Editorial
SARS: Facts and considerations for the orthopaedic community

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Hong Kong is known as HKSAR (special administrative region) of China. It is ironic that the atypical pneumonia emanating from, or at least made notorious by Hong Kong, is named the SAR (severe acute respiratory) syndrome.

The outbreak began in November 2002 in the Southern Chinese city of Foshan, where a family of 4 contracted a new and serious atypical pneumonia. By February 2003 clusters of infected patients had been identified in Guangzhou. It was still relatively well contained then, until a professor of nephrology came from there and spread the disease to 12 others at the Hong Kong Metropole Hotel. He later developed the full-blown SARS and died at the Kwong Wah Hospital despite intensive resuscitation. The 12 took the disease to Vietnam, Canada, Singapore, Ireland and US, and various hospitals in Hong Kong. Among these was the Prince of Wales Hospital (PWH), where a nebuliser that was used on an infected patient contaminated the whole ward. 18 staff attending the ward, and 16 medical students who visited the patient came down with SARS. A visitor at the ward caused a massive outbreak at a housing estate, the Amoy Garden. He had diarrhoea, and there was a leak in the sewage pipes. In addition, the drains installed beneath bathroom floors were emitting gas from the sewage pipes, because water could not be retained in the U-traps. This gas was sucked up from the pipes by powerful exhaust fans which residents had installed in their bathrooms. Massive infection ensued. Daily updates of the pandemic are available from the WHO website (http://www.who.int/csr/sars/en/).

Symptoms of SARS[1,2] include a body temperature of more than 38° C (observed in 99–100% of cases), chills and rigors (73%), myalgia (49–61%), cough (51–69%), sputum production (29%), dyspnoea (42%), headache (56%), dizziness (43%), and diarrhoea (20%). Blood tests show leukopenia (34%), lymphopenia (70%), thrombocytopenia (45%), prolonged activated partial thromboplastin time (43%), and elevated creatine phosphokinase (CPK; 32%), lactic dehydrogenase (LDH; 71–87%), and hyponatraemia (20%).

The incubation period from initial contact with the virus now appears to be no more than 10 days. There are 3 clinical phases, each lasting roughly a week. In the first week, infected individuals are still relatively well but febrile. The virus replicates rapidly during this phase and peaks at 7–10 days. Fever may diminish in the second week. This is the immune reaction phase. If the immune system is overcome, lung parenchymal damage occurs in the third week and heralds acute respiratory distress. Post-mortem studies have shown a range of lung pathology suggesting a role for cytokine-invoked tissue destruction.[3]

The chest X-ray may be normal or show a single area of consolidation in a lower peripheral zone. By the end of the first week lesions increase. Still, 54% of lesions remain unifocal, while a third become multiple and bilateral. High-resolution computer tomography of the lungs has given the best correlation with lung infection where plain radiographs are negative or doubtful.

A novel coronavirus was first identified by cell culture by K Y Yuen and his team in Hong Kong and reported by Peiris et al.[4] in *Lancet*. Soon afterwards, Ksiazek et al.[5] in Atlanta, US, and then Drosten et al.[6] from Hamburg, Germany reported the same. It is now

widely believed that the novel coronavirus (SARS-CoV) is the causative agent of SARS. Specific laboratory tests depend on isolating the causative virus from specimens of blood, respiratory secretions, stool, urine, and tissue biopsies. Cell culture is technically demanding, but a polymerase chain reaction (PCR) test for genetic material of the SARS-CoV is available from WHO collaboration laboratories. The currently available PCR has a high specificity but low sensitivity (a negative result gives poor value for excluding SARS). Antibody tests, on the other hand, by either enzyme linked immunosorbent assay (ELISA) or immunofluorescent assay (IFA) can detect if a patient has been or is recently infected by the virus. A repeatedly negative result excludes infection.

Treatment remains controversial. One regimen gives broad spectrum antibiotic and antiviral coverage early on. Antiviral agents used include ribavirin and Kaletra (combination of lopinavir and ritonavir). Convalescent serum should logically work best during the initial viral replication phase, but has also been used effectively in late unresponsive cases.[1] The use of steroids is based on the finding of cytokine-mediated tissue damage. High-dose pulsed steroids are reserved for cases that progress to lung damage. Respiratory support is necessary for hypoxaemia, but cases that require intubation and mechanical ventilation carry an increased fatality rate.

Mortality from SARS, originally thought to mimic that of most community-acquired pneumonia is around 5%, has been steadily climbing. While the final mortality rate remains to be seen, at the time of writing 623 fatalities have been reported out of 7761 cases worldwide (8%).[7] In Hong Kong 243 of 1710 patients have died, whereas 1191 have been discharged from hospital. Singapore reported 28 deaths from 205 cases and 157 recoveries. The respective figures are 35, 274, 46 for Taiwan; 23, 140, 106 for Canada; 5, 63, 58 for Vietnam, and 282, 5209, and 2009 for mainland China.[7]

There are different ways of calculating mortality, and while there is wide variation, WHO has announced a consensus mortality rate of 14–15%.[7] Mortality increases with age (3.4% for ages up to 44 years, 14% for ages 45–64 years, and 56.8% for ages over 64 years). Other adverse outcome indicators include pre-existing chronic disease such as diabetes mellitus, hepatitis B, and cardiorespiratory conditions (65.6% among all deaths in Hong Kong), male sex, and very high CPK and LDH levels.

Perhaps the greatest concern over the SARS epidemic has been the infection rate among health care workers. 378 of 1710 cases (22.1%) in Hong Kong were health care workers, including medical students. Mainland China reported that 21% of all patients were health care staff. The widespread involvement of medical personnel worldwide must call into serious question the effectiveness of infection control measures in hospitals. Proper isolation of patients and prevention of cross infection is of paramount importance. Areas that require special attention include staff training and compliance with recommended procedures, ventilation systems, bed arrangement for cohorts of patients, personal protection equipment, and interventions that may cause aerolisation of secretions. Unwary doctors in Hong Kong hospitals caused widespread contamination when they used nebulisers on 3 different patients, although none of the 3 was suspected to have SARS at the time. Chest physiotherapy, bronchoscopy, bronchial suction, gastroscopy, and even the use of high-flow oxygen masks carry similar risk. Details on infection control procedures are available at the WHO website (http://www.who.int/csr/sars/infectioncontrol/en).[8]

Infected health care workers have expressed anxiety over stigmatisation, uncertainty, and contagions affecting colleagues and family. In addition, many who have had contact with SARS patients have voluntarily quarantined themselves from family and friends. It has been shown that health care workers at risk require clear communication and proper education, emotional support, adequate protection, and effective leadership.[9]

Statistics from Hong Kong show a gradual decline in the number of new cases, while mainland China and Taiwan currently still show a climbing curve.[10] Singapore had only one recent new case, while Canada and Vietnam have reported no new cases for at least 10 days.[10] In part, therefore, the disease appears to have come under control. However sporadic occurrences and even resurgent epidemics seem probable from where we currently stand. While new and more effective treatment is being tested, molecular modelling suggests that available viral inhibitors can be modified for use against the SARS-CoV.[11] Hopes are also rising for an eventual vaccine although difficulties are expected because of viral mutation.

Do orthopaedic surgeons have to be well informed on SARS? To the extent that we all need to recognise and prevent spread of the disease, a working knowledge of SARS is imperative. Many of our orthopaedic colleagues have now volunteered to work in SARS step-down wards out of both necessity and the call of duty. They must first undergo a rigorous training programme in infection control. They pay meticulous attention to basic infection control measures and practise until these measures become natural habit.

From the third week of March to the end of April

2003, elective orthopaedic surgery was at a virtual standstill in public hospitals in Hong Kong. Resources had to be concentrated on the fight against SARS. Patients defaulted follow-up at specialist clinics or simply cancelled their admissions for elective surgery. Orthopaedic wards in major teaching hospitals were decanted to make way for SARS step-down patients. More recently elective orthopaedics has returned to about 50% of normal activity.

Many local and international scientific meetings originally scheduled to be held in China, Hong Kong, Taiwan and Singapore during this spring season were cancelled. The teaching of orthopaedics was also impaired. For several weeks students could not access hospital wards. They can now do so under a strict infection control protocol including a daily record of their body temperatures.

At least 2 patients in Hong Kong were confirmed to have SARS after being treated for fractures, but confirmation was only available post-mortem. A third patient was suspected of having SARS. She expired but no post-mortem was performed. An orthopaedic trainee at the PWH has contracted the disease but is fortunately in a stable clinical state.

It is obvious that the orthopaedic community must maintain constant vigilance. Frontline physicians, nurses and health care assistants, usually at the prime of adult life, have succumbed to the disease. On the other hand, it is very disheartening to learn that some doctors in certain localities have reneged on their duty and quit their jobs when faced with the risk of working with SARS patients.

To our colleagues who have volunteered to help with SARS patients, and indeed to all health care workers who have dedicated themselves to combat SARS, we owe the highest respect and our unreserved support. The rest of us still have to do our best to contribute to the battle against SARS. So far, we have already witnessed the rapid and unprecedented cooperation of WHO collaborating laboratories worldwide. Such collaboration will no doubt greatly enhance the quest to control and if possible eradicate the disease. What we have learned from the SARS pandemic will also help us to prevent and control major epidemics in future. Finally, may all of us from the 31 afflicted countries or territories emerge healthy, hardy, and more united than ever before.

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