How to combat nosocomial infection in developing countries

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Hospital-acquired infections constitute a significant problem throughout the world. Ways of dealing with them are reviewed below, with particular reference to conditions in the developing countries.

Hospital-acquired, or nosocomial, infections constitute a significant medical, social and economic problem in both developed and developing countries, causing morbidity, mortality and extended hospital stays. In the developing world the methods employed to tackle such infections should not simply copy those employed in developed countries, because of the different economic and cultural contexts. In this connection, WHO is endeavouring to stimulate effective action in developing countries by:

- proposing mechanisms for organizing the control of hospital-acquired infections;
- identifying mechanisms for the establishment of intercountry networks concerned with the conduct and preparation of hospital epidemiological studies and with the development of methods and procedures aimed at guaranteeing the quality of medical care in hospitals;
- disseminating information on procedures and standards for the prevention of hospital infections, on recent advances in disinfection and the control and use of antibiotics, and on methods for the surveillance of the health of hospital workers;
- establishing regional centres for training, each with access to a reference laboratory where plasmid and chromosomal enzyme restriction assays can be performed.

Control programmes can be expected to differ considerably from one country to another. Moreover, each hospital and medical centre has its own characteristics, even though similarities in category, numbers of beds, and medical and paramedical services may exist. Differences between institutions make it difficult to generalize about the effects of specific surveillance and control activities: it is important for every health care facility to have a specific programme for reducing the risk of hospital-acquired infections.

Some of the principal elements in an infection control programme for hospitals are:
- a surveillance system;
- regulations and policies aimed at reducing the risk of hospital-acquired infections;
- continuing education for hospital personnel.

Surveillance

The establishment of a surveillance system for the recognition of hospital-acquired infections is the logical first step. The nature of the system should reflect the characteristics of the hospitals covered and the intended goals. Priorities for surveillance should be estab-
lished in each institution, depending on the resources available and the complexity and heterogeneity of the population of patients. Initial investigations should lead to a realistic assessment of the nosocomial infection rate and should throw some light on associated morbidity, mortality and cost. Data on these matters are essential if adequate financial support for the infection control programme is to be obtained.

It is important to appreciate that surveillance may not have the desired influence on infection rates if objectives are not set. The aims of surveillance are to:

- identify nosocomial infections;
- identify outbreaks and epidemics;
- evaluate the appropriateness and effectiveness of isolation and other precautions;
- identify problems associated with procedures, policies, practices and equipment;
- report communicable diseases to infection control bodies;
- track resistant organisms and draw the attention of staff in hospital units to them;
- identify patients with resistant organisms on readmission;
- check the sensitivity of organisms to antibiotics in use and remind staff about resistance.

Surveillance is a continuous process with the following elements:

- definition of infections that are nosocomial, maternaly acquired and community-acquired, and of those that occur after patients have been discharged;
- systematic case-finding and consistent data collection;
- tabulation of data;
- analysis and interpretation of data;
- reporting to infection control committees and to individual units and services;
- monitoring the effects of control measures.

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No system of routine prospective surveillance is completely sensitive in respect of the identification of all nosocomial infections. Prospective clinical ward surveillance should be designed to give special attention to recognized high-risk groups; the highest priority should go to surgical patients in intensive care units.

Among the risk factors for nosocomial infections are:

- surgical procedures;
- indwelling urethral catheterization;
- continuous mechanical ventilatory support;
- immunosuppressive drug therapy;
- presence of community-acquired infection;
- confinement of patients in intensive care units.

**Infection control committees**

A special committee should be formed in each institution to provide basic support for hospital epidemiologists and to act as the central decision-making and policy-making body dealing with the control of nosocomial infections. Separate sets of guidelines should be prepared for tackling the problem in clinics, small hospitals and big hospitals. The regular members should be attached to major hospital departments, including that of clinical microbiology. The number, type and administrative placement of infection control personnel are usually determined by the size of the hospital and whether it is affiliated to a medical school.
In developing countries an infection control committee should comprise at least:

- a physician or, in the event that there is a special concern with wound infection, a surgeon;
- a nurse specially trained in infection control;
- the director of the laboratory in a large institution or a senior technician in a small one;
- a senior hospital administrator.

The infection control nurse occupies the key position in surveillance and control programmes, since nurses are the personnel having most physical contact with patients, including those at greatest risk. If the person in question is not energetic and adequately qualified the infection control committee is unlikely to achieve its objectives.

Laboratory support is required if blood infection occurs and also, to some extent, if there is urinary tract infection, but may not be needed in the event of wound infection or pneumonia. The regulation of different procedures as well as the policy of isolating patients should be determined according to the circumstances in each hospital. All recommendations should take account of the capabilities of the hospital and its personnel.

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Training

The training of personnel working on the programme can be simple, not unduly time-consuming, and incorporated into other training activities. It may be arranged to take place on two or three days every year. Simple textual materials should be prepared and distributed to the trainees.

For laboratory personnel, training should be simple, focused and should cover such matters as Gram-staining, the use of spores to test the efficacy of sterilization, the preparation of blood agar media, and the learning of definitions, for instance that of wound infection. Special attention should be given to techniques capable of serving more than one programme, such as the enzyme-linked immunosorbent assay.

Training at the district level is of value in teaching people to use the tools at their disposal, and supervision through field visits is very important. The most effective training, and the least wasteful of resources, is that given to personnel from institutions committed to the programme of hospital infection control.

First level of infection control

In developing countries, where funds are very limited and hospital-acquired diarrhoeal infections are a major problem, control should be tackled in stages. Resources should not be concentrated so as to give complete infection control in a small number of hospitals while others remain, for instance, without even clean water.

The first consideration should be the provision of water and food free from infective organisms, and laboratory tests should be conducted to ascertain whether this is being achieved, with special attention to milk and other foods that are particularly likely to be contaminated. A tuberculosis control programme and a vaccination programme should be initiated, covering all employees, including cleaning staff. Persons with diarrhoea or skin infections should be instructed to absent themselves from work.
Some matters may be of basic significance in some areas but not in others. Where there is a high incidence of malaria, for example, it is necessary to use screens or mosquito control measures and to ensure that hospitals do not become foci for the transmission of resistant malaria parasites. With regard to blood donations, tests should be carried out to exclude human immunodeficiency virus and hepatitis B and C viruses. It may eventually be possible to test for human T cell leukaemia viruses if the cost declines.

**Second level of infection control**

The sterilization of surgical instruments and other items is vital. Steam sterilization is the cheapest and easiest procedure, although chemical sterilization with glutaraldehyde is used in many countries. In the latter case, glutaraldehyde residues have to be removed by rinsing with sterile, or at least clean, water, depending on the purposes for which the sterilized items are intended. Water quality is very important for both dissolving glutaraldehyde and rinsing. Testing for sterilization and its efficiency should be performed at frequent intervals.

**Third level of infection control**

At this level one is concerned with choosing approaches to the control of nosocomial infections. Some examples follow.

**Wound infection.** Surgical wound infection is easy to diagnose and is the most readily preventable kind of nosocomial infection. Dealing with it is cost-effective and significantly diminishes the lengths of most hospital stays. The importance of wound infection is heightened in developing countries for a variety of reasons, among them the low resistance of many patients, attributable to poor nutrition.

The task of identifying wound infections is easy for hospital laboratories. If Gram-positive organisms are detected it is deduced that contamination has come mainly from a human, whereas with Gram-negative organisms the source is more likely to be a device or instrument. Gram-staining can lead to the identification of organisms of epidemiological significance which are not revealed in cultures.

**Bacteraemias.** Bacteraemias are difficult to diagnose. Sterile needles, fluids and tubing have to be checked, and if intravenous lines are used it is important to change the tubing every three days and the bags daily.

**Urinary infections.** With an open system it is impossible to prevent infection: patients become infected within three to four days. With a closed system, infection begins after 14 days on average, and consequently the system should be used for the shortest possible time. If urinary catheters are reused it is necessary to ensure that they are clean and sterile. Laboratories may simply report the presence of Gram-positive or Gram-negative organisms, or, if the facilities exist, species identification may be performed.

**Resistance to antibiotics**

The antibiotics employed should be the least expensive ones that are effective. Testing for antibiotic susceptibility is therefore desirable. Where resources are limited it is possible to
use sample sensitivity testing. If, for example, it is known that Staphylococcus is resistant to a certain antibiotic and sensitive to others, testing can be performed at intervals of, say, 30 to 40 specimens. Thus testing for sensitivity to penicillin and methicillin could be conducted for a while and a check could be made after some time in order to see if the situation had changed. On this basis very few patients are likely to receive an ineffective antibiotic. Where such a product is given, this is usually recognized clinically and a different one can then be administered. Data obtained on bacterial resistance not only help the committee responsible for the purchase of antibiotics to make sound choices but also provide a basis for subsequently monitoring the phenomenon. If antibiotics are used for prophylaxis they should not be given for more than two days; indeed there is evidence that administration is necessary for only one day. Most resistance appears after four to five days of treatment.

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In tackling the problem of nosocomial infections it is necessary to develop a surveillance system for the identification of patients at risk. Certain basic requirements have to be met, such as the provision of clean water, the sterilization of equipment, and the testing of blood intended for transfusion. The next steps are to control wound infection, to introduce antibiotic susceptibility testing, and to gather data on resistance. Where the resources are available, every isolate should be tested for resistance and species identification should be undertaken; other investigations might even be considered, such as plasmid testing.

The next stage, the development of a detailed surveillance system, would be very expensive, involving, for example, preparing cultures for all bacteraemias and urinary tract infections.

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