There are no many publications to show that kind of progression on many serial CXRs on the same patient. Her radiological changes correspond to clinical severity and O_2 requirements. With mild infiltrates, she was maintaining O_2 saturations on room air, with further progression of consolidations she was requiring nasal O_2 and then non-invasive ventilation, with widespread GGO she required mechanical ventilation in ICU, and with improvement of bilateral shadowing she was back on nasal O_2.

The classical CXR changes in COVID-19 are bilateral lower zone or peripheral consolidations or ground glass appearance that peak at 10-12 days from symptom onset (2).

The standard practice for community acquired pneumonia is to repeat CXR within six weeks to ensure resolution (7). However, this is unlikely going to be the practice in the setting of this COVID-19 pandemic apart from selected cases with lobar pneumonia, though little is known about the natural course of COVID-19 consolidations. In this case, we show that the widespread bilateral opacities are incompletely resolved at six weeks from symptom onset, though significantly improved. Despite the absence of history of smoking or pre-existing lung disease, this patient remained O_2-dependent after 6 weeks of the onset of symptoms, which raises questions about the mechanism of lung damage in COVID-19, as this is unusual with other infective lung pathologies.

Author Statement

The authors below confirm their contribution in the manuscript titled "**Progression of CXR features on a COVID-19 survivor"** and submitted to ID Cases journal

Dr Loay H Abdelnour, MSc, has designed the manuscript, obtained patient's consent, collected data, and wrote the manuscript

Dr Mohammed E Abdalla, MSc, has designed the manuscript, collected data, and reviewed the manuscript

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Figure 1. Serial CXRs from admission to day 41

A- Patchy air space change in both lower zones with left basal atelectasis
B- Increased consolidation in both lungs
C- Internal jugular venous catheter projected over the right atrium. Extensive peripheral consolidation particularly on the left side
D- Worsened consolidations bilaterally
E- Intubated. Right internal jugular line tip in the right atrium. Deterioration of bilateral consolidation particularly within the right upper lobe
F- Airspace shadowing in the lung fields reduced slightly in the interim
G- Extubated. Position of the central line and nasogastric tube unchanged. Extensive air space shadowing persists in both lungs
H- Extensive air space change throughout the lung fields
I- Worsened diffuse air space changes in both lungs. Typical of COVID-19 pneumonitis
J- Improving aeration in both lungs.
K- Some improvement of the right midzone consolidation. Bilateral ground glass changes and areas of collapse remain unchanged.
L- Slightly improved aeration in both lungs

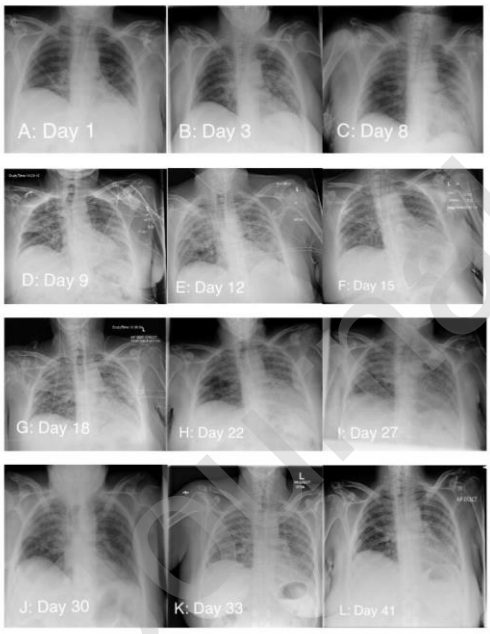

Table 1. Initial and subsequent laboratory results and oxygen therapy

	Day 1	Day 3	Day 8	Day 13	Day 18	Day 22	Day 25	Day 27	Day 30	Day 41
COVID-19 RT-PCR	positive	-	-	-	-	negative	-	-	-	Negative
White cell count 10^9/L	4.8	6.3	12.2	33.6	15.1	-	-	-	-	7.2
Lymphocyte Count 10^9/L	0.84	0.98	0.55	1.52	1.46	-	-	-	-	1.44
CRP mg/L	72	155	270	461	80	23	-	-	-	5
Serum urea mg/Dl	21	12	18.5	40	45.7	36.7	-	-	-	12
Serum creatinine mg/Dl	1.18	0.84	0.86	1.39	0.58	0.76	-	-	-	0.62
LDH U/L	-	377	532		400	-	-	-	-	-
D-dimer mcg/mL	-	-	-		>4	-	-	-	-	-
Troponin T ng/L	-	8.1	-	72	18.9	-	-	-	-	-
Creatinine kinase U/L	-	85	-	13	102	-	-	-	-	-

Arterial pH		7.49								
Arterial O_2 kPa		13.8								
O_2 delivery mode	RA	RA	Airvo 40L, 95%	CPAP then MV	4L, NC	35% VM	98% VM	40% VM	3L, NC	2L, NC

RT-PCR = reverse transcriptase polymerase chain reaction; CRP= C-reactive protein; LDH= lactate dehydrogenase; O_2= oxygen; RA= room air; CPAP= continuous positive airway pressure; MV= mechanical ventilation; L= litre; NC= nasal cannula; VM= venture mask