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Misuse of Antibiotics in a Hospital, An Environmental Health Problem

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Abstract: Nosocomial infection surveillance is not common in the Iran but few hospitals use it. The incidence of nosocomial infection and prevalence of antibiotic misuse were studied in a 70-bed community hospital in Iran. All pathogenic strains were tested for their susceptibility to antimicrobial agents using the standardized agar disc diffusion test. Mueller-Hinton agar and Mast antibiotic discs (Mast Diagnostics Ltd, Bootle and Merseyside, UK) were used. Different panels of antibiotics were employed for Gram-positive and Gram-negative organisms and also for urinary isolates. Susceptibility or resistance was determined on the basis of the size of the diameter of the zone of growth inhibition, according to the chart of interpretive standards. 45% of patients admitted developed nosocomial infection. The rates were highest for nursery (32%), intensive care (21%), gynaecological (15.5%) and surgical (9.8%) patients. Urinary tract (39%), wound (24%) and blood (11.2%) infections accounted for more than 70% of the infections. *Staphylococcus aureus* (24.9%) and *Pseudomonas aeruginosa* (14.7%), caused more than 90% of the infections. The most frequent pathogens were *Staphylococcus aureus, Pseudomonas aeruginosa*, other *Gram-negative aerobes* and Candida spp. Some microorganisms such as *Klebsiella, E-coli* were resistance to 5 antibiotics. *Coccobacill gram negative* was resistance to 3 antibiotics. Some gram negative bacteria showed resistance to 6 antibiotics. The majority of the bacterial pathogens (75%) were multidrug resistant. Overall, Nosocomial infections were associated with an increased risk of antibiotics resistance.

Key words: Nosocomial infection · antibiotics · hospital · health problem · North of Iran

INTRODUCTION

Globally, antibiotic resistant bacteria increasing in frequency and numbers can cause an environmental health problem in the community. Infection is the most common cause of death following injury. Now, Nosocomial infection or Hospital-acquired infections have been common problems in every hospital or places prepared for patient cares. This problem is likely to be greater in developing countries than the developed countries. Resistance casts a shadow on the treatment of all microbial diseases-bacterial, viral and parasitic. The phenomenon includes a variety of organisms and drugs. The public health consequences of resistance are greater now than ever before because an expanding multidrug resistance in a single organism severely restricts therapeutic options [1].

The incidences of nosocomial infections have been reported in very high rate in limited studies in Iran and some developing countries [2-4]. In general, *gram-positive cocci* are reported with increasing frequency in nosocomial infections.[2] Pseudomonas aeruginosa reported the leading cause of nosocomial infections in Iranian burn center in Tehran, Iran [4, 5]. Incidence of an antibiotic resistance of strains is roughly proportional to the quantity of an antibiotic used in a hospital [6, 7]. These resistance strains, which are carried by patients and hospital personnel, infect wounds and cause pneumonia, enteritis, genitourinary-tract infections and septicemia. Therefore, patients go to the hospital to be cured, but will take some acquire infections as well as prolong their stay and bed shortage in the hospital. Antibiotic misuse is a major public health problem in many areas of the world and Iran is one of this areas. Multi-drug resistance of the microorganism is another complication in these patients [8-10].

Purpose of this study was analyzed the incidence of nosocomial infection and prevalence of antibiotic misuse in a 70-bed community hospital in north of Iran.

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MATERIALS AND METHODS

The study was conducted during a period of 6 months (from June to Nov) at the Shohada Hospital in Bandar Gaz City, North of Iran. 80 patients admitted in this study. All 80 patients admitted to the 70-bed hospital over the 30 days period between Oct. and Nov. was included in the study of nosocomial infection and antibiotic resistance. All pathogenic strains isolated from patients, were tested for their susceptibility to antimicrobial agents using the standardized agar disc diffusion test. Nutrient Agar or Mueller-Hinton agar and antibiotic discs (Mast Diagnostics Ltd, Bottle and Merseyside, UK) were used. Different panels of antibiotics were employed for Gram-positive and Gram-negative organisms and also for urinary isolates. Susceptibility or resistance was determined on the basis of the size of the diameter of the zone of growth inhibition, according to the chart of interpretive standards. All antibiotic used in the hospital obtained from 20 March until Nov. We had taken 91 samples from all over the hospital (medical instruments, beds, hands, ground, kitchen rooms, patient clothes and etc. then cultured the samples in blood agar and EMB (eosin methylene blue) and followed by IMViC and Catalase tests for isolation bacteria and determination of genus and species. The patient's files were all evaluated and questioned by an infection control nurse for details of diagnosis on admission, any underlying illness or apparent host risk factor and etc. On discharge of each patient, the information from the patient's case notes of any surgical or other procedures, antibiotic prophylaxis or treatment, clinical condition, infection, laboratory diagnosis and date of discharge were studied.

Nosocomial infections were diagnosed on the basis of clinical and/or laboratory data. Any infection manifesting 72 h or more after admission was considered nosocomial [11, 12]. For newborns, we considered nosocomial all infections that did not appear to have been transmitted transplacentally [13].

RESULTS AND DISCUSSION

Eighty patients were admitted to the various sections of the hospital during the study period, of whom 42.6% were male and 57.4% female. Their ages varied between less than one year and 85 years; 63% were 50 years old or younger. About 4% of the patients had culture confirmed community-acquired infections but this increased to 42% when including those infections diagnosed on admission only clinically. Patients were hospitalized a mean of 4.1 days per patient. The incidence density or the rate of nosocomial infection per 1000 patient-days was 20.4. 45% of patients admitted developed nosocomial infection. The rates were highest for nursery (32%), intensive care (21%), gynaecological (15.5%) and surgical (9.8%) patients. Urinary tract (39%), wound (24%) and blood (11.2%) infections accounted for more than 70% of the infections. Staphylococcus aureus (24.9%) and Pseudomonas aeruginosa (14.7%), caused more than 90% of the infections. The most frequent pathogens were Staphylococcus aureus, Pseudomonas aeruginosa, other Gram-negative aerobes and Candida spp. Some microorganisms such as Klebsiella, E-coli were resistance to 5 antibiotics. Coccobacill gram negative was resistance to 3 antibiotics. Some gram negative bacteria showed resistance to 6 antibiotics. The majority of the bacterial pathogens (75%) were multidrug resistant. 1639 patients admitted during one year (from March until March). Mean antibiotic used for each patient in this hospital, was 10.11 injection antibiotic. 1045 patients confined to bed From Apr. to Nov. which mean injection antibiotic used for each patient was 8.94 antibiotic. Samples cultured from 80 admitted patients in this study showed 36 cases infection positive and 44 cases negative. All positive cases studied for antibiotic resistance of strains by standardized agar disc diffusion test which just one case was sensitive to antibiotics. The other cases were resistance to many specific antibiotics. Meanly each microorganism was resistance to 2.5 antibiotics.

A mean of 10.8 days per patient while the non-infected patients, were in hospital for a mean of only 3.5 days. Among those who developed nosocomial infection, seven (3.4%) died; 11(5.3%) were referred to other hospitals and another 11(5.3%) left the hospital against medical advice. Various host-associated risk factors for nosocomial infection were diagnosed on admission, of which a number were significantly associated with infection (Table 1). Many patients were also subjected to therapeutic and/or prophylactic instrumentation and surgery. Some of these were significant risk factors for nosocomial infection (Table 2). Community acquired infections were also significant risk factors for adult and paediatric patients. Of 336 obstetric patients, 36 patients underwent caesarean section, of whom 14 (38.9%) were infected, while only two (0.7%) of the 300 patients not subjected to caesarean section developed infection. Two hundred and seven patients acquired nosocomial infection with an overall incidence of 8.5%, the rates varying between 2.7% and 35.8% for the different types of patients (Table 3). The types of

Table 1: Specialties and rates of admitted patients

Section duration (month)	Internal	Infant	Caesarean	Surgery	CCU	Natural maternity
12	533	276	521	451	173	219
6	262	139	284	290	90	98

Table 2: Evaluation of antibiotics resistance in bacteria in the studied hospital

Microorganism	Resistance to antibiotics
Shigella	Am- Van-Ct-Tc-Oxtc-Nf
E-coli	Amp-Amx-Gm-Cot
G-neg	Van-Am-Amx-Sxt-Ct- Tc-E-Ctx-Cp-fm
G-pos -Staphylococcus aureus	Van-Am-Sxt-Cx-Fm-Ctx-Stx
Klebsiella	Van-Am-Amx-Sm-Ct-Gm-Tc-E-Ctx-Cp-Nf-Ot
Coccobacill-G-neg	Gm-Van-Cn
Pseudomonas aeruginosa	Cb-Ct- Cf-Tc-Gm– Amk–Cpf

Cefazoline-1g(Cz), Ceftazoxime (Ctz), Carbenicillin (Cn), Co-trimoxaazol (Cot), Oxitetracyclin (Ot),
Tetracycline (Tc), Streptomycin (Sm), Vancomycin (Van), Ceftazoxime (Cft), Ceftriaxone (Ctx),
Cephalexine (Cp), Oxitetracycline (Oxtc), Gentamicin (Gm), Ampicillin (Am), Amoxicillin (Amx),
Amikacin (Amk), Penicillin-g (P), Cefuroxime (Cx), Erythromycin (E), Nitrofurantoin (Nf),
Carbenicillin (Cb), Ceftizoxime (Cf), Gentamicin (Gm), Ciprofloxacin (Cpf)

Table 3: Microorganism resistance and antibiotics in the hospital

Antibiotics	Resistant Microorganism (%)
Ampicillin	58.3
Nitrofurantoin	16.6
Gentamicin	2.7
Ceftazoxime	5.5
Tetracycline	19.4
Vancomycin	47.2
Carbenicillin	5.5
Oxitetracycline	11.1
Norofreloxazine	5.5
Amoxiciline	8.3
Cefuroxime	8.3

infections comprised urinary tract (31.3%), wound (27.1%), blood (14.9%), respiratory tract (8.9%), umbilical and other skin (8.9%) infections and other iscellaneous types (8.9%) including lower genital, gastrointestinal, eye and ear infections. The total number of infections was 214 and a few patients had more than one type of infection. These comprised infections with the same organism occurring at noncontiguous body sites, not spread haematogeneously or extended from the primary site. Those caused by different organisms at the same or different body sites were also counted as different infections. Physicians requested cultures for only 287(11.7%) of the total 2445 admitted patients. The nosocomial pathogens isolated were Escherichia coli Table 2 Hospital-associated risk factors for nosocomial infection in 2445 patients.

A comerstone of efforts to control antibiotic resistance is therefore to control and improve antibiotic use [14]. Recommended strategic goals to detect, report and prevent transmission of organism in hospital are: developing systems to recognize and report trends in resistance within hospitals; developing systems to rapidly detect, report and act on the presence of resistance organisms in individual patients; improving compliance with basic infection control procedures and policies; incorporating the detection, prevention and control of antimicrobial resistance into institutional strategic goals; and developing plans for identifying, transferring, discharging and re-admitting patients colonized with resistant organisms. There is now an urgent need to implement control of hospital infection and resistant organisms [15].

CONCLUSION

The results emphasize the need for effective measures to reduce both the high infection rates and widespread antibiotic misusage in the hospital. Such measures should include institution of an effective infection control committee and a hospital antibiotic policy. It is also necessary to introduce urgent measures for control of antibiotic misuse and restriction of the spread of *P. aeruginosa* and *Staphylococcus aureus*.

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