SARS Coronavirus

Disease Agent:
- SARS coronavirus

Disease Agent Characteristics:
- Family: Coronaviridae; Genus: Coronavirus
- Virion morphology and size: enveloped, helical nucleocapsid, spherical to pleomorphic, kidney-shaped, or rod-shaped particles, 100-130 nm in diameter
- Nucleic acid: linear, positive-sense, single-stranded RNA, ~29.8 kb in length
- Physicochemical properties: Virions sensitive to treatment with lipid solvents, nonionic detergents, formaldehyde, and oxidizing agents; stable in feces and urine at room temperature for at least 1-2 days, especially if diarrhea is present (high pH); only minimal reduction in infectivity after 21 days at 4°C and reduced by one log only after 48 hours at room temperature; heating to 56°C inactivates the agent quickly

Disease Name:
- Severe acute respiratory syndrome (SARS)

Priority Level:
- Scientific/Epidemiologic evidence regarding blood safety: Theoretical
- Public perception and/or regulatory concern regarding blood safety: Very low as there have been no cases since 2004. It is likely that reemergence of agent would alter public perception.

Background:
- First cases occurred in Guangdong province in November 2002.
- Major outbreaks occurred in various countries in Southeast Asia (China/Hong Kong, Vietnam, and Singapore) from March through June 2003 and ended by July 2003.
- A North American outbreak occurred during the same time frame in Toronto.
- These outbreaks were categorized as having an unusually high level of infectivity through community exposure.
- There were very few well-documented SARS cases in the US.
- A few additional cases were reported in late 2003 and early 2004, and no cases have been reported since May 2004.

Common Human Exposure Routes:
- Bulk of spread is via droplets.
  - Up to 100 million genomes per mL are found in nasopharyngeal secretions detected in 32% of patients at mean 3.2 days after onset of illness and in 68% at Day 14.
  - Aerosol spread may occur during invasive procedures, such as endotracheal intubation.
- Contact with secretions or excretions of SARS-infected patients
  - Viral RNA detected in stool samples from 97% of patients 2 weeks after onset and in 42% of urine samples.
  - Fecal-oral transmission is strongly suspected.

Likelihood of Secondary Transmission:
- Significant by direct contact with symptomatic cases

At-Risk Populations:
- Family members in close contact with cases
- Health-care workers in close contact with cases
- Elderly and immune compromised individuals appear at increased risk.

Vector and Reservoir Involved:
- The civet cat (palm civet) in Southeast Asia is the likely source of introduction of the agent into humans. The SARS CoV RNA sequence found in palm civets is 99% identical to that found in humans. Similar RNA sequences have been found in bats, snakes, and monkeys.

Blood Phase:
- No data on viremia during asymptomatic phase
- Viral RNA is detectable in plasma from 2-16 days after onset of acute illness with one study reporting peak levels at days 5-7 of illness.

Survival/Persistence in Blood Products:
- Unknown

Transmission by Blood Transfusion:
- No cases have been documented.

Cases/Frequency in Population:
- Over 8000 cases and 900 deaths were reported to the World Health Organization, as of August 2003.
- No community acquired cases since May 2004
- Sporadic cases associated with laboratory accidents have occurred.

Incubation Period:
- 2-10 days
Likelihood of Clinical Disease:
- Most cases are thought to be symptomatic.
- Manifestations are shorter and milder in children.

Primary Disease Symptoms:
- Patients usually hospitalized 3-5 days following the onset of symptoms with clinical deterioration in the second week and recovery in the third week. Symptoms include fever, nonproductive cough, myalgia, dyspnea, headache, malaise, diarrhea, nausea/vomiting, high respiratory rate (>35/min), or progressive respiratory failure.
- From 14 to 26% of patients require mechanical ventilation.

Severity of Clinical Disease:
- Severe
- 20% of patients required ICU admission in a case series of 144 cases.
- Asymptomatic infection as evidenced by seropositivity in case-contacts has been reported.

Mortality:
- Case fatality rates range from 6.6 to 17.1%.

Chronic Carriage:
- No

Treatment Available/Efficacious:
- Supportive care
- Several antiviral drugs that have in vitro activity are available, but clinical efficacy has not been proven and resistance is a major concern.

Agent-Specific Screening Question(s):
- The FDA recommended a series of questions in the spring of 2003 when the SARS epidemic occurred.
  - In the past 28 days, have you been ill with SARS or suspected SARS?
  - In the past 14 days, have you lived with, or had direct contact with a person with SARS or suspected SARS?
  - In the past 14 days, have you traveled through, or resided in areas affected by SARS?
- Subsequently, with cessation of new SARS cases, the FDA removed the recommendation for these questions.

Laboratory Test(s) Available:
- No FDA-licensed blood donor screening test exists.
- Diagnostic assays include virus culture, NAT, and virus detection by immunofluorescence in tissue samples.

Currently Recommended Donor Deferral Period:
- The FDA recommended the following deferral criteria in conjunction with the agent-specific screening questions, while new cases were being identified.
  - 14 days from last exposure or 14 days after arrival in the US following travel/residence exposure
  - 28 days after complete symptom resolution and the cessation of any treatment

Impact on Blood Availability:
- Exposure to diagnosed SARS cases had minimal impact, but deferral based on travel/residence had moderate local impact during the outbreak period with loss of a large number of prospective donors dependent on the magnitude and location of the epidemic.
- Laboratory test(s) available: Not applicable

Impact on Blood Safety:
- Agent-specific screening question(s): Unknown, as transfusion transmission has not yet been proven.
- Laboratory test(s) available: Not applicable

Leukoreduction Efficacy:
- Unknown

Pathogen Reduction Efficacy for Plasma Derivatives:
- Multiple pathogen reduction steps used in the fractionation process have been shown to be robust in removal of enveloped viruses.

Other Prevention Measures:
- Developmental pathogen reduction methods (psoralens, riboflavin) have been shown to be effective.

Suggested Reading:
4. Drosten C, Gunthers S, Preiser W, van der Werf S, Brodt HR, Becker S, Rabenau H, Panning M, ...


15. Wang WK, Fang CT, Chen HL, Yang CF, Chen YC, Chen ML, Chen SY, Yang JY, Lin JH, Yang PC, Chang SC; Members of the SARS Research Group of National Taiwan University College of Medicine-National Taiwan University Hospital. Detection of severe acute respiratory syndrome coronavirus RNA in plasma during the course of infection. J Clin Microbiol 2005;43:962-5.