

# **Evaluation and Management of Hospital Infections**

**edited by  
Ralph van Furth**

**5 New Perspectives in  
Clinical Microbiology**

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# EVALUATION AND MANAGEMENT OF HOSPITAL INFECTIONS

*edited by*

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# CONTENTS

LIST OF CONTRIBUTORS	XI
1. Introduction	
R. van Furth	1
2. Evaluation of antimicrobial resistance	
D.R. Schaberg	7
3. Plasmid typing as an epidemiological tool	
B. van Klingeren	13
Discussion	17
4. Clinical implications of acquired antimicrobial resistance	
I. Phillips	20
5. Antibiotic resistance in various municipalities in The Netherlands	
M.F. Michel	30
Discussion	34
6. Antibiotic prescribing in a general hospital	
F. Moss	37

7.	Insights into antibacterial pharmacotherapy and measures leading to control of drug use C.W.R. Phaf	49
	Discussion	56
8.	Antimicrobial resistance in hospital: New trends and control R.A. Weinstein	58
9.	Computer monitoring of drug resistance in the hospital R.P. Mouton	75
	Discussion	82
10.	Occurrence of infections and antibiotic prophylaxis in non-surgical patients P.J. van den Broek and W.E. Fibbe	85
11.	Implications and consequences of antimicrobial therapy for the development and transfer of resistance D. van der Waaij	119
	Discussion	128
12.	Don't touch the blade: Control of surgical sepsis O.M. Lidwell	131
13.	Comments on the occurrence and prophylaxis of surgical infections R.K.J. Koumans	151
	Discussion	155

14.	Nosocomial infections in compromised hosts	
	L.S. Young	160
15.	Antibiotic strategy in myelocompromised patients	
	J.W.M. van der Meer, W.E. Fibbe and	
	P.J. van den Broek	173
	Discussion	178
16.	Bacterial infection in the critically-ill neonate	
	D.A. Goldmann	180
17.	Nosocomial infections in the neonatal intensive	
	care unit	
	J.J. Roord, R.Ch. Senders and A. Fleer	200
	Discussion	206
18.	Infection in the renal transplant patient	
	N.E. Tolkhoff-Rubin and R.H. Rubin	209
19.	Factors contributing to an increased infection rate	
	after kidney transplantation	
	J.P. van Hooff and P.J. van den Broek	222
	Discussion	226
20.	Cost-benefit aspects of surveillance of hospital	
	infections	
	R.W. Haley	230
21.	Comments on issues in studying the cost-benefit	
	of hospital infection surveillance and control	
	programs	
	J.I. Hudson	244
	Discussion	249

22. Future trends in nosocomial infections:  
Understanding selectivity and specificity in  
microbial opportunism  
G.G. Jackson 251

## INTRODUCTION

R. VAN FURTH

Infection is an inseparable part of communal life, and infections are more common and more severe in hospital communities because the sick are more easily infected than the healthy. However, even though progress in the medical sciences has meant that many more patients suffering from relatively severe diseases can be helped at present, the use of more sophisticated and complex treatment leads to impairment of the defence mechanisms in more patients than was the case ten to twenty years ago, and these patients are also more prone to develop an infection.

Two questions are particularly relevant in this context.

1) Under what conditions do hospital infections occur? Defects of host defence mechanisms are of great importance in this respect. Such defects can be due to the disease or to the treatment given to the patient. 2) Which of the host defence mechanisms can be affected by a stay in the hospital? Among the factors involved in the host defence against infections (Table I), a number are especially important in this respect. For instance, venepuncture, indwelling catheters, and surgery all cause a breach in the surface structures. Anaesthesia causes temporary impairment of mechanical factors. Vascularization may be defective -- especially in the aged and patients with diabetes mellitus -- and this may complicate the healing of wounds in the skin and mucous membranes after surgery. The nutritional state is extremely important, because wound healing may be disturbed in the obese and malnourished, and infections are difficult to control in patients with endocrine disorders. All kinds of chemotherapy and other forms of treatment may interfere with host defence mechanisms, and patients are particularly susceptible to infections when granulocytopenia is severe, i.e., fewer than 500 cells per mm<sup>3</sup>.

Table I.

## FACTORS INVOLVED IN THE HOST DEFENCE AGAINST INFECTIONS

---

Surface structures	Horny layer of skin Mucosal epithelia
Surface secretions	Fatty acids and lactic acid of skin secretions Gastric acid
Mechanical factors	Ciliary movement Intestinal motility
Non-specific humoral factors	Lysozyme Lactoferrin Transferrin Complement
Specific humoral factors (immunoglobulins)	Antibodies
Cells	Polymorphonuclear leucocytes Mononuclear phagocytes (macrophages and monocytes) Lymphocytes
Vascularization	
Age	
Nutritional state	

---

Infections can be caused by micro-organisms either already carried by the patient himself (endogenous flora) or originating from another patient or personnel or inanimate objects (exogenous flora). When infections of the latter type occur in a hospital, they are called hospital-acquired infections to distinguish them from the community-acquired infections.

An important point with respect to hospital infections is the possibility of patients becoming colonized with new micro-organisms while in the hospital. Such newly acquired bacteria may have a pattern of antibiotic sensitivity differing from that of the patient's endogenous bacteria, and may even be multi-resistant. Colonization is unquestionably promoted by treatment of patients with antimicrobial drugs used for either therapeutic

or long-term prophylactic purposes. The main problem associated with the colonization of patients by (multi-)resistant bacteria in the hospital is that it may lead to the failure of standard regimens for routine antibiotic prophylaxis in surgery and the initial treatment of infections.

In view of the many risks to which patients are exposed during a stay in a hospital it would be interesting to know the true incidence of hospital-acquired infections, but such information is scarce. It may be assumed that in developed countries 5% of all admitted patients will acquire an infection during hospitalization; the rate varies among the wards, the highest usually being reported for surgical wards, followed by the medical and obstetrical-gynaecological wards. The rate is higher for very young infants and older people than for the other age groups. According to the summarized data from eight studies, given in Table II, the number of hospital-acquired infections showed no marked changes between 1964 and 1975 (1).

Table II.

INFECTIONS IN HOSPITAL PATIENTS\*

Infections	Community- acquired	Hospital- acquired	All infections
Urinary	15	30	22
Upper respiratory	6	3	5
Lower respiratory	32	17	25
Wound: minor	1	11	6
major	1	8	5
Skin	18	14	16
Female genital	4	4	4
Gastro-intestinal	3	1	2

\* from reference 1

A survey of the prevalence of hospital infections in England and Wales yielded some very interesting data (1). For instance, the infections most frequently acquired in a hospital were urinary-tract infections (30% of all infections), and these were found almost twice as often in females as in males. The results also showed that 9% of all patients had been catheterized, that 21% of the catheterized and 3% of the non-catheterized patients developed a urinary-tract infection, and that among the infected patients, 41% had been catheterized. These figures raise the question whether catheterization is properly performed; it seems highly probable that a proportion of these hospital-acquired infections can be prevented. Another interesting finding made in this prevalence study is that 78% of the infected non-catheterized patients, 60% of the infected catheterized patients, and 31% of the non-infected catheterized patients were treated with antimicrobial drugs. It is extremely doubtful that this treatment was necessary in the last two of these groups of patients. Among the other localizations the respiratory tract took the lead, such infections accounting for about 30% of the cases; in about 5% of them the upper respiratory tract was involved and in about 25% the lower respiratory tract. However, most of the latter infections (16%) were community acquired, which means that the patient had already had the infection before admission. In this survey, furthermore, about 5% of all wounds were infected, which is only slightly lower than the percentage found in other surveys.

These examples give an impression of the occurrence of hospital-acquired infections, which are still a serious problem. It is therefore very important to be aware of the risks a patient runs on being admitted to a hospital. Familiarity with the current state of affairs seems to produce oblivion: despite the regular presence of infection in the wards, the hospital's doctors and nurses frequently deny its existence, and acknowledge it only in the more exceptional circumstances of an outbreak. This situation often leads to overreaction when such events overtake the hospital staff, and this in turn sometimes leads them to take measures based not on careful consideration or proven facts but on belief.

The consequences of hospital-acquired infections for the patient are pain and misery, temporarily impaired functions, and perhaps even death. But these infections also involve an increased burden of extra expenditure for treatment and a longer stay in the hospital. In a recent study the extra costs were calculated of longer nursing in a hospital because of infection after colon surgery if short-term prophylaxis is not applied. If we assume for The Netherlands that 32,000 colon operations are performed a year (Centrum voor Informatie Verwerking Nederlandse Ziekenhuizen), and that the rate of infections amounts to 10%, the duration of hospitalization is increased by about 13 days (2), and one day in a hospital costs 600 Dutch guilders, we arrive at a total figure of about 25 million guilders extra hospital costs per year, not including the costs of the drugs, bandages, etc.

During the past year, interest in the control of hospital infections has increased. We must, however, define the conditions to be considered mandatory for reduction of the number infections acquired in the hospital, for example:

Awareness of endemic hospital-acquired infections.

Availability of quantitative information about endemic hospital infections.

Identification of areas in the hospital where infections are more likely to occur.

Rapid recognition of an outbreak of infections.

Awareness of the greater susceptibility of some categories of patients to infection by certain micro-organisms.

Awareness that some kinds of surgical or drug treatment make patients more susceptible to infections.

Availability of adequate regimes for prophylaxis with respect to infections.

Maintenance of a restricted antibiotic policy throughout the hospital.

Continuous education and practical instruction for the entire staff of the hospital.

Implementation of the regimens for aseptic techniques by infection-control personnel.

Awareness of the cost-benefit relationship in infection control.