

Lessons Learned From SARS for Future Epidemics

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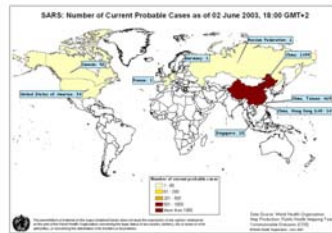


MICB-524: Emerging Infectious Diseases: The Past as Prologue
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Epidemiology

The SARS (**severe acute respiratory syndrome**) pandemic affected 8098 patients in 26 countries from Nov. 16th, 2002 to Jul. 5th, 2003. The 5 worst-hit countries in term of case fatality rates are China 6.6%. (349/5327), Hong Kong 17.0 (299/1755), Taiwan 10.7% (37/346), Canada 17.1% (43/251), and Singapore 13.9% (33/238).



(Ref. 3)

Animal origin

SARS was speculated to be zoonotic from animal reservoir. SARS-like viruses were successfully isolated from horseshoe bat (*Rhinolophus*) and Himalayan palm civets (*Paguma larvata*).



Horseshoe bat Palm civets

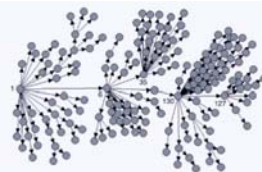
<http://www.dkimages.com/discover/home/Animals/Mammals/Bats/Families/Horseshoe-Bats/Lesser-Horseshoe-Bat/Lesser-Horseshoe-Bat-9.html>

Starting Point

In November 2002, cases of a highly contagious and severe atypical pneumonia were noted in the Guangdong Province of southern China.

Global Spread

SARS was carried out of the Guangdong Province on February 21, 2003, when an infected medical doctor spent a single night on the 9th floor of a Hong Kong hotel when he visited his family. Before the end of February, guests and visitors to the hotel's ninth floor had seeded outbreaks of cases in the hospital systems of Hong Kong, Vietnam, and Singapore. Simultaneously, the disease began spreading around the world along international air travel routes as guests at the hotel flew home to Toronto and other cities around the world.



Probable cases of severe acute respiratory syndrome, by reported source of infection-Singapore, February 25-April 30, 2003. (Ref. 6)

Eradication

As the number of new cases continues to dwindle, SARS appeared to be under control at the beginning of July. After the first SARS pandemic was declared, sporadic new cases were reported between September 2003 to May 2004, but was really rare. It might not be all over, though. One of the most important questions for the future is whether SARS can be eliminated or eradicated from its new human host.

Symptoms

Initial symptoms are flu like and may include: fever, myalgia, lethargy, gastrointestinal symptoms, cough, sore throat and other non-specific symptoms. The only symptom that is common to all patients appears to be a fever above 38 °C (100.4 °F). Shortness of breath may occur later. Symptoms usually appear 2–10 days following exposure, but up to 13 days has been reported. In most cases symptoms appear within 2–3 days. About 10–20% of cases require mechanical ventilation.

Probable Case Clinical Criteria (CDC)

- Close contact with a patient or having infected other people.
- Fever (> 38 °C) and symptoms of respiratory illness.
- One or more clinical findings of lower respiratory illness.
- Radiographic evidence of infiltrates consistent with pneumonia or respiratory distress syndrome on chest X-ray.

(Ref. Public Health Guidance for Community-Level Preparedness and Response to Severe Acute Respiratory Syndrome (SARS) Version 2/3, <http://www.cdc.gov/ncidod/sars/casedefinition.htm>)

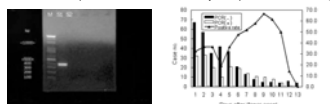


Chest X-rays of SARS Patient (Ref. 7)

Laboratory Diagnosis

- RT-PCR
- Seroconversion by ELISA or IFA
- Virus isolation

RT-PCR of throat swab specimens collected on different days from probable SARS cases (Ref. 8)

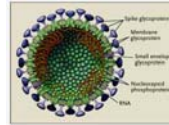


Experimental Treatment

- Antiviral therapy and ACE-2 inhibitor
- Convalescent plasma
- siRNA
- Vaccines



Pathogenesis



Schematic representation of SARS-CoV virion (WHO)

<http://www.wpro.who.int/sars/docs/interimguidelinespart1.asp>

The pathogen responsible for the atypical pneumonia was determined as a novel member of group II coronaviruses, called SARS-CoV, in the family Coronaviridae. It is an enveloped, positive-sense (+), single-stranded (ss) RNA virus. A SARS-CoV infection usually causes an innate immune response and apoptosis in patients' lung epithelial cells. Thus, SARS-CoV induced apoptosis would have a deleterious pathogenic role, leading to sever tissue damage.

How is SARS Spread?



The primary way that SARS appears to spread is by close person-to-person contact. SARS-CoV is thought to be transmitted most readily by respiratory droplets produced when an infected person coughs or sneezes.

<http://www.courjcrp.com/2007/07/17/interesting-engineering.html>

Incubation Period

The time between exposure to SARS-CoV and the onset of symptoms is called the "incubation period." The incubation period for SARS is typically 2 to 7 days, although in some cases it may be as long as 10 days. In a very small proportion of cases, incubation periods of up to 14 days have been reported.

Prevention

Protecting yourself when you are caring for someone with SARS

- Wash your hands frequently.
- Use a disposable tissue to rub your eyes or nose when needed.
- Wear disposable gloves if you have contact with the patient's body fluids or feces.
- Wear a surgical mask when you're in the same room as a person with SARS.
- Use soap and hot water to wash everything for someone with SARS.
- Use a household disinfectant to regular clean any possible contaminated surfaces.
- Keep children home from school when necessary.

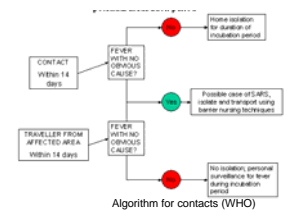
Protecting others if you've been diagnosed with SARS

- Wash your hands carefully and frequently.
- Cover your mouth and nose with a tissue when you cough or sneeze.
- Don't share your silverware, towels or bedding with anyone in your home.
- Avoid going to school, work or other public places.



What Have We Learned For Future Epidemics

- What we have learned:
 - Honesty is needed. Concealing what happens lead to panic rather than to social stability.
 - Controversy can lead to lost chances to diagnose the new virus.
 - Enforce regulations to control the outbreaks.
- How can we do better next time?
 - All the professional should collaborate closely to contain any emergent infections.
 - Constant consultation with healthcare professionals would provide the evidence that an authority needs for developing appropriate, rather than arbitrary, policies.
 - The international monitoring system with a far reaching network is crucial for the early alerting of infectious diseases.



(Ref. <http://www.wpro.who.int/sars/docs/interimguidelinespart1.asp>)

It is too early to conclude that SARS-CoV is eradicated outside laboratories. Lessons learned from SARS-CoV can apply to future respiratory epidemics such as avian flu or "SARS II" or entirely new virus. BE PREPARED ALL THE TIME!!!

References

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Acknowledgments

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