

“Evolution of Asepsis with Microbiology Review”

Pamela H Caudell, RN, CNOR, CSPDS, ACSP

Objectives:

At the end of the article, staff will be able to:

- ? Define Infection
- ? Discuss the evolution of asepsis
- ? Know what the chain of infection consists of

The Code of Hammurabi was among the earliest reference to asepsis and surgery. This code was established in 1800B.C. Not only did it list the laws of Babylonia, it also listed the penalties for unsuccessful surgeries. Hippocrates in the early 400 B.C. time frame, recognized that it was important to clean one's hands before surgery. One of Caesar's physicians, Marcus Varro, from around 95 B.C., stated that small creatures invisible to the eye, fill the atmosphere, and if breathed in can cause dangerous diseases. In 1559, Ambroise Pare, one of the world's first recognized surgeons, proved that if blood vessels were tied off rather than being cauterized with hot oil or a hot iron, hemorrhages were stopped quicker and safer and there was a lower incidence of infection. In 1546, It was stated in the De Contagione, a journal on infective medicine by Francastorious that diseases were being spread by direct contact. In 1882, Robert Koch, a German bacteriologist and his assistant, Wolffhagel, introduced steam sterilization. Therefore, surgery took the form of a mixed anti-septic-aseptic technique. In other words, surgeons scrubbed up; towels were treated by steam heat; some instruments were boiled; sharp instruments, such as scissors and scalpels were still soaked for twenty (20) minutes in carbolic acid. Heads, face and hair were still uncovered and antiseptics such as carbolic acid and mercuric chloride were still freely used. In 1890, Ludwig Lautenschlagen, a German pharmacologist, along with two (2) surgeons, Ernst Von Bergmann and Ernst Schimmelbusch introduced an improved apparatus for

steam sterilization. This was the first apparatus that enabled almost pure aseptic technique. Aseptic technique has evolved since Lister introduced the use of carbolic acid. The basic objective, however, remains unaltered: To prevent infection by eliminating microorganisms.

Infection is usually defined as the presence or growth of pathogenic organisms (pathogens) on skin or in body tissue or fluids when the presence of growth is accompanied by a clinically adverse effect either local or systemic. Less pathogenic microorganisms, often called opportunistic, are capable of causing disease in persons whose defense mechanisms may be deficient or compromised. Microorganisms capable of causing infections can arise from endogenous or exogenous sources. Endogenous sources of infections are the patient's own microbiologic flora, the normal flora of the skin, nose, pharynx and gastrointestinal tract. Exogenous sources of infection are those that arise from outside the patient, such as those from infected or colonized patients and hospital personnel, or from inanimate objects in the hospital.

Infection will **NOT** occur unless the essential components for infection are present and interaction occurs among them. The three (3) essential components are: infectious agent, susceptible host and a means of transmission. Infectious agents can be bacteria, fungi, parasites, or viruses. Bacteria are by far, the most common microorganism isolated from cultures within the hospital environment. Bacteria are found in three distinct shapes; bacilli which are rod shaped, spirilla are shaped like corkscrews and cocci which are ball shaped. They can also be classified as to whether or not they grow in the presence or absence of oxygen. If they grow in the presence of oxygen, they are considered to be aerobic and can be found on the surface of the body, i.e., skin. If they grow in the absence of oxygen, they are considered to be anaerobic. This type of bacteria is usually found only within deep body tissues or organs.

The second chain is the susceptible host. There are many things that make a host susceptible to infection. Some of these factors include; age, current disease processes, immune status or nutritional status. For example, if a patient is undergoing surgery, the

act of making an incision in the skin interrupts the barrier to infectious agents. Anesthesia is also considered something that makes the patient susceptible to bacteria as it interrupts the cough and sneeze reflex and can compromise other normal defenses of the respiratory tract. Procedures that involve biopsies or other diagnostic or therapeutic procedures can also increase the susceptibility of the patient.

The third part of the chain is the transmission of the infectious agents to the susceptible host. This can be done in any one of four different ways or a combination of two or more. **(1) Contact transmission** is the most common as well as the most frequent means of transmission. This is especially true within hospitals. This can occur as a result of direct, indirect or droplet contact between the source of the infectious agent and the susceptible host. Direct transmission occurs when the infected person comes in contact with the susceptible host. This could be from nurse to patient or from visitor to patient provided the person who is infected actually touches the patient. Indirect transmission occurs when the contact is done by some inanimate object that has been contaminated by the source and touched by the susceptible host. For example, a piece of patient care equipment, like an IV pump that has not been cleaned between patient uses, is considered to be contaminated until cleaned appropriately and can thereby infect the next patient. Droplet contact occurs when large infectious particles are spread through the air when the infected source and susceptible host are in close proximity, usually less than five (5) feet from each other.

The other three methods of transmission; **(2) airborne transmission**, **(3) vector-borne transmission** and **(4) common-vehicle transmission** are considered to be much more infrequent than is contact transmission. The difference between air-borne transmission and droplet transmission is that with droplet contact, the droplets are relatively large and stay suspended in the air for a very short period of time. On the other hand, airborne infectious agents can reside on particles of dust or remain suspended in the air for quite a long time. They are also known for moving around on air currents so opening doors or windows can create air flow that carries these contaminants far from the original contamination. Vector-borne

transmissions occur when lice or ticks bite the susceptible host and infects the host. Common-vehicle transmissions occur when contaminated inanimate objects such as food becomes the medium by which numerous susceptible is the carrier for transmission of the infectious hosts.

In order to prevent the spread of infection, the chain of infection has to be interrupted. We know that all three components must be present under the right conditions for the spread of infection to occur. We also know that by altering or removing any one of the three components it changes the chances of an infection occurring. The chain of infection can be broken by:

- destroying the infectious agent
- increasing the resistance of the susceptible host
- interrupting the transmission of infectious agents.

If you want to completely destroy the infecting agent, the only absolute way to accomplish this is by sterilization, particularly in the hospital arena. Disinfection is another way to reduce the number of microorganisms on objects, but sterilization is still the only way to completely destroy them. If the infecting agents are found on waste materials, these can be destroyed thru incineration.

If your object is to increase the host resistance, that is very difficult to do. If the patient undergoing surgery has diabetes, for example, the predisposition of the patient will most certainly cause the host resistance to be less than optimal. In some cases, it may become necessary to postpone the surgery until the patient's resistance has become more optimal.

Thirdly, interrupting the transmission of the infectious disease, is generally the most positive way to break the chain of infection. This can be accomplished in several ways. The easiest and least expensive is plain old hand washing. Hand washing is considered to be the single most important method for interrupting the transmission of microorganisms. This can be accomplished by the use of soap and water and vigorously washing for a minimum of 15 seconds or the use of waterless hand scrubs provided the hands are not visibly soiled.

Each of us working in a healthcare facility has the responsibility to use the information gained here to help prevent the transmission of microorganisms to any host that may prove to be susceptible whether it's one of our co-workers, physicians, patients or their families.

1) Hippocrates in the early 1800's recognized it was important to clean ones hands before surgery.

True False

2) In 1882, Robert Koch and his assistant Wolffhagel, introduced steam sterilization.

True False

3) Infection is defined as the presence or growth of pathogenic organisms in body tissues when this is accompanied by a clinically adverse effect.

True False

4) Endogenous sources of infections are those that arise from outside the patient.

True False

5) Opportunistic microorganisms are capable of causing diseases in persons whose defense mechanisms may be deficient or compromised.

True False

6) Bacteria is the most common microorganism isolated from cultures within the hospital environment.

True False

7) Infection will not occur unless the essential components for infection are present and interaction occurs among them.

True False

8) Procedures that involve biopsies or other diagnostic therapeutic procedures do not increase the susceptibility of the patient.

True False

9) Contact transmission in the least common as well as the least frequent means of transmission.

True False

10) Vector-borne transmissions occur when lice or ticks bite the susceptible host and infects the host.

True False

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