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**Руководство
к практическим
занятиям по общей
хирургии
(на английском языке)**

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General SURGERY

THE MANUAL

**The book is recommended by the Educational and Methodological Association
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In surgery, infections are very common and may even lead to death in spite of a high quality of operative technique. The prevention of such a complication in surgical practice is therefore a major challenge which should be based on the principles of asepsis and antisepsis.

The measures to prevent an infection from entering a wound are referred to as *asepsis*, while those to cause the exclusion or destruction of harmful microbes are generally called *antisepsis*.

The two principles represent the united whole in the prophylaxis of surgical infections. They have to be considered in terms of the interrelationship between the source of infection, its mode of transmission and the susceptibility of the body.

The *source* is taken to mean the place of dwelling, growth and proliferation of microorganisms. Relative to the patient the source of infection can be either *exogenous* (from outside) or *endogenous* (from within the body).

The main sources of *exogenous infections* include patients with purulent inflammation or «healthy» carriers of the microbes, and occasionally animals.

The *modes of transmission* from exogenous sources are usually as follows: airborne, direct contact and implantation (fig. A).

The major *sources of endogenous infections* incorporate chronic infections outside the area of the operation (e.g. skin diseases, dental or tonsillar conditions) or of the organs operated on as is (e.g. appendicitis, cholecystitis, osteomyelitis), as well as the oral, intestinal and respiratory saprophytes (fig. B).

Among the *modes of transmission* of endogenous infections are direct contact, lympho- and haematogenous spread.

To successfully prevent an infection, it is necessary to affect each stage of the infectious process, i.e. the source of infection, the mode of transmission, and the host.

ASEPSIS

A surgical hospital contains the main functional blocks which are as follows: a surgical block, surgery departments, plaster and treatment rooms and dressing-rooms.

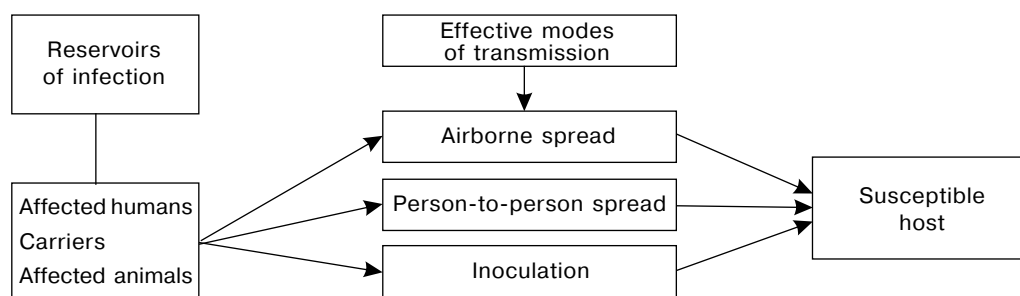


Fig. A. Extrinsic infection.

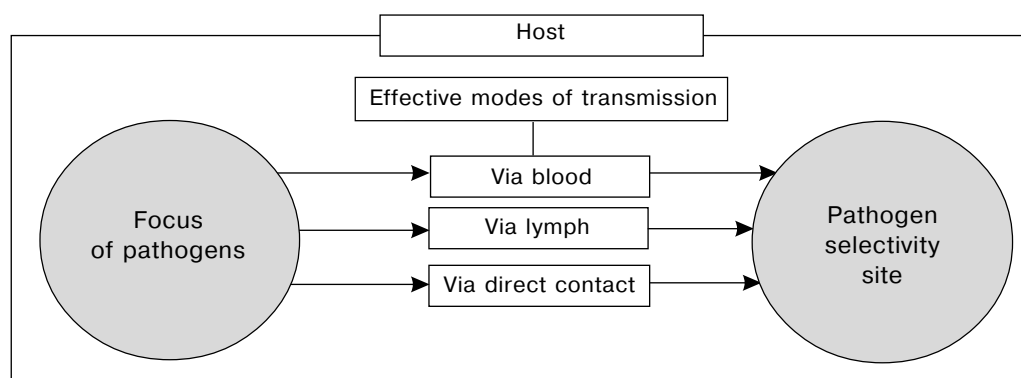


Fig. B. Intrinsic infection.

An operating unit houses special rooms for operating on patients. It has to be isolated from surgery departments on a separate floor or detachment of the building and be connected with them by a corridor.

To provide the regimen of sterility, there are the four special functional zones in the surgical block:

1. **The sterile zone**, i.e. the operating theatre (to operate on patients), scrub-up room (for preoperative cleansing surgeons' hands and arms) and the room for sterilisation (to sterilise the instruments to be used during the operation).

2. **The clean zone**, i.e. the rooms for personal hygiene and changing clothes of the staff.

3. **The technical zone**, i.e. the rooms where apparatus for air-conditioning or oxygen supplying and vacuum devices are stored.

4. **The dirty zone**, i.e. the sister's room, the room of the head of surgery and the one for dirty clothes etc.

The operating theatres equipped for using laminated sterile conditioned air are needed for the following types of operation: tissue grafting with subsequent application of immune suppressors, implantation of prosthetics, operations for burns.

Setting of a special isolator box with laminated air flow is possible in the operation rooms built long ago.

The compounds that have antibacterial effects fall into two main groups – chemotherapeutic agents (see «Antiseptics») and chemical agents for disinfection and sterilisation.

The compounds for disinfection and sterilisation are used to prevent microbes from entering the wound, i.e. to affect their transmission. Several chemical antibacterial agents can be applied as both a chemotherapeutic agents and those for disinfection and sterilisation (e.g. chlorhexidine, hydrogen peroxide).

Among the chemical agents for disinfection and sterilisation commonly used in surgical practice are as follows:

Trade name	Formulation	Indications	Notes
Iodine	1–5% alcohol solutions of iodine	Cleaning the skin around the wound, cleansing superficial wounds and bruises, and the operative field.	Lugole's solution is used for the sterilisation of catgut.
Iodate	Iodine plus sulphate; contains about 4,5% free iodine	Cleaning the operative site	Before use it has to be dissolved in distilled water in the ratio of 1:4,5
Povidon – iodine	A combination of iodine (0,1–1%) and polivinylpyrrolidone	Scrubbing the hands and cleaning the operative site.	
Chloramine B	1–3% solutions	Disinfecting the hands, items used for patient care, non-metallic instruments, rooms	
Formic acid		Cleaning hands before operations, washing surgical instruments and gloves.	Special solutions of the formic acid are prepared e.g. in combination with hydrogen peroxide (pervomur)
Mercury dichloride	Mercury dichloride 1:1000	Disinfecting rubber gloves, patient care items	This solution is seldom used (mainly in the outpatient set-up) due to its toxicity
Ethyl alcohol	70% and 96% solutions.	Disinfecting hands, operative site, and optical instruments, suturing material.	
Formaldehyde	Formaldehyde (36,5–37,5%)	Disinfecting gloves, instruments catheters drainage systems (2–5% solution)	

Trade name	Formulation	Indications	Notes
Triple solution	Formaldehyde — 20 g, carbolic acid or phenol — 10 g, sodium carbonate — 30 g, distilled water — up to 1000 ml.	Disinfecting gloves, instruments and drainage systems	A very effective disinfectant
Carbolic acid	Phenol (3–5% solution)	Disinfecting items of patient care	
Roccal (Roccal)	1% or 10% alkyl diethyl benzyl ammonia chloride	Sterilising instruments (1:1000; exposition period 30 minutes), gloves, drainages (1:4000; exposition period — 24 hours)	To prevent the instruments from corrosion sodium carbonate is added to the «working» solution in the ratio of 2 g/l.
Chlorhexidine	Cleaning the operative site and disinfecting instruments (70% solution alcohol; 1:400; exposition period — 2 minutes)		

Prevention of microorganisms' contact with the wound

Prevention of the contact (contagious) infection requires that everything that touches the wound be sterile. This is achieved via disinfection of instruments, as well as cleaning the surgeon's hands and operative site. Sterilisation of the suturing material prevents both contact and implant infection of wounds.

Sterilising instruments, operating sheets, towels and dressing materials involves the following stages:

- stage 1 — preparation of the materials,
- stage 2 — preparing for sterilisation itself,
- stage 3 — sterilisation,
- stage 4 — safe-keeping of the materials sterilised.

All these stages are to be performed in accordance with specific standards «Sterilisation and disinfection of materials for medical use».

Sterilisation of instruments

Stage 1 — preparation of the materials — is aimed at thorough mechanical cleansing of instruments; removal of pyogenic compounds and destruction of hepatitis viruses. The person responsible for this should always wear gloves.

The instruments that were used but not infected will be washed under running water separately with a brush for 5 minutes. In contrast, blood-stained

equipment must be washed immediately (without subsequent drying!), then soaked in one of special washing solutions, warmed to a temperature of 50 °C for 15–20 minutes, syringes being dismantled before washing.

The formulations of the washing solutions are as follows:

- *Solution A*
 Perhydrol — 20 g
 washing detergent — 5
 water — 975 ml.
- *Solution B*
 2,5% hydrogen peroxide — 200 ml
 washing detergent — 5
 water — 795 ml.

After soaking the instruments, particularly their corners and folds, instruments are washed with brush in the same solution and then rinsed in warm water for 5 minutes and in distilled for another. The instruments are then packed into a drying air steriliser under the temperature of 85 °C; thereupon these are ready for sterilisation.

The instruments contaminated with pus or intestinal contents are first soaked in enamel containers with 5% lysol for 30 minutes, then washed in the same solution with brush, rinsed with running water and soaked in one of the washing solutions; the further steps are as given above.

It is noteworthy that the equipment used to operate on patient with anaerobic infection should be soaked in a special solution that contains hydrogen peroxide (6%) and washing agent (0,5%) for 1 hour, then washed with a brush in the same solution be-

fore boiling for 90 minutes (it is only after this that the instruments will be ready for thorough sterilisation as is the case with instruments which have not been infected).

Injection needles are washed by first attaching syringes to them using warm water and 1% sodium hydrocarbonate, the canal being emptied with a mandrin and washed with 0,5% liquid ammonia and running water. The needle with its mandrin still in is then boiled for 30 minutes in 2% sodium bicarbonate and after 8–12 hours boiling is repeated in distilled water for 40 more minutes and dried. After this, the canal of the needle is to be dried by pushing in ether or alcohol with a syringe. The needles which have been contaminated with pus are thoroughly washed, the canal washed with running water and then soaked for an hour in 5% lysol, simultaneously washing the canal with lysol with the aid of a syringe before proceeding as in the case if the instruments have not been contaminated.

Drug and blood transfusion sets need to be washed thoroughly to prevent post-transfusion reactions and complications. Recently, these have been made disposable (to be used only once), which are sterilised by the producer. The other sets that can be resterilised will be dismantled immediately after use – the glass side, droppers and plastic tubes – to be thoroughly washed with running water by pressing on the plastic side to clear away any blood remnants. Certain parts of the system are soaked for 2 hours in a special solution (1% sodium bicarbonate and 1% ammonium solution) which had previously been warmed to the temperature of 60 °C. The other parts of the set should be boiled for 30 minutes in distilled water after washing with running water, washed again with water under pressure on the plastic tube to force out any blood stains, and boiled once again for 20 more minutes in distilled water. Thereafter, this set is arranged and packed for sterilisation.

Currently, medical *gloves* are disposable and previously sterilised by the manufacturer. If plastic gloves are to be used several times, those stained with blood are not disposed but washed under running water until all the blood is washed away, dried with a towel and soaked for 30 minutes in 0,5% ammonium or in a washing solution A or B. They are then to be washed with running water, dried, and packed for sterilisation.

To make sure the materials are free of blood stains following presterilisation, the benzidine test is applied. Three drops of 1% benzidine and hydrogen peroxide are put on the material or instrument tested; a bluish-green coloration suggests the presence of blood. This requires that washing (stage 1) be repeated.

Stage 2 – arrangement and package for sterilisation. For sterilisation in an air-drying steriliser the

instruments are arranged in a metallic box, vertically and in one layer with the lid open but lying by its side. Dismantled syringes are wrapped in two layers of special thick paper.

For the sterilisation in an autoclave (steam under pressure) the instruments are wrapped into towels or cotton cloth made into bag and arranged on a metal tray or net. Sets of instruments for typical operations on the heart, lung, bone, vessels are sterilised together; they are arranged on special trays and wrapped in sheets.

The cylinder and piston of the syringe are wrapped separately into gauze napkins then into a cotton bag, which is then placed into the dressing box. The sets are wrapped in cotton napkins and put in the steriliser.

Dried rubber gloves are sprinkled with talcum powder both inside and outside, arranged in pairs in gauze napkins and placed in a separate dressing box.

Stage 3 – sterilisation. Sterilisation of instruments, syringes (with the inscription «200 °C»), needles, glass containers is done with an dry-air oven (fig. 1). The materials are freely arranged on the steriliser's shelf and the apparatus switched on. With its doors open the steriliser is heated to a temperature of 80–85 °C to dry its interior and the instruments for 30 minutes. The doors are then closed and the temperature increased to 180 °C and maintained

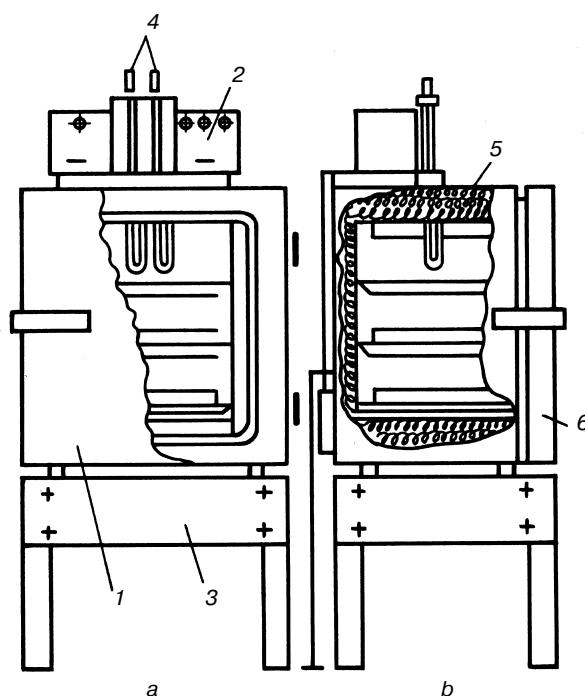


Fig. 1. Dry heat steriliser.

a – anterior view; *b* – lateral view; 1 – body; 2 – control panel; 3 – support; 4 – thermometers (direct contact and transistor thermal regulators); 5 – electric heaters; 6 – door.