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Usually staphylococcal infections only constitute a serious problem in hospitalized patients; these infections are not unduly important in private practice.



(Photo: Zoutpansberg Review)

Dr. Uys

dealing with the problem of acquired resistance.

Sites and Types of Infection

The most important and common sites and types of infection are:

1. *Infections during operations.* The infection usually occurs in the theatre, the hospital staphylococcus invading surgical wounds. It can also invade the nasopharynx postoperatively—the portal of entry being an abrasion of the mucous membrane which may occur during anaesthesia. The organisms can then spread to the wound area. Other sources of infection of surgical wounds are the patient's clothes or the clothes or skin of a member of the surgical or nursing team.

2. *Cutaneous infections.* These are especially dangerous in newborn infants. Members of the hospital staff with cutaneous infections can be a potent cause of spread of the germs by contact. These persons should keep away from the hospital area until it is certain they are no longer a source of infection. Porters and nurses are particularly liable to get this type of infection.

3. *Postpartum breast abscesses.*

4. *Staphylococcal pneumonia* and pneumonitis, especially following an influenza attack.

5. *Severe enteritis* in postoperative surgical patients. It has been suggested that so-called antibiotic enteritis and colitis may actually be due to an antibiotic-resistant staphylococcus.

6. *Osteitis.*

7. *Cystopyelitis.*

Staphylococci form a large group of micro-organisms, widely distributed throughout the world. The one which concerns us is the *Micrococcus pyogenes*; this is pathogenic if it produces a golden-yellow pigment on a special type of culture medium, and if the pigment-producing strain regularly manufactures an enzyme capable of coagulating blood plasma (coagulase positive).

Staphylococci are typed by either bacteriophage typing or antibiotic sensitivity. The haemolytic *Staphylococcus aureus* is the organism which is most important when

8. *Septicaemia.* This can be particularly dangerous among doctors and nursing personnel, and is often fatal when caused by the hospital staphylococcus.

Background to the Change in the Hospital Staphylococcus

There are a number of reasons for the resistance of this organism to antibiotics, and for the growth of the problem in hospitals. These include:

1. *Improper use of antibiotics.* Antibiotics are often used improperly for prophylactic and therapeutic purposes. These abuses include: (a) prescribing of antibiotics for conditions of a non-bacterial nature; (b) so-called prophylactic use, which is largely futile; (c) giving antibiotic combinations to patients who should either have no drugs at all, or at most a single agent; and (d) using an inadequate dose when antibiotics are indicated, thus allowing resistant strains to appear.

2. *Change in type of patient in hospital.* By and large, more of the patients now admitted to hospital are susceptible to infection. These include aged and debilitated patients, premature and newborn infants, postoperative patients, those with diminished respiratory excursions or vital capacity, uncontrolled diabetics, and those suffering from viral infections and their aftermath. Patients with leukaemia, agranulocytosis and agammaglobulinaemia, and those receiving steroids, are also more susceptible to infections.

3. *Neglect of the principles of asepsis.* Some doctors and hospital personnel have become over-confident since the introduction of antibiotics, and are becoming careless in their attitude towards asepsis and antiseptics.

Infections at Pietersburg Hospital

During the period April - December 1961, 87 cases of *Staph. aureus* (coagulase positive, mannitol positive) infection were notified at Pietersburg Hospital, where the average daily number of inpatients is 400.

During this same period, 8 members of the staff were proved to be nasal carriers. Actual staphylococcal infections among the staff included the following: furunculosis—2 nurses and 2 out of 5 porters; staphylococcal pneumonia—1 admission clerk and 1 student nurse. This gives an idea of the occupational hazard this problem has become. Regular nasal and/or throat swabs were taken from personnel in the critical areas of the hospital—the theatre and the maternity and surgical wards.

Mechanism of Resistance to Antibiotics

Although we know that resistance to antibiotics does occur, we do not know the mechanism behind it; it is thought to be either 'adaptation' or 'mutation'.

MODE OF SPREAD, CONTROL AND PREVENTION

Mode of Spread

1. *Direct contact* is one of the most important ways in which infection is spread, especially in the newborn infant. The ambulatory septic patient is a common source of spread.

2. *Dust, air and linen* spread results from a 'contagious institution'. The nasopharynx is the most important portal

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of entry for bacteria carried in the air or dust, and if the mucous membrane is traumatized, bacteria can invade the tissues giving rise to septic emboli. Faulty handling of dressings spreads the infection throughout the immediate environment, while faulty ventilation, infected linen, etc., spread the infection throughout the whole institution. Non-touch dressing techniques must be developed to provide a barrier between the dangerous organisms and the nasopharynx, where they tend to multiply profusely in all individuals. Where patients are isolated, we expect everyone in attendance to wear gowns, masks, etc., but these precautions are not always carried out.

3. *Carriers*, especially those with organisms in the nasopharynx and the skin (particularly the axilla and the groin areas). One of our student nurses, who was working in the staphylococcal isolation ward, developed a vaginal discharge — proved to be due to the hospital staphylococcus — that took a long time to cure. The carrier rate is an index of the infectivity of a hospital; except in the critical areas (theatre, and maternity and surgical wards) carriers are not important causes of spread of the infection.

Control of Infection in the Hospital

1. Isolate every suspected and proved patient, and notify the occurrence immediately on the prescribed form to the Superintendent. It must be remembered that 'infections with these antibiotic-resistant organisms do not constitute a temporary epidemic, but a problem which must be faced for an indefinite period in our antibiotic-saturated hospital society'. Successful control can only be gained with sterile techniques and intelligent limitation of the use of antibiotics.

2. Discontinue the prophylactic use of antibiotics.

3. Avoid cross-infection through fomites such as blankets, linen, etc.

4. Maintain strict asepsis, especially in the scrupulous washing of hands between attending to patients. Control the methods of sterilization and the sterilizing apparatus.

5. Take periodic swabs from personnel in the critical areas or where there is a sudden flare-up of notified cases and send the swabs for culture and sensitivity tests. Generalized epidemics (especially in the nursery) with many deaths have been traced to a single nurse or physician with skin lesions.

6. Hospital plant — providing sterile, filtered air and a positive air flow to prevent ventilation invaders — must be maintained in a high state of efficiency. Closed doors are important to keep up the positive pressure.

7. Disinfection of fomites must be efficient. Most of the articles of linen that have gone through an ordinary laundry washing process are sterile, and no mixing of soiled and clean linen should ever occur, e.g. transportation by the same laundry carts. Woollen blankets, important carriers of staphylococci, and pillows, should be sterilized with ethylene oxide or washed at a low temperature and given a final rinse in a disinfectant. The most important disinfectants used in combating the staphylococcus are hexachlorophene, quaternary ammonium compounds, and synthetic phenols. Cotton blankets are better than woollen ones, because they are sterile after the ordinary laundry process and are not damaged in any way by laundering.

8. *The newborn nursery*. No visitors should be allowed in the nursery. Nurses should wash their hands after handling each individual baby, and there should be no physical contact between babies. All incubators should have a separate pure-air intake. If staphylococcal infection should occur, 'rooming-in' with mothers with strict isolation should be practised. The wards in the maternity section should be single, or at the most double, to make this possible.

Control of Infection in the Theatre

Most staphylococcal infections occur here, and rigid enforcement of asepsis is essential. At all times the number of people in an operating theatre should be kept to a minimum, and movement restricted as far as possible. Theatre clothes should be worn and masks must be changed regularly, between cases if possible. The anaesthetic face mask used for each patient should have been cleaned with a reliable disinfectant. *Conversation must be kept at a minimum.*

Wet drapes and gowns invite the entry of organisms into

the operating field, while the rough handling of tissues and the formation of haematomas create a fertile soil for infection.

In connection with antisepsis in the theatre, the aphorism of Sir George Murray Humphrey should always be kept in mind: 'In surgery, eyes first and most, fingers next and little, tongue last and least'.

Personnel must not enter the theatre if they have a respiratory infection, and they should not leave the theatre in theatre clothes. If they have to do so in an emergency, they should put on fresh theatre clothes on their return. No unauthorized person may enter the theatre area and no peeping through doors should be allowed.

Scrubbing of hands must be carried out correctly and thoroughly, 10 minutes being the minimum time before the first operation and 5 minutes before each following case.

Control of Infection in the Wards

The practice of antisepsis and asepsis in the wards must be meticulous. Non-touch dressing technique must be followed and the hands must be scrubbed after attending to each patient. In some hospitals a special dressing room is provided in each ward, in which there is an incinerator for soiled dressings. All patients are dressed in this room and their dressings disposed of at once.

The whole ward area must be wiped and sprayed with a disinfectant at least twice weekly, over and above the individual areas done daily and on discharge of patients. Plastic hospital screens attract bacteria to them because of a positive electrical charge, and they must be wiped regularly with a disinfectant.

Comment

To sum up the problems of control, I can do no better than to quote Dr. C. W. Walters, Surgeon at Peter Bent Brigham Hospital, Boston:

'The hardest problem — *human behaviour* — remains. No amount of talking makes any impression. Individuals shun responsibility while endorsing recommendations, but only as they apply to someone else — it is always the other fellow's patients that must be isolated.

'All doctors, nurses and other personnel with respiratory disease or skin infections should eliminate themselves from the environment. Everybody must wear a mask properly. Everybody should be openly critical of those who ignore the criteria of safety — as an example, the joker at the operating table, who busily spreads his organisms into the wound with ill-timed humour. The guiltiest person in any situation can be found by looking into a mirror. Everybody must cooperate to suppress the hazard.'

TREATMENT OF THE ACTUAL INFECTION

The only time antibiotics should be prescribed is for the specific treatment of a particular infection. It is important that new drugs which are effective against the staphylococcus be withheld from general administration in the hospital. For the patients with serious staphylococcal infections, an active, short course of treatment with two suitable drugs given together should be used — this will help to prevent the rapid emergence of resistant strains. The drugs usually used in such cases are novobiocin and erythromycin in short, high-dosage courses.

In most cases of abscess formation, e.g. breast abscess, septic fingers, etc., only surgical drainage and isolation precautions are necessary. However, in staphylococcal pneumonia, pneumonitis and septicaemia, active antibiotic treatment is essential.

Staphylococcal carriers, and all persons during epidemics, should use nasal sprays and/or ointments specifically active against the staphylococcus, if they are working in the operating theatre and the maternity and surgical wards.

CONCLUSION

Finally, I must emphasize that it is important always to be aware of the staphylococcus as an occupational hazard for all hospital personnel, and as a potential danger to all patients. It is essential to keep the hospital clean at all times to avoid this serious infection.