

# Presentation of severe acute respiratory syndrome (SARS) patients in a screening centre

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## ABSTRACT

**Introduction:** On 22 March 2003, the Ministry of Health, Singapore, designated Tan Tock Seng Hospital as the nationwide severe acute respiratory syndrome (SARS) hospital and its Emergency Department (ED) took over the role as the screening center for SARS on 26 March 2003. We describe the initial clinical characteristics of probable or suspect SARS patients that presented to the ED.

**Methods:** A retrospective study of patients who were admitted through the ED and subsequently diagnosed to have probable SARS and suspect SARS was done. The data of these patients from the ED log were reviewed and analysed.

**Results:** From 13 March 2003 to 31 May 2003, 11,461 patients were screened for SARS and 1,386 patients were admitted. Of these, 117 patients were diagnosed to have probable SARS and 146 suspect SARS. Their mean age was 36.7 years (range 1-80). Among these patients, there were 122 men (46.4 percent), and 205 were Singaporeans (77.9 percent). 13 patients had no initial contact history upon presentation to the ED. The mean duration between onset of symptom to presentation to the ED was 3.1 days. Travel history was less common in probable SARS cases than in suspect SARS cases as the epidemic was due mainly to local transmission. Fever was the most common presenting symptom (91.6 percent), and gastrointestinal symptoms were the least (6.9 percent). In the ED, 249 (94.7 percent) patients had chest radiographs and 86 (32.7 percent) had full blood count done. 22.2 percent of probable SARS patients had normal chest radiographs when they first presented to the ED.

**Conclusion:** The World Health Organisation criteria were important screening tools and admission guides, but should not be strictly followed. It was difficult to differentiate between probable and suspect SARS patients in the ED.

**Keywords:** emergency department, infectious disease screening, pneumonia, severe acute respiratory syndrome (SARS)

*Singapore Med J 2005; 46(4):161-164*

## INTRODUCTION

The first case of atypical pneumonia was diagnosed in Foshan City in Guangdong Province, China, in November 2002<sup>(1)</sup>. This disease, now known as severe acute respiratory syndrome (SARS), caused much morbidity and mortality. Its infectivity, aided by ease of modern travel, had spread to 29 countries<sup>(2)</sup> by the end of the SARS outbreak. In Singapore, the first case presented on 1 March 2003. The virus spread rapidly among hospital staff, patients, visitors and their close family contacts. On 13 March 2003, the Ministry of Health, Singapore (MOH) alerted<sup>(3)</sup> the local medical community on the outbreak of atypical pneumonia in Hong Kong, Vietnam and China.

On 22 March 2003, MOH designated Tan Tock Seng Hospital (TTSH) as the nationwide SARS hospital<sup>(4)</sup>. Its Emergency Department (ED) assumed the role as the screening center for SARS on 26 March 2003. Patients who had fever, upper respiratory symptoms, infective changes on chest radiographs, or positive contact history were referred to the ED. These referrals were from private medical practitioners, nursing homes, hospitals and immigration authorities. There were also self-referral patients.

As SARS was a new disease, the ED adopted the World Health Organisation (WHO) case definitions<sup>(5)</sup> as well as information of local at-risk areas provided by the hospital's epidemiology team for the screening and initial assessment of patients. We describe the clinical characteristics of probable and suspect SARS patients who presented to the ED. This information will provide better recognition of the disease and facilitate any future screening process.

## METHODS

From 13 March 2003 to 31 May 2003, patients who came to ED for screening were captured in a

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computerised log. They included patients who were self-referred or were referred by medical practitioners. A retrospective study was undertaken of admitted patients subsequently diagnosed to have probable and suspect SARS. The data of these patients were reviewed and analysed. Patients who were infected with SARS in the wards or had been admitted via the Communicable Disease Centre were not included in this study.

The patients' demographics, contact history, symptoms, findings on chest radiographs and full blood count results, if done, were recorded. A positive contact history was defined as having any of the following exposures<sup>(5)</sup> in the last 10 days prior to presentation at the ED: close contact with a person who is a suspect or probable SARS case, history of travel to an affected area<sup>(6-8)</sup> (overseas or local), or residing in an at-risk area. The different variables were compared using chi-square test and independent t-test, where appropriate. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) for Windows software version 10.0 (Chicago, IL, USA). A p-value of <0.05 was considered to be statistically significant. The study was approved by the hospital's ethics committee.

## RESULTS

From 13 March 2003 to 31 May 2003, 11,461 patients were screened and 1,386 patients were admitted. Of these, 263 patients were diagnosed to have SARS, of which 117 were probable and 146 suspect SARS. Their mean age was 36.7 years (range 1 to 80). There were 141 (53.6%) females and 122 (46.4%) males. The proportion of female healthcare workers (46%) were greater than that of males (20%). There were 205 (77.9%) Singaporeans and 58 (22.1%) non-Singaporeans.

The mean duration between symptom onset to ED presentation was 3.1 days (range 0.2 to 16.0 days; 95% confidence interval, 0.79 to 2.08 days), with that of probable and suspect SARS patients being 3.9 days (range 0.2 days to 16 days) and 2.4 days (range 0.3 days to 11 days), respectively. The mean duration to presentation was  $4.2 \pm 0.6$  days for healthcare workers with probable SARS, compared to  $3.7 \pm 0.3$  days for non-healthcare workers with probable SARS. This was not statistically significant ( $p=0.5$ ). 13 (4.9%) patients had no initial exposure history upon presentation to the ED. History of close social contact (47.1%) and working as a healthcare worker (33.5%) made up the majority of all positive exposure history. There were statistically more cases with positive travel history in the suspect group.

Fever was the most common symptom in both probable and suspect SARS patients. Table I shows

**Table I. Summary of symptoms in patients with probable and suspect SARS.**

Variable	Probable SARS (n=117)	Suspect SARS (n=146)	p-value
<b>Gender (%)</b>			
Female	70 (64.0)	71 (47.9)	0.07
Male	47 (36.0)	75 (52.1)	
<b>Nationality (%)</b>			
Singaporean	90 (76.9)	115 (78.8)	0.72
Foreigners	27 (23.1)	31 (21.2)	
<b>Close history (%)</b>			
Close social contact	59 (50.4)	65 (44.5)	<0.05
Healthcare worker	47 (40.2)	41 (28.1)	
Travel	3 (2.6)	35 (24.0)	
<b>Presenting symptoms (%)</b>			
Fever	108 (92.3)	133 (91.1)	0.72
Cough	46 (39.3)	56 (38.4)	0.87
Myalgia	27 (23.1)	39 (26.7)	0.50
Sore throat	24 (20.5)	28 (19.0)	0.79
Running nose	7 (6.0)	19 (13.0)	0.07
Chills	15 (12.8)	11 (7.5)	0.15
Malaise	9 (7.7)	8 (5.5)	0.47
Diarrhoea	9 (7.7)	4 (2.7)	0.07
Headache	9 (7.7)	10 (6.8)	0.79
Vomiting	8 (6.8)	2 (1.4)	<0.05
Dyspnoea	8 (6.8)	14 (9.6)	0.42
Nausea	4 (3.4)	2 (1.4)	0.27
Abdominal pain	3 (2.6)	0 (0.0)	0.05
Chest pain	3 (2.6)	2 (1.4)	0.48
Giddiness	3 (2.6)	1 (0.7)	0.22
Rash	3 (2.6)	1 (0.7)	0.22

**Table II. Chest radiographical findings in patients with probable and suspect SARS.**

Variable	Probable SARS (n=117)	Suspect SARS (n=146)	p-value
Non infective changes (%)	26 (22.2)	78 (53.4)	} p<0.05
Infective changes (%)	82 (70.1)	63 (43.2)	
Not done (%)	9 (7.7)	5 (3.4)	

**Table III. Mean total leukocyte, platelet and absolute lymphocyte count in probable and suspect SARS patients.**

Variable	Probable SARS (n=31)	Suspect SARS (n=55)	p-value
Total leukocyte count	$6.8 \pm 3.8 \times 10^9/L$	$8.0 \pm 3.6 \times 10^9/L$	0.15
Platelet count	$206.9 \pm 73.1 \times 10^9/L$	$259.2 \pm 120.6 \times 10^9/L$	0.04
Absolute lymphocyte count	$1.1 \pm 0.8 \times 10^9/L$	$1.8 \pm 1.7 \times 10^9/L$	0.01

the frequency of the different symptoms in the respective group of patients. Vomiting was more common in the probable SARS group. 22 (8.4%) patients did not complain of fever. Of these 22 patients, their presenting symptoms included cough (59.1%), sore throat (9.1%), myalgia (9.1%), runny nose (9.1%), vomiting (4.5%), chest pain (4.5%), headache (4.5%) and chills (4.5%). 11 patients (50.0%) were admitted because they had a temperature  $\geq 37.5^{\circ}\text{C}$  in the ED. Four patients were admitted because of strong contact history or travel history, while one patient had a positive chest radiograph with low lymphocyte count. Six patients were discharged but were admitted when they reattended.

Table II shows the findings on the chest radiographs. 14 patients (5.3%) did not have a chest radiograph in the ED. Infective changes were seen in a larger number of patients with probable SARS ( $p < 0.05$ ). Of the patients who had a full blood count done in the ED, there was no significant difference in the mean leukocyte count of probable and suspect SARS patients (Table III). However, the differences in mean platelet count and mean absolute lymphocyte count in both groups were statistically significant ( $p < 0.05$ ) (Table III).

## DISCUSSION

Initially, there was no diagnostic or screening kit for SARS. The only tool available was WHO case definitions and information of local at-risk areas provided by the hospital epidemiology team. These guided the physicians working at the frontline<sup>(9)</sup>. There is currently still no easily available point-of-care tool for rapid screening of SARS. Generally, the WHO case definitions and information of local at-risk areas provided by the hospital epidemiology team had served the frontline staff well. However, although 91.6% of patients did present with fever, 8.4% of patients did not have the "classical symptom" of fever – according to the WHO criteria. This was consistent with other reports<sup>(10-13)</sup>.

11 patients had a temperature  $\geq 37.5^{\circ}\text{C}$  in the ED and were hence admitted. The remaining 11 patients were admitted because they were reattendances, had a strong contact history or travel history (seven patients), or positive chest radiograph with low lymphocyte count (one patient). These patients were subsequently diagnosed to have probable or suspect SARS. In our opinion, clinical acumen and a high index of suspicion along with the use of the WHO definitions were required to avoid discharging a SARS patient. Not all SARS patients had a positive exposure history at presentation.

Close social contact (47.1%) and healthcare workers (33.5%) formed the majority in overall exposure history. This suggested that the disease was initially imported from abroad and transmitted locally<sup>(14)</sup>. The high percentage of healthcare workers accounted for the gender difference as most healthcare workers were females. Eventually, all patients except one were found to have a positive contact history. Contact history was a useful guide in the screening process and as an admission criterium. However, the lack of initial contact history in 4.1% of cases could have resulted in missed cases. Its absence should not exclude the possibility of a patient having SARS, especially at the point of screening.

The finding that SARS patients presented on an average after three days of symptoms had important implications for public health<sup>(15)</sup>. Furthermore, probable SARS patients presented later than suspect SARS patients. This suggested that individuals who may be infectious were unlikely to present early in the course of illness. This may be due to the fact that little was known of the disease initially and hence, the delay in seeking treatment.

One postulated reason for a longer time taken for probable SARS patients to seek help was that individuals who knew that they were at high risk might have been more hesitant to seek treatment out of fear. Another was that healthcare workers who were probable SARS patients would have self-treated before seeking medical attention in the initial phase of the outbreak but this would have changed with the isolation and hospitalisation of healthcare workers as the outbreak progressed. The mean duration of presentation for healthcare workers compared to non-healthcare workers in probable SARS cases was not statistically significant.

Chest radiographs were not done in the ED for some patients as they had brought their own radiograph, or had mild symptoms or were pregnant. The findings of infective changes in 70.1% of probable SARS patients were similar to those reported in China<sup>(16)</sup>, where chest radiographical changes consistent with pneumonia were detected in 67% to 80% of SARS patients by the third day of illness. The remaining patients developed radiographical findings subsequently, fulfilling the WHO criteria for probable SARS.

43.2% of suspect SARS patients had infective changes in their chest radiographs in the ED. This was due either to over-reading by the ED doctors causing falsely raised positive results, or the chest radiographical changes were determined during the course of evaluation to be due to other causes. No data were collected on the occurrence of chest radiographical findings in relation to onset of fever.

Chest radiographical abnormalities typically appeared by the seventh day of illness in most probable SARS patients, but had been reported to occur as late as the second week of illness<sup>(17)</sup>.

Only a small number of patients diagnosed to have probable or suspect SARS had their full blood count done at the ED. This was due to the fact that many were admitted on the basis of clinical judgment. Total leukocyte count did not show a statistical difference between both groups of patients. The platelet and absolute lymphocyte counts were different in both groups. The difference in the platelet count between the two groups, although statistically significant, had no clinical importance as it was within the normal range. However, absolute lymphopenia was seen in probable SARS patients.

The differentiation between probable and suspect SARS patients in the ED was difficult and impractical as the clinical signs were similar. Our study showed that vomiting was more common in probable SARS, but the actual number was small and was unlikely to be of any clinical significance. However, a strong history of close social contact (being healthcare workers), abnormal chest radiograph findings, and absolute lymphocyte count would strongly suggest the diagnosis of probable SARS cases.

One limitation of this study was that it had excluded those who did not present to the ED in our hospital. The full blood count result was also based on a small sample size. Rapid contact tracing by the epidemiology team, and an efficient follow-up and recall system contributed to the accuracy of screening and initial assessment. In conclusion, the WHO criteria were not adequate as a screening tool and admission guide. The patient's overall clinical presentation must be taken into account when deciding admission. It is essential to bear in mind that patients can present with atypical features.

#### ACKNOWLEDGEMENTS

We thank Drs Lim Poh Lian and Mark Chen from the Communicable Disease Centre for input on the relationship between chest radiograph findings and onset of fever. We thank the staff of the Emergency Department in Tan Tock Seng Hospital for their support in the collection of data.

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