The natural history and etiology of disease

The natural history of disease

Every disease has a life time. The progression of a disease from start to end in absence of medical or public health intervention is called natural history of the disease. But we don't want diseases to take their natural history because some of them may have sever and long-lasting implications on the individual or even lead to death. In stead we want to modify the natural course the disease. The goal of therapeutic and preventive interventions is to alter the natural history of the disease in favorable way i.e. to prevent the disease from happening or make its course less sever and less eventful. .

Stages of disease

All cases of a disease do not take a uniform course. This diversity in the course of a particular disease could take a wide range from very mild and even unnoticeable cases to very sever and fatal cases. In fact in many diseases, especially the infectious diseases, a majority of cases of the disease are subclinical or asymptomatic and therefore not noticed. This is called iceberg phenomenon. The following stages of disease are described:

1. Pre-disease stage: this stage the disease has not yet affected the individual directly i.e. the pathologic process has not begun in hid/her body. The aim of health services at this stage is to prevent occurrence of the disease.

2. Latent stage: the pathologic process of the disease has begun but the disease is still asymptomatic. In infectious disease like measles, the infection has begun in the individual, but the person is still asymptomatic. In noninfectious diseases such as coronary atherosclerosis, the changes have started in the coronary vessel but the patient has not yet developed any symptoms. The aim of the health services in this stage is to identify people with the disease in order to start treatment as soon as possible and prevent spread in case of infectious disease.

3. Symptomatic stage: after a variable period of latent stage, signs and symptoms of the disease become manifest. For example in case of measles when fever, rash and other symptoms become apparent. The aim of the health services in this stage is to treat the patients adequately and prevent complications and death.

Outcome of disease

All disease do not end in the same way in terms of its effect on the life of the patient. Diseases differ in their severity and the end result. The outcome of a disease process could be any of the following:

1. Recovery: when the patient recovers fully and re-enters the healthy population. He may be protected from the disease in the future (immune) like in some infectious diseases such as measles; or he may not be protected and could get the disease again (susceptible) like in most other diseases e.g. common cold, minor accidents etc.
2. Complications: many disease lead to complications during the course of the disease some of which could recover by itself or be controlled by treatment. For example common cold could be complicated by sinusitis which could be treated. Infarction could be complicated by arrhythmia and fractures could be complicated by bleeding.

3. Disability: lasting disability happens in some diseases which may require rehabilitation later on. For example poliomyelitis and stroke may cause weakness of lower legs, diabetes may cause impairment of vision, meningitis may cause brain damage and mental retardation.
4. Death: many diseases could lead to death if proper management is nor provided such as fatal accidents, infarction and cholera.

Etiology of disease

The humoral theory: the humoral theory developed by Hippocrates and his followers dominated medical thinking for many centuries. According to Hippocrates, the human body contains the following liquids (humors) blood, phlegm, yellow bile, and black bile which are responsible for health and disease. Health is primarily a state in which these substances are in the correct balance with each other in strength and quantity, and are well mixed. When one of these liquids change inside the body e.g. too moist, too dry, too hot, or too cold; diseases occurs. These changes could happen because of foods, drinks, exertion, injuries, smell, sound, sight, venery, heat and cold.

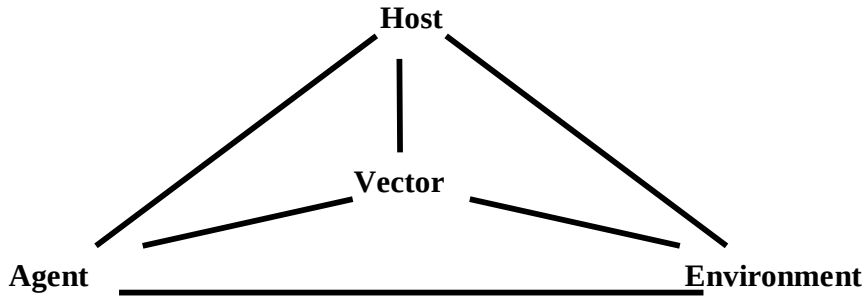
The miasmatic theory: This theory was prevalent during the middle ages and believed that miasmas (bad airs) such as bad vapours, gases, wastes etc. carried by the wind were responsible for diseases. Word malaria derived from mala aria (bad air) is product of this concept.

The germ theory: with the finding of microorganisms and diseases caused by them in 19th century, the work of scientists such as Robert Koch, Joseph Lister, Luis Pasteur and others led to the development of the germ theory which stated that diseases were caused by single causative agents. Koch postulated the following criteria to prove that a disease is caused by a microorganism:

1. The agent must be found in every case by isolation in a pure culture
2. The agent must not be found in cases of other diseases
3. The isolated agent must be capable of reproducing the disease in experimental animals
4. The agent must be recovered from the experimental disease produced

The epidemiological approach

The epidemiological approach to disease causation is a broad one. The mechanism of disease causation usually involves more than one single factor. In epidemiology we are interested in both biological causes of the disease and the social and environmental causes of disease. Disease is not simply caused by a single factor but it results from interaction of three factors: the host, the agent and the environment. These three interacting factors are called the epidemiologic triad of disease. Yet, in some disease a fourth factor is also involved which is the a living organism such as an insect which transports the direct causative pathogen of the disease. This factor is called the vector. Presence of only one of these factors is not enough to cause the disease. These factors must interact in particular way to lead to the disease.



Example:

Measles:
Host: susceptible person
Agent: measles virus
Environment: conditions for exposure of susceptible persons
Measles vaccine is present in a classroom. This does not mean that all children in the classroom get infected. This depends on the interaction of host, agent and environmental factors.

Burns
Host: susceptible person
Agent: physical/chemical agents
Environment: conditions for exposure/injury
Kerosene devices are present in all houses and the children are at risk, but all children will not get burnt. This depends of interaction between the home environment and the children.

1- Host factors
Host factors are characteristics of the person which are responsible for the degree of susceptibility or resistance of the individual to the effects of the agent. These host factors are influenced by certain characteristics of the person such as the genotype, nutritional status, immune system, social behavior.

Example of host factors

- Age: childhood vaccine preventable diseases
- Sex: coronary heart disease/ pregnancy related problems
- Race: Type I diabetes more common in non-Hispanic American whites
- Religion/ culture: AIDS in Africa
- Behavior/Habits: diarrhea
- Occupation: pneumoconiosis in workers
- Genetics: hemophilia in males
- Marital status: sexually transmitted diseases
- Other/Previous diseases: malnutrition/AIDS
- Immune status: immune/ immunosuppression

2- Agent factors

- Biologic: allergens/ infectious agents
- Chemical: toxins(lead, organophosporous)/ dusts
- Physical: kinetic(bullets/ accidents), heat, cold, radiation, noise
- Nutritional: lack/ excess
- Social and psychogenic factors

3- Environmental factors

Conditions that facilitate contact between the host and the agent

- Temperature(colds/ cholera)

- Humidity(fungal infections)
- Altitude (malaria)
- Crowding (colds)
- Housing (TB)
- Water (giardiasis)
- Food (goiter/ gastroenteritis)
- Radiation (cancers)
- Air pollution(asthma)
- Noise (impairment of hearing)
- Socioeconomic(anemia, TB, coronary heart disease)
- Political

4- Vector factors

A living carrier such as an insect that transports an infectious agent directly or indirectly from a host to another.

- A vector can be considered part of the environment or treated separately
- The vector has a specific relation to the host, the agent and the environment

Examples of vectors

- Insects: anopheles mosquito→ malaria
- Arthropods: tick→ relapsing fever
- Animals: dog → rabies

Some people prefer to use the term vector more widely to include:

- Human beings: vendors of heroin and cocaine → drug addiction
- Contaminated needles → HIV/AIDS
- Airplanes

But classically vector is applied to a living transmitter of disease that is essential to the disease cycle.

Further reading

James F Jekel et al. Epidemiology, biostatistics and preventive medicine.