WFHSS ÖGSV

Sterile Supply Specialist Training Course
Level II

SPECIAL MICROBIOLOGY

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Special Microbiology

Here we present a number of special microorganisms of particular importance in medical device reprocessing or occupational safety and which cause major concerns.

1 Bacterial Infections

1.1 Tuberculosis

1.1.1 Causative organism

The main causative organism of tuberculosis in humans is ***Mycobacterium tuberculosis***.

1.1.2 Incidence

Worldwide. The areas most affected are Sub-Saharan African countries, South and East Asia, a number of Latin American countries and increasingly also the former republics of the Soviet Union. Humans are the only relevant reservoir for ***M. tuberculosis***.

1.1.3 Route of infection

Infection is caused almost always by very fine expired droplets (aerosols) that are released, in particular, when coughing and sneezing. Transmission through unpasteurized milk of infected cattle is possible in principle, however, this is no longer of importance, e.g. in Central Europe, since cattle herds are to a large extent free of tuberculosis.

1.1.4 Clinical manifestations

The incubation period can range between weeks and several months. Pulmonary tuberculosis is at its most contagious for as long as acid-fast bacilli (rods) can be detected on microscopy (in sputum, aspirated bronchial secretions or gastric juice). Conversely, patients for whom bacteria can be detected only in culture or using molecular biology techniques are essentially less infectious.

The general symptoms manifested can include a feeling of malaise, weight loss, concentration difficulties, fever, increased perspiration (especially at night), loss of appetite, tiredness, general weakness, signs of flu infection. Respiratory complaints can occur in the form of cough, chest pain and breathing difficulties.

1.1.5 Treatment

Tuberculosis can be treated only with a combination of medications because tuberculosis infection always involves bacteria with proven resistance to a certain drug. Treatment is being hampered by the spread of increasingly more common multi-resistant tuberculosis strains (MDRTB = multi-drug-resistant tuberculosis).

1.1.6 Hygiene (infection control) rules

Isolation poses a considerable challenge to both the patient and staff. Therefore, on the one hand, this should not be resorted to without justification but, on the other hand, in justified cases it should be rigorously imposed. The problem often encountered in practice is that when tuberculosis is clinically suspected, no microbiological results are available to diagnose infection or the existing results are not sufficiently conclusive.

1.1.7 Instrument reprocessing

There is no increased resistance to thermal processes.

Mycobacteria are highly resistant to chemical disinfectant processes, and products with demonstrated tuberculocidal properties must be used (instruments and surfaces:

1.2 Salmonellosis (enteritis salmonellae)

1.2.1 Causative organisms

Salmonella spp, primarily ***S. Enteritidis*** und ***S. Typhimurium***.

1.2.2 Incidence

Worldwide

1.2.3 Transmission route

Mainly through consumption of contaminated foodstuffs, e.g. raw or inadequately cooked eggs, raw milk, meat and poultry products. Group infections or even epidemic outbreaks are common. Faecal-oral person-to-person transmission is also possible but this tends to be very rare because of the "requisite" infectious dose of 10^3-10^5 bacteria). Infected young children and incontinent persons pose a particular risk in this respect. The main reservoir is various domestic and working animals (in particular poultry).

1.2.4 Diagnosis

The causative organism is detected by growing cultures from stools or rectal swabs.

1.2.5 Clinical manifestations

Onset of infection is acute with abdominal pain, headache, nausea, vomiting and watery, mainly non-bloody, diarrhoea. Almost all patients develop fever of around 39-40 ºC. Severe dehydration can occur especially in young children and elderly people. Symptoms generally last for a few days. Overall mortality tends to be low. But because of dehydration young children and elderly people are particularly at risk.

1.2.6 Treatment

Symptomatic. Only in special cases are patients treated with antibiotics.

1.2.7 Precautionary measures

Good kitchen hygiene and well-trained kitchen staff are indispensable for prevention. For example, no raw eggs may be used for communal catering in many countries.

1.2.8 Hygiene rules

General hygiene (infection control) rules, in particular hand hygiene.

1.2.9 Instrument reprocessing

No special requirements.

1.3 EHEC infection

1.3.1 Causative organisms

Enterohaemorrhagic ***Escherichia coli*** strains (EHEC)

1.3.2 Incidence

Worldwide. Ruminants, in particular cattle, sheep and goats, but also game ruminants (especially deer and stags) are thought to be the principle reservoirs for EHEC.

1.3.3 Transmission route

The number of ingested bacteria needed to cause infection appears to be very small (approx. 100 bacteria!), and this can occur when consuming certain foodstuffs, such as inadequately cooked beef mincemeat and unpasteurized milk. But other foodstuffs, too, such as yoghurt, salami, cheese, raw vegetables or unpasteurized apple juice have been found to be the source of outbreaks. These bacteria have been detected as part of the intestinal flora of around .8% of cattle, and inappropriate slaughter processes can result in spread of the bacteria. Less common sources of infections are direct contact with

animals (petting zoo) or transmission within the family.

1.3.4 Diagnosis

In the presence of bloody diarrhoea and fever, a stool test should definitely be carried out.

1.3.5 Clinical manifestations

The incubation period is generally 1–3 days, but can be as long as 8 days.

Infection can be spread for as long as EHEC bacteria are detected in stools. In general, bacteria are shed for 5–10 days but this can continue for one month (especially in the case of young children).

Many EHEC infections manifest no clinical symptoms and hence often go undetected. Around one-third of infections manifest as mild diarrhoea. Onset of infection generally involves watery diarrhoea, which as infection progresses increasingly is of a watery-bloody nature, with dysentery-like manifestations. Concomitant symptoms include nausea, vomiting and increasing abdominal pain, rarely fever. Young children, elderly people and immunosuppressed persons are known to have more severe courses of infection, and infection can result in death.

1.3.6 Treatment

Antibacterial treatment is not indicated. This can prolong bacterial shedding and lead to production of toxin. Infection is treated symptomatically.

1.3.7 Precautionary measures

Ensure foodstuffs, such as beef mincemeat and unpasteurized milk, are adequately heated.

1.3.8 Hygiene rules

General hygiene rules. Hand hygiene!

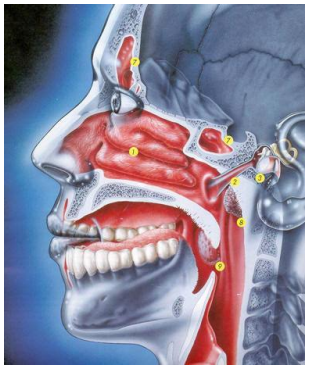
1.3.9 Instrument reprocessing

No special requirements; the bacterium is killed by disinfection measures.

1.4 Infections by Staphylococcus aureus, with special attention to MRSA

1.4.1 Causative organism

Staphylococcus aureus



Resistance is developed relatively fast in staphylococci. This is seen mainly in hospitals and nursing homes. The best known multi-resistant bacterium is MRSA (**M**ethicillin-**r**esistant ***Staphylococcus aureus***). Multiple resistance, as manifested by the classic MRSA strains, is aimed at a number of different substance groups, making treatment extremely difficult to impossible.

1.4.2 Incidence

Worldwide. These bacteria play a pivotal role in causing healthcare-associated (hospital-acquired/nosocomial) infections. The human being is the main reservoir for ***S. aureus*** as a human pathogen. Carriage rate in adults ranges between 15 % and 40 %. Like S***. aureus*** in general, MRSA can also colonise e.g. the nasal-throat region.

1.4.3 Transmission route

1. Onset of infections

Like ***S. aureus*** in general, MRSA infections in the persons concerned can also originate from the patient's own flora or infection is spread from one person to another, most commonly via the hands of nursing or medical personnel.

2. Intoxications in the form of food poisoning

Around 30 % of all ***S. aureus*** strains produce toxins. Once these have multiplied in foodstuffs, in particular in meat products and milk, the amount of toxin present can be enough to cause food poisoning. While subsequent heating will kill the bacteria, it will not destroy the already formed heat-resistant toxins.

1.4.4 Diagnosis

Bacteriological investigation. Detection of the bacterium in culture is needed for diagnosis.

1.4.5 Clinical manifestations

The incubation period is only a few hours (around 2-6 hours) in the case of food poisoning, and 4-10 days for infections. The infection can be spread for as long as clinical symptoms are manifested. But the bacteria can also be spread by clinically healthy persons who are colonised by staphylococci.

Diseases caused by ***S. aureus***: furuncles, carbuncles, abscesses, wound infections, middle ear infection, sinusitis, (secondary) meningitis, pneumonia, osteomyelitis, endocarditis, sepsis..

1.4.6 Treatment

Treatment of MRSA is difficult and calls for close interaction with the bacteriology laboratory. Appropriate treatment must be administered on the basis of the bacteriology results and in collaboration with microbiologists/infectiologists.

1.4.7 Precautionary measures

Appropriate kitchen hygiene must be observed to prevent food poisoning. MRSA patients should be isolated if airborne transmission is possible (e.g. colonisation of the respiratory tract).

1.4.8 Hygiene rules

Stringent hygiene rules must be observed when dealing with MRSA patients.

Hand disinfection: before and after contact with MRSA patients or their immediate surroundings and after removing gloves.

Shaking hands should definitely be avoided.

An individual-patient gown and disposable shoes must be worn for all episodes of nursing and medical care given to the patient as well as if there is risk of contamination.

Contaminated waste (e.g. gloves, dressings, handkerchiefs, etc.) and textiles (laundry, hand towels, nigh dresses, etc) must be packed into bags in the patient's room, sealed and disposed of in the usual manner; while ensuring that no dust is raised.

Healthy persons, medical personnel and their relatives are not endangered!

1.4.9 Instrument reprocessing

No special reprocessing requirements apply; the bacterium is killed by disinfection measures.

1.5 Legionellosis (legionnaires disease)

1.5.1 Causative organism

The most important species is ***Legionella pneumophila***.

1.5.2 Incidence

Legionellae are bacteria that are widespread in freshwater, but even here they are mainly found only in very low concentrations. Legionellae reproduce at temperatures between 25 °C and 50 °C and encounter such conditions especially in hot-water systems. The bacteria can survive temperatures of up to 55 °C without any damage, and are killed only as from 60 °C.

1.5.3 Transmission

Infection is contracted through inhalation of aerosols (droplets) harbouring legionellae, e.g. while taking a shower, via the open cooling towers of air conditioning systems, room air humidifiers, whirlpools, etc.

Person-to-person transmission has not been reported so far.

1.5.4 Diagnosis

Diagnosis is made by culture of bronchial secretions or using other laboratory diagnostic techniques.

1.5.5 Clinical manifestations

The incubation period is mainly between 5 and 6 days. In legionnaires disease, flu-like symptoms are followed by high fever, often with shaking chills, dry cough and muscle pain and headache. Involvement of other organs apart from the lungs can result in diarrhoea, confusion as well as liver and kidney disorders. Infection leads to death in around 15- 20 % of cases.

1.5.6 Treatment

Antibiotics that are effective against legionellae are used.

1.5.7 Precautionary measures

Prevention of legionnaires disease is based on measures that counter the growth of legionellae in water.

1.5.8 Hygiene rules

No special rules apply

1.5.9 Instrument reprocessing

No special requirements.

1.6 Antibiotic-associated diarrheae and pseudomembranous colitis

1.6.1 Causative organisms

Clostridium difficile that is a spore-forming gram positive anaerobic bacillus.

1.6.2 Incidence

Worldwide

1.6.3 Transmission route

This pathogen is a major cause of healthcare-associated diarrhea and has been responsible for many large outbreaks in healthcare settings that were extremely difficult to control. Important factors that contribute to healthcare-associated outbreaks include environmental contamination, persistence of spores for prolonged periods of time, resistance of spores to routinely used disinfectants and antiseptics, hand carriage by healthcare personnel to other patients, and exposure of patients to frequent courses of antimicrobial agents.

1.6.4 Diagnosis

The causative organism is detected by growing cultures from stools or detection of toxins in stool or molecular methods.

1.6.5 Clinical manifestations

Onset of infection is diarrhoea associated with antibiotic usage. In some cases pseudomembranous colitis may occur which is more severe. Symptoms generally last for a few days after antibiotic treatment is stopped.

1.6.6 Treatment

Symptomatic and supportive therapy is important. All antibiotics must be stopped. Only in severe cases, patients can be treated with metronidazole or vancomycin.

1.6.7 Precautionary measures

Prevention of transmission focuses on application of Contact Precautions for patients with diarrhea, accurate identification of patients, environmental measures (e.g., rigorous cleaning of patient rooms) and consistent hand hygiene.

1.6.8 Hygiene rules

Use of soap and water, for mechanical removal of spores from hands as well as alcohol based handrubs (to kill the vegetative forms), and a bleach-containing disinfectant (5000 ppm) for environmental disinfection, may be valuable when there is transmission in a healthcare facility.

1.6.9 Instrument reprocessing

No special requirements.

1.7 Multidrug-Resistant Organisms (MDROs)

1.7.1 Causative organisms

- Methicillin-resistant ***Staphylococcus aureus*** [MRSA],
- Vancomycin resistant enterococcus [VRE],
- Multidrug-resistant gram-negative bacteria,
    - ***Acinetobacter baumannii***
    - ***Pseudomonas aeruginosa***
    - Carbapenem-resistant ***Klebsiella pneumoniae***
- ***S. aureus*** that are intermediate or resistant to vancomycin (i.e., VISA and VRSA).

1.7.2 Incidence

Worldwide

1.7.3 Transmission route

Patient-to-patient transmission in healthcare settings, usually via hands of Healthcare Workers (HCWs), has been a major factor accounting for the increase in MDRO incidence and prevalence.

1.7.4 Diagnosis

The causative organisms are detected by growing cultures from clinical specimens

1.7.5 Clinical manifestations

Clinical manifestations are not different than the manifestations with susceptible ones.

1.7.6 Treatment

Antibiotics are very limited.

1.7.7 Precautionary measures

Preventing the emergence and transmission of these pathogens requires a comprehensive approach that includes administrative involvement and measures (e.g., nurse staffing, communication systems, performance improvement processes to ensure adherence to recommended infection control measures), education and training of medical and other healthcare personnel, judicious antibiotic use, comprehensive surveillance for targeted MDROs, application of infection control precautions during patient care, environmental measures , and decolonization therapy when appropriate.

1.7.8 Hygiene rules

Hand hygiene, cleaning and disinfection of the patient care environment and equipment, dedicated single-patient-use of non-critical equipment.are the most important hygiene rules

1.7.9 Instrument reprocessing

Dedicated single-patient-use of non-critical equipment.must be preferred.

2 Viral Infections

2.1 Blood-borne viruses (BBV)

The BBVs present most cross-infection hazard to HCWs. Occupational risks of transmission of BBVs to HCWs arise from the possibility of exposure to blood and exceptionally to certain other body fluids or body tissues from an infected patient.

Body fluids and tissues which carry risk for BBV

- Blood
- Cerebrospinal fluid
- Peritoneal fluid
- Pleural fluid
- Pericardial fluid
- Synovial fluid
- Amniotic fluid
- Semen
- Vaginal secretions
- Breast milk
- Saliva including visible blood,
- Unfixed tissues and organs

2.1.1 Hepatitis B

2.1.1.1 Causative organism

Hepatitis B virus (HBV)

HBV is highly resistant and continues to be infectious for a very long time, for example in serum at a temperature of 30 to 32° C for at least 6 months or at a temperature of -20° C for 15 years. Nor does exposure to temperatures of 60° C for 4 hours result in any loss of infectiousness. HBV is definitely inactivated only when exposed to temperatures of 90° C or over for around 5 min.

2.1.1.2 Incidence

Worldwide.

2.1.1.3 Transmission

HBV occurs in humans and some other primates. As such, the human being is virtually the only relevant source of infection.

HBV is transmitted primarily from person to person through sexual contact, direct contact with blood and other body fluids as well during childbirth from mother to child. Indirect routes of infection are transmission via blood transfusions and blood products as well as through contaminated syringes and instruments. Infections have also been reported from tattooing, piercings, including ear piercing, with inadequately reprocessed instruments.

2.1.1.4 Diagnosis

Hepatitis B is diagnosed by detection of antibodies in blood in a virology/serology laboratory.

2.1.1.5 Clinical manifestations

The incubation period in most cases is 60-90 days.

In cases of an acute course of HBV infection, this stage lasts 3-4 weeks and, with chronic courses of infection, for several years or decades and can lead to cirrhosis and other complications.

2.1.1.6 Treatment

As in other acute forms of viral hepatitis, the most important measures include avoidance of physical exertion, of alcohol and of fatty foods.

2.1.1.7 Precautionary measures

Active immunisation is the most important protection against hepatitis B infection.

2.1.1.8 Hygiene rules

See Level 1 Script

2.1.1.9 Instrument reprocessing

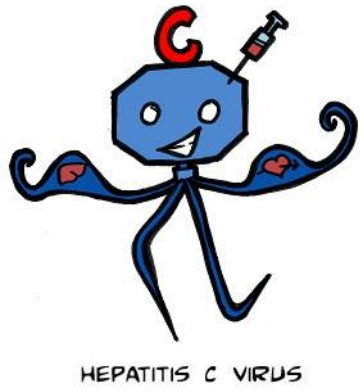
The most reliable way of inactivating HBV is heating, therefore as far as possible thermal processes must be used for instrument disinfection:

Thermal disinfection at 80 °C / 50 min or 85 °C / 16 min or 90 °C / 5 min

If chemical instrument disinfection is required, substances with proven efficacy against HBV must be used For surface disinfection use disinfectants based on active chlorine, percompounds or aldehydes, while for hand disinfection use skin-compatible disinfectants based on alcohol or active chlorine.

2.1.2 Hepatitis C

2.1.2.1 Causative organism



Hepatitis C virus (HVC)

The human being is the only relevant source of infection. HCV is found in blood as well as in other body fluids such as saliva, perspiration, tears, sperm and mother's milk.

2.1.2.2 Incidence

Worldwide. The incidence is higher in Mediterranean countries than in other EU states.

2.1.2.3 Transmission route

Transmission is mainly through blood. The risk of transmission rises in line with the viral load. Typically hepatitis C is a form of posttransfusion hepatitis. Transfusion of HCV-positive blood conserves or administration of contaminated blood products was the most common route of transmission until the introduction of serology test systems. Now intravenous drug use involving the sharing of needles or the use of unsterile implements are the most important sources. Other potential sources of infection are poor hygiene conditions in tattooing and piercing studios, in manicure and pedicure establishments, hairdressing salons, acupuncture or dental treatment leading to bleeding. The transmission route is unknown in up to around one-third of HCV infections, hence the risk factor in unclear.

2.1.2.4 Diagnosis

Hepatitis C is diagnosed by detection of antibodies in blood in a virology laboratory.

2.1.2.5 Clinical manifestations

The incubation period is on average 40-50 days. The majority of infections are asymptomatic. At most 20 % of patients develop clinical symptoms. The most common manifestations are mild, in particular, fatigue, nausea and/or signs of flu. Since a proportion of HCV infections do embark on a chronic course, infected persons can act as a source of infection for decades.

2.1.2.6 Treatment

Combination therapy increases the ongoing response to treatment by up to 50%.

2.1.2.7 Precautionary measures

Since at present there is no immunisation, the following precautionary measures represent the only protection. In general the same precautionary measures apply as for HBV (see Specialist Course 1 Script).

The following point should be borne in mind: the risk of transmission is very low within the family or among members of a household.

2.1.2.8 Hygiene rules

See Level 1 Script

2.1.2.9 Instrument reprocessing

See hepatitis B

2.1.3 Other hepatitis viruses

2.1.3.1 Causative organism

Hepatitis D virus (HDV)
HDV causes infection only in those who have active HBV infection. HDV infection can occur either as co-infection with HBV or as superinfection of an HBV carrier.

GB virus-type C (Hepatitis G virus)
Recently a further BBV has been described, provisionally designated either as GBV-C agent or hepatitis G virus.

Incidence, transmission route, diagnosis, clinical manifestations and treatment are the same as Hepatitis B and C.

Since HDV depends on an HBV-infected host for replication, prevention of HBV infection by immunisation will also prevent HDV infection.

2.1.3.2 Hygiene rules

See Level 1 Script

2.1.3.3 Instrument reprocessing

See hepatitis B

2.1.4 Human immunodeficiency virus (HIV)

2.1.4.1 Causative organism

Human immunodeficiency virus (HIV) which causes defects in the immune system, whose most severe form is acquired immunodeficiency syndrome (AIDS).

2.1.4.2 Incidence

Worldwide.

More than 95 % of all HIV-infected persons live in developing countries.

2.1.4.3 Transmission route

Every infected person will continue to be potentially infectious throughout their lifetime. The risk of spreading infection is particularly high within the first weeks of contracting infection. After this, infectiousness declines in general but increases once again as immunodeficiency progresses with onset of clinical symptoms.

The highest concentrations of HIV are found in the blood, seminal fluid and vaginal secretions. Transmission in mother's milk is also possible. With the exception of the few cases described in the literature, HIV infections can be imputed to one of the main three transmission routes:

- **Unprotected sexual intercourse**: anal sex, vaginal sex, oral sex (orogenital contact) 85% of all infections are contracted in this way; the risk is increased when where is a frequent change of partner.
- **Blood or blood products** (sharing syringes among several persons - "needle exchange" among drug addicts, transfusion of contaminated blood conserves or coagulation products). Blood donors are tested for HIV antibodies. Blood donations containing HIV antibodies are discarded. Furthermore, persons who cannot definitely rule out that they do not pose a risk of infection are called upon not to donate blood. By taking these measures, it was possible to reduce the statistical risk of HIV transmission, posed by undetected HIV infection of the donor at the time of donation (diagnostic window), to around one case per 1,000.000 donations.
- **Pre -, peri – or postnatal** spread from infected mother to her child. European studies have shown that the risk of HIV transmission from an infected mother to her child was between 15 % and 25 % before the introduction of preventive measures. Today the probability of transmission can be reduced to less than 2 % through treatment during pregnancy and opting for caesarean section. HIV can also lead to infection of children in mother's milk. In countries in which formula milk is readily available, HIV infected mothers should not breastfeed their babies.
- Everyday bodily contact, sharing of crockery, cutlery, etc, or use of communal sanitary facilities do not pose a risk of infection. HIV is not transmitted in droplets or insect bites.

2.1.4.4 Diagnosis

HIV diagnosis can be initiated only after providing the patient with information and advice. Diagnosis of HIV infection is based essentially on detection of specific antibodies. These

specific antibodies generally appear within four weeks to three months of contracting infection (diagnostic window).

To date, there have only been isolated reports in the literature of cases where antibodies were detectable only after three months. If antibodies cannot be detected even six months after possible infection, infection can be ruled out with a great margin of certainty.

2.1.4.5 Clinical manifestations

The problem is that the infected body is unable to eliminate the HIV virus, and its spread within the body cannot be prevented in the long term. Immunodeficiency, with its attendant clinical manifestations, continues unabated – even if the rate at which this happens varies from one patient to another. The most common causes of death are infection complications that can no longer be controlled.

2.1.4.6 Treatment

In the meantime a number of substances are available for treatment of HIV infection. In view of the rapid pace at which insights are gained into this topic, please consult the regularly updated consensus recommendations on treatment of HIV infection. In Germany, the current recommendations can be consulted, for example, on the Robert Koch Institute website (http://www.rki.de).

Diagnosis of HIV infection can give rise to major psychosocial problems. In many places there are special services available to help overcome these problems, e.g. self-help groups, psychosocial advisory services, etc. The treating physician should try to promote close cooperation with such services.

2.1.4.7 Prevention

Both non-infected and infected persons must avoid the risk of contracting and spreading infection, respectively, and must protect against these. Both parties must know how to behave such that infection is avoided and the available knowledge is put to use. Attention has been drawn repeatedly to the fact that HIV is spread only through sexual intercourse, inoculation (introduction) of virus-containing material, or from mother to child. On the other hand, the risks posed by sexual contact with new or changing partners must be clearly addressed. Drug addicts are made aware of the risks of sharing syringes and of the need to dispose safely of used syringes.

Prevention and limitation of discrimination of HIV infected persons or those at risk for HIV are important.

2.1.4.8 Hygiene rules

Observance of well-established hygiene rules is indispensable for treatment of HIV infected persons and of AIDS patients. The same precautionary measures apply as those which have proved their merit in prevention of hepatitis B virus infection. See Specialist Course 1 Script

The virus can be inactivated (destroyed) through disinfection measures since, strictly speaking, viruses cannot be killed because they are not living entities.

Disinfectants and disinfection processes with proven efficacy against HIV must be used. For hygienic hand disinfection disinfectants that have been approved as drugs and contain 70 to 85 vol. % alcohol are suitable.

2.1.5 Instrument reprocessing

See hepatitis B

2.2 Viruses spreading via faecal-oral route

2.2.1 Norovirus (=Norwalk virus) Infection

2.2.1.1 Causative organism

Noroviruses (formerly Norwalk and Norwalk-like viruses)

2.2.1.2 Incidence

Worldwide. In infants and young children, after rotaviruses, they are the second most common cause of acute gastroenteritis. Noroviruses are often the cause of acute gastroenteritis outbreaks in communal catering institutions such as homes for the elderly, nursing homes and childcare establishments, but they can also cause sporadic gastroenteritis. Infections caused by viruses belonging to the norovirus group can occur throughout the year, but clusters of such infections have been observed in the winter months. The human being is the only known reservoir for this virus.

2.2.1.3 Route of infection

The viruses are excreted in the stools of infected persons in very large quantities. Transmission takes place primarily via the faecal-oral route, with direct person-to-person transmission playing a pivotal role. But infections or outbreaks can also originate from contaminated foodstuffs (salads, crabs, mussels, etc.) or drinks (contaminated water). Contaminated objects can also give rise to transmission.

Infectiousness is very high, with the minimum infectious dose being between 10-100 virus particles.

The very rapid spread of infection within communities suggests that, in addition to the faecal-oral route, other routes of transmission are also possible, e.g. airborne spread through formation of virus-containing aerosols as released during vomiting.

2.2.1.4 Diagnosis

Detection of noroviruses in stools is possible only in special laboratories.

Clinical manifestations: The incubation period is between 12 and 48 hours. Noroviruses cause gastroenteritis of acute onset, accompanied by projectile vomiting and profuse diarrhoea, which can lead to considerable fluid loss. In general, there are well-pronounced clinical manifestations of malaise, abdominal pain, nausea and fatigue.

2.2.1.5 Treatment:

In general, outpatient treatment is adequate. The symptoms are treated by restoring the, in some cases, widespread loss of fluids and electrolytes. No antiviral treatment is available.

2.2.1.6 Hygiene rules

In outbreaks it is important to identify the source as quickly as possible. If contaminated foodstuffs or drinks are a possible source of the outbreak, measures must be initiated immediately to stop infection from this source.

To prevent faecal-oral transmission, extensive hygiene measures must be initiated (wearing of gloves and gowns, isolation of infected persons, extra scrupulous cleaning of toilets, more intensive hand hygiene, frequent disinfection of bed linen). However, in view of the highly contagious nature of noroviruses these measures are effective only to a certain extent. In practice it has been observed time and again that even meticulous hygiene measures are not able to prevent further spread.

In communal establishments such as hospitals and homes for the elderly, movement of patients, residents and personnel within wards should be limited as far as possible to prevent spread between different wards and areas of the establishment. Infected personnel should be released from their duties even if they suffer from only slight gastrointestinal complaints and should resume work by the earliest only 2 days after clinical symptoms have resolved.

2.2.1.7 Instrument reprocessing

No special reprocessing requirements

2.2.2 Rotavirus Infections

2.2.2.1 Causative organism

Rotaviruses

2.2.2.2 Incidence

Worldwide, rotaviruses trigger more than 70 % of cases of severe diarrhoea in children and, as such, are the most common cause of intestinal infections in this age group. In Western industrialised countries infants and children between the age of 6 months and 2 years are the most commonly affected. In neonates and young children rotaviruses are the main cause of healthcare-associated intestinal infections. The incidence of infection is highest in the winter months because the virus is more easily transmitted in enclosed spaces, in particular in dry room air. In adults, infections – which generally have a mild course – occur mainly as travellers' diarrhoea, in parents of infected children or during outbreaks in homes for the elderly. The human being is the main reservoir for rotaviruses. Rotaviruses have also been detected in domestic and working animals, however, the viruses found apparently are not implicated to any great extent in human infections.

2.2.2.3 Route of infection

Rotaviruses are spread, in particular, as smear infections via the faecal-oral route but also through infected water and foodstuffs. Although the viruses cannot reproduce in the respiratory tract, during the acute phase of infection they can also be shed in respiratory tract secretions, hence airborne transmission is also possible. The virus is easily spread, with as few as 10 virus particles sufficing to infect a child. In the case of persons suffering from acute infection, between 10^9–10^{11} viruses per g stools are shed.

2.2.2.4 Diagnosis:

The laboratory diagnostic method of choice entails detection of an antigen from stools.

2.2.2.5 Clinical manifestations

The incubation period is between 1 and 3 days.

Symptoms of rotavirus infections range from subclinical infections through mild diarrhoea to severe infections. Infection begins with acute watery diarrhoea and vomiting. Mucus is often found in stools. Fever and abdominal pain can occur. Infection resulting in dehydration gives rise to complications which, if not properly treated in a timely manner, can lead to death.

2.2.2.6 Treatment

In general, administration of fluids and electrolytes suffices. Only in rare cases are intravenous fluids needed.

2.2.2.7 Hygiene rules

The spread of rotavirus infections in children's hospitals, kindergartens and similar establishments can be countered only through strict observance of hygiene rules. The aim here is to break the faecal-oral transmission chain. Special emphasis must be put on hand hygiene! Practical experience shows that it is very difficult to prevent secondary infections. The virus survives in an infectious state for a long time on contaminated surfaces and hands.

In the hospital setting, infected children should be isolated and cared for by specific nursing staff.

In the home, scrupulous hand hygiene suffices, and gloves are needed only when changing nappies / diapers.

2.2.2.8 Instrument reprocessing

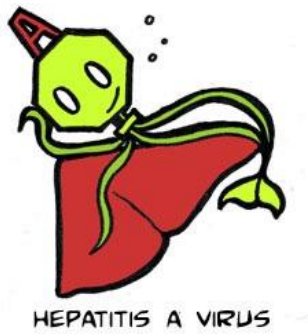
No special reprocessing requirements

2.2.3 Hepatitis A

2.2.3.1 Causative organism

Hepatitis A virus (HAV)

2.2.3.2 Incidence



This virus is found mainly in tropical and subtropical regions, i.e. in Central and Southern Asia, Central Africa, the Far East and Middle East but also in parts of South American and Central America and in various Mediterranean countries. There is also a high risk in the former republics of the Soviet Union. Humans are the principle host and, possibly, the only reservoir for hepatitis A viruses.

2.2.3.3 Route of infection

Transmission is normally via the faecal-oral route, mainly through contaminated foodstuffs, water or everyday use utensils. Outbreaks are mainly caused by contaminated drinking water or foodstuffs, especially mussels or oysters as well as vegetables and salads for which faecal fertiliser was used.

2.2.3.4 Diagnosis

Hepatitis A is diagnosed by detection of antibodies in blood in a virology/serology laboratory.

2.2.3.5 Duration of infectiousness

Viral shedding - and hence infectiousness – begins around 1-2 weeks before onset of symptoms and continues for around a further week. Viral shedding is greatest during the first phase, i.e. during the incubation period and then continues to decrease. To date, there has been no evidence of ongoing viral shedding.

2.2.3.6 Clinical manifestations

The incubation period lasts on average 30 days. In children infection is often asymptomatic compared to adults. The symptoms are: fever, malaise, weakness, loss of appetite, nausea,

vomiting. In general, patients will have made a complete recovery within 3-6 months. In some cases symptoms maybe very severe like hepatic coma.

2.2.3.7 Treatment

Only the symptoms can be treated.

2.2.3.8 Precautionary measures

Hepatitis A virus immunisation is available and is recommended for travellers to areas with increased risk as well as for healthcare workers or, for example, laboratory staff engaged in testing of stool specimens.

2.2.3.9 Hygiene rules

The usual hygiene measures apply, with special emphasis naturally on hand disinfection. There is also a risk of cross-infection when using communal toilets.

2.2.3.10 Instrument reprocessing

No special measures are required

2.3 Other important viruses

2.3.1 Severe Acute Respiratory Syndrome (SARS)

2.3.1.1 Causative organism

SARS is caused by SARS CoV, a previously unrecognized member of the coronavirus family

2.3.1.2 Incidence

SARS is a newly discovered respiratory disease that emerged in China late in 2002 and spread to several countries. Mainland China, Hong Kong, Hanoi, Singapore, and Toronto were affected significantly.

2.3.1.3 Route of infection

Droplet and contact transmission are important. Aerosolization of small infectious particles generated during these and other similar procedures could be a risk factor for transmission to others within a multi-bed room or shared airspace.

2.3.1.4 Diagnosis

Detection of antibodies to SARS-CoV or detection of SARS-CoV using RT PCR in virology laboratories.

2.3.1.5 Clinical manifestations

Signs and symptoms usually include fever >38.°C and chills and rigors, sometimes accompanied by headache, myalgia, and mild to severe respiratory symptoms. Fatality rate is 6%.

2.3.1.6 Treatment:

Treatmant should be done in hospital.

2.3.1.7 Hygiene rules:

CDC recommends Standard Precautions, with emphasis on the use of hand hygiene, Contact Precautions with emphasis on environmental cleaning due to the detection of SARS CoV RNA by PCR on surfaces in rooms occupied by SARS patients, Airborne Precautions, including use of fit-tested NIOSH-approved N95 or higher level respirators, and eye protection.

2.3.1.8 Instrument reprocessing

No special reprocessing requirements but if possible single used items should be used. Personell protective equipment with eye protection is very important during handling of the instruments.

2.3.2 Hemorrhagic fever viruses (HFV)

2.3.2.1 Causative organism

The more commonly known HFVs are Ebola and Marburg viruses (Filoviridae), Lassa virus (Arenaviridae), Crimean-Congo hemorrhagic fever and Rift Valley Fever virus (Bunyaviridae), and Dengue and Yellow fever viruses (Flaviviridae)

2.3.2.2 Incidence

These viruses are endemic in areas of Africa, Asia, the Middle East, and South America.

2.3.2.3 Route of infection

These viruses are transmitted to humans via contact with infected animals or via arthropod vectors. Person-to-person transmission is associated primarily with direct blood and body fluid contact. Percutaneous exposure to contaminated blood carries a particularly high risk for transmission and increased mortality. Airborne transmission of naturally occurring HFVs in humans has not been seen.

2.3.2.4 Diagnosis

Detection of antibodies to causative organism or detection of viruses using RT PCR in virology laboratories.

2.3.2.5 Clinical manifestations

They cause serious disease with high fever, skin rash, bleeding diathesis, and in some cases, high mortality.

2.3.2.6 Treatment:

Treatmant should be done in hospital.

2.3.2.7 Hygiene rules:

In less developed countries, outbreaks of HFVs have been controlled with basic hygiene, barrier precautions, safe injection practices, and safe burial practices. Contact and Droplet Precautions with eye protection are effective in protecting healthcare personnel

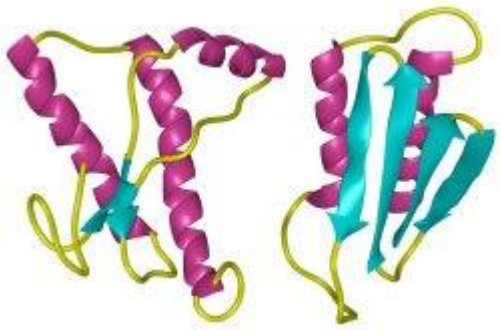
2.3.2.8 Instrument reprocessing

No special reprocessing requirements but if possible single used items should be used. Personell protective equipment with eye protection is very important during handling of the instruments.

3 Prion Diseases

3.1 Creutzfeldt-Jakob disease (CJD and vCJD)

3.1.1 Causative organism



This disease is caused by prions. Prions are not living creatures but rather “infectious” protein particles.

Creutzfeldt-Jakob disease (CJD), which was first described in 1920, belongs to the prion diseases and is a rare disease. This disease occurs sporadically or in families (around between 10 and 15 % of all CJD cases are genetically mediated) and inevitably leading to death.

The sporadic form is the most common, with a worldwide, similar incidence of around 1-2 cases per million inhabitants per year. In recent years this disease has been increasingly the focus of public interest because of the occurrence of bovine spongiform encephalopathy (BSE) in cattle in the United Kingdom and the probability of transmission through foodstuffs to people.

3.1.2 Incidence

In general CJD occurs sporadically, i.e. without any demonstrable cause; the average age for onset of disease is 64 years, and the average duration of disease is 4 months. Among the acquired forms of this disease is kuru, which is a neurodegenerative disease found in a group of people with a specific language in Papua-New Guinea following consumption of human brain during cannibalistic rituals. There is also the possibility of unintentional transmission when performing medical procedures. The new variant of Creutzfeldt-Jakob disease (vCJD), which is associated with BSE in cattle, has occurred mainly in the United Kingdom and France.

3.1.3 Transmission route

The disease can be transmitted through administration of human hypophyseal hormones, corneal eye transplants or through neurosurgical instruments. The interval between exposure and onset of the first clinical symptoms is between 1 and 30 years.

3.1.4 Diagnosis

With onset of disease, patients have concentration and attention disorders, progressing later to impaired movements, personality changes, impaired vision and gait. After, in general rapid progression of symptoms, the disease inevitably leads to death. Apart from clinical symptoms, the diagnostic methods used include electroencephalogram (EEG), cerebrospinal

fluid (CSF) tap test and magnetic resonance imaging (MRI). CJD can be definitively diagnosed only through post mortem examination.

At present there is no treatment.

3.1.5 Precautionary measures

Today in industrialised countries hypophyseal hormones can be safely produced using recombinant technologies, and there are also strict safety regulations and restrictions in place for transplantations.

There is no evidence of a risk of transmission in routine nursing and when dealing with infected persons, and conventional hygiene measures suffice.

3.1.6 Instrument reprocessing

See "CJD" chapter in Instrument Reprocessing

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The script has been proof read and authorized by the wfhss education group

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6 Learning Objectives

Understand and be able to cite the mentioned special microorganisms of particular importance in medical device reprocessing or occupational safety their most important characteristics

Be able to tell, which of the pathogens require special treatment of MDs and why