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Original Research

Point prevalence survey of antibiotic utilization in secondary care hospital in the United Arab Emirates

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Abstract

Objectives: The present study was carried out to identify and report the pattern of antibiotics prescribing to determine the adherence to the international empirical and therapeutic guidelines of antibiotic use. **Methods:** A point prevalence survey took place at a selected date of January 26, 2020, in which data collection was performed to all the patients present in the hospital who used at least one systemic antibiotic agent as an inpatient from 00:00 am until midnight of that day. This was performed using European Surveillance of Antimicrobial Consumption (ESAC – audit tool). The participated hospital in this point prevalence study represents a major government hospital in the UAE. Descriptive statistics were used and results were expressed using standard statistical methods. **Results:** Out of the 125 hospitalized patients, a total of 41 (32.8%) patients were included in the survey and treated with different trends of antibiotics on the date point prevalence survey. The total number prescribed antibiotics was 54 with a higher percentage of treatment indication (70.4%), compared to prophylaxis indication (29.6%). The combinations of penicillin's win in being the most commonly used agents by a percent of 31.5%, including the use of Amoxicillin-clavulanic acid by 22.2% and Piperacillin-tazobactam with 9.3%. The compliance with local/international guidelines accounts for 78.0% of the treated & prophylaxis patients. **Conclusions:** Considerable results have been obtained which can assure the quality improvement of the antibiotic use in the studied hospital.

Keywords: prevalence survey; antibiotic; prescribing; hospital; secondary care; UAE

INTRODUCTION

Throughout the history of medicine, antibiotics have been one of the most powerful fighters in a war against deadly organisms.[1] Imprudent antibiotic use is a well-established risk factor which has been shown, worldwide, to be associated with the acquisition of infections involving Clostridium difficile (CD), methicillin resistant Staphylococcus aureus (MRSA) and extended-spectrum beta-lactamase (ESBL)-producing organisms.[2-6] Clostridium difficile, a spore-forming gram-positive anaerobic bacillus, is a common pathogen in healthcare settings. The clinical spectrum of Clostridium difficile infection (CDI) ranges from uncomplicated diarrhea to severe life-threatening pseudomembranous colitis.[7,8] Several studies have identified a growing resistance pattern to antibiotics due to the increased use of existing antibiotics[9,10] and the slow pace of new antibiotic discovery.[11] This has resulted in an international public health crisis of antimicrobial resistance,[10,12] which represents a great threat to the humankind.[13,14] In some countries, including the European Union, the disseminated risk of antibiotic resistance introduced devastating tragedy and has reached alarming levels [15,16] with a paradigm shift in prescribing patterns to broader spectrum agents of antibiotics in the last several decades.[9] In the Middle East region, such as Saudi Arabia and Egypt, high prescribing rates of broad-spectrum antibiotics were identified in one study, which identified high resistance rates to antibiotics in the hospital settings.[9] The continued emergence of both CDI and pathogens that produce beta-lactamase enzymes pose significant therapeutic implications, i.e. complicated therapy and limited treatment options, predisposing infected patients to higher mortality rates, longer hospital stays, higher antibiotic usage, increased treatment expenditure and causing considerable challenges for infection control.[5,7] In one study conducted in 2003, it was shown that in the United States (US) alone, over than 7 billion dollars were consumed to treat both community and hospital-acquired infections (HAIs) associated with different bacterial strains. However, for the treatment of the hospital-acquired infections alone, around 4 billion dollars were consumed in the US due to the developed bacterial resistance to the over-prescribed antibiotics.[9] The effective use of antibiotics with the appropriate practices and guidelines is of considerable importance to reduce and/or prevent the associated developed antibiotic resistance. On the other hand, the ineffective use of the antibiotics has been primarily associated with the disseminated resistance of different bacterial strains, including hospital-acquired infections.[1,16] Despite the importance of

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education and guideline-based strategies within antibiotic stewardship programmes, it is frequently reported that compliance with such guidelines is relatively low.[17] This point prevalence study aims to identify and report the pattern of antibiotics prescribing in one of the major hospitals in the UAE, to determine the adherence to the international empirical and therapeutic guidelines of antibiotic use, e.g. Infectious Diseases Society of America (IDSA) and National Institute for Heath and Care Excellence (NICE).

METHODS

Study setting

The participated hospital in this point prevalence study represents a major government hospital in the UAE at the time the research was conducted. The Hospital provides health care services in variety of specialty including general surgery, pediatrics, critical care, urology, orthopedics, ophthalmology, Ear-Nose-Throat (ENT) surgery, neurosurgery, vascular surgery, thoracic surgery, maxillofacial surgery, plastic surgery, accident & emergency and out-patient services. A total of 6 wards of the hospital were included in the survey to examine the risk of HAI. This includes the intensive care unit (ICU), surgical, pediatric and other wards. Under the umbrella of infection prevention and control committee, antibiotic Stewardship programme launched in Saqr hospital in January of 2014. In October, 2017, a nominated hospital Antibiotic Stewardship Committee was formulated, which represented multidisciplinary team, including physician leader and clinical pharmacist as coordinator of the committee. Additional team member included surgeon, anesthetist, pediatrician, internal medicine specialist, clinical microbiologist, infection control practitioner, nurse and quality staff. During the study period, the hospital bed capacity was 125 beds. During the month of January, the highest bed occupancy date was 26 January 2020.

Compliance with ethical standards

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For the purposes of conducting this study, governance approvals were obtained from the Ministry of Health and Prevention Research Ethics Committee RAK Subcommittee (Reference No: MOHAP/REC/2019/36 -2020-F- P). For this type of study (retrospective in design), formal individual patient consent was not required by the MOHAP Research Ethics Committee.

Study design

The survey took place at a selected date of January 26, 2020, in which data collection was performed to all the patients present in the hospital who used at least one systemic antibiotic agent as an inpatient from 00:00 am until midnight of that day to investigate the pattern of antibiotics prescribing. Any patient on only anti-retroviral, anti-tuberculosis, and anti-parasitic, antifungal, or antiviral agent medications or present in emergency room who were not yet admitted or patients who were treated as an out-patient were all excluded from the survey. Each detail about the prophylaxis and the given therapy was collected, considering also the prophylactic antibacterial if it were given for the surgical patients during the last 24 hours.

Antibiotic guidelines

The determination of the patient plan of therapy was assessed (either compliant or non-compliant) based on hospital antibiotic surgical prophylaxis guideline, and international guidelines from IDSA such as urinary tract infection, respiratory tract infection and skin & soft tissue infection.

Outcome measures

The antibiotic prescription prevalence was basically determined on the day of the survey by taking a percentage of the number of the patients getting antibiotic out of the whole number of patients exist as inpatients in the studied hospital.

Data collection

Data was extracted from the system with no direct contact with the patients. However, the hospital staff of clinical pharmacists was responsible to review patients' notes of the antibiotic prescribing patterns. This was performed using European Surveillance of Antimicrobial Consumption (ESAC – tool). The collected data included details on patients' demographics such as age, gender and other details of the prescribed antibiotics (e.g., strength, generic name, route of administration, dose and frequency). The number of inpatients included in each ward, admission source (home, other hospital, other department), duration of the hospital stays and the anatomical site of each treated infection were collected. Data regarding the local and/or international guidelines compliance of the hospital was documented based on the treatment indication; HAIs, community-acquired infection, surgical prophylaxis or medical.

Definitions

Community-acquire infections' definition was explained as cases in which the antibiotic use or symptoms appear in less than two days (48 hours) after hospital admission. In contrast, when symptoms start at 48 hours or more of an admission to hospital, it is defined as a hospital-acquired infections (HAI) case. Compliance with the local /international guidelines for prescribing antibiotics was assessed through a "yes" or "no" question in the survey.

Statistical analysis

Descriptive statistics were used and results were expressed using standard statistical methods such as median, interquartile range and frequency (%). The statistical analyses were performed on SPSS for Windows (Advanced Statistics Release 25.0, SPSS® Inc, Chicago).

RESULTS

Data from the studied hospital was obtained with variations in several variables. The general characteristics of the point

prevalence study population are shown in Table 1. Out of the 125 hospitalized patients, a total of 41 (32.8%) patients were included in the survey, and treated with different trends of antibiotics on the date of point prevalence survey, as shown in Table 1. The majority of treated patients were male 31 (75.6%), while the female patients were 10 (24.4%), with a median duration of hospitalization of 5 days. Of the 41 treated patients, the median age was 31 years. The total number prescribed antibiotics was 54 with a higher percentage of treatment indication (n= 38, 70.4%), compared to prophylaxis indication (n= 16, 29.6%). The greater usage of parental antibiotics was observed (n= 42, 77.8%), in contrast to oral antibiotics (n= 12, 22.2%). Different indications of the prescribed antibiotics were observed; HAI had the lowest indication (n= 3, 7.3%), compared to community-acquired infection indication (n= 24, 58.5%), surgical prophylaxis (n= 7, 17.1%) and others (n= 7, 17.1%). The most common anatomical site of the infection was the respiratory system (34.1%), compared to the skin and soft tissues (39.0%), the urinary system (9.8%), the gastrointestinal system (7.3%), Otolargycology (2.4%) and the cardiovascular system (2.4%). Out of the 41 treated patients included in the study, more than half were admitted to the surgical ward (51.2%), 19.5% were admitted to the pediatric ward, 4.9% were admitted to the intensive care unit (ICU) and 24.4% were admitted to the other wards in the hospital. In the studied hospital, the compliance with local/international guidelines accounts for 78.0% of the treated & prophylaxis patients.

Table 1. General Characteristics of the study population, in participating study hospital, the point prevalence survey in Jan 2020, sample size=125

Characteristics	**Participating study hospital, Jan 2020**
Number of hospitalized patients	125
Number of treated patients, n (%)	41 (32.8%)
Number of prescribed antibiotics	54
Age of treated patients, median (Interquartile range), years	31.0 (11.0-43.0)
Duration of hospital stay, median (Interquartile range), days	5 (2.0-9.0)
Gender, n (%)	
• Male	31 (75.6)
• Female	10 (24.4)
Admission source	
• Home	35 (85.4)
• Other hospital	6 (14.6)
• Another department	0 (0.0)
Admission ward, n (%)	
• Intensive care unit	2 (4.9)
• Surgical	21 (51.2)
• Pediatric	8 (19.5)
• Others	10 (24.4)
Specialty, n (%)	
• Medical	8 (19.5)
• Surgical	33 (80.5)
• Intensive care unit	0 (0.0)
• Others	0 (0.0)
Antibiotic rout of administration, n (%)	
• Oral	12 (22.2)
• Intravenous	42 (77.8)
Antibiotic indication, n (%)	
• Treatment	38 (70.4)
• Prophylaxis	16 (29.6)
Anatomical site, n (%)	
• Respiratory system	14 (34.1)
• Cardiovascular system	1 (2.4)
• Gastrointestinal system	3 (7.3)
• Urinary system	4 (9.8)
• Skin, soft tissues	16 (39.0)
• Otolargycology	3 (7.3)
Duration of surgical prophylaxis, n (%)	
• Single dose	0 (0.0)
• One day	6 (37.5)
• More than One day, n (%)	10 (62.5)
Compliance with local/international guidelines	
• No	9 (22.0)
• Yes	32 (78.0)
Indication of antibiotic treatment (diagnosis), n (%)	
• Hospital- acquired infection (HAI)	3 (7.3)
• Community-acquired infection (CAI)	24 (58.5)
• Surgical prophylaxis	7 (17.1)
• Others	7 (17.1)

Getting to the results of Table 2, which represents the antibiotic agents prescribed in the participating hospital. The combinations of penicillin's win in being the most commonly used agents by a percent of 31.5%, including the use of Amoxicillin-clavulanic acid by 22.2% and Piperacillin-tazobactam with a 9.3%. Then it's followed by the third-generation cephalosporin's, which takes a percent of 18.6%. The second most prescribed antibiotics were including Ceftazidime with a 13% and Cefotaxime with a 5.6%. The other most commonly used antibiotic was the following: second-generation cephalosporin's (14.8%), which includes Cefuroxime (11.1%) and Cefprozil (3.7%), in addition to macrolides with a 7.4 % for Azithromycin and Clarithromycin (both with a 3.7% of use). Carbapenems (5.6%) for the use of Meropenem. Fluoroquinolones (7.4%) for the use of ciprofloxacin. Finally, Tetracyclines (1.9%) goes for the use of Tigecycline.

DISCUSSION

Resistance to antibiotics is an international public concern. However, it is a local concern at its first stage.[17] The considerable misuse of the antibiotics is a major cause of the global antibiotic Resistance.[18] Therefore, it is very crucial to search for

Table 2. Antibiotic agents prescribed, with participating hospital, during the point-prevalence survey Jan 2020, sample size=125

Antibiotic prescriptions	**Number (%)**
Tetracyclines (J01AA)	1 (1.9)
• Doxycycline	0 (0.0)
• Tigecycline	1 (1.9)
Penicillins with extended spectrum (J01CA))	0 (0.0)
• Amoxicillin	0 (0.0)
Beta-lactamase-sensitive penicillins (J01CE)	0 (0.0)
• Phenoxymethylpenicillin	0 (0.0)
• Benzylpenicillin	0 (0.0)
Beta-lactamase-resistant penicillins (J01CF)	0 (0.0)
Combinations of penicillins (J01CR)	17 (31.5)
• Amoxicillin-clavulanic acid	12 (22.2)
• Piperacillin-tazobactam	5 (9.3)
First-generation cephalosporins (J01DB)	0 (0.0)
• Cefalexin	0 (0.0)
Second-generation cephalosporins (J01DC)	8 (14.8)
• Cefuroxime	6 (11.1)
• Cefprozil	2 (3.7)
Third-generation cephalosporins (J01DD)	10 (18.6)
• Cefotaxime	3 (5.6)
• Ceftazidime	7 (13.0)
• Ceftriaxone	0 (0.0)
Monobactams (J01DF)	0 (0.0)
• Aztreonam	0 (0.0)
Carbapenems (J01DH)	3 (5.6)
• Meropenem	3 (5.6)
Trimethoprim and derivatives (J01EA)	0 (0.0)
• Combination of trimethoprim/	0 (0.0)
sulfamethoxazole (J01EE)	0 (0.0)
Macrolides (J01FA)	4 (7.4)
• Erythromycin	0 (0.0)
• Azithromycin	2 (3.7)
• Clarithromycin	2 (3.7)
Lincosamides (J01FF) 6 (0.9)	0 (0.0)
• Clindamycin	0 (0.0)
Aminoglycosides (J01GB)	0 (0.0)
• Gentamicin	0 (0.0)
• Tobramycin	0 (0.0)
Fluoroquinolones (J01MA)	4 (7.4)
• Ofloxacin	0 (0.0)
• Levofloxacin	0 (0.0)
• Ciprofloxacin	4 (7.4)
Glycopeptide antibacterials (J01XA)	2 (3.7)
• Vancomycin	2 (3.7)
• Teicoplanin	0 (0.0)
Steroid antibacterials (J01XC)	1 (1.9)
Imidazole derivatives (J01XD)	4 (7.4)
Nitrofuran derivatives (J01XE)	0 (0.0)
Other antibacterials (J01XX)	0 (0.0)
• Linezolid	0 (0.0)
Chloramphenicol (J01BA)	0 (0.0)

the weakness points in using the antibiotics in hospitals, and therefore, work on areas of improvement.[1] Accordingly, local evaluation of the followed patterns of antibiotic prescribing is fundamental for the antibiotic stewardship program.[18] The aim of this point prevalence study is to assess the local antibiotic prescribing patterns in one of the major government hospitals in emirate of Ras Al Khaimah in the UAE, and to determine the compliance with the international and local guidelines for antibiotic prescribing. The overall adherence percentage to the established guidelines was 78.0%. In fact, it can be very helpful in the monitoring and identifying the effectiveness of the antimicrobial stewardship program by the process of having a repeated point – prevalence surveys at the same setting,[19] in addition to the inexpensive nature of the method.[1]

The prevalence of the antibiotic usage in the studied hospital was 32.8%. Interestingly, the highest prevalence was accounted for the antibiotics treating the community-acquired infections (58.5%), which in its turn reflect the high load within the healthcare system and its resources. The penicillins were shown to have the highest prescribing percentage following by the third generation cephalosporins. The prescribing patterns of fluoroquinolones, carbapenems and WHO AWaRe-reserve antibiotics in the study site were low. This represents a good compliance in the guidelines as this reduces c. difficile (CDI) as well as methicillin-resistant Staphylococcus aureus (MRSA) infections.[3,4,20] Good clinical practices were observed with a high percentage representing good compliance with the international prescribing guidelines and may be related to early establishment of antibiotic stewardship programme.

Nonetheless, considerations must be given for the high prescribing patterns of the penicillin amoxicillin-clavulanic acid as it was manifested as one risk factor for acquiring CDI and MRSA.[3,4,20] Therefore, future optimization for its prescribing is encouraged. The findings of this study are consistent with other reported studies in Northern Ireland, Turkey and China.[1,21,22] In the previous study conducted in Northern Ireland which in a total of five hospital setting. In fact, slight differences in findings have been found possibly due to either the different patient cases itself, or some local difference in interpreting and using the guidelines.

The current study investigated the appropriate implementation of antibiotic stewardship program and its importance, it evaluated the guidelines implementation besides the physicians' adherence to them. The study showed that

cephalosporins and penicillins were the most commonly used agents as surgical prophylaxis. This comes in line with previous studies that showed a single dose of cefazolin antibiotic was the most frequently administered operative antibiotic prophylaxis.[23,24] Additionally, these latter findings agree with the recommendation of NICE clinical guidelines (2011) regarding the best antibiotic selection and time to administer antibiotic prophylaxis.[23,24] The study findings encourage the importance of the clinical pharmacist in making the physicians have a better compliance to the guidelines, which shows the benefit of involving the clinical pharmacist during the stewardship program.

In summary, this study has implemented very important points regarding the hospital antibiotic guidelines. Starting from the importance and the benefits of using European Surveillance of Antimicrobial Consumption (ESAC – audit tool) which is a simplified audit tool that helped in showing a quit important detail about the prescribing patterns of antibiotics in hospitals. Overall, the point prevalence survey must be taken in consideration as it showed to be very effective in improving the antibiotic therapy, mostly in secondary healthcare settings as they provide a very valuable information that indeed help in optimizing the antibiotic use, targeting quality improvement and reducing the resistance surveillance.

Study strengths and limitations

The study has flowing limitation: the retrospective nature of the study makes it susceptible to the effects of biases and confounding.

CONCLUSION

Considerable results have been obtained which can assure the quality improvement of the antibiotic use. Furthermore, the study has shown a better adherence to the hospital / international guidelines regarding the antibiotic use with an overall rate of 78%. With low prevalence of the antibiotic usage 32.8 %.

DECLARATIONS OF INTEREST

None.

FINANCIAL SUPPORT

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

DATA AVAILABILITY

The datasets generated during the current study are available from the corresponding author on reasonable request.

PATIENT CONSENT FOR PUBLICATION

Not required.

AUTHORSHIP STATEMENT

All authors have contributed significantly to the publication. Their contributions meet the criteria for authorship. All authors reviewed and approved the final draft of the submitted manuscript.

CONFLICTS OF INTEREST STATEMENT

No declarations of interest to be mentioned. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ETHICS STATEMENT

For the purposes of conducting this study, governance approvals were obtained from the Ministry of Health and Prevention Research Ethics Committee RAK Subcommittee (Reference No: MOHAP/REC/2019/36 -2020-F- P).

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