

Chest Radiographic Findings of A Case of Severe Acute Respiratory Syndrome (SARS) in Singapore

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ABSTRACT

A new form of atypical pneumonia was reported in the East Asian region beginning from early 2003. This was later termed by the World Health Organisation as Severe Acute Respiratory Syndrome (SARS). The diagnosis of SARS relies on a combination of clinical features and chest radiographic findings. A preliminary review of SARS in Singapore shows chest radiographic findings of patchy air-space shadowing with severe cases progressing to diffuse air-space shadowing. We illustrate these findings with temporal correlation in our case report.

As SARS is a contagious, rapidly progressive and potentially fatal condition, early diagnosis is crucial for prompt management and isolation of patients. Recognition of chest radiographic findings aids in the early diagnosis and containment of SARS.

Keywords: SARS, atypical pneumonia, viral pneumonia, thoracic radiography, coronavirus

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INTRODUCTION

On 12 March 2003, the World Health Organisation (WHO) issued a global alert about outbreaks of a severe form of pneumonia in Vietnam, Hong Kong and Guangdong province in China⁽¹⁾. The name of this disease was subsequently revised to Severe Acute Respiratory Syndrome⁽²⁾ (SARS). The infection has spread to many other countries including Singapore⁽³⁾.

The diagnosis of SARS relies on a combination of clinical features and chest radiographic findings⁽⁴⁾.

At the time of writing, the hypothesised causative organism is a coronavirus⁽⁵⁾ and/or paramyxovirus⁽⁶⁾. The mode of transmission is probably by contact with infected droplets. As such, family members and healthcare workers are at the highest risk of contracting the disease.



Fig. 1 Chest radiograph on admission, day 5 from the start of symptoms. Two foci of air-space shadowing within the right lung.

Three persons who had travelled to Hong Kong at the end of February 2003 were admitted to hospital with pneumonia after their return to Singapore. From these three index cases, the infection has (as of 31 March 2003) spread to 91 people⁽⁷⁾.

We present the chest radiographic findings of one of the first cases of SARS in Singapore.

CASE REPORT

The patient is a female adult patient below 30 years with no past medical history of note, who presented to this hospital with fever, non-productive cough, headache and myalgia. She had a significant travel history to Hong Kong and developed symptoms on the last week of February 2003. The onset of symptoms is designated day zero of her illness.

On admission (day 5 of her illness), she had no sore throat or rhinorrhoea. She was initially afebrile, had stable clinical parameters (pulse rate 72/min, BP 100/60 mmHg), was not tachypnoeic and auscultation did not reveal crepitations. No

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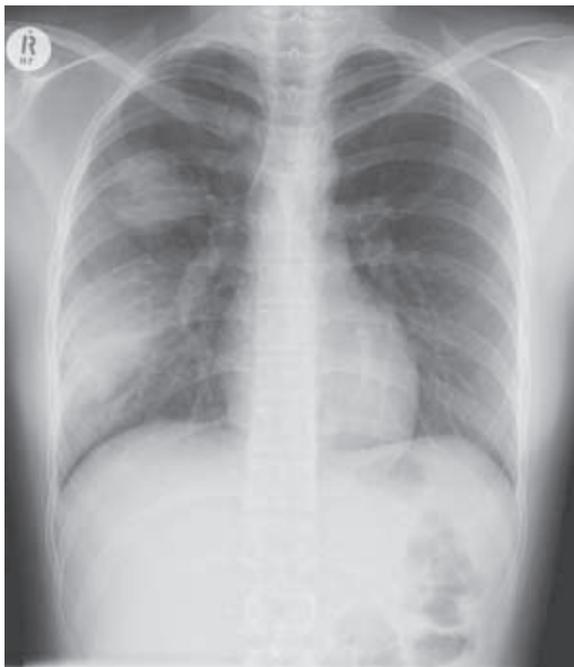


Fig. 2 Chest radiograph on day 7 shows progression of air-space shadowing in the right lung.

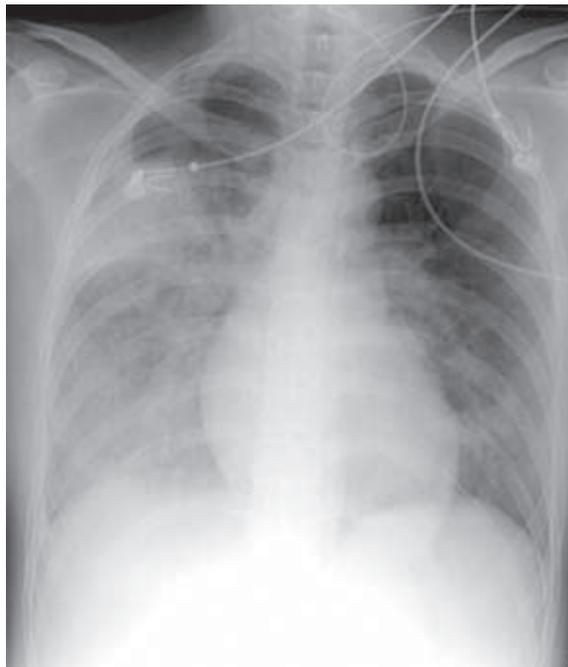


Fig. 3 Chest radiograph on day 13 shows the most florid pulmonary changes in the right lung with an additional new focus of air-space shadowing in the left lower zone.



Fig. 4 Chest radiograph on day 30 shows resolution of air-space shadowing with minimal residual scarring.

other clinical findings e.g. viral exanthem were noted. Investigations done at this point showed leukopaenia ($2.2 \times 10^9/l$) and thrombocytopenia ($84 \times 10^9/l$). The renal and liver function tests were within normal limits.

The chest radiograph on day 5 showed a rounded focus of hazy air-space shadowing measuring 3 cm at the lateral aspect of the right upper zone with sparing

of the medial portion of the lung. A larger focus of air-space shadowing measuring 4cm was seen in the periphery of the right lower zone (Fig. 1).

On day 6, the patient developed a fever (38.6°C) and basal crepitations in the right lung. A provisional diagnosis of viral pneumonia was made.

The chest radiograph on day 7 demonstrated progression of the findings, with increasing size and density of the foci of air-space shadowing within the right lung (Fig. 2).

The patient remained clinically stable. She was febrile and required supplemental oxygen. She was empirically treated with antibiotics and antiviral agents. Serology for influenza, parainfluenza, legionella, dengue fever, Hantavirus and respiratory syncytial virus was reported as negative.

The most florid chest radiographic changes were seen on day 13. There was progression of air-space shadowing in the right upper and lower zones. The right hemidiaphragm was ill-defined. A small focus of hazy air-space shadowing was also seen in the left lower zone (Fig. 3). The patient was ill but remained clinically stable. She received supportive treatment but did not require endotracheal intubation.

The patient improved clinically and became afebrile on day 16.

A final diagnosis of SARS was made because her illness was consistent with the WHO case definition in the global alert, healthcare workers and persons in close contact with her also fell ill and contact tracing later revealed that there was a

Table I. WHO case definitions for Surveillance of Severe Acute Respiratory Syndrome (SARS).

A person presenting after 1 February 2003 with history of:
– high fever (more than 38°C)
AND
– one or more respiratory symptoms including cough, shortness of breath, difficulty in breathing
AND one or more of the following:
– close contact, within 10 days of onset of symptoms, with a person who has been diagnosed with SARS
– history of travel, within 10 days of onset of symptoms, to an area in which there are reported foci of transmission of SARS

chain of transmission back to a specific floor of a hotel in Kowloon, Hong Kong.

Follow-up chest radiographs showed resolution of the areas of air-space shadowing. The latest chest radiograph on day 30 showed complete resolution of air-space shadowing with minimal scarring in the right upper and lower zones (Fig. 4).

In this patient, the chest radiographs showed no mediastinal or hilar enlargement to suggest lymphadenopathy, and no pleural effusions, pneumothorax or pneumatocele.

DISCUSSION

SARS is a new form of atypical pneumonia that is contagious, rapidly progressive and potentially fatal. As of 26 March 2003, there have been 49 deaths worldwide, out of 1,323 suspected and/or probable SARS cases⁽⁸⁾. This gives a case-fatality proportion of 4%.

At this point in time, the likely causative organism is suspected to be a coronavirus. These viruses are enveloped single-stranded RNA organisms and the known human infections involving coronaviruses affect the lower respiratory tract in adults and children, and the colon in neonates⁽⁹⁾. These viruses are able to survive on contaminated surfaces in the environment for up to three hours. The postulated mode of transmission is droplet infection via close contact, so early diagnosis is crucial for management and immediate isolation. Close contact is defined as having cared for, having lived with, or having had direct contact with respiratory secretions and/or body fluids of a patient suspected of having SARS.

The diagnosis of SARS is, at the time of writing, based on clinical criteria. Cases are classified into either suspected or probable cases. The definition of a suspect case is given in Table I.

The presence of radiographic findings of pneumonia or respiratory distress syndrome classifies

a suspect case as a probable case of SARS⁽⁴⁾. As such, radiographic findings play a vital part in both diagnosis and classification of cases. Until serological tests for the causative organism are widely used, the current classification of a probable case remains the best available definition.

The initial chest radiographic findings of SARS may be subtle, with small areas of non-specific air-space shadowing or increased haziness in the periphery of the lungs. Meticulous adherence to proper radiographic technique is essential as artefacts produced by errors in positioning or exposure may either obscure or mimic these initial radiographic findings. While this single case will not represent the varied patterns of involvement of the lungs in SARS, it illustrates the features on chest radiography at presentation, during progression and subsequent recovery of a patient with SARS.

As a new and emerging disease, there is little published evidence on which to base management. This will depend on accurate observation and review of the information that is collected about the disease. While accuracy of information available about this disease is important, the speed of dissemination of this same information has proved critical in the handling of this disease so far.

Isolation and the implementation of barrier nursing procedures are probably the most effective methods to limit the spread of disease. Healthcare workers who treat and manage suspected cases should use a combination of airborne, droplet and contact precautions. Strict adherence to handwashing techniques, the use of filtration masks, gowns and gloves should be standard procedure. Voluntary or enforced isolation of suspected cases will also reduce the risk of spread to the community in general.

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REFERENCES

1. Press release issued by World Health Organisation. Acute respiratory syndrome in Hong Kong Special Administrative Region of China/ Vietnam [online]. Available at www.who.int/csr/don/2003_03_12/en/. Accessed on March 27, 2003.
2. Press release issued by World Health Organisation. Severe Acute Respiratory Syndrome — multi-country outbreak [online]. Available at www.who.int/csr/don/2003_03_15/en/. Accessed on March 27, 2003.
3. Press release issued by Ministry of Health, Singapore. Outbreak of atypical pneumonia in Hong Kong, Vietnam and Guangdong province in China. MH 34:03 Vol 14.
4. World Health Organisation. Case definitions for surveillance of Severe Acute Respiratory Syndrome (SARS) [online]. Available at <http://www.who.int/csr/sars/casedefinition/en/>. Accessed on March 27, 2003.
5. Center for Disease Control. Update on SARS investigation. March 24, 2003 [online]. Available at <http://www.cdc.gov/od/oc/media/transcripts/t030324.htm>. Accessed on March 27, 2003.

6. World Health Organization. Disease outbreak reported: acute respiratory syndrome in China — update 4 [online] Available at http://www.who.int/csr/don/2003_03_19/en. Accessed on March 27, 2003.
7. Press release issued by Ministry of Health, Singapore. SARS: New measures at airport to curb importation of new cases; more patients recovering and discharged. 30 March 2003 [online]. Available at <http://app.moh.gov.sg/new/new02.asp?id=1&mid=5740>. Accessed on March 31, 2003
8. Update: Outbreak of Severe Acute Respiratory Syndrome —Worldwide, 2003. *MMWR Morb Mortal Wkly Rep.* 2003 Mar 28;52(12):241-248
9. McIntosh K. Coronaviruses. In: Mandell GL, Bennett JE, Dolin R, eds. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*, 5th ed. Philadelphia: Churchill Livingstone, Inc., 2000.