**Microbial infection**

**Entry, exit and transmission of microorganisms:**

* The mammalian host can be considered as a series of body surfaces. To establish themselves on or in the host, microorganisms must either attach to, or penetrate, one of these body surfaces. The outer surface covered by skin protects and isolates the body from the outside world.
* Respiratory and urinogenital tracts, where food is obsorbed, gases exchanged and urine and sexual products released, the lining consist of one or more layers of living cells.
* In the eye, the skin is replaced by a conjunctiva.
* Successful microorganisms therefore, possess efficient microorganism for attaching to, and often traversing, these body surfaces.
* There are specific molecules on microbes that bind to receptor molecules on host cells, either at the body surface (viruses, bacteria) or in tissues (viruses).
* The receptor molecule is present only in certain cells, which are susceptible to infection.
* CD4 molecule and the CCR5 beta-chemokine, receptor for HIV.
* C3d receptor for Epstein-Barr virus.
* Alpha-dystroglycan acts as receptor for *M. leprae*.
* In these cases, the receptor molecule determines microbial pattern of infection.
* After binding to the susceptible cells, the microorganism can multiply at the surface (*Mycoplasma, Bordetella pertusis*). Or enter the cell and infect it (viruses, *Chlamydia*).

**Exit from the body:**

**Sites of entry:**

1. **Skin:**

Microorganisms gaining entry via the skin may cause a skin infection or infection elsewhere. Microorganism infects or enters the body via the skin:

|  |  |
| --- | --- |
| Microorganism | Disease |
| Staphylococci | Boils, etc. |
| Rickettsia | Typhus, spotted fever |
| Leptosporia | Leptospirosis |
| Streptococci | Impetigo |
| B. antracis | Coetaneous anthrax |
| Treponema pallidum | Syphilis |
| Treponema pertenus | Yaws |
| Yersinia pestis | Plague |
| Yersinia plasmodia | Malaria |
| Trichophyton spp. And other fungi | Ring worm, athletes foot |
| Ancylostoma duodenal | Hook worm |
| Schistosoma spp. | Schistosomiasis |

* Wounds, burns are more common sites of infection. Even a small break in the skin can be a portal of entry if virulent M.O. such as *Streptococci,* *Leptospira* or Hepatitis B virus is present at the site. A few microbes, such as *Leptospira* or the Larvae of Ancylostoma and Schistosoma, are able to traverse the unbroken skin by their own activity.

1. **The conjunctiva:**

* The conjunctiva can be regarded as a specialized area of the skin. M.O. that infects the normal conjunctiva (*Chlamydia, gonococci*) must have efficient attachment mechanisms.
* Contaminated fingers, flies or towels carry infections materials to the conjunctiva (ex. Trachoma) antimicrobial substances in tears, including lysozyme, an enzyme and certain peptides have a defensive role.

1. **Respiratory tract.**

* Some M.O. can overcome the respiratory tracts cleansing mechanisms.
* Air normally contains suspended particles, including smoke, dust and microorganisms.
* M.O. has specific molecules called adhesions bind to the receptors molecule in the susceptible cell.
* Inhibitory ciliary activity is another way of interfering with cleansing mechanisms. This helps invading M.O. establish themselves in the RT.
* *B. pertussis* not only attaches to respiratory epithelial cells, but also interferes with ciliary activity, while other bacteria produce various ciliostatic substances of generally unknown nature.

**Some microbes entry via RT.**

* *Mycoplasma pneumoniae*
* *Haemophilus influenza*
* *Strep. Pneumoniae*
* *Klebsiella pneumonia*

1. **Gastrointestinal tract:**

* Some M.O. can survive the intestines defenses of acid, mucus and enzymes.
* Infecting bacteria must attach themselves to the intestinal epithelium if are to establish themselves and multiply in large numbers.
* *V. cholerae* establishment in surface mucus may be sufficient for infection and pathogenicity.
* The fact that certain microbes infect mainly the large bowel (*Shigella spp*) or small intestine (most *Salmonella,* retro viruses) indicates the presence of specific receptor molecules on mucosal cells in these sections of alimentary canal.
* Giardia lamblia has specific molecules for adhesion to the microvilli of epithelial cells.
* Hook worms attach the intestinal mucosa by large mouth capsule containing hooked teeth.
* Trichinella worms that activity penetrates into the mucosa or enters to deeper penetrate into the mucosa or enter to deeper tissues.

1. **Urinogenital tract:**

* M.O gaining entry via the urinogenital tract can spread easily from one part of the tract to another, and the distinction between vaginitis and urethritis or between urethritis and cystitis, is not always easy or necessary.

1. **Oropharynx:**

* M.O can invade the oropharynx when mucosal resistance is reduced.
* Some M.O in oropharynx
* Oral streptococci
* Nisseria spp.
* Corynebacteria
* Anaerobic cocci (veillonella)
* Candida albicans
* Haemophilus influnzae
* Klebsiella pnumoniae
* Pseudomonas
* E. coli Especially after antibiotic treatment
* C. albicans
* M. tuberclulosis

**Exit and transmission:**

* M.O has a variety of mechanisms to ensure exit from host and transmission.

**Transmission depends upon three factors:**

* The number of M.O shed
* The M.O stability in the environment
* The number of M.O required infecting a fresh host (the sufficiency of infection).

**Transmission from the respiratory tract**

* A smaller number of M.O (hundreds) is expelled from the mouth, throat, larynx and lungs during coughing (whooping cough, tuberculosis)..

**Transmission from the gastrointestinal tract**.

* The microbe appears in the feces in sufficient numbers and there are susceptible individuals in the vicinity, diarrhea gives it an additional advantage.

**Transmission from the urinogenital tract**

* UTI, are common, but most are not spread via urine. Urine can contaminate food, drink and living space.

**Transmission from the oropharynx**

* Saliva is often the vehicle of transmission. M.O such as streptococci and tubercle bacilli reach saliva during upper and lower respiratory tract infections.

Certain viruses infect the salivary gland are transmitted in this way

Paramyxovirus, herpes simplex V., cytomegalovirus and human herpesvirus type 6 are shed into saliva.

**Transmission from the skin**

* Dermatophytes (fungi such as those that cause ring worm) are shed from skin and also from hair and nails; skin is also an important source of certain other bacteria and viruses.
* Transmission by direct contact or by contaminated fingers, M.O transmitted in this way include pathogenic staphylococci and human papilloma virus.

**Transmission from blood**

* Blood is often the vehicle of transmission. M.O and parasites spread by blood-sucking arthropods are effectively shed into the blood.

Infectious agents present in blood or when contaminated needle are used for injections or intravenous during misuse.

**Vertical and horizontal transmission**

When transmission is direct from parents to offspring, via sperm, ovum, placenta, milk or blood, it is referred to as vertical.

Other infections, in contrast are said to be horizontally transmitted, with an individual infecting other individuals by contact, respiratory or fecal-oral spread.