

Surgical Wound

Infection

Essay Presented in Partial Fulfilment

For

The Master Degree of Surgery

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Surgical wound infection -----

Introduction : -----

During the last decades improved hygienic conditions have considerably reduced the frequency of infection among hospital patients. The introduction of new antibiotics has also led to marked reduction in the mortality rate of such infections.

Nevertheless, hospital infections remain a serious problem. This is due to several factors. The resistance of bacteria to antibiotics has continued to increase, operations have become more complicated and take longer time. Patients suffering from serious illness that increase their liability to infection are living longer. Many patients are receiving treatment that lower their resistance to infection.

In the present study an attempt has been made to throw light on the

- Types of wounds which are more predisposed to infection.
- Bacteriology and sources of wound infection.
- Factors that influence wound sepsis.
- Prevention of wound sepsis.
- Treatment of wound sepsis.

Types of wounds which are
more predisposed to infection
- - - - -

1) Lacerated wounds are more predisposed to infection than incised wounds because there is more destruction of tissues, the blood vessels are torn off so that the blood supply to such areas is interfered with causing death of large masses of tissues, which are good media for multiplying of microorganisms.

They are more liable to be ingrained with portions of clothing or other foreign materials such as soil or dirt.

2) Punctured wounds are also more predisposed to infection because they are deep wounds, the O_2 tension in the depth of the wound is low, so anaerobic microorganisms such as tetanus clostridium, can multiply in the depth of the wound (Romanis, 1952).

Factors that influence post
operative wound infection

I) Factors related to the operation :-

I) Type of operation :

The rates of wound sepsis vary considerably from one type of operation to another, it was found that it is highest for abdomino-perineal resections and for amputations, and lowest for head and neck (Forbes, 1961), (Theburn 1968)

It is highest for abdomino-perineal resection because the wound is potentially contaminated and lowest for head and neck operations because its blood supply is rich.

2) Duration of operation :-

The longer duration of the operation the higher incidence of wound sepsis. This may be due to increased time of exposure of the wound to air with increased contamination of the wound, wound cells are damaged by drying, and retractors, reduction of general resistance of the patient with longer procedures due to more blood loss and shock, also increased amount of suture and electrocoagulation may reduce the local resistance of the wound.

3) Type of wound:

Surgical wounds were divided into three groups according to the probable degree of contamination during the operation (National Research Council, 1964) (Teffrey, 1958)

They are clean wounds, potentially contaminated wounds, and contaminated wounds.

Contaminated wounds are more liable for post operative infection than the other types.

4) Length of incision:

Wounds more than 15 cm in length were classified as long. In operations embracing more than one incision the classification was made on the basis of the total length.

In long incisions the incidence of post operative wound infection is high. (Johan N. 1970).

5) Insertion of drain :-

It was found that wounds with drains inserted are more liable for post operative infection than that without drain, drains either inserted in the wound itself or in a separate stab wounds.

(Johan N., 1970).

6) Skin draps :-

(Peter, and Rosmary 1980) were found that the use of adhesive plastic draps did not reduce the infection rate of clean wounds. with the use of the usual cotton drapes the infection rate of clean wounds was 1.5 %, with adhesive plastic drapes, it was 2.3 %, Paskin and lerner 1969 also

found the incidence of infection of wounds was double when adherent plastic draps was used so they are not used routinely and this will save money.

7) Closed suction drainage :-

Alexander et al.1976 found that after 24 hours

the complement level in wound fluid falls so that opsonization of bacteria is impaired. Removal of stagnant wound fluid with closed suction drainage allows fresh fluid with opsonines to enter the wound. In a clinical trial (Mc Ilrath 1976) showed a decrease in the infection rate when the subcutaneous layer of a cholecystectomy wound was drained with closed suction drainage.

II) Factors related to the patient :

1) Sex and age it was found that male sex and old age are more prone to post operative infection than young age and female sex. (Johan N., 1970).

2) Preoperative hospitalization :

The longer a patient stays in hospital before an operation the more susceptible he or she becomes to wound infection. With a one-day preoperative stay the infection rate is 1.2 % with one week preoperative stay it is 2.1 per cent, and for a stay of more than 2 weeks 3.4 %. It is likely the patient's skin becomes colonized with bacteria to which he or she is not resistant (Peter, and Rosemary 1980).

3) Preoperative preparation of patient's skin :-

Shower: A preoperative shower with hexachlorophene appeared to lower the infection rate of clean wounds. If the patient did not shower, the infection rate was 2.3%. If the patient showered before operation and used soap, the infection rate was 2.1 per cent, and if hexachlorophene was used in the shower, the infection rate was 1.3% (Gruse, 1973)

Shaving (Peter and Rosmary 1980) found that shaving the operation site increased the infection rate of clean wounds. In patients who were shaved with a razor, the infection rate was 2.5%, in patients who were not shaved but had their pubic hair clipped, the infection rate was 1.7%, in patients who were shaved with an electric razor, the infection rate was 1.4% and in patients who were neither shaved nor clipped, the infection rate was 0.9%

(Hamelton et al 1977) used a scanning electron microscope to examine skin prepared with a safety razor, an electric clipper, or a depilatory. Their paper contains arresting photographs showing that the safety razor produced gross crusts, the clipper tended to nip the skin at creases, and the depilatory caused no visible injuries.

Altmeier 1974: as well as Seropian 1971 have stressed the importance having shaving take place immediately before operation to prevent bacterial growth in the razor nicks.

Skin preparation before operation: The skin in the operation area was vigorously washed for 10 minutes with green soap, then alcohol was applied, the rate of infection was 2%. This routine was changed. A few hours before the operation the patient was washed

with a providone-iodin scrub spong on the ward, and in the operating room, the skin was painted with tincture of chlorohexidine (Hibitane). With the use of this three minute preparation, the rate of infection of clean wounds was 1.6 %. (Peter, and Rossmary 1980).

3) Steriod treatment :

Steriod treatment for three days or more in connection with the operation including the day of operation or the day after the operation of a dose more than 50 mg cortisone per day. It was found with steriod treatment the incidence of wound sepsis is higher.

If the infection rate without steriod therapy was 13% - it was 17.5 % with steriod treatment. (Johan N., 1970).

4) Diabetes mellitus :

Infection rate increase with diabetic patients it was found that if infection in normal patients who have not diabetes mellitus was 12.9 % - that the infection rate was 22 % in patients suffering from diabetes mellitus (Johan N., 1970).

5) Malignant disease :

Patients with carcinoma, sarcoma, leukaemia or malignant reticulosis are more prone to post operative infection than others. Because of the ultra-tion of the host defense mechanisms in cancer patients also the use of immunosuppressive agents,

and the malnutrition state are factors which make infection rate higher.(Johan N.,1970).

- 6) Remote infection : Infections not situated in -----
the surgical wound, with clear clinical signs of active infection .Urinary tract infection were only included if accompanied by pyrexia or generalized symptoms. It was found if the infection rate postoperatively with no remote infection was 11.9 % it was 34.2 % in patients having remote infection else where(Johan N.,1970).

8) Staphylococcal Carrier state, all strains:-

The patients were classified into 5 carrier states according to the highest number of staphylococci isolated from carrier sites:

0. No, or less than 10, staph.
1. 10-99- staphylococci
2. 100-999 staph.
3. 1000 - 10,000 staph.
4. more than 10,000 staph.

The classification was based upon samples obtained between the operation and the healing of the wound if the surgical wound was colonized with staph, only samples obtained two or more days prior to the colonization were used.

It was found that the infection rate increase with increasing the staphylococcal carrier state all types.(Johan N.,1970).

9) Staphylococcal carrier state(resistant types)

It was found that the incidence of infection post operatively is higher than that with all strains of staph. and increase by increasing the staphylococcal carrier state (resistant types). (Johan N., 1970).

10) Carriage of non-staphylococcal pathogens :

Patients in whom non-staphylococcal pathogens were isolated from blood, urine, sputum and skin lesions or wounds remote from the surgical wound. Only patients who were carrier between the operation and the healing of the wound were included in this group. If the surgical wound was colonized with non staph. pathogens, only samples obtained prior to the colonization were taken into consideration. All patients with acute enterocolitis were regarded as carrying non. staph. pathogens as the risk of auto-infection from enteric microorganisms was considered to be increased in these patients. (Johan N., 1970).

II) Exogenous contamination-(scrub solutions)

The use of iodophor (Betadine) or hexachlorophene did not affect the rate of infection of clean wounds. Many surgeons now use a chlorohexidine scrub (Hibitane), hexachlorophene became unpopular when Butcher et al 1973 demonstrated that it was absorbed and detectable in the blood.

Scrub time :

(Dineen 1969) found no difference between 5 and 10 minute surgical scrubs. He studied counts of bacteria on the hands of surgeons at the end of two-hour-operations and could show no variation with use of previdone iodine or hexachlorophene. Dineen's in vitro tests indicate that a scrub for one minute or less should be enough.

Galle et al 1978 found that no difference between a 10 minutes scrub with Betadine or a 5 minutes sponge scrub with iodophore. The economics in scrub time is obvious, the water conservation factor is rarely considered. Galle et al stated that a 10 minutes scrub uses 50 gallons of water. Most surgeons at their institution now brush scrub with one of the detergent antiseptics for only three to five minutes before the 1st operation and for two to three minutes with a sponge between operations. This practice has not been associated with an increase in their rate of infection of clean wounds.

III) Factors potentiating infection of surgical wound. -----

Infection potentiating factors in the soil

(I.P.F)

Rodeheaver et al (1974)

It was found that wounds which are contaminated with soil are more prone to infection than others why ?

The I.P.Fs. in soil appear to arise from clay fractions of soil as well as the colloidal organic fraction. The clay particles are extremely small in size possessing a diameter smaller than 0.002 mm. due to the fineness of their size and their crystalline structure, the clay particles expose a large amount of external surface. In addition expanding clay minerals like montmorillonite have large internal surfaces as well the internal surfaces occur between the crystalline structural layers that make up each particle. Buckman and Brady (1960) suggested that exposed surface area of an acre of soil containing 60% clay exceeds the land of Florida at least forty to fifty times, the surfaces of clay carry a negative charge that attract positively charged cations. This cation exchange capacity of clay minerals makes nutrients readily available to plants. Hydrogen ions from the root hairs of plants and soil microorganisms replace the nutrient cations on the surface of the clay particles. As a consequence of this exchange huge numbers of cations are forced into the soil solution and are assimilated by the adsorptive surfaces of roots and soil organisms. This same type of exchange may occur in the wound. Large quantities of cations are dumped into the wound as a result of the addition of clay. This exchange may either destroy tissue or impair the wound's ability to resist infection.