Air-borne diseases

Many bacteria and viruses invade the body through the respiratory tract. These microorganisms can affect the upper and lower respiratory tract and some of them can spread to other organs as well. Upper respiratory infections are very common. Acute lower respiratory infections are a major cause of mortality in children in the developing countries.

Major air-borne infections include the following:

Viral infections
- Mumps
- Measles
- Rubella (German measles)
- Influenza
- Acute upper respiratory infections
- Infectious mononucleosis
- Chickenpox

Bacterial
- TB
- Pneumonia (pneumococcus, streptococcus, haemophilus, klebsiella, mycoplasma)
- Whooping cough (Borditella pertusis)
- Streptococcal infections (tonsillitis, rheumatic fever)
- Meningitis (Neisseria menegitidis)
- Diphtheria (Clostridium diphtheriae)
- Plague, pneumonic

Fungal
- Histoplasmosis (histoplasma capsulatum)

Transmission of air-borne infections
Air-borne microorganisms are transmitted to the new host through three methods:

1. Droplets: particles of saliva and mucous secretions are ejected by coughing, sneezing, talking, laughing and spitting. These droplets may contain food debris and microorganisms. Since the droplets are heavy they tend to settle to the ground so transmission with this route only occurs at very short distance. Droplets are also larger than being capable of entering the lower respiratory tract.
2. Droplet nuclei: when droplets evaporate before settling on the ground, the dry nucleus remains which is small and light, hence easily carried away by air and capable of entering the bronchioles and alveoli.

3. Dust: some organisms can persist for a long time in dust which then acts as a reservoir. These organisms may be derived from sputum or settled droplets.

**Control of air-borne diseases**

Main lines of controlling these diseases can be grouped under three headings; the agent, mode of transmission and the host.

1. Elimination of the agent; the causative organism can be reduced and eliminated through
   - Elimination of the human or animal reservoir
   - Elimination of dust, cleanliness and disinfection of floors and interior of dwellings

2. Interruption of transmission: transmission of the agent to a new host can be minimized through the following measures:
   - Air hygiene, good ventilation of living places and disinfection of the air with ultraviolet light in contaminated places.
   - Avoidance of overcrowding at home, in working places and outdoors.
   - Personal hygiene: avoidance of coughing, talking and sneezing directly to the face of other people. Use of masks by patients can limit spread of the microorganism to others.

3. Protection of the host: individual can be protected from air-borne infections by
   - Specific immunization in case of diseases for which a specific vaccine is available such as measles, influenza and whooping cough or by using immunoglobulins such as for measles.
   - Chemoprophylaxis: using medication to prevent disease in high risk people such as isoniazid for prevention of TB.
Diphtheria

An acute bacterial infection involving the tonsils, pharynx, nose and larynx caused by bacillus corynebacterium diphtheriae which liberates a cytotoxin. Asymptomatic cases (colonization of the bacteria on the mucosa) are much more common than symptomatic cases.

The characteristic feature of the disease is presence of whitish membrane adherent to the mucosa with surrounding inflammation. Sore throat and cervical lymphadenopathy are common. Nasal diphtheria may cause nasal discharge and obstruction. In moderate and severe cases there is swelling of the neck with extensive membrane formation in the trachea which may lead to airway obstruction.

The toxin may cause myocarditis, hearth block and congestive heart failure. Neuropathy and skeletal muscle weakness can happen later. Case fatality rate is 5-10%.

Diagnosis: clinical diagnosis is based on the presence of the membrane in a patient with upper respiratory infection and lymphadenopathy. Confirmation is by microscopy and culture of the lesion.

Occurrence
Diphtheria is the disease of colder months that happens among children or adults who have not been vaccinated. A massive outbreak started in Russia in 1990 and spread to all countries of the former Soviet Union during 1990-1997. more than 150,000 cases and 5000 deaths were reporting during this period.

Reservoir: human

Mode of transmission: air-borne through contact with a patient or a carrier or rarely contact with items contaminated with the lesions. Contaminated milk can serve as a vehicle for the bacteria.

Incubation period: 2-5 days

Period of infectiousness: as long as virulent bacteria are discharged from the lesions, usually 2 weeks. Antibiotics can quickly stop shedding of the bacteria. Very rarely carriers can shed the bacteria for as long as 6 months.

Control
A. Preventive measures:
   • Education of the public about danger of diphtheria and need for vaccination of children.
• Vaccination: vaccination is the best and most effective way for preventing diphtheria. A toxoid vaccine is available and part of routine immunization of children. Diphtheria vaccine is given along with tetanus toxoid and killed pertussis vaccine (DTP or triple vaccine) to all children. In Iraq three doses are given 2-months apart starting from age of 2 months. Booster doses are advice during the second year and before school.

B. Control of patients and contacts:

• Notification: Reporting all cases to health authorities

• Isolation of the patients until 2 throat and nose cultures are negative. If culture facility is not available isolation should continue for 2 weeks of antibiotic therapy.

• Disinfection of all items used or contaminated by the patient.

• Isolation of contacts: contacts who work in food handling or who mix with un-immunized children must stay away from their work until they are managed as below.

• Management of contacts: all close contacts of patients must have cultures of throat and nose taken and kept under surveillance for one week. All household contacts must receive a single dose of benzathine penicillin or one week oral erythromycin regardless of their immunization status. Food handlers and those working with non-immunized children must stay away from work. Previously immunized contacts must get a booster dose of diphtheria toxoid if 5 years have lapsed since the last dose. Non-immunized contacts must get a new series of the vaccine.

• Specific treatment: diphtheria antitoxin should be given as soon as diagnosis is suspected and bacteriological specimens are taken without waiting for results. Antibiotics such as penicillin or erythromycin must also be given but this is not a substitute for the antitoxin.
Chickenpox

An acute generalized viral infection caused by human herpes virus 3 (varicella zoster virus). The disease presents as a sudden onset of mild fever and mild constitutional symptoms followed by a maculopapular rash which after few hours becomes vesicular and stays for 3-4 days. The vesicles are more common on covered skin areas but can happen anywhere and may also involve the mucous membranes on mouth and respiratory tract.

Fatality rate of chickenpox is one per 100,000 in children and one per 5,000 in adults. Complications include secondary skin infections, pneumonia, and hemorrhage and encephalitis. Herpes zoster is a local manifestation of reactivation of varicella infection in the dorsal root ganglia.

Occurrence: chickenpox is worldwide. Vast majority of people has had chickenpox before adulthood. In temperate climates it usually happens in winter and spring. Zoster is more common in the elderly.

Reservoir: human

Mode of transmission: Droplet transmission from person to person from upper respiratory secretions or air-borne transmission from vesicle fluids. Transmission can also happen from zoster vesicles.

Incubation period: 2-3 weeks.

Period of infectiousness: up to 5 days before the onset of the rash and until the vesicles are crusted which usually takes 5 days. Chickenpox is very contagious and up to 90% of susceptible household contacts may be infected. Susceptible contacts must be considered infectious even before developing any symptoms between 10-20 days after exposure.

Control

C. Preventive measures:
   • Vaccination: a live attenuated vaccine is available which is effective but is not part of the routine EPI immunization. It is usually recommended for high risk adults and children.
   • Varicella zoster immune globulin: if given 3 days after exposure can modify or prevent the disease.

D. Control of patients and contacts:
   • Notification: Reporting all cases to health authorities
• Isolation: children and susceptible adults should be kept away from infected persons until the vesicles become dry.

• Disinfection of all items used or contaminated by the patient.

• Protection of contacts: immunization by varicella vaccine 3 days after exposure can prevent or modify the disease. Varicella zoster immune globulin is also effective for the same purpose if given 4 days after exposure. Antiviral drugs are also useful in modifying the disease.

• Specific treatment: antiviral drugs such as acyclovir are effective for treating varicella infections.
Control of tuberculosis

Control of tuberculosis involves action on the following areas:

1. General health promotion
2. Specific protection
3. Early diagnosis and treatment
4. Surveillance

1. General health promotion
Improvement of housing and reduction of overcrowding can reduce the chances of spread of air-borne infections. Health education for better personal hygiene and cleanliness regarding coughing and spitting is very important. Good nutrition improves host immunity and plays a role in TB spread.

2. Specific protection
Specific protection against tuberculosis includes immunization, chemoprophylaxis and control of animal reservoir.

- Immunization: vaccination with live-attenuated tubercle bacilli, BCG, confers immunity for many years against tuberculosis. BCG vaccination is part of routine immunization of children, usually given at birth in the developing countries. BCG can also be given to tuberculin-negative persons who are at high risk such as close contacts, doctors and health staff.

- Chemoprophylaxis: isoniazid is an effective drug to prevent infection and progression of latent infection to severe disease. Isoniazid prophylaxis is recommended for close contacts of TB patients, persons who have recently converted from tuberculin negative to positive and children under 3 years who are tuberculin positive from infection not from vaccination.

- Control of bovine TB: bovine tuberculosis can be controlled by identification and elimination of infected animals; pasteurization of milk and examination of carcasses of cattle in slaughter houses.

3. Early diagnosis and treatment of cases
Finding active TB cases and their treatment are fundamental for control of tuberculosis. It is important to try to find and treat cases as early as possible because the earlier the cases are found and treated, the less is the chance for spread of the disease in the community.

- Screening for cases: search for cases is done by tuberculin test, microscopic examination of the sputum and chest X-ray. High risk groups that should be screened include: contacts of TB patients;
people with cough for more than 3 weeks; workers in TB treatment hospitals; residents in common lodging houses.

- Drug treatment: WHO recommends Directly Observed Therapy (DOTS) for TB which include 2 months treatment with four drugs (isoniazid, rifampicin, pyrizinamide and ethambutol) given daily under close observation followed by 4 months of isoniazid and rifampicin given twice weekly. DOTS strategy requires that patients must be observed by health workers swallowing each dose and the health services monitor the progress of each case until he/she is cured. Political commitment and ensuring availability of drugs and testing facilities are also essential for DOTS strategy.

- Rehabilitation: physical rehabilitation may be needed to limit disability. Social rehabilitation is required to limit the social impacts of the disease.

4. Surveillance

An effective surveillance programme must be in place to collect relevant data for control of TB. Such data include notification of cases, investigation of contacts, laboratory reports, special surveys and immunization records.