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Nosocomial Infections in General Surgery: Surveillance Report from a German University Clinic

Summary: At the general surgery clinics, University of Giessen, we developed our own system for surveillance of nosocomial infections according to the guidelines of the Centers of Disease Control. Atlanta, USA, and according to the results of the SENIC Project. We wanted to receive information about the overall infection rate, the procedure specific infection rate, site specific infection rate, distribution of nosocomial infections by pathogen and resistance pattern of antibiotics at the general surgery clinics. The overall infection rate of operations, classified as clean, clean – contaminated, and contaminated and dirty, was 13%. The surgical wound infection rate of 3% after clean operations was mainly caused by an elevated infection rate of 13% after clean operations of a prolonged duration and hyperthermic perfusion of the extremities in patients with melanoma. There is also a difference in nosocomial infection rates at the general surgery ward (11%) and at the intensive care unit (29%). At the intensive care unit candida and coagulase negative staphylococci are mainly isolated whereas *Escherichia coli, Staphylococcus aureus* and *Enterococcus faecalis* dominated the general surgery ward. Different operations show different distributions of isolates; operations on the pancreas are prone to have infections with coagulase negative staphylococci, candida and *Pseudomonas aeruginosa*. The antibiotic susceptibility tests for the most commonly used antibiotics revealed no resistance problems for *E. coli, E. faecalis,* and *Staphylococcus aureus*, common pathogens at the general surgery ward, but did for coagulase-negative staphylococci where we can consider only a few antibiotics like amikacin in obvious infections at the intensive care unit.

Zusammenfassung: *Nosokomiale Infektionen in der Allgemeinchirurgie. Überwachungsstudie einer deutschen Universitätsklinik.* An der Allgemeinchirurgischen Klinik der Universität Giessen wurde in Anlehnung an die Richtlinien der Centers for Disease Control und die Ergebnisse der SENIC-Studie ein System zur Überwachung nosokomialer Infektionen entwickelt. Es sollten Daten zur Gesamtinfektionsrate und Verfahrens-spezifischen und Lokalisations-spezifischen Infektionsrate, zur Verbreitung nosokomialer Infektionen unter Berücksichtigung der Erreger und der Resistenzmuster an der Allgemeinchirurgischen Klinik erhoben werden. Die Gesamtinfektionsrate bei operativen Eingriffen, aufgeteilt nach sauberen, sauber kontaminierten, kontaminierten und schmutzigen Operationsbereichen betrug 13%. Die Wundinfektionsrate von 3% nach operativen Eingriffen in sauberen Bereichen war hauptsächlich dadurch bedingt, daß die Infektionsrate bei langdauernden Eingriffen in sauberen Bereichen und Operationen mit hypothermer Perfusion der Extremitäten bei Patienten mit Melanomen auf 13% erhöht war. Es ergaben sich auch Unterschiede in den Raten nosokomialer Infektionen auf der Allgemeinchirurgischen Station (11%) und der Intensivpflegestation (29%). Die Erregerisolate auf der Intensivpflegestation waren vor allem Candida und koagulasenegative Staphylokokken während auf der Allgemeinchirurgischen Station *Escherichia coli, Staphylococcus aureus* und *Enterococcus faecalis* am häufigsten waren. Das Erregerspektrum variierte mit der Art der Operation. Bei Eingriffen im Pankreas ergab sich eine Tendenz zu Infektionen durch koagulasenegative Staphylokokken, Candida und *Pseudomonas aeruginosa*. Häufig isolierte baktierelle Erreger wie *E. coli, E. faecalis* und *S. aureus* zeigten bei der Testung gegenüber den gebräuchlichsten Antibiotika keine Resistenzprobleme: Anders war es bei den koagulasenegativen Staphylokokken, wo uns zur Behandlung eindeutiger Infektionen auf der Intensivpflegestation nur wenige Antibiotika zur Verfügung stehen wie etwa Amikacin.

Introduction

There is a growing tendency to make reports on the impact of hospital acquired infections not only in scientific literature but also in the public press [1]. According to estimates of the German Federal Health Authority we have to take into account nearly 700,000 nosocomial infections in the Federal Republic per year [2]. Prolonged hospital stays and a rise in antibiotic consumption increase the hospital costs. The complications mean discomfort for the patients, an enhanced postoperative risk, and for some of them death. The most common nosocomial infections apart from wound infections (surgical infections) are urinary tract infections, pneumonia and sepsis [3]. The risk depends not only on the type of underlying disease, but also on the duration of the operation [4]. The incidence of nosocomial infections fluctuates between 5.9% and 15.5% according to the literature whereas the infection risk has evidently increased. The reasons for that are manifold: more patients

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with impaired host defenses are operated on, increasingly we use invasive methods, often antibiotics are used thoughtlessly and the preoperative diagnostic procedures in the hospital lengthen the hospital stay [5]. Despite all precautionary measures there will always remain a certain amount of nosocomial infections; our intention has to be to lower the rate of infection. Studies demonstrate that after initiation of hospital infection control measures infection rates decrease dramatically *(Cruse, Daschner)* [6, 15]. Perhaps the most reliable estimates of the overall rates and distribution of nosocomial infection are derived from the Study on Efficacy of Nosocomial Infection Control (SENIC) that gave a description of the current status of infection control surveillance, control programs and nosocomial infection rates in a representative sample of general hospitals in the USA. Besides these two objectives the relationship between the characteristics of hospitals and patients, the components of infection surveillance and control programs, and changes in nosocomial infection rates at specific infection sites and on specific services were studied [7–9]. In Germany reports on epidemiologically controlled infection rates are only rarely published. Despite efforts for surveillance of nosocomial infections and for education in infection control in Germany, infection control could not get off the ground basically because of the fact that there is no institutional infection and disease control authority. Effective surveillance programs must use information from a wide variety of sources keeping in mind that it is impossible to review data from all patients on a daily or weekly basis. Therefore programs must be developed by individual institutions to identify patients who are at the greatest risk for acquiring nosocomial infections [9]. This includes:

1) Definition of categories of infection;
2) Systematic case finding and data collection;
3) Tabulation of data;
4) Analysis and interpretation of data;
5) Reporting of relevant infection surveillance data to individuals and groups for appropriate action [9].

At the general surgery clinics, University of Giessen, we carry out surveillance of nosocomial infections by help of electronic data processing to get information about:

1) Overall infection rate;
2) Procedure specific infection rate;
3) Site specific infection rate;
4) Distribution of nosocomial infections by pathogens;
5) Resistance patterns of antibiotics.

Methods

During the follow-up of the investigation all nosocomial infections of patients at the general surgery clinics were registered. According to definition we considered all infections which occurred 48 hours after hospital admission or which were related to operations as nosocomial infections. For the surveillance of superficial and deep surgical wound infections, sepsis, pneumonia and urinary tract infections we use the definitions of the Centers of Disease Control (CDC), Atlanta, USA [4, 11]. All operations were classified according to the criteria of the National Nosocomial Infection Study [13] into the categories of clean, clean – contaminated, and contaminated and dirty. Thyroid operations, herniotomies, dissection of regional lymphnodes in melanoma were considered clean; lung resections or uncomplicated appendectomy or cholecystectomy belonged to the category clean – contaminated; operations on the large bowel were in general contaminated; perforation of bowel and hollow organs or manifest infection at the time of operation (local or diffuse peritonitis, abscess formation) was classified dirty. The classification was done immediately after the operation. Moreover time and course of the operation as well as intraoperative complications were recorded. In regard to our recommendations for antibiotics, antibiotic one-shot prophylaxis (mezlocillin or cefuroxime/metronidazole) is mandatory in large bowel surgery. Also all patients at risk of developing a nosocomial infection with concomitant diseases such as carcinoma or bleeding ulcers of the stomach, cholangitis or biliary obstruction and old age or with clean operations and prolonged duration such as in hyperthermic perfusion of the extremities should receive prophylactic antibiotics. A second shot is normally given after three or four hours operation time. On a nosocomial infection worksheet we took note of the patients' personal data, diagnosis and clinical data on infection signs and location (respiratory tract, urinary tract, superficial and deep surgical wound infections, sepsis, catheter infections), in addition therapeutic interventions, in particular time and duration of antibiotic treatment. Samples for microbiologic evaluation were obtained in case of supposed infection or evident intraoperative infection. In the case of wound swabs transport to the laboratory was carried out by aerobic and anaerobic transport media (Port-à-Cul, Becton Dickinson, Heidelberg; Transwab, Mast Diagnostika Hamburg). In wound infections wound swabs or material from drainages was investigated and depending on each single case also blood cultures, catheter tips of central venous lines and urine cultures. In supposed respiratory tract infections the sputum, and in intubated patients the tracheal secretions were examined. Besides blood cultures and swabs from the trachea all material collection was done by the nurses of the ward when requested by the physician. The author was responsible for infection surveillance.

Patient charts or microbiology reports were discussed with the physician responsible or nurse in the case of differences to criteria and reporting standards of the infection control program. The cultivation and identification of the pathogens was carried out according to the recommendations of the German Microbiology Society (Deutsche Gesellschaft für Hygiene und Mikrobiologie [DGHM]) [12]. Susceptibility testing was done using the agar diffusion test according to the National Committee for Clinical Laboratory Standards (NCCLS) [13]. Information on the amount of isolated pathogens (abundant, many, few isolates) as well as on relevance (e. g. prolonged transport time, contaminated samples) were included in the examinations. Another sample was obtained in general when we suspected a newly developed infection or resistance. Secondary infections or a change of pathogens were especially distinguished. A change of pathogen in an existing infection was considered a new infection. So called copy strains were excluded from the survey. The data from operation records, standard infection sheet, microbiology reports and from the hospital administration were stored in a personal computer. A software program, which was developed by us for this purpose, enabled us to receive information on the relation between the frequency of infections, contamination, operations and pathogens.

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Figure 1: Distribution of nosocomial infection, wound infection, bacteremia, urinary and respiratory tract infection.

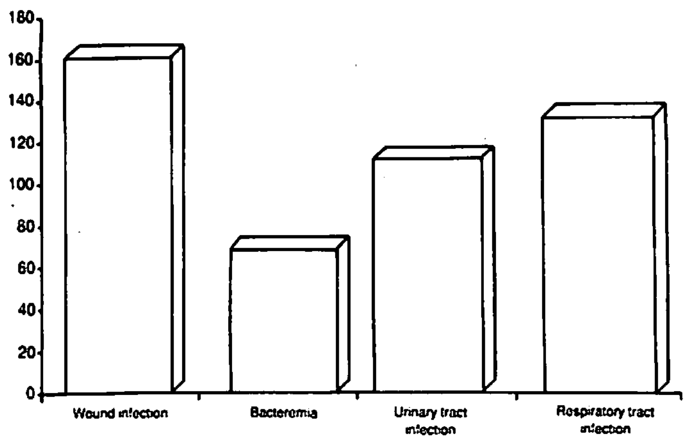


Figure 2: Pathogens in nosocomial wound infections.

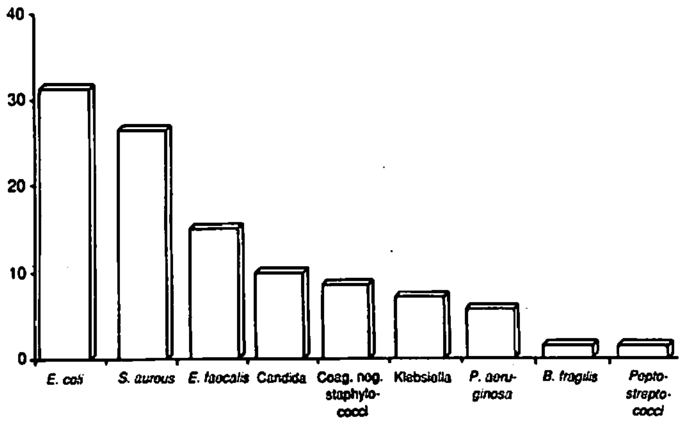


Figure 3: Pathogens in nosocomial infections.

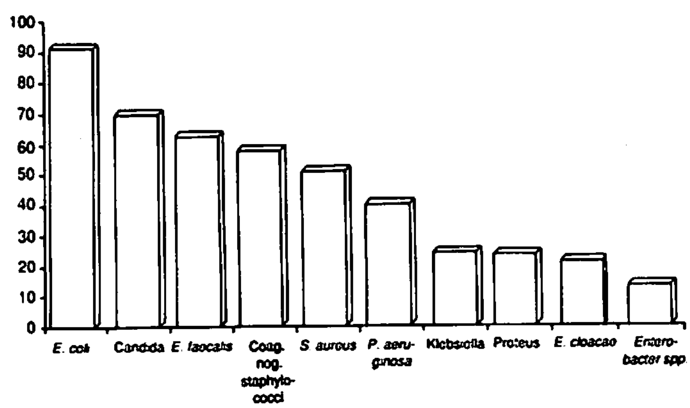


Figure 4: Distributions of pathogens in nosocomial infections at the intensive care unit.

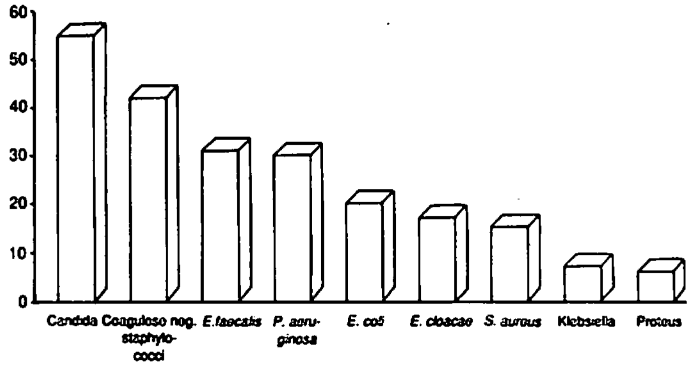
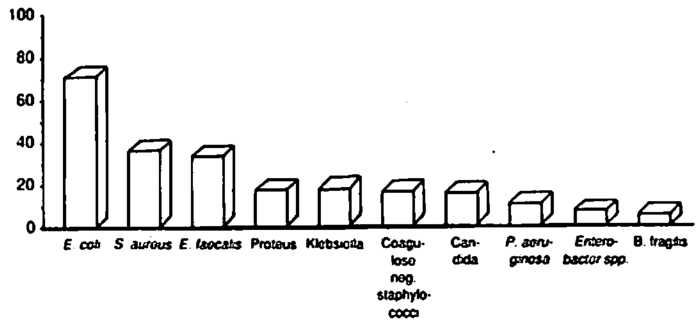


Figure 5: Distribution of pathogens in nosocomial infections at the general surgery ward.



Results

From 1 January 1988 to 31 March 1989 3,220 patients were admitted to the general surgery clinics. The nearly 700 pediatric operations are not included in this survey. 286 patients were temporarily at the 14 bed intensive care unit. The mean age of all patients was 54 years, and the patients stayed 12 days in hospital on average. 2,255 operations were necessary in all these patients: in 1,773 patients one operation, in 137 patients two operations and in 53 patients more than two operations were carried out. The operations were divided into the following categories: neck, thorax, esophagus, abdomen (in general), stomach and duodenum, hepatobiliary tract, pancreas, small bowel, appendix, large bowel, proctological surgery, hernia, melanoma, and other operations (if not included in one of the other areas).

A total of 529 nosocomial infections occurred of which 164 were surgical wound infections. The prevailing pathogens in surgical wound infections were *Escherichia coli* and *Staphylococcus aureus* (Figure 2) and in all nosocomial infections *Escherichia coli*, candida and *Enterococcus faecalis* (Figure 3). The intensive care unit showed a striking difference in the distribution of pathogens isolated from nosocomial infections (Figure 4) with candida and coagulase

Table 1: Distribution of operations and nosocomial surgical wound infections according to the contamination.

Contamination	Operations		Infections Total nosocomial		Infections Surgical wound	
	n	%	n	%	n	%
Clean	804	41	57	7	27	3.3
Clean-contaminated	521	26	79	15	23	4.4
Contaminated	311	16	64	20	36	11.5
Dirty	326	17	57	17	33	10.2
	1962	100	257	13	119	6

Table 2: Distribution of operations and nosocomial infections according to contamination at the first operation at the general surgery ward.

Contamination	Operations		Nosocomial infections	
	n	%	n	%
Clean	742	42	47	6
Clean-contaminated	445	25	54	12
Contaminated	277	16	53	19
Dirty	293	17	44	15
	1757	100	198	11

negative staphylococci in almost 50% of the isolates. In the distribution of nosocomial pathogens at the general surgery ward *E. coli, Staphylococcus aureus* and *E. faecalis* were the prevailing pathogens (Figure 5). In clean operations, which make up 41% of all primary operations, there were 7% nosocomial infections in total and 3.3% surgical wound infections. The more contaminated the operation was, the more the risk for a nosocomial infection grew. In contaminated and dirty operations there were about 10% surgical wound infections (Table 1). It was not unexpected that the nosocomial infection rates at the intensive care unit would be high in comparison to the general surgery wards (Tables 2, 3). The infection rate varied according to the operation classification. Only seldom we saw surgical wound infections after clean operations in the neck and thorax (Table 4). Clean – contaminated, contaminated and dirty operations showed surgical wound infections up to 13.3%. The pathogens were mainly gram-positive bacteria (Table 5). In operations on the stomach and duodenum, small bowel and large bowel there was a growing number of contaminated and dirty operations in this order. To our surprise the surgical wound infection rate in contaminated and dirty small bowel operations was higher (15–30%) than in operations of the same degree of contamination in the large bowel (13%). This is also true for contaminated and dirty operations of the pancreas with a high rate of surgical wound infection of 37.5% and 42.8%, respectively (Table 4). In operations of the proximal part of the gastrointestinal tract the majority of isolated pathogens were enterobacteriaceae and enterococci. Besides these pathogens often anaerobes were cultured in nosocomial infections after large bowel operations (Table 5). We had a relatively high surgical wound infection rate of 13% (n = 12) after clean operations with tumor excision and resection of regional lymph nodes due to melanoma in the extremities. In 91 patients, 16 nosocomial infections were observed. In the majority perfusion with cytotoxic agents for progressive melanoma had been carried out with operation times of more than three hours. The main pathogens isolated from wound infections were *S. aureus*, coagulase negative staphylococci and enterococcus (Table 5). The antibiotic susceptibility tests revealed that at the general surgery ward, where *S. aureus, E. coli* and *E. faecalis* dominate, we do not see any problems with resistance to frequently used antibiotics (Table 6). No doubt, coagulase negative staphylococci, in the case of obvious infection, restrict antibiotic treatment to a few antibiotics such as amikacin with a susceptibility of 90% of this pathogen (not shown in Table 6).

Discussion

The risk of surgical wound infection after clean operations is indicated in the literature [14] at 1.5–5.1%, in clean – contaminated operations at 7.7–10.8%, in contaminated operations at 15.2% to 16.3% and after dirty operations at 28–40%. In our hospital the infection rate in clean-contaminated, contaminated and dirty operations was lower (Table 1) than in other studies [15], although we had 10–13% more operations in these categories. While 75% of all operations in the NAS-NRC study were clean operations we had only 41% clean operations [16, 17].

The infection rate after operations of the pancreas was remarkably high in our hospital. This may be due to the relatively small case numbers, the prolonged operation time or the often necessary postoperative supervision at the intensive care unit. The impact of operation time on infection rate has already been demonstrated [17]. In any case we

Table 3: Distribution of operations and nosocomial infections according to contamination at the first operation at the intensive care unit.

Contamination	Operations		Nosocomial infections	
	n	%	n	%
Clean	62	30	10	16
Clean-contaminated	76	37	25	33
Contaminated	34	17	11	32
Dirty	33	16	13	39
	205	100	59	29

Table 4: Surgical wound infections according to the operation classification and contamination.

Contamination	Neck		Thorax		Stomach duodenum		Small bowel		Hepato-biliary		Pancreas		Large bowel	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Clean	174	0.5	95	0	10	0	–	–	6	33.3	–	–	–	–
Clean-Contaminated	35	11.3	133	2.2	56	10.7	25	12	167	4.2	19	15.8	–	–
Contaminated	8	12.5	17	19.7	16	18.7	14	21.4	29	6.9	8	37.5	170	12.3
Dirty	5	0	15	13.3	14	14.3	19	31.6	13	15.4	7	42.8	60	13.3

have to pay more attention to those operations which we have recently done by extension of the indication for perioperative antibiotic prophylaxis for procedures with prolonged duration and elevated infection rate.

The infection rate after contaminated small bowel operations was higher than reported in the literature [14] which may be due mainly to the fact that small bowel operations had to be carried out very often as emergency procedures. In clean operations it is now quality standard to have a surgical wound infection rate below 2.5% [14]. In our survey a wound infection rate of 3.3% after clean operations was found; the 12 patients suffering from surgical wound infections after melanoma operations were mainly responsible for this elevated rate. In these patients we have to take into account an infection rate above the average 13% for surgical wound infections. Certainly the operation time of more than three hours will influence the infection rate [15]. But it is also possible that pathogens such as *S. epidermidis* (coagulase negative staphylococci) play an important role because the local immune defense system is impaired by the perfusion with cytotoxic agents. If we exclude the melanoma, the surgical wound infection rate drops to 1.8%. The percentage of isolated coagulase negative staphylococci in wound infections after clean operations is at 9% only insignificantly higher compared to a survey by *Daschner* from 1976 to 1980 [19].

Table 5: Distribution of pathogens in nosocomial/surgical wound infections according to the operation classification.

Pathogens	No.		Thorax		Stomach duodenum		Hepato-biliary		Pancreas		Small bowel		Large bowel		Melanoma	
	n	c	n	c	n	c	n	c	n	c	n	c	n	c	n	c
Aerobes:																
Staphylococcus aureus	32	15	6	–	3	3	6	4	6	2	3	–	4	2	4	4
Coagulase negative staphylococci	39	8	7	–	8	3	–	–	11	3	4	–	5	–	4	2
Enterococci	44	15	6	–	7	3	5	1	6	2	5	3	11	4	4	2
Streptococcus pneumoniae	5	–	2	–	–	–	1	–	–	–	1	–	1	–	–	–
Haemophilus influenzae	2	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–
Escherichia coli	68	27	4	–	7	3	10	3	7	2	15	8	23	10	2	1
Klebsiella sp.	18	8	–	–	–	–	5	–	4	3	4	2	4	2	1	1
Proteus	14	9	–	–	3	1	–	–	–	–	5	5	5	2	1	1
Enterobacter	16	5	–	–	3	1	3	–	1	1	2	–	6	2	1	1
Serratia	3	2	–	–	–	–	–	–	2	2	–	–	1	–	–	–
Pseudomonas	25	8	2	–	2	–	1	–	9	5	6	2	4	1	1	–
Anaerobes:																
Bacteroides fragilis	7	6	–	–	–	1	–	–	–	–	–	–	7	5	–	–
Peptostreptococci	6	4	2	–	1	1	–	–	2	2	–	–	1	1	–	–
Candida	45	13	7	–	8	3	1	–	10	3	5	2	13	5	1	–

n = Nosocomial infections;
c = surgical wound infections.

Table 6: Antibiotic susceptibility results of the main pathogens isolated at the general surgery clinics.

	Ampicillin %	Gentamicin %	Cefuroxime %	Ofloxacin %	Cotrimoxazole %	Cefotiam %	Cefotaxime %	Cephazolin %	Amoxicillin/Clavulanic acid %
Escherichia coli	65	100	85	100	90	93	100	81	74
Streptococcus faecalis/faecium	93	0	0	21	86	0	0	0	100
Coagulase negative staphylococcus	8	50	63	47	34	66	24	66	68
Staphylococcus aureus	22	94	93	69	94	96	79	96	87
Pseudomonas aeruginosa	0	46	4	88	0	0	7	0	0
Klebsiella	0	92	67	95	88	96	92	79	67
Enterobacter cloacae	0	95	6	100	95	14	35	5	0
Enterobacter species	0	100	43	100	92	67	70	0	0
Proteus	59	91	69	100	66	68	100	55	77

% = Percent of isolates sensitive.

In the past coagulase negative staphylococci were regarded as harmless contaminants, but in the last few years they have been recognized more and more as pathogens especially in combination with transient or permanent foreign bodies like plastic material [20–22]. Especially in the case of an impaired immune defense system they cause life threatening infections. Due to the growing number of multiresistant strains they are becoming more and more of a problem [23]. *E. coli* and *S. aureus* were the most common pathogens in surgical wound infections at our clinics (Figure 2). Enterococci were in the third position as infectious agents after operations in the gastrointestinal tract, which is compatible with their natural location. These data agree with the results of the NNIS study and the study of *Daschner* [3, 14]. The isolation rate of candida in nosocomial infections was remarkably common (Table 5). An increase of candida infections in surgical departments has been reported in other surveys [24–26]. Broad spectrum antibiotics and impairment of the immune system by cortisone and cytotoxic agents may be responsible for this increase. In our study the isolates were mainly from tracheal cultures of intubated patients in the intensive care unit. These patients have a weakened immune defense system in addition and are at increased risk of infection due to prolonged antibiotic therapy.

The spectrum of pathogens varies according to the operation areas (Table 5) which has to be considered when we start antibiotic therapy before the results of the susceptibility tests are available (empiric antibiotic therapy). There are differences between hospitals and departments. Also the resistant situation shows fluctuations from hospital to hospital. One multicenter study clearly demonstrated that susceptibilities to antimicrobial agents vary among medical institutions [27]. Geographical differences may also exist, resistance may develop or difference in the broth may cause conflicting results [28]. The results of anonymous collection statistics cannot be transfered to the single department [29]. Only the continuous surveillance of the pathogen and resistance situation of the department or the clinics can give appropriate information for the selection of antibiotic therapy. Combined with the results of the resistance patterns, our data permit clear recommendations for perioperative prophylaxis and antibiotic therapy tailored for our clinics and each single situation. The costs due to the nosocomial infections are enormous [2]. In contrast to the recommendations of the Centers of Disease Control, the advice of the German Federal Health Authority (Bundesgesundheitsamt) for the prevention of nosocomial infections is rather vague [30]. Thus, we should look for measures which are suitable to lower the risk of nosocomial infections.

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Information

DIN Deutsches Institut für Normung e. V.

Normenausschuß Medizin (NAMed) would like it to be known that the standardized results of working committee E 10 "Chemotherapeutic Methods of Investigation" of the DIN Deutsches Institut für Normung e. V. (German Institute for Standards) will be made available to interested parties.

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Prolonged Unexplained Pyrexia: A Review of 221 Paediatric Cases from Kuwait

Summary: Over a three year period (January 1985 through December 1987), 221 children with prolonged pyrexia were admitted to the paediatric departments in two regional hospitals in Kuwait. Infections, connective tissue diseases and malignancies constituted 78%, 5% and 2%, respectively, and 15% of the cases remained undiagnosed. Brucella was the most common infectious agent encountered (38% of all cases), followed by typhoid fever (9%). The duration of fever was more helpful in the differential diagnosis than its height or pattern. The erythrocyte sedimentation rate and the white blood count were of limited value, and the C-reactive protein was positive in bacterial infections, malignancies and connective tissue diseases. Since a child presenting with prolonged pyrexia in this country has over a 70% chance of having a bacterial infection, both diagnostic and therapeutic procedures should be performed as an emergency measure. Particular emphasis should be put on the exclusion of brucellosis.

Zusammenfassung: *Anhaltendes Fieber unbekannter Ursache: Übersicht über 221 pädiatrische Fälle aus Kuwait.* Innerhalb drei Jahren (Januar 1985 bis Dezember 1987) wurden in die pädiatrischen Abteilungen von zwei regionalen Krankenhäusern in Kuwait 221 Kinder mit anhaltendem Fieber unbekannter Ursache eingewiesen. 78% der Fälle beruhten auf Infektionen, 5% auf Erkrankungen des Bindegewebes, 2% waren maligne Erkrankungen; ohne ätiologische Abklärung blieben 15% der Fälle. Brucella war mit 38% aller Fälle der häufigste Infektionserreger. Die zweithäufigste Infektionskrankheit war Typhus mit 9% der Fälle. Von differential-diagnostischem Wert war mehr die Dauer als die Höhe des Fiebers und der Fieberverlauf. BKS und Leukozytenwerte waren von begrenztem Wert; das C-reaktive Protein war sowohl bei bakteriellen Infektionen wie bei Erkrankungen des Bindegewebes oder malignen Krankheiten erhöht. Die Tatsache, daß mehr als 70% der Fälle von anhaltendem Fieber bei Kindern in diesem Land durch Infektionen bedingt sind, rechtfertigt, sowohl die diagnostische Abklärung wie die Therapie unverzüglich einzuleiten. Auf den Ausschluß einer Brucellose sollte besonders großer Wert gelegt werden.

Introduction

Prolonged pyrexia of unknown origin has been the subject of numerous reviews, both in adults [1–4] and in children [5–7]. All of these reviews have addressed the clinical dilemmas of prolonged pyrexia of unknown origin in the developed world, where infections constitute one third to one half of all cases [1, 4–7]. A recent review [8] discussed the changing patterns of prolonged pyrexia of unknown origin and highlighted the increase in the proportion of neoplastic conditions and viral infections, and the decline of tuberculosis and similar infections that predominate in developing countries. However, clinicians working in developing countries have few guidelines for the differential diagnosis of prolonged pyrexia of unknown origin. This prompted us to review this problem in Kuwait, a rich country that still shares with other developing countries their major health problems. The patterns of prolonged pyrexia of unknown origin in this area are highlighted and compared with published experiences from the developed world.

Patients and Methods

The study is a retrospective analysis of the hospital records of all children admitted with prolonged pyrexia of unknown origin between January 1985 through December 1987. It was conducted in two of the country's five regional hospitals, serving a population of 0.8 million, 38% of whom are under the age of 12 years (1985 census).

Prolonged pyrexia of unknown origin was defined as a rectal temperature of ≥ 38.3 °C for at least two weeks [5], or for over a week of study in hospital [1, 4]. The final diagnosis was based on a constellation of clinical and laboratory findings [5], that included positive culture, serology, tissue biopsy and various imaging procedures. The diagnosis of systemic onset of juvenile rheumatoid arthritis (JRA) brucellosis was made on the basis of positive serology (a titre of > 1 : 320) using standard agglutination test. Typhoid fever and septicaemia were diagnosed on the basis of positive blood culture. The diagnosis of urinary tract infection was made on the finding of a colony count of > 10^8/l in at least two morning midstream urine samples, or any count in a urine sample taken through suprapubic puncture in infants and young children. Children were included under "pneumonias" on the basis of clinical and radiological findings. Direct identification of viruses was not performed and cases were included under viral infections when there was clinical and/or serological evidence of the nature of the illness (infectious mononucleosis, herpetic infections, hepatitis). Children with a self-limited course and without such evidence were included in the category of undiag-

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