ORIGINAL ARTICLE

Impact of a severe acute respiratory syndrome outbreak in the emergency department: an experience in Taiwan

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Objectives: To evaluate the impact of a severe acute respiratory syndrome (SARS) outbreak in the emergency department (ED).

Methods: Computerised records of all ED visits in January and May 2003 were analysed and compared, representing before and during the SARS epidemic respectively. Data were grouped into two categories. Group 1 was the indicators of impact on patients, including visitor's condition classification, number of patients that died on arrival (DOA), received cardiopulmonary resuscitation, underwent endotracheal intubation, needed mechanical ventilation, discharged against medical advice (AAD), died in the ED, and the admission rate to wards. Group 2 was the indicators of impact on the quality of medical care, including number of visits that returned within 72 hours (early returns), underwent chest radiography, upper abdomen sonography or computed tomography, and the length of stay.

Results: There were 6650 and 3901 consecutive encounters in January and May 2003 respectively. There were significant differences on condition classifications (p = 0.000), increased rate of patients that underwent endotracheal intubation (p = 0.003), needed mechanical ventilation (p = 0.020), and admission (p = 0.000). The rate of AAD decreased significantly (p = 0.024). There was no significant difference on early returns, although the length of stay in the ED increased (p = 0.043). The number of visits that underwent chest radiological examination increased (p = 0.000) and upper abdomen sonography (p = 0.007) decreased significantly in May.

Conclusions: SARS had an impact on the medical service system and decreased visits by 40% in the ED. Patients visiting the ED had more severe conditions than before. The impact of SARS on quality of medical care can be minimised when adequate infection control measures are applied.

Severe acute respiratory syndrome (SARS) has infected more than 8400 people and killed more than 800 people worldwide,[1] including hundreds of exposed medical and nursing personnel. Like terrorism, the spread of SARS in hospitals strikes fear among people, especially the patients and medical staff. Evaluating the impact of this deadly disease on patients and quality of medical care may provide important information for public health, epidemiology, medical services and education, and development of an effective strategy to prevent future SARS-like outbreaks.

In Taiwan, the first SARS case was reported in February 2003. The reported cases surged in late April, climbed in May, and tapered off in June (fig 1).[2] A total of 671 probable cases were recorded from February to June 2003. Several major hospitals or emergency departments (ED) were closed by the government due to clusters of SARS spreading. Eighty four patients have died, including two junior residents after close contact or performing endotracheal intubation on their patients with pneumonia as initial diagnosis. Our hospital reported 58 cases with 18 probable cases and 11 deaths in this outbreak. People in Taiwan became anxious in late April and feared visiting hospitals. We conducted this study to evaluate the difference of patients' condition and quality of medical care in the ED before and during the SARS outbreak. This is the first study to evaluate the impact of SARS in the ED.

METHODS

This study was conducted in the ED of Kaohsiung Veterans General Hospital, Taiwan. The institution is a 1176 bed, urban, medical centre with an annual ED census of 76 183 in 2002. Computerised records of all ED visits in January and May 2003 (representing before and during SARS epidemic respectively) were analysed for information that included the classification of patients' condition on arrival. Class 1 defined patients with conditions that must be managed in the resuscitation room, including trauma cases. Class 2 were patients with fever (body temperature >39℃), or unstable vital signs. Class 3 were patients with an illness but stable vital signs. Class 4 were non-emergency visits. Number of visits that died on arrival (DOA), received cardiopulmonary resuscitation (CPR), underwent endotracheal intubation, needed mechanical ventilation, discharged against medical advice (AAD), died in the ED, returned within 72 hours (early returns), were admitted for further care, and the length of stay in the ED were included for analysis. These data were grouped into two categories: the indicators of impact on patients and quality of medical care. Data were compared with χ^2 test. Fisher's exact test was used for correction if necessary. A p value of less than 0.05 was considered to be significant.

RESULTS

There were 6650 and 3901 consecutive ED patient encounters in January and May 2003 respectively.

Table 1 lists the indicators of impact on patients. There are significant differences on condition classification (p = 0.000), rate of patients that underwent endotracheal intubation (p = 0.003), needed mechanical ventilation (p = 0.020), AAD (p = 0.024), and admission rate (p = 0.000). Although the number of patients who died in the ED increased in May, there is no statistical significance as compared with that in January.

Abbreviations: ED, emergency department; SARS, severe acute respiratory syndrome; DOA, died on arrival; CPR, cardiopulmonary resuscitation; AAD, discharged against medical advice

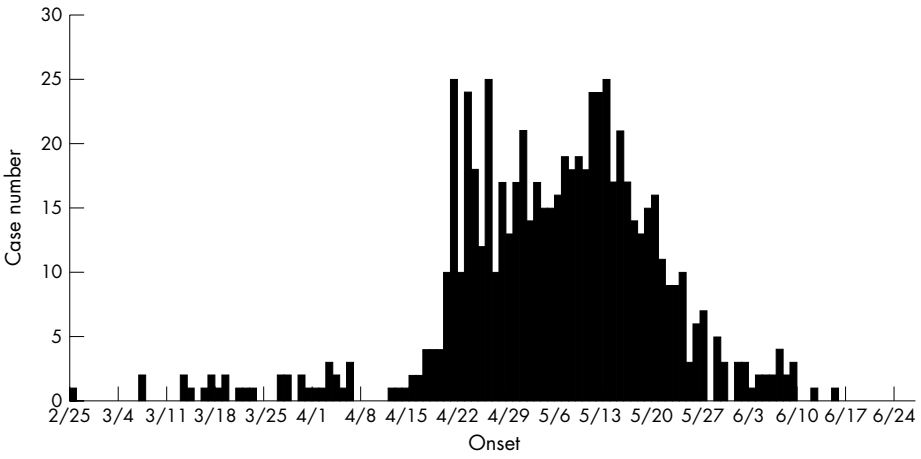

Figure 1 Epidemiological curve of SARS probable cases in Taiwan (accessed 28 June 2003 at http://www.cdc.gov.tw/sarsen/).

Table 2 lists the indicators of impact on quality of medical care. There is no significant difference on early returns. But the length of stay in the ED increased ($p = 0.043$). The number of cases that undergoing chest radiological examination increased ($p = 0.000$) and abdominal sonography decreased ($p = 0.007$) significantly in May.

DISCUSSION

More than 80% of SARS cases were infected in the hospital. Hospitals became a danger area rather than a place to save lives and treat illnesses. People in Taiwan feared visiting hospital in late April 2003. This crisis cut down visits by about 40% in our ED in May. It is probable that some of the patients isolated themselves at home or sought alternative treatment for their illness before visiting the ED during the epidemic. As the other two medical centres in and around our city had been closed temporarily because of SARS spreading, patients seemed not to have another choice in visiting a different ED. This may also explain why the AAD ratio decreased.

As table 1 shows the largest reduction of visits belonged to class 3, conditions that could be delayed to treatment. Some of the conditions might also be managed in outpatient departments or clinics. The increased rate of undergoing endotracheal intubation, receiving mechanical ventilation, and admission illustrated the severity of the condition of the visitors in May. These phenomena beg the question: how many unnecessary visits happened at the usual time? This interesting issue needs further study. But we do realise that about 40% of the patients will not visit the ED when outbreaks may spread in the hospital.

Early returns to the ED and the length of stay in the ED are often tracked by hospitals as potential indicators of quality of care from doctors.[3] To avoid exposure to suspected patients with SARS and infection spreading in the ED, doctors may not keep their patients in the ED for observation as long as before. This may shorten the length of patient's stay in the ED. But for screening suspected case, more patients underwent chest radiological examination than before. The examinations took time. This may explain why the length of stay in the ED increased.

During the epidemic, all cases of fever, cough, dyspnea, community acquired pneumonia, and history of exposure to a patient or hospital with probable SARS were suspected according to the criteria established by the Centers for Disease Control and Prevention (CDC) and World Health Organisation (WHO).[4 5] For screening, the ratio of patients undergoing chest radiological examination increased significantly (43.9% *v* 60.2%, $p = 0.000$). As the front line of hospitals, ED took the responsibility for screening all suspected cases. This increased the workload in the ED even the amount of visits decreased. To avoid unnecessary exposure or shorten the exposure time with suspected cases, also under the radiologist's request, it is reasonable that the ratio of upper abdomen sonographic examination decreased. Computed tomography is an alternative examination for avoiding contact with patients. For infection control measures, we postponed some examinations to be performed after admission rather than in the ED if the examination was not so urgent and not necessary for initial diagnosis. This may explain why the ratio of abdominal computed tomography had not increased in this study.

Table 1 Indicators of impact on patients in the ED

	January n=6650	May n=3901	p Value
Classification			0.000
Class 1	585 (8.8%)	454 (11.6%)	
Class 2	2750 (41.4%)	1741 (44.6%)	
Class 3	3310 (49.8%)	1700 (43.6%)	
Class 4	5 (0.1%)	6 (0.1%)	
DOA	18 (0.3%)	12 (0.3%)	NS (0.710)
CPR	34 (0.5%)	20 (0.5%)	NS (1.000)
Endotracheal intubation	70 (1.1%)	69 (1.8%)	0.003
Mechanical ventilation	86 (1.3%)	73 (1.9%)	0.020
AAD	206 (3.1%)	91 (2.3%)	0.024
Died in the ED	6 (0.1%)	8 (0.2%)	NS (0.164)
Admission	1542 (23.2%)	1096 (28.1%)	0.000

DOA, died on arrival; CPR, cardiopulmonary resuscitation; AAD, discharge against medical advice; ED, emergency department.

Table 2 Indicators of impact on quality of medical care in the ED

	January n = 6650	May n = 3901	p Value
Early returns	317 (4.8%)	175 (4.5%)	NS (0.534)
Length of stay >2 hours	2442 (36.7%)	1510 (38.7%)	0.043
Chest radiological examination	2919 (43.9%)	2350 (60.2%)	0.000
Upper abdomen sonography	210 (3.2%)	88 (2.3%)	0.007
Abdomen CT	213 (3.2%)	125 (3.2%)	NS (0.952)

SARS is a contagious disease and two young residents in Taiwan died of SARS after performing endotracheal intubation for SARS patients. We found that our young residents took risks and bore heavy pressure for undergoing intubation and invasive procedures after the onset of the outbreak. Senior and experienced staff soon took over the jobs in most situations during the epidemic. This decision shortened the time of exposure and also comforted our colleagues, including the nursing staff and physician assistants. From the increasing number of endotracheal intubation and lack of difference on the rate of CPR, we can be sure that our staff did a superb job and our patients had received quality service. This may also explain why there was no difference on the rate of early returns.

This study has a number of limitations. The study was performed in a tertiary care centre in Taiwan. This may limit the generalisations of the results to other ED and worldwide. The psychological impact was huge but not evaluated. The economic costs of SARS could not be estimated. We also did not analyse patients of trauma or non-trauma group. Trauma seemed not to be affected by the SARS outbreak.

Although the aetiological agent was not known and there was no reliable, rapid diagnostic test available at the onset of the outbreak, our medical staff were encouraged by adequate infection control measures, sufficient N95 respirators, gloves, disposable gowns, and eye protection. Only one colleague had been quarantined due to not wearing an N95 respirator but a surgical mask while performing an ECG examination for a suspected SARS patient. None of our medical staff were infected and no one quit in our ED. The SARS crisis provided an opportunity to examine our infection control measures and profession.

In conclusion, SARS had an impact on our medical service system and decreased 40% of visits to the ED. Patients visited EDs with more severe condition than before. The impact of SARS on quality of medical care can be minimised when adequate infection control measures are applied.

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REFERENCES

1 **World Health Organisation**. *Cumulative number of reported probable cases of SARS*. Geneva: World Health Organisation, 2003. http://www.who.int/csr/sars/country/2003_06_30/en/ (accessed 30 Jun 2003).
2 **Centers for Disease Control and Prevention**. Epidemiological curve of SARS probable cases in Taiwan. http://www.cdc.gov.tw/sarsen/ (accessed 28 Jun 2003).
3 **Riggs JE**, Davis SM, Hobbs GR, *et al*. Association between early returns and frequent ED visits at a rural academic medical center. *Am J Emerg Med* 2003;**21**:30–1.
4 **Centers for Disease Control and Prevention**. *Severe acute respiratory syndrome (SARS)*. Atlanta: Centers for Disease Control and Prevention. 2003. http://www.cdc.gov/ncidod/sars/ (accessed Jun 30 2003).
5 **World Health Organisation**. *Case definitions for surveillance of severe acute respiratory syndrome (SARS)*. Geneva: World Health Organisation, 2003. http://www.who.int/csr/sars/casedefinition (accessed Jun 30 2003).