Different Patterns of Inappropriate Antimicrobial Use: A Cross Sectional Study

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Abstract: Background: Because of increasing concern and awareness of antibiotic resistance problems worldwide and frequent inappropriate use of antimicrobial agents in hospitals, these drugs have often been the target of attempts to evaluate and control their uses. A cross sectional study was conducted to evaluate the appropriateness of use of antimicrobials in both therapy and prophylaxis at a tertiary care hospital. **Methods:** All patients in the medical, surgical, as well as ICU wards in the period between September to December 2012 were evaluated. Data were collected with structured questionnaires, and appropriateness was evaluated by local and international guidelines and the decisions were carefully discussed with the infectious disease physicians. **Results:** 56.8% of patients with antimicrobial therapy, and 55.9% of patients with antimicrobial prophylaxis were judged as inappropriate. Categories of patients with inappropriate prescriptions included: 44.1% incorrect choice, and 12.7% incorrect application. Patterns of inappropriate antimicrobial varied widely in the different hospital units. In the present study as well as other studies, the main problem was in the surgical wards due to inappropriate choice which may be caused by the lack of indication for the antibiotic use .This is probably based on the consideration that potential or possible bacterial infection is more hazardous to the patient than the risk from use of antibiotics. **Conclusion:** In the present research, the divergence from local and international guidelines was the most frequent error. Based on these results, we recommend improving educational and surveillance programs and being adherent to the antibiotic policies and guidelines.

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1. Introduction

Inappropriate use of antimicrobials is associated with the emergence of antimicrobial resistance, increased morbidity, unnecessary length of hospital stay, and health care costs. In addition, resistant pathogens in the hospital environment result in hospital-acquired infections which are expensive to control and extremely difficult to eradicate ***(Smith and Coast, 2013).*** Antimicrobial therapy and prophylaxis in hospitals has been reported to be incorrect in 9 to 64%**.** Examples include excessive treatment duration, inappropriate dosing, lack of conversion from parenteral to oral therapy, or inadequacy of drugs selected and pathogen-susceptibility profile (***Tunger et al., 2009)***.

Enhanced antimicrobial surveillance is one of the strategies to guide control of antimicrobial overuse or misuse. This is because the ability to study population based pattern of antimicrobial use provides a more comprehensive understanding of how the physician and patient use these agents. Promoting appropriate use of antimicrobials through various interventions will help stop unnecessary prescribing and misuse of antimicrobials ***(Vaccheri et al.,2002).***

The aim of this study is to assess the pattern of prophylactic as well as therapeutic use of antimicrobials in the medical, surgical, as well as ICU wards at tertiary care hospital which can be important for the initiation of the prudent and appropriate use of antimicrobials in the hospitalized patients.

2. Methods

Hospital setting and study population

This was a descriptive cross-sectional study, undertaken from September to December 2012, in King Abdulaziz Hospital, a 255-beded tertiary care hospital, Makkah, KSA. Hospitalized patients (number = 354) in surgical, medical, as well as ICU wards were evaluated, and the appropriateness of antibiotic prescription was analyzed.

Data collection

All data were collected by patient files and the electronic patient files. The following patients' variables were recorded: ward, file number, date of admission, date of interview, age, sex, nationality, weight, height, diagnosis, associated medical problems (co-morbidities) and does the patient take antibiotic(s). In patients with antibiotic prescriptions, we recorded all prescribed antibiotics, including dose, frequency, route of administration, duration, and whether the drugs were given in prophylactic or therapeutic purpose. Furthermore, the results of laboratory and microbiological investigations available at the time of the survey were reviewed to assess the appropriateness of diagnosis of infectious

disease leading to the prescription of antibiotic(s). The antibiotic prescriptions were classified as 'empirical' when all prescriptions are given in the absence of microbiological documentations throughout the antibiotic course, as 'empirical secondarily documented ' when the antibiotic courses are initiated empirically, but subsequently associated with microbiological documentations whether the initial antibiotic choice is maintained or modified, and as documented' when a full documentation of infection and identification of a likely pathogen available at the start of therapy ***(Thuong et al., 2000; Cusini et al., 2010).***

Assessment of appropriateness of antibiotic use

Data were collected with structured questionnaires, and appropriateness was evaluated by local and international guidelines ***(Gilbert et al., 2012),*** and considering microbiological findings, if available, and co-morbidity and the decisions were carefully discussed with the infectious disease physicians ***(Gyssens et al., 1992; Willemsen et al., 2007).***

Antimicrobial treatment was judged as follows:

(A) Appropriate decisions; all criteria of correct antimicrobial use are fulfilled.
(B) Inappropriate choice; including inappropriate spectrum of the antimicrobial agent (too broad, too narrow, not effective), or divergence from guidelines.
(C) Inappropriate application; including inappropriate dosage, and duration of therapy.
(D) Missing, or insufficient data to judge the appropriateness of antimicrobial use.

Ethical considerations:

The study protocol, including data collection, was approved by the hospital Ethics Committee. The heads of the various clinics and their staff physicians were prospectively informed about the study, and accepted the evaluation methods.

Statistical analyses

Data were analyzed by SPSS V 16. Categorical data were presented as percentages. Quantitative data were presented as the mean +/- standard deviation as well as the median and the range. Percentages of various prescription indications, purpose of prescribing antimicrobial, (whether prophylactic or therapeutic), and appropriateness of prescription were calculated with reference to the total number of patients on anti-microbial and stratified by ward. Percentages of ordering individual antimicrobials and antimicrobial classes and type of therapy (empirical, empirical secondarily documented, documented) were calculated with reference to the total antimicrobials prescribed and were also stratified by ward.

3. Results

The demographic and clinical characteristics of study participants are summarized in **Table (1)**. A total of 354 patients were included in the study; 205 patients were registered on the medical wards, 124 on the surgical wards, and 25 on the ICU. The mean age was 48.8 years (range: 13-96), 132(56.9%) were males and 100(43.1%) were females. Of the 354 evaluated patients, 232(65.5%) had antimicrobials, and received a total of 511 prescriptions. Moreover, 306(59.9%) prescriptions were for therapy and 205(40.1%) for prophylaxis. The highest proportion of patients on antimicrobials treatment was in the ICU with 92.0%. In the medical wards the proportion of patients on antimicrobials were 61.5%, and In the surgical wards 66.9%.

In **Table (2)**, diagnosis and main indications for therapeutic use are summarized. The indications for antimicrobial therapy varied widely between the different units because of differences in underlying diseases of patients hospitalized in these units. Overall, the most frequent diagnosis were respiratory tract infections (n= 43, 18.5%), Urinary tract infections (n= 22, 9.5%), Traumatic wound/open fracture (n= 22, 9.5%), and skin/soft tissue infections (n= 14, 6.0%). In 100 (43.1%) patients receiving antimicrobials, no infection was present.

Table (3) displayed the variation in the number of antibiotics prescribed for the patients in the medical, surgery and ICU departments. Majority of patients (98= 42.3%) and (70= 30.2%) were prescribed single and two antibiotics respectively. Patients of medical (50= 39.7%), surgery (46= 55.5%) and ICU (2= 8.8%) were prescribed one antibiotic. While, (39= 31.0%), (23= 27.7%) and (8= 34.8%) patients were prescribed two antibiotics in the medical, surgery and ICU respectively. On the other hand, the patients in medical (11= 8.8%), surgery (2= 2.4%) and ICU (2= 8.6%) were prescribed 6 or more antibiotics.

Table (4) summarizes the classification of prescriptions with regard to empirical versus empirical secondary documented and versus documented. Across all wards, empirical prescriptions were judged more often (58.7%) than documented (27%) or empirical secondary documented (14.3%). Moreover, empirical prescriptions were judged more in surgical ward (72.8%), while empirical secondary documented and documented were judged more in ICU (32.9% for each).

Table (5) shows the prescription of the different antibiotic classes in the different wards of the hospital; third generation Cephalosporins (120), Penicillins (79), Second generation Cephalosporins (45), Fluroquinolones (43) and Macrolides (40) were the most commonly prescribed antibiotics in all hospital wards. 73.3% of third generation

Cephalosporins, 57.0% of Penicillins, 58.1% of Fluroquinolones and 82.5% of Macrolides prescriptions were prescribed in Medical ward while 77.8% of second generation Cephalosporins were prescribed in Surgery.

Table (6) summarizes the prescribing frequency of each antibiotic distributed in different hospital wards. Ceftriaxone 78(26.2%) and Pipracillin-Tazobactam 31(10.4%) were the most commonly prescribed antibiotics in Medical ward. Cefuroxime 35(23.8%) and Ceftriaxone 22(15.0%) were the most frequently used antibiotics in Surgery, while Ciprofloxacin 10(13.75) and Imipenem 9(12.3%) were the most prescribed in ICU.

Table (7) gives an overview of the evaluation of the appropriateness of antimicrobial use. Patients with prescriptions were judged as inappropriate [67(56.8%) patients with antimicrobial therapy, and 61(56.0%) with antimicrobial prophylaxis] Categories of patients with inappropriate therapy included: 52(44.1%) incorrect choice, 8(6.8%) incorrect dose, 4(3.4%) incorrect duration and 3(2.5%) incorrect dose and duration. In the various hospital units there were remarkable differences in the patterns of appropriateness. In surgical wards the main problem was inappropriate choice in 62.5% of patients. In the medical wards, inappropriate choice was found in 36.9% of patients, while in the ICU, incorrect choice was observed in 38.5%, incorrect dose 15.3% and incorrect duration in 7.7% of patients. Categorizing patients with inappropriate prophylaxis has similar trend with incorrect choice accounting for 53(48.6%), 3(2.8%) incorrect dose, and 4(3.7%) incorrect duration.

Table (1): Patient characteristics, in 2012 from 30 September to 18 December

Characteristics	Medical wards No (%)	Surgical wards No (%)	ICU No (%)	Total No (%)
Number (No.) of evaluated patients (%)	205(100.0%)	124(100.0%)	25(100.0%)	354(100.0%)
Total no. of patient on antimicrobials	126(61.5%)	83(66.9%)	23(92.0%)	232(65.5%)
No. on therapy	73(57.9%)	32(38.6%)	13(56.5%)	118(50.9%)
No. on prophylaxis	49(38.9%)	50(60.2%)	10(43.5%)	109(47.0%)
Data insufficient	4(3.2%)	1(1.2%)	0(0%)	5(2.1%)
Male	63(50.0%)	49(59.0%)	20(87.0%)	132(56.9%)
Female	63(50.0%)	34(41.0%)	3(13.0%)	100(43.1%)
Saudi	63(50.4%)	40(48.2%)	15(65.2%)	118(51.1%)
Non-Saudi	62(49.6%)	43(51.8%)	8(34.8%)	113(48.9%)
Mean age (range)	51.8(13-96)	43.2(14-80)	53.1(25-80)	48.8(13-96)
Days of hospital stay at time of evaluation mean± standard deviation (range)	9.5±19.4(1-157)	12.2±20.5 (1-143)	7.4±12.7(1-63)	10.2±19.2(1-157)
Prescriptions for therapy	186(63.7%)	73(50.0%)	47(64.4%)	306(59.9%)
Prescriptions for prophylaxis	106(36.3%)	73(50.0%)	26(35.6%)	205(40.1%)
Total no. of prescriptions (%)	292(100.0%)	146(100.0%)	73(100.0%)	511(100.0%)

Table(2): Main indications for antimicrobial therapy

Characteristics	Medical wards No (%)	Surgical wards No (%)	ICU No (%)	Total No (%)
Respiratory tract infection	33(26.2%)	5(6.0%)	5(21.7%)	43(18.5%)
Sepsis, bacteraemia	1(.8%)	1(1.2%)	1(4.3%)	3(1.3%)
Skin, soft tissue infection	3(2.4%)	11(13.3%)	0(.0%)	14(6.0%)
Gastrointestinal tract infection	6(4.7%)	4(4.8%)	0(.0%)	10(4.3%)
Traumatic wound/open fracture	2(1.6%)	15(18.1%)	5(21.7%)	22(9.5%)
Cardiovascular infection	1(.8%)	0(.0%)	0(.0%)	1(.4%)
Urinary tract infection	19(15.1%)	1(1.2%)	2(8.7%)	22(9.5%)
Infections with Candida	1(.8%)	1(1.2%)	0(.0%)	2(.9%)
Central nervous system infection	2(1.5%)	0(.0%)	0(.0%)	2(.9%)
Liver abscess	0(.0%)	1(1.2%)	0(0%)	1(.4%)
Mixed infection	5(4.0%)	0(.0%)	2(8.7%)	7(3.0%)
No infection	49(38.9%)	43(51.8%)	8(34.9%)	100(43.1%)
Count (insufficient data)	4(3.2%)	1(1.2%)	0(.0%)	5(2.2%)
Total	126(100.0%)	83(100.0%)	23(100.0%)	232(100.0%)

Table(3): Number of antibiotics prescribed by percentage

No. of Antibiotic	Departments			Total (%)
	Medical (%)	Surgery (%)	ICU (%)	
1	50 (39.7%)	46 (55.5%)	2 (8.8%)	98 (42.3%)
2	39 (31.0%)	23 (27.7%)	8 (34.8%)	70 (30.2%)
3	12 (9.5%)	6 (7.2%)	6 (26.1%)	24 (10.3%)
4	8 (6.3%)	5 (6.0%)	1 (4.3%)	14 (6.0%)
5	6 (4.7%)	1 (1.2%)	4 (17.4%)	11 (4.7%)
≥ 6	11 (8.8%)	2 (2.4%)	2 (8.6%)	15 (6.5%)
Total	126 (100.0%)	83 (100.0%)	23 (100.0%)	232 (100.0%)

Table (4): Classification of prescriptions with regard to empirical versus empirical secondary documented and documented

Therapy	Total	Medical ward	Surgical ward	ICU
Empirical	304(58.7%)	172(57.7%)	107(72.8%)	25(34.2%)
Empirical secondary documented	74(14.3%)	45(15.1%)	5(3.4%)	24(32.9%)
Documented	140(27%)	81(27.2%)	35(23.8%)	24(32.9%)
Total	518(100%)	298(100%)	147(100%)	73(100%)

Table (5): The prescription of the different antibiotic classes in the different wards

Antibiotic classes	Departments			Total(%)
	Medical ward(%)	Surgical ward(%)	ICU (%)	
Penicillins	45 (57.0%)	30 (38.0%)	4 (5.0%)	79 (100.0%)
Carabepenem	16 (53.3%)	2 (6.7%)	12 (40.0%)	30 (100.0%)
Monobactam	0 (.0%)	0 (.0%)	1 (100.0%)	1 (100.0%)
Cephalosporins 1st generations	4 (50.0%)	3 (37.5%)	1 (12.5%)	8 (100.0%)
Cephalosporins 2nd generations	9 (20.0%)	35 (77.8%)	1 (2.2%)	45 (100.0%)
Cephalosporins 3rd generations	88 (73.3%)	24 (20.0%)	8 (6.7%)	120 (100.0%)
Cephalosporins 4th generations	1 (50.0%)	0 (.0%)	1 (50.0%)	2 (100.0%)
Aminoglycosides	5 (27.8%)	7 (38.9%)	6 (33.3%)	18 (100.0%)
Fluoroquinolones	25 (58.1%)	6 (14.0%)	12 (27.9%)	43 (100.0%)
Macrolides	33 (82.5%)	3 (7.5%)	4 (10.0%)	40 (100.0%)
Tetracyclines	0 (.0%)	0 (.0%)	1 (100.0%)	1 (100.0%)
Lincosamides	19 (55.9%)	10 (29.4%)	5 (14.7%)	34 (100.0%)
Glycopeptides	14 (56.0%)	4 (16.0%)	7 (28.0%)	25 (100.0%)
Sulfonamides	0 (.0%)	4 (80.0%)	1 (20.0%)	5 (100.0%)
Antiprotozoal	14 (41.2%)	16 (47.1%)	4 (11.8%)	34 (100.0%)
Polymyxin	5 (62.5%)	1 (12.5%)	2 (25.0%)	8 (100.0%)
Anti-mycobacterials	16 (94.1%)	1 (5.9%)	0 (.0%)	17 (100.0%)
Anti-fungal drugs	2 (33.3%)	1 (16.7%)	3 (50.0%)	6 (100.0%)
Anti-viral drugs	2 (100.0%)	0 (.0%)	0 (.0%)	2 (100.0%)
Total(%)	298 (57.5%)	147 (28.4%)	73 (14.1%)	518 (100.0%)

Table (6): The prescribing frequency of each antibiotic distributed in different wards

Medical ward(%)		Surgical ward(%)		ICU (%)	
Total no.(%)	298 (100.0%)	**Total no.(%)**	147 (100.0%)	**Total no.(%)**	73 (100.0%)
Ceftriaxone	78 (26.2%)	Cefuroxime	35 (23.8%)	Ciprofloxacin	10(13.7%)
Pipracillin-Tazobactam	31 (10.4%)	Ceftriaxone	22(15.0%)	Imipenem	9(12.3%)
Clarithromycin	27 (9.1%)	Pipracillin-Tazobactam	18(12.2%)	Ceftriaxone	7 (9.6%)
Ciprofloxacin	25 (8.4%)	Metronidazole	16 (10.9%)	Vancomycin	7 (9.6%)
Clindamycin	19 (6.4%)	Clindamycin	10 (6.8%)	Amikacin	6 (8.2%)
Vancomycin	14 (4.7%)	Amoxicillin-Clavulanate	6(4.1%)	Clindamycin	5 (6.8%)
Metronidazole	14 (4.7%)	Ciprofloxacin	6 (4.1%)	Metronidazole	4 (5.5%)
Amoxicillin-Clavulanate	11 (3.7%)	Amikacin	(3.4%)	Pipracillin-Tazobactam	3 (4.1%)
Meropenem	10 (3.4%)	Amoxycillin	4 (2.7%)	Meropenem	3 (4.1%)
Cefuroxime	9 (3.0%)	Vancomycin	4 (2.7%)	Moxifloxacin	2 (2.7%)
Rifampin	8 (2.7%)	Co-Trimoxazole	4 (2.7%)	Erythromycin	2 (2.7%)
Imipenem	6 (2.0%)	Clarithromycin	3 (2.0%)	Clarithromycin	2 (2.7%)
Ceftazidime	6 (2.0%)	Ampicillin	2 (1.4%)	Colistin	2 (2.7%)
Erythromycin	6 (2.0%)	Cephradine	2 (1.4%)	Fluconazole	2 (2.7%)
Colistin	5 (1.7%)	Gentamicin	2 (1.4%)	Amoxycillin	1 (1.4%)
Cefotaxime	4 (1.3%)	Imipenem	1 (0.7%)	Aztreonam	1 (1.4%)
Others	25 (8.5%)	*Others*	7 (4.9%)	*Others*	7 (9.8%)

Table (7): Evaluation of the appropriateness of antimicrobial therapy and prophylaxis

Antimicrobial use			Total	Medical ward	Surgical ward	ICU
Therapy	No. of patients with antimicrobial therapy		118 (100%)	73 (100%)	32 (100%)	13 (100%)
	Total no. of patients with appropriate prescriptions		50 42.4%)(	34 46.5%)(	11 (34.4%)	5 (38.5%)
	Total no. of patients with inappropriate prescriptions		67 56.8%)(	38 (52.1%)	21 (65.6%)	8 (61.5%)
		Choice	52 44.1%)(	27 (36.9%)	20 (62.5%)	5 38.5%)(
		Dose	8 6.8%)(	5 6.8%)(	1 (3.1%)	2 15.3%)(
		Duration	4 3.4%)(	3 4.2%)(	0 (0%)	1 7.7%)(
		Dose and duration	3 2.5%)(	3 (4.2%)	0 0%)(	0 0%)(
	Data insufficient for Evaluation of the appropriateness		1 (0.8%)	1 (1.4%)	0 (0%)	0 (0%)
Prophylaxis	No. of patients with antimicrobial prophylaxis		109 (100%)	49 (100%)	50 (100%)	10 (100%)
	Total no. of patients with appropriate prescriptions		46 42.2%)(	18 36.8%)(	25 50%)(	3 30%)(
	Total no. of patients with inappropriate prescriptions		61 56%)(	30 61.2%)(	24 48%)(	7 70%)(
		Choice	53 48.6%)(	23 46.9%)(	24 48%)(	6 60%)(
		Dose	3 2.8%)(	2 4.1%)(	0 0%)(	1 10%)(
		duration	4 3.7%)(	4 8.2%)(	0 0%)(	0 0%)(
		Dose and duration	1 0.9%)(	1 2%)(	0 0%)(	0 0 %)(
	Data insufficient for Evaluation of the appropriateness		2 (1.8%)	1 (2%)	1 (2%)	0 (0%)

4. Discussion

The efficacy of antibiotics has decreased with the advent of antibiotic resistance and the drying up of the pharmaceutical antibiotic development pipeline ***(Hsu et al., 2008).*** Hence prudent and rational use of antibiotics has to be promoted to retard the development of resistance and extend the viability of the existing medicines, which is only possible if baseline data about antibiotic utilization is available. This study focused mainly on studying the pattern of prophylactic as well as therapeutic use of antimicrobials in the medical, surgical, as well as ICU wards in tertiary care hospital which can be important for the initiation of the prudent and appropriate use of antibiotics in the hospitalized patients.

In a multicenter study undertaken in adult hospitals in Turkey, the frequency of antimicrobial prescription was found to be 30.6% of hospitalized patients ***(Usluer et al., 2005).*** In the current study, 65.5% of patients were receiving antimicrobial treatment; this frequency is similar to those reported from developing countries, such as 77.8% in China and 65.0% in Costa Rica ***(Mora et al., 2002; Hu et al., 2003).***

The antimicrobial prescription rate was found to be higher in surgical wards compared to other hospital wards in Turkey and also in Germany as a developed country ***(Hartmann et al., 2004; Usluer et al., 2005).*** The present research showed that, the highest proportion of patients on antimicrobial treatment was in the ICU (92.0%). While, in the surgical wards the proportion of patients on antimicrobials was 66.9%, and in the medical wards was 61.5%.

The current results revealed that the indications for antimicrobial therapy varied widely between the different units because of differences in underlying diseases of patients hospitalized in these units. Overall, the most frequent diagnosis was respiratory tract infections (18.5%) with the highest percentage in the medical wards (26.2%) followed by the ICU (21.7%) and lastly the surgical wards (6.0%). These results coincide with those of ***Cusini et al., 2010.*** They studied inappropriate antimicrobial use at a tertiary care hospital in Switzerland. They found that the most common infection was in the respiratory tract (21.3%) with the highest incidence in the medical wards (30.7%) and lowest incidence in the surgical wards (7.2%).

The present data showed that across all wards, the empirical prescriptions were more used (58.7%) than other types of prescriptions. Moreover,

they were judged more in surgical ward (72.8%), while empirical secondary documented and documented prescriptions were judged more in ICU (32.9% for each). In Turkish hospitals, the empirical use of antimicrobial drugs was the second most common indication for therapy after infections ***(Ceyhan et al., 2010),*** which were comparable to results found in the literature ***(Hickner, 2006).*** The high rate of empirical therapy is possibly related to the low positive results of microbiological tests as higher and previous antimicrobial use will affect the sensitivity of these tests.

The present study revealed that 42.2% of the surveyed patients were receiving one antimicrobial, whereas combination therapy was given to 30.2% of the patients. The results of the combined therapy are comparable to those in the previous studies ***(Guven and Uzun, 2003; Usluer et al., 2005; Ceyhan et al., 2010).*** This high proportion of combination therapy may be related to the prescription of empirical treatment without the support of microbiological test results in order to increase the spectrum of action.

In the present research, the third generation Cephalosporins were generally the most frequently prescribed antimicrobials. On other hand, Tetracyclines were the least prescribed antibiotics in all wards. These observations were similar to those in previous studies (***Kulkarni et al., 2005; Rehan et al., 2010; Shah et al., 2011).*** Regarding the individual antibiotics, the current results showed that in the medical wards the most frequently prescribed antibiotics were Ceftriaxone followed by Pipracillin-Tazobactam. In study of **Cusini *et al.,*** 2010, they found that the most prescribed antibiotics in the medical wards were Pipracillin-Tazobactam followed by amoxicillin-clavulanate. While in another study, Amoxicillin-clavulanate followed by Ceftriaxone were the most commonly used antibiotics in medical wards ***(Katakam et al., 2012).*** These observations may be explained by the high incidence of respiratory tract infections in medical wards. Moreover, in the present study as well as the previous ones ***(Cusini et al., 2010; Katakam et al., 2012)*** it was found that Cefuroxime, Ceftriaxone, and Amoxicillin-clavulanate were the most frequently prescribed antibiotics in the surgical wards.

The current results indicated that 56.3% of total patients on antimicrobials were judged as inappropriate (56.8% with antimicrobial therapy and 55.9% with antimicrobial prophylaxis). Previous studies evaluating antibiotic use in hospitals have reported that 28-65% of prescriptions can be inappropriate ***(Thuong et al., 2000; Erbay et al., 2003; Tunger et al., 2009; Cusini et al., 2010).*** Specific rates of inappropriateness reported in the literature vary widely because of the diversity of the methods used to make such assessment. The cross-sectional studies are feasible for the surveillance allowing antibiotic policy to be assessed ***(Erbay et al., 2003).***

In the study of ***Cusini et al., 2010,*** 32% of prescriptions were judged as inappropriate. Categories of inappropriateness regarding antimicrobial therapy in their study included: 33.1% incorrect choice and 9.3% incorrect application. This was near to the current results in which categories of patients with inappropriate therapy included 44.1% incorrect choice and 12.7% incorrect application. In the present study as well as other studies ***(Erbay et al., 2003; Cusini et al., 2010),*** the main problem was in the surgical wards due to inappropriate choice which may be caused by the lack of indication for the antibiotic use .This is probably based on the consideration that potential or possible bacterial infection is more hazardous to the patient than the risk from use of antibiotics. Various studies have demonstrated that administration of antibiotics to uninfected patients accounts for 32/60% of irrational antibiotic use ***(Dunagan et al., 1991; Tunger et al., 2009).***

Inappropriate antimicrobial use has negative effects beyond increased rates of mortality and morbidity. Treatment failures can require extra hospital days, additional laboratory costs, and other infection control measures, and may affect subsequent empirical antibiotic choices, resulting in higher drug costs. Additional costs also stem from the need to develop new antimicrobial agents and to implement educational programs on antimicrobial resistance ***(Howard et al., 2001).***

We can conclude that in the present study**,** A total of 128 (56.3%) patients with antimicrobial prescriptions were judged as inappropriate. The divergence from local and international guidelines was the most frequent cause for inappropriate use of antimicrobial.

Recommendations:

Improving antibiotic usage in hospitals through different approaches as: Improving educational and surveillance programs, regulation of interactions between pharmaceutical representatives and physicians, presence of written justification or requirement by infectious diseases experts before prescribing antimicrobial agents, and being adherent to the antibiotic policies and guidelines which will lead to reduction of resistance, decreased cost and improved quality of antibiotic usage.

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References:

1. **Ceyhan, M.; Yildirim, I.; Ecevit, C.; *et al.*** (2010). Inappropriate antimicrobial use in Turkish pediatric hospitals; A multicenter point prevalence survey. International Journal of Infectious Diseases; 14, e55-e61
2. **Cusini, A.; Rampini, SK.; Bansal, V.; *et al.*** (2010). Different Patterns of Inappropriate Antimicrobial Use in Surgical and Medical Units at a Tertiary Care Hospital in Switzerland; A Prevalence Survey. PLoS ONE 5(11): e14011.
3. **Dunagan, WC.; Woodward, RS.; Medoff, G.; *et al.*** (1991). Antibiotic misuse in two clinical situations: positive blood culture and administration of aminoglycosides; Rev Infect Dis ; 13(3):405-12.
4. **Erbay, A.; colpan, A.; Bodur, H.; *et al.*** (2003). Evaluation of antibiotic use in a hospital with an antibiotic restriction policy; International Journal of Antimicrobial Agents 21 308-312. Elsevier Science B.V. and the International Society of Chemotherapy..
5. **Gilbert, DN.; Moellering, RC Jr.; Eliopoulos, GM.; *et al.*** (2012). The Sanford Guide to Antimicrobial Therapy; 42nd ed. Antimicrobial Therapy, Incorporated
6. **Guven, GS.; Uzun, O.** (2003) Principles of good use of antibiotics in hospitals; J Hosp Infect; 53:91-6.
7. **Gyssens, IC.; van den Broek, PJ.; Kullberg, BJ.; *et al.*** (1992). Optimizing antimicrobial therapy. A method for antimicrobial drug use evaluation; J AntimicrobChemother 30: 724-727.
8. **Hartmann, B.; Junger, A.; Brammen, D.; et al.** (2004). Review of antibiotic drug use in a surgical ICU: management with a patient data management system for additional outcome analysis in patients staying more than 24 hours; ClinTher ;26:915-24.
9. **Hickner, J.** (2006). A new look at an old problem: inappropriate antibiotics for acute respiratory infections; Ann Fam Med ; 4:484-5.
10. **Howard, D.; Cordell, R.; McGowan, JE Jr.; *et al.*** (2001). Measuring the economic costs of antimicrobial resistance in hospital settings: summary of the Centers for Disease Control and Prevention-Emory Workshop; Clin Infect Dis ; 33: 1573–1578.
11. **Hsu, L.Y.; Kwa, A. L.; Lye, D. C.; *et al.*** (2008). Reducing antimicrobial resistance through appropriate antibiotic usage in Singapore. Singapore Medical Journal, 49(10), 749-755.
12. **Hu, S.; Liu, X.; Peng, Y.** (2003). Assessment of antibiotic prescription in hospitalised patients at a Chinese university hospital. J Infect; 46:161-3.
13. **Katakam, P.; Elfituri, A. A.; Ramadan, Z.H.; *et al.*** (2012). A retrospective study on antibiotic use in different clinical departments of a teaching hospital in Zawiya, Libya. Ibnosina J Med BS,4(1):13-19
14. **Kulkarni, R. A.; Kochhar, P. H.; Dargude, V. A.; *et al.*** (2005). Patterns of antimicrobial use by surgeons in India. The Indian Journal of Surgery, 67, 308–315.
15. **Kunin, CM.; Tupasi, T.; Craig, WA.** (1973). Use of antibiotics. A brief exposition of the problem and some tentative solutions; Ann Intern Med 79: 555–560.
16. **Mora, Y.; Avila-Aguero, ML.; Umana, MA.; *et al.*** (2002). Epidemiological observations of the judicious use of antibiotics in a pediatric teaching hospital. Int J Infect Dis; 6:74-7.
17. **Rehan, H. S.; Kakkar, A.; Goel, S.** (2010). Surgical antibiotic prophylaxis in a tertiary care teaching hospital in India. International Journal of Infection Control. Retrieved January 5, from http://www. ijic.info/article/viewFile/4584/4210
18. **Shah, A.; Gajjar, B.; Shankar, R.** (2011). Antibiotic utilization for surgical prophylaxis in a tertiary care teaching rural hospital; International Journal of User-Driven Healthcare, 1(4), 1-14
19. **Smith, R; Coast, J.** (2013). The true cost of antimicrobial resistance; BMJ ;346:f1493
20. **Thuong, M.; Shortgen, F.; Zazempa, V.; *et al.*** (2000). Appropriate use of restricted antimicrobial agents in hospitals; the importance of empirical therapy and assisted re-evaluation. J AntimicrobChemother;46:501-8
21. **Tunger O, Karakaya Y, Cetin CB, Dinc G, Borand H** (2009) Rational antibiotic use. J Infect Dev Ctries 3: 88–93.
22. **Usluer, G.; Ozgunes, I.; Leblebicioglu, H.** (2005). A multicenter point prevalence study: antimicrobial prescription frequencies in hospitalized patients in Turkey; Ann Clin Microbiol Antimicrob; 3:4-16.
23. **Vaccheri, A.; Bjerrum, L.; Resi, D.; *et al.*** (2002). Antibiotic prescribing in general practice: striking differences between Italy (Ravenna) and Denmark (Funen); J AntimicrbChemother; 50 : 989-97.
24. ***Willemsen, I.; Groenhuijzen, A.; Bogaers, D.; et al.*** (2007). Appropriateness of antimicrobial therapy measured by repeated prevalence surveys; Antimicrob Agents Chemother 51: 864–867.

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