



A PROSPECTIVE OBSERVATIONAL STUDY ON PRESCRIBING PATTERN OF ANTIMICROBIAL AGENTS IN PATIENTS WITH INFECTIOUS DISEASES IN TERTIARY CARE HOSPITAL

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Received: 27-06-2023; Accepted: 04-08-2023; Published: 31-08-2023

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ABSTRACT

Antimicrobials are used to treat infectious diseases. However, antimicrobial agents are frequently prescribed in excess, which leads to antimicrobial resistance. As a result, the prescribing pattern of antimicrobial agents must be evaluated. The study included 100 patients. The study lasted 6 months in a tertiary health care hospital. This is a Prospective observational study. Among 100 patients, 51 were male and 49 were female. Most of patients were between the age group of 51- 60 and 61-70 (20%) in each group. The most frequently seen infectious diseases were LRTI (39%), UTI (25%), GE (13%), Dengue (6%), Sepsis (6%). The length of hospital stay in LRTI patients for less than 4 days was 41.04% and more than 4 days was 58.96%. The length of hospital stay in UTI patients for less than 4 days was 44% and more than 4 days was 56%. The most common antibiotics used were Cefoperazone-Sulbactam (25.49%) followed by Ceftriaxone (21.38%) and Oseltamivir (10.98%).

In Lower Respiratory Tract Infection (LRTI) the most commonly used antimicrobial agents are Ceftriaxone (25.92%) and Oseltamivir (20.98%). In Urinary Tract Infection (UTI) the most commonly used antimicrobial agent is Cefoperazone-Sulbactam (48.29%). Ceftriaxone (22.72%) and Cefpodoxime (9.09%) are used for the treatment of Gastroenteritis (GE).

Keywords: A Prospective observational study, Antimicrobial agents, infectious diseases, Tertiary care hospital.

1. INTRODUCTION

Infectious diseases are one of the leading causes of death worldwide, accounting for 13.3 million deaths (25% of all deaths) in 1998 [1]. Five of the 10 US leading causes of death are related to infectious diseases (pneumonia, acquired immunodeficiency syndrome [AIDS], chronic liver disease, chronic obstructive lung disease, and cancer). Between 1980 and 1992, the US death rate from infectious diseases increased 58% (including only people for whom the primary cause of death was an infectious disease) [2]. The increase was not only due to deaths associated with AIDS but to pneumonia and septicemia in other patient populations. Furthermore, the incidence of acute otitis media increased 64% among children between 1982 and 1991 [3], and otitis media diagnosis was the most commonly recorded emergency department diagnosis in 1992 [3].

Antibiotics are now the second most commonly prescribed category of drugs [3].

The reasons for the increase in incidence of infectious diseases are not fully understood. Changes in human demographics and behavior (eg, increasing use of day care facilities, a risk factor for otitis media); technology and industry; economic development and land use (possibly accounting for an increase in zoonotic diseases); international travel and commerce; and breakdown of public health measures are thought to contribute to new infectious diseases and reemergence of infectious diseases thought to have been controlled [4]. For example, tuberculosis, malaria, and cholera have reemerged or spread geographically since 1973, often in more virulent forms [5]. More than 30 new disease agents have been identified since 1973 [6]. *Escherichia coli* 0157, first identified in humans in the

1980s, has caused numerous disease outbreaks and deaths associated with contaminated food and water. The doubling of US food imports during the last 5 years contributes to millions of food borne illnesses and deaths, many of which are due to newly identified pathogens [7]. In 1993, a new hanta virus caused deaths associated with a pulmonary syndrome in the south western United States [8]. In 1997, an avian strain of influenza began to kill previously healthy people in Hong Kong [9]. In 1999, the first known human case of West Nile virus infection was recorded in the western hemisphere [10]. In 2000, a new hemorrhagic fever virus, the White water Arroyo virus, caused deaths in California [11].

Need for the study was Antimicrobial agents are effective to prevent and treat infections. Indiscriminate use of antimicrobial agents leads to mortality, resistance, increased hospital stay and cost burden. People with certain chronic diseases are at increased risk of infection and the infections in them need to be treated aggressively to avoid the spread of infections. In patients with infectious diseases the dosage regimen of antimicrobial agents should be modified according to the degree of sensitivity and resistance. So, there is a need to evaluate the dosage regimen of antimicrobial agents used in various infectious diseases. The aim of the study was to assess the prescribing pattern of antimicrobial agents in patients with infectious diseases in tertiary care hospital. Objectives are to assess the prescribing patterns of antimicrobial agents, to evaluate the empirical antibiotic therapy and evidence-based therapy, to establish the infections commonly seen in patients in tertiary care hospital.

2. MATERIALS AND METHODOLOGY

2.1. Study Design

A prospective observational study. Duration of the study was 6 months at Gleneagles Global Hospitals with sample size of 100 patients.

2.2. Source of data collection

- ✓ Patient data collection form.
- ✓ Patient case notes/prescription.
- ✓ Laboratory test reports.
- ✓ Patient medication history.
- ✓ Pathogen-Culture sensitivity test.

2.3. Inclusion criteria

- Patients above 18 years of age admitted in hospital.

- Both male and female patients are included.
- Patients with suspected infections.
- Patients with confirmed infections.
- Patients who are conscious and co-operative.

2.4. Exclusion criteria

- Pregnant and lactating women.
- Patients who have not been prescribed with antimicrobial agents.
- Patients who don't give consent.
- Patients above 90 years.

3. RESULTS

3.1. Age wise distribution of patients

In the study conducted, out of 100 patients it was observed that more number of patients were observed between the age groups of 51-60(n=20, 20%), 61-70 (n=20, 20%), followed by 31-40 years (n=15, 15%), 71-80 (n=12, 12%), 21-30 (n=11, 11%), 41-50 (n=10, 10%) respectively. Less number of patients were observed in the age groups of 11-20 (n=6, 6%) and 81-90 (n=6, 6%).

Table 1: Age wise distribution of patients

Age	Number of patients	Percentage
11-20	6	6%
21-30	11	11%
31-40	15	15%
41-50	10	10%
51-60	20	20%
61-70	20	20%
71-80	12	12%
81-90	6	6%

3.2. Gender wise distribution of patients

In the study among 100 patients, Male patients were 51 (51%), female patients were 49 (49%).

Table 2: Gender wise distribution of patients

Gender	Number of patients	Percentage
Male	51	51%
Female	49	49%
Total	100	100%

3.3. Distribution of patients based on weight

Out of 51 male patients, 7 were below 60 kgs and 44 were above 60 kgs. Out of 49 female patients, 19 were below 60 kgs and 30 were above 60 kgs.

Table 3: Distribution of patients based on weight

Weight	Male	Female
Below 60 kgs	7	19
Above 60 kgs	44	30
Total	51	49

3.4. Distribution of comorbidities based on gender

Out of 51 male patients, 28 patients had no comorbidities, 4 patients were having hypertension, 4 patients were having diabetes mellitus, 7 patients were having both HTN and DM-2, 1 Patient was having DM-2 and hypothyroidism and 7 were having others (AKI+RTI, COPD, CKD, asthma, fungal sinusitis, CAD)

Out of 49 female patients, 22 patients had no comorbidities, 3 were having HTN, 3 were having DM-2, 2 were having hypothyroidism, 13 were having both HTN and DM, 2 were having both DM and hypothyroidism and 4 were having others (Parkinsonism, bronchial asthma, HTN + hypothyroidism).

Table 4: Distribution of co-morbidities based on gender

Comorbidites	Male	Female
Normal	28	22
Hypertension	4	3
Diabetes mellitus	4	3
HTN+ DM-2	7	13
DM-2 +Hypothyroidism	1	2
Hypothyroidism	0	2
Others	7	4
Total	51	49

3.5. Total co-morbidities

Out of 100 patients, 50 patients had no co-morbidities, 20 patients were having both HTN and DM-2, 7 were having HTN, 7 were having DM-2, 3 were having both DM-2 and hypothyroidism, 2 were having hypothyroidism and 11 were having others (AKI+RTI, COPD, CKD, asthma, fungal sinusitis, CAD, parkinsonism, bronchial asthma, HTN + hypothyroidism).

3.6. Distribution of patients with infectious diseases in tertiary care hospital

Out of 100 patients, 39 were infected with LRTI, 25 were having UTI, 13 were having GE, 6 were having

dengue, 6 were having sepsis and 11 were having other infectious diseases (TB, viral hepatitis, meningitis, meningoencephalitis).

Table 5: Total co-morbidities

Comorbidities	Total	Percentage
Normal	50	50%
Hypertension	7	7%
Diabetes mellitus	7	7%
HTN+ DM-2	20	20%
DM-2 + Hypothyroidism	3	3%
Hypothyroidism	2	2%
Others	11	11%

Table 6: Distribution of patients with infectious diseases in tertiary care hospital

Infection	No. of patients	Percentage
Lower respiratory tract infection	39	39%
Urinary tract infection	25	25%
Gastro-enteritis	13	13%
Dengue	6	6%
Sepsis	6	6%
Others	11	11%
Total	100	100%

3.7. Gender wise distribution of patients with common infectious diseases

Out of 51 male patients, 16 were having LRTI, 13 were having UTI, 6 were having GE, 6 were having dengue, 4 were having sepsis and 6 were having others.

Out of 49 female patients, 23 were having LRTI, 12 were having UTI, 7 were having GE, 2 were having sepsis, 5 were having others.

Table 7: Gender wise distribution of patients with common infectious diseases

Infection	Male	Female	No. of patients
Lower respiratory tract infection	16	23	39
Urinary tract infection	13	12	25
Gastro-enteritis	6	7	13
Dengue	6	0	6
Sepsis	4	2	6
Others	6	5	11
Total	51	49	100

3.8. Lower respiratory tract infection

3.8.1. Age wise distribution of patients infected with LRTI

Out of 39 patients, it was observed that a greater number of patients were between the age group of 61-70 (n=9, 23.07%), followed by 21-30years (n=7, 17.94%), 51-60 years (n=6, 15.38%), 31-40 years (n=5, 12.86%), 41-50 years (n=4, 10.25%), 71-80 years (n=4, 10.25%), 81-90 years (n=3, 7.69%) and 11-20 years (n=1, 2.56%) respectively.

Table 8: Age wise distribution of patients with LRTI

Age	Number of patients	Percentage
11-20	1	2.56%
21-30	7	17.94%
31-40	5	12.86%
41-50	4	10.25%
51-60	6	15.38%
61-70	9	23.07%
71-80	4	10.25%
81-90	3	7.69%
TOTAL	39	100%

3.8.2. Distribution of patients based on culture test in LRTI

Out of 39 patients, culture tests were performed for 15 patients.

Table 9: Percentage of patients based on culture test in LRTI

Culture test	Number of patients	Percentage
Performed	15	38.47%
Not performed	24	61.53%

3.8.3. Distribution of data based on culture report

Out of 15 culture tests performed, 10 (66.67%) were positive and 5 (33.33%) were negative.

Table 10: Percentage of patients based on culture report

3.8.4. Distribution of data according to antimicrobial agents prescribed in LRTI

In 39 patients highest prescribed antimicrobial agents were Ceftriaxone (25.92%) followed by Oseltamivir (20.98%), Piperacillin/Tazobactam (14.81%), Doxycycline (24.81%), Azithromycin (9.87%), Cefaperazone-Sulbactam (7.40%), Cefepime (1.29%), Cefpodoxime (1.23%), Clarithromycin (1.23%), Faropenem (1.23%) and Remdesivir (1.23%).

Culture report	Number of patients	Percentage
Positive	10	66.67%
Negative	5	33.33%

Table 11: Distribution of data according to antimicrobial agents prescribed in LRTI

Antimicrobial agent	Percentage
Ceftriaxone	25.92%
Cefepime	1.29%
Azithromycin	9.87%
Oseltamivir	20.98%
Doxycycline	14.81%
Piperacillin/tazobactam	14.81%
Cefpodoxime	1.23%
Clarithromycin	1.23%
Faropenem	1.23%
Remdesivir	1.23%
Total	100.00%

3.8.5. Percentage of data based on length of hospital stay in LRTI

Among 39 LRTI patients, most of the patients were hospitalized for more than 4 days - below 60 years (35.89%) and above 60 years (23.07%).

Table 12: Percentage of data based on length of hospital stay in LRTI

Age	Length of hospital stay			
	Less than 4 days	Percentage	More than 4 days	Percentage
Below 60 years	9	23.07%	14	35.89%
Above 60 years	7	17.97%	9	23.07%

3.9. Urinary Tract Infection

3.9.1. Age wise distribution of patients in UTI

Out of 25 patients, it was observed that a greater number of patients were between the age of 51-60

(n=10, followed by 61-70years (n=4, 17.94%), 71-80 years (n=4, 15.38%), 21-30 years (n=2, 12.86%), 31-40 years (n=2, 10.25%), 41-50 years (n=2, 10.25%), 81-90 years (n=1, 7.69%) respectively.

Table 13: Age wise distribution of patients in UTI

Age	Number of patients	Percentage
11-20	0	0%
21-30	2	8%
31-40	2	8%
41-50	2	8%
51-60	10	40%
61-70	4	16%
71-80	4	16%
81-90	1	5%
TOTAL	25	100%

3.9.2. Distribution of patients based on culture test in UTI

Out of 25 patients, culture tests were performed for 17 patients.

Table 14: Percentage of data based on culture test of UTI

Culture test	Number of patients	Percentage
Performed	17	68%
Not performed	8	32%

3.9.3. Distribution of data based on culture report

Out of 17 culture tests performed, 9(52.94%) were positive and 8 (47.06%) were negative.

Table 15: Percentage of data based on culture report

Culture report	Number of patients	Percentage
Positive	9	52.94%
Negative	8	47.06%

3.9.4. Distribution of data according to antimicrobial agents prescribed in UTI

Out of 25 patients, most of the patients were prescribed with Cefoperazone-Sulbactam (48.29%) followed by Ceftriaxone (24.17%), Linezolid (6.89%), Clindamycin (6.89%), Cefepime (3.44%), Amikacin (3.44%), Meropenem (3.44%) and Ceftazidime-Avibactam (3.44%).

Table 18: Percentage of patients in UTI with and without DM

Urinary tract infection	Less than 4 days	Percentage	More than 4 days	Percentage
UTI with diabetes	6	24%	5	20%
UTI without diabetes	5	20%	9	36%
Total	11	44%	14	56%

3.10. Distribution of diabetic patients with UTI

Out of 25 UTI patients, 11 patients were having diabetes mellitus, 14 patients were not having diabetes mellitus.

Table 16: Distribution of data according to antimicrobial agents prescribed in UTI

Antimicrobial agent	Percentage
Cefoperazone-sulbactam	48.29%
Ceftriaxone	24.17%
Linezolid	6.89%
Clindamycin	6.89%
Cefepime	3.44%
Amikacin	3.44%
Meropenem	3.44%
Ceftazidime-avibactam	3.44%
Total	100.00%

Table 17: Distribution of Diabetic patients with UTI

Urinary tract infection	Number of patients	Percentage
UTI with diabetes	11	44%
UTI without diabetes	14	56%
Total	25	100%

3.10.1. Percentage of patients in UTI with diabetes mellitus and without diabetes mellitus

Out of 25 UTI patients, over 11 patients were having diabetes mellitus out of which 6 patients (24%) were hospitalized for less than 4 days and 5 patients (20%) were hospitalized for more than 4 days.

Out of 25 UTI patients, over 14 patients without diabetes mellitus out of which 5 patients (20%) were hospitalized for less than 4 days and 9 patients (36%) were hospitalized for more than 4 days.

3.10.2. Distribution of patients based on length of hospital stay in UTI

Among 25 UTI patients, most of the patients were hospitalized for more than 4 days - below 60 years (32%) and above 60 years (24%).

Table 19: Distribution based on length of hospital stay in UTI

Age	Length of hospital stay			
	Less than 4 days	Percentage	More than 4 days	Percentage
BELOW 60YEARS	7	28%	8	32 %
ABOVE 60YEARS	4	16%	6	24%

3.11. Gastroenteritis

3.11.1. Age wise distribution of patients in gastroenteritis

Out of 13 patients, it was observed that a greater number of patients were between the age of 21-30 (n=4, %), followed by 31-40years (n=3, %), 61-70 years (n=2, 15.38%), 41-50 years (n=1, 12.86%), 51-60 years (n=1 10.25%), 71-80 years (n=1, 10.25%) and 81-90 years (n=1,) respectively.

Table 20: Age wise distribution in GE

Age	Number of patients	Percentage
11-20	0	0%
21-30	4	30.8%
31-40	3	23.06%
41-50	1	7.69%
51-60	1	7.69%
61-70	2	15.38%
71-80	1	7.69%
81-90	1	7.69%
TOTAL	13	100%

3.11.2. Distribution of data according to antimicrobial agents prescribed in gastroenteritis

In 13 patients, highest prescribed antimicrobial agents were Metronidazole (31.81%) followed by Ceftriaxone (22.72%), Piperacillin/Tazobactam (9.09%), Rifaximin (9.09%), Doxycycline (9.09%), Cefpodoxime (9.09%), Ciprofloxacin (4.57%), and Meropenem (4.54%) respectively.

3.11.3. Distribution of data based on pathogens identified in common infectious diseases

In Infectious diseases *E. Coli* was found in highest number that is 8 (25.80%).

3.12. Distribution of data according to antimicrobial agents prescribed in common infectious diseases

In 100 patients, the highest prescribed antimicrobial agents are Cefoperazone-Sulbactam (25.49%) followed

by Ceftriaxone (21.38%), Oseltamivir (10.98%), Doxycycline (8.09%), Piperacillin/Tazobactam (6.98%), Azithromycin (5.78%), Metronidazole (4.60%), Fluconazole (3.46%), Linezolid (2.36%), Meropenem (1.15%), Rifaximin (1.25%), Clindamycin (1.15%), Ceftazidime-Avibactam (1.15%), Clarithromycin (1.15%), Pyrazinamide (0.57%), Fosfomycin (0.57%), Ciprofloxacin, (0.57%), Cefepime (0.57%), Amikacin (0.57%), Cefpodoxime Proxetil (0.57%), Cotrimoxazole (0.57%), Diethylcarbamazine (0.57%) and Faropenem (0.57%) respectively.

Table 21: Distribution based on antimicrobial agents prescribed

Antimicrobial agent	Prescribed percentage
Ceftriaxone	22.72%
Cefpodoxime	9.09%
Meropenem	4.54%
Metronidazole	31.81%
Doxycyclin	9.09%
Ciprofloxacin	4.57%
Rifaximin	9.09%
Piperacillin/tazobactam	9.09%
Total	100.00%

Table 22: Distribution based on pathogens identified in common infectious diseases

Type of pathogen	Number of pathogens	Percentage
<i>Candida albicans</i>	1	3.23%
<i>E. Coli</i>	8	25.80%
<i>Aspatate hyphae</i>	3	9.67%
<i>Streptococcus pneumoniae</i>	5	16.13%
<i>K. Pneumoniae</i>	6	19.35%
<i>E. Faecalis</i>	1	3.23%
<i>Enterococci</i>	1	3.23%
<i>Staphylococcus auerus</i>	3	9.67%
<i>Influenza-a</i>	1	3.23%
<i>H. Pylori</i>	1	3.23%
<i>P. Aeuroginosa</i>	1	3.23%
Total	31	100%

Table 23: Distribution based on prescribed percentage of antimicrobial agents

Antimicrobial agent	Prescribed percentage
Cefoperazone/sulbactam	25.49%
Ceftriaxone	21.38%
Oseltamivir	10.98%
Doxycycline	8.09%
Piperacillin/tazobactam	6.98%
Azithromycin	5.78%
Metronidazole	4.60%
Fluconazole	3.46%
Linezolid	2.36%
Meropenem	1.15%
Rifaximin	1.15%
Clindamycin	1.15%
Ceftazidime-avibactam	1.15%
Clarithromycin	1.15%
Pyrazinamide	0.57%
Fosfomycin	0.57%
Ciprofloxacin	0.57%
Cefepime	0.57%
Amikacin	0.57%
Cefpodoxin-proxetil	0.57%
Clotrimazole	0.57%
Diethyl carbamazepine	0.57%
Faropenem	0.57%
Total	100.00%

4. DISCUSSION

We have conducted a prospective observational study on prescribing pattern of antimicrobial agents in patients with infectious diseases. 100 patients were enrolled in the study out of which 51 were male and 49 were female. Patient's age group was categorized into 8 classes 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90. The highest number of patients were observed between the age groups of 51-60 and 61-70 years, the lowest number of patients were observed between the age groups of 11-20 and 81-90 years. In this study, 74 patients among 100 weighed above 60kgs and 26 patients weighed below 60kgs. Out of 100 patients, over 50 patients had no comorbidities, 20 were having DM with HTN, 7 patients with HTN, 7 patients with DM. Out of 100 patients, 50 patients were having comorbidities out of which 27 were female and 23 were male. Mostly seen comorbidities were DM and HTN. Female were having highest number of comorbidities than male. Out of 100 patients, 39

patients were having LRTI, 25 were having UTI, 13 having GE, 6 were having Dengue, 6 were having Sepsis and 11 were having other infectious diseases (TB, Viral hepatitis, Meningoencephalitis). Mostly seen infection was LRTI followed by UTI, GE, Dengue, Sepsis. Out of 39 LRTI patients, it was observed that a greater number of patients were between the age group of 61-70 (23.07%) and the most commonly seen infection was Pneumonia. Out of 39 LRTI patients, culture test was performed for 15 patients. Out of which 10 were positive and 5 were negative. In LRTI patients the highest prescribed antimicrobial agents were Ceftriaxone (25.92%) and Oseltamivir (20.98%). Among 39 LRTI patients, most of the patients were hospitalized for more than 4days (58.96%). In UTI, out of 25 patients, it was observed that a greater number of patients were between age group of 51-60 (40%). Out of 25 UTI patients, culture tests were performed for 17 patients out of which 9 were positive and 8 were negative. Among 25 UTI patients, most of the patients were hospitalized for more than 4days. Out 25 UTI patients, over 11 patients were having diabetes mellitus out of which 6 patients (24%) were hospitalised for less than 4 days and 5 patients (20%) were hospitalised for more than 4 days. In UTI patients, the highest prescribed antimicrobial agents were Cefoperazone-Sulbactam (48.29%) and Ceftriaxone (24.17%). Out of 13 GE patients, it was observed that a greater number of patients were between the age group of 21-30 and highest prescribed antimicrobial agent was Ceftriaxone. The most commonly identified organisms in common infectious diseases were *E. coli* (25.80%) followed by *K. Pneumoniae* (19.35%), *Streptococcus Pneumoniae* (16.13%), *Staphylococcus Aureus* (9.67%), *Aspartate Hyphae* (9.67%), *Candida Albicans* (3.23%), *Enterococcus Faecalis* (3.23%), *Influenza-A* (3.23%), *H. Pylori* (3.23%), *P. Aeruginosa* (3.23%). Most commonly prescribed antimicrobial agents were Cefoperazone-Sulbactam (25.49%) followed by Ceftriaxone (21.81%), Oseltamivir (10.98%), Doxycycline (8.09%), Piperacillin-Tazobactam (6.98%), Azithromycin (5.78%), Metronidazole (4.60%), Fluconazole (3.46%), Linezolid (2.36%), Meropenem (1.15%), Rifaximin (1.15%), Clindamycin (1.15%), Ceftazidime-Avibactam (1.15%), Clarithromycin (1.15%), Pyrazinamide (0.57%), Fosfomycin (0.57%), Ciprofloxacin (0.57%), Cefepime (0.57%), Amikacin (0.57%), Cefpodoxime-proxetil (0.57%), Cotrimoxazole (0.57%), Diethylcarbamazine (0.57%), Faropenem (0.57%).

5. CONCLUSION

From our study done for a period of 6 months we assessed the prescription pattern of antimicrobial agents in patients with infectious diseases. Sample size was 100 patients, among them 51 were male and 49 were female. The patient age was categorized into 8 classes. In them the age groups of 51-60, 61-70 are more in number (20%) in each group. The infectious diseases observed in our study were Lower Respiratory Tract Infection (LRTI), Urinary Tract Infection (UTI), Gastroenteritis (GE), Sepsis and Dengue. Lower Respiratory Tract Infection (LRTI) was the most common infection seen in 39% of patients. Ceftriaxone (25.92%) was the most commonly used antimicrobial agent in LRTI. The length of stay in hospital for many patients with LRTI was more than 4days (58.96%). Urinary Tract Infection (UTI) was seen in 25% of patients. The length of hospital stay in UTI patients with Diabetes mellitus for less than 4days was 24%, UTI patients without diabetes for less than 4days was (20%). The commonly used antimicrobial agents were Cefoperazone-Sulbactam (25.49%), Ceftriaxone (21.38%) and Oseltamivir (10.98%).

Conflict of interest

None declared

Source of funding

None declared

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