Laboratory abnormalities in MERS-CoV infection include lymphopenia with or without neutropenia, thrombocytopenia, and elevated levels of lactate dehydrogenase. MERS-CoV can be isolated in tissue culture in Vero and LLC-MK2 cells, but PCR techniques are more sensitive and rapid and are the standard for laboratory diagnosis. Serologic tests using ELISA and immunofluorescence techniques have also been developed.

Laboratory diagnosis of coronavirus-induced colds is rarely required. Coronaviruses that cause those illnesses are frequently difficult to cultivate in vitro but can be detected in clinical samples by ELISA or immunofluorescence assays or by RT-PCR for viral RNA. These research procedures can be used to detect coronaviruses in unusual clinical settings.

TREATMENT CORONAVIRUS INFECTIONS

There is no specific therapy for SARS with established efficacy. Although ribavirin has frequently been used, it has little if any activity against SARS-CoV in vitro, and no beneficial effect on the course of illness has been demonstrated. Because of suggestions that immunopathology may contribute to the disease, glucocorticoids have also been widely used, but their benefit, if any, likewise remains to be established. Supportive care to maintain pulmonary and other organ-system functions remains the mainstay of therapy. Similarly, there is no established antiviral therapy for MERS. Interferon α2b and ribavirin have displayed activity against MERS-CoV in vitro and in a rhesus macaque model, but data are not available on its use in human cases of MERS. The approach to the treatment of common colds caused by coronaviruses is similar to that discussed above for rhinovirus-induced illnesses.

PREVENTION

The recognition of SARS led to a worldwide mobilization of public health resources to apply infection control practices to contain the disease. Case definitions were established, travel advisories were proposed, and quarantines were imposed in certain locales. As of this writing, no additional cases of SARS have been reported since 2004. However, it remains unknown whether the disappearance of cases is a result of control measures, whether it is part of a seasonal or otherwise unexplained epidemiologic pattern of SARS, or when or whether SARS might reemerge. The U.S. Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) maintain recommendations for surveillance and assessment of potential cases of SARS (*www.cdc.gov/sars/*). The frequent transmission of the disease to health care workers makes it mandatory that strict infection-control practices be employed by health care facilities to prevent airborne, droplet, and contact transmission from any suspected cases of SARS. Health care workers who enter areas in which patients with SARS may be present should don gowns, gloves, and eye and respiratory protective equipment (e.g., an N95 filtering facepiece respirator certified by the National Institute for Occupational Safety and Health).

Similarly, the WHO and the CDC have issued recommendations for identification, prevention, and control of MERS-CoV infections (*www.cdc.gov/coronavirus/mers/index.html*). Isolation precautions against airborne spread of infection should be instituted for patients hospitalized for suspected MERS, as described above for SARS.

Vaccines have been developed against several animal coronaviruses but not against known human coronaviruses. The emergence of SARS-CoV and MERS-CoV has stimulated interest in the development of vaccines against such agents.

HUMAN RESPIRATORY SYNCYTIAL VIRUS INFECTIONS

ETIOLOGIC AGENT

Human respiratory syncytial virus (HRSV) is a member of the Paramyxoviridae family (genus *Pneumovirus*). It is an enveloped virus ~150–350 nm in diameter and is so named because its replication in vitro leads to the fusion of neighboring cells into large multinucleated syncytia. The single-stranded RNA genome codes for 11 virus-specific proteins. Viral RNA is contained in a helical nucleocapsid surrounded by a lipid envelope bearing two glycoproteins: the G protein, by which the virus attaches to cells, and the F (fusion) protein, which facilitates entry of the virus into the cell by fusing host and viral membranes. HRSV is considered to be of a single antigenic type, but two distinct subgroups (A and B) and multiple subtypes within each subgroup have now been described. Antigenic diversity is reflected by differences in the G protein, whereas the F protein is relatively conserved. Both antigenic groups can circulate simultaneously in outbreaks, although there are typically alternating patterns in which one subgroup predominates over 1- to 2-year periods.

EPIDEMIOLOGY

HRSV is a major respiratory pathogen of young children and the foremost cause of lower respiratory disease in infants. Infection with HRSV is seen throughout the world in annual epidemics that occur in late fall, winter, or spring and last up to 5 months. The virus is rarely encountered during the summer. Rates of illness are highest among infants 1–6 months of age, peaking at 2–3 months of age. The attack rates among susceptible infants and children are extraordinarily high, approaching 100% in settings such as day-care centers where large numbers of susceptible infants are present. By age 2, virtually all children will have been infected with HRSV. HRSV accounts for 20–25% of hospital admissions of young infants and children for pneumonia and for up to 75% of cases of bronchiolitis in this age group. It has been estimated that more than half of infants who are at risk will become infected during an HRSV epidemic.

In older children and adults, reinfection with HRSV is frequent, but disease is milder than in infancy. A common cold–like syndrome is the illness most commonly associated with HRSV infection in adults. It has been increasingly appreciated that severe lower respiratory tract disease with pneumonitis can occur in elderly (often institutionalized) adults, in individuals with cardiopulmonary disease, and in patients with immunocompromising disorders or treatment, including recipients of hematopoietic stem cell transplants (HSCTs) and solid-organ transplants (SOTs). HRSV is also an important nosocomial pathogen; during an outbreak, it can infect pediatric patients and up to 25–50% of the staff on pediatric wards. The spread of HRSV among families is efficient: up to 40% of siblings may become infected when the virus is introduced into the family setting.

HRSV is transmitted primarily by close contact with contaminated fingers or fomites and by self-inoculation of the conjunctiva or anterior nares. Virus may also be spread by coarse aerosols produced by coughing or sneezing, but it is inefficiently spread by fine-particle aerosols. The incubation period is ~4–6 days, and virus shedding may last for ≥2 weeks in children and for shorter periods in adults. In immunosuppressed patients, shedding can continue for weeks.

PATHOGENESIS

Little is known about the histopathology of minor HRSV infection. Severe bronchiolitis or pneumonia is characterized by necrosis of the bronchiolar epithelium and a peribronchiolar infiltrate of lymphocytes and mononuclear cells. Interalveolar thickening and filling of alveolar spaces with fluid can also be found. The correlates of protective immunity to HRSV are incompletely understood. Because reinfection occurs frequently and is often associated with illness, the immunity that develops after single episodes of infection clearly is not complete or long-lasting. However, the cumulative effect of multiple reinfections is to temper subsequent disease and to provide some temporary measure of protection against infection. Studies of experimentally induced disease in healthy volunteers indicate that the presence of nasal IgA neutralizing antibody correlates more closely with protection than does the presence of serum antibody. Studies in infants, however, suggest that maternally acquired antibody provides some protection from lower respiratory tract disease, although illness can be severe even in infants who have moderate levels of maternally derived serum antibody. The relatively severe disease observed in immunosuppressed