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SHORT REPORT
Hospitalized patients with bacterial infections: a potential focus of SARS transmission during an outbreak

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REPORT

Severe acute respiratory syndrome (SARS) has emerged as a new respiratory disease caused by a novel coronavirus and is associated with substantial morbidity and mortality [1, 2]. Dynamic mathematical models have suggested that SARS, if uncontrolled, would infect the majority of people wherever it was introduced [3–5]. The patterns of spread suggest droplet or contact transmission [6]. Close proximity of persons enhances the risk of transmission, and this together with handling of human secretions (respiratory secretions, faeces, etc.) have made the hospital setting particularly vulnerable to the rapid spread of SARS.

In Singapore, 157 out of 206 (76%) infections were acquired in a health-care facility [7]. In the setting of a hospital-related outbreak of SARS, patients with other infectious diseases may also contract SARS. In such patients there is a danger that the diagnosis of SARS may be missed, and this may lead to significant secondary transmission.

We report the difficulties and pitfalls of diagnosing SARS in hospitalized patients with concomitant infections.

Two patients were admitted to Tan Tock Seng Hospital, the first hospital affected by SARS in Singapore, in early March 2003 at a time when the problem of SARS was just being recognized, and prior to this hospital being designated for SARS patients only.

A 53-year-old lady with diabetes and ischaemic heart disease was admitted with fever and vomiting. Blood cultures were positive for *Klebsiella pneumoniae*, *Acinetobacter baumanii* and *Enterococcus*. She developed septic shock. Pulmonary changes were at the time attributed to congestive heart failure. A diagnosis of concomitant SARS infection was only made after epidemiological investigations directly linked her to 23 secondary SARS cases. She had been exposed to a SARS case (then unknown as SARS) on the first 2 days after her admission.

A 60-year-old man with diabetes was admitted to Tan Tock Seng Hospital for chronic kidney problems on 5 March and discharged on 20 March. He was readmitted 4 days later, with gastrointestinal bleeding and melaena, to a surgical ward of another hospital, because by then the Tan Tock Seng Hospital had been designated a SARS hospital. On admission the patient had a low-grade fever; a chest radiograph was normal. Blood cultures grew *Escherichia coli*. Pulmonary infiltrates occurred only 10 days later. In early April an outbreak of SARS involving 62 patients (25 health-care workers, 20 in-patients, and 17 family and social contacts) occurred on the surgical wards of this hospital. Subsequent epidemiological investigations identified this patient as the source and focus of this outbreak. Faecal stool samples and throat swab were found to be PCR positive for SARS coronavirus. He is thought to have been infected during his hospital stay at Tan Tock Seng Hospital, at a time when hospital-wide infection control measures for SARS were not yet in place.

These two cases led to super-spread events (as defined by having infected $\geqslant 10$ persons [7]), and they were responsible for 63 (30%) of the 206 cases with probable SARS during the outbreak in Singapore, as notified to the Ministry of Health in Singapore by 31 May 2003.

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Patients hospitalized with other infections at the time of a SARS outbreak can be co-infected with SARS coronavirus. In such patients the clinical manifestations of original SARS may be attributed to the original infection. The diagnosis of SARS in these two cases with concomitant bacterial infections was initially missed because there were other explanations for their illnesses. The patients were not isolated. By the time the diagnosis of SARS was made, both cases had become a new focus of SARS transmission during the national outbreak in Singapore and were responsible for a large proportion (30%) of secondary cases with SARS. With the absence of a reliable early diagnostic test, the diagnosis was late and only uncovered when the epidemiology showed that it was likely.

Most SARS cases (161 persons, 81%) in Singapore showed no evidence of transmitting the infection to other persons. This was the result of early suspicion, identification and isolation. Unrecognized cases of SARS in Singapore were rare, but were the main cause of perpetuation of the national outbreak because they were not isolated early enough. Unrecognized cases were either due to atypical presentations in co-morbid patients [8] or, as presented here, to concomitant infection. As a reliable early diagnostic test remains elusive, such cases are likely to be missed in the future.

CONCLUSION

Two lessons can be learned from these two patients. First, discharged patients from a hospital with known SARS cases should be kept under surveillance for at least 14 days after discharge, and readmitted to the original hospital should medical problems arise within this time-frame. Secondly, all patients with fever, even when there is another known aetiology, should be isolated in times of a hospital-related SARS outbreak. In response to the experience of these cases, both policies were implemented in Singapore and contributed to the successful containment of the epidemic. Isolating all patients with fever may be difficult and impractical in some places without sufficient isolation facilities, and probably most hospitals would have to confine these patients to designated wards.

The WHO definition for probable SARS states: 'A case should be excluded if an alternative diagnosis can fully explain their illness' [9]. Whilst this definition is reasonable for epidemiological surveillance purposes, our cases show that it should not be the basis on which infection control measures are implemented during an outbreak, as SARS is not necessarily a diagnosis of exclusion.

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