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ATC/DDD Evaluation of Antibiotics and Drug Utilization in Specific Departments of a Tertiary Care Hospital: A Retrospective Study

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ABSTRACT

Many countries are involved in usage of antibiotics with or without prescription (OTC drugs). In this DDD/ATC value is involved in improvement the of quality of use of antibiotics. The purpose of this study is to conduct a retrospective investigation into the drug utilization and ATC/DDD evaluation of antibiotics in specific departments of tertiary care hospital categorize ego rise the case reports of patients based on demographics, we also identified the most commonly used antibiotics in different diseases and departments, Data would be collected from treatment charts, prescriptions, and case sheets of the in-patients who are admitted to specific departments such as General Medicine, General Surgery, and Orthopaedics during our ward participation of inpatients departments from September 2017–December 2019 and data revised under 6 months. In this study, a total of 900 subjects treated with antibiotics were included. In this Study the average number of drugs per encounter (2%), prescribed injections (59%), generic names (96%), prescribed in the essential drug list (100%), encounter prescribed antibiotics (100%). Generic prescribing is less this shows that all these parameters should be checked and improved to provide quality and rational treatment to the patient.

INTRODUCTION

Antibiotics are used to treat only bacterial infections. Usually, an antibiotic is a substance that inhibits and kills the growth of other microorganisms. Many countries are involved in the usage of antibiotics and they are the largest single group of drugs purchased for the development of antibiotics[1]. The greater the use of antibiotics, whether appropriate or not, exerts selective pressure by reducing the reproductive success of microorganisms and, here, by speeding up the development of antimicrobial resistance (AMR)[2]. Drug utilization is defined by the WHO as the "marketing, distribution, prescription, and use of drug in society, with special emphasis on the resulting medical, social, and economic consequences"[3]. Studies on drug usage evaluation serve as a tool to assess the quality of therapeutic care and evaluate drug usage and play an important role in improving drug dispensing policies in tertiary care hospitals at every level to promote the rational use of antibiotics[4]. The drug usage pattern is being studied to analyze the present scenario and the development of drug usage at various levels of the healthcare system[5].The Anatomical Therapeutic Chemical (ATC) code is a tool to express drug utilization research to improve the quality of drug use. DDD is appropriate for drugs that have already been provided with an ATC code. These parameters are useful for evaluating drug utilization at every level of the healthcare system[6]. To assess the units of measurement used to quantify antibiotic use and discussions about the interpretation of these units are rarely presented in the scientific literature.

$$\text{DDD per 1000 persons per day} = \frac{N \times M \times Q \times 1000}{DDD \times P \times T}$$

- Prescriptions refers to the number of prescriptions generated or dispensed (N),
- Mass is the dose in, e.g., milligrams or grams (M),
- Quantity refers to the pack size (Q),
- DDD is the figure assigned in the WHO guidelines (check dose units),
- Population is the sample size reflected (P); the calculation is multiplied by 1000 to convert the population size to "per 1000 population",
- Time is the number of days of the study duration (days)[7,8].

The ultimate goal is to guide the development of rational-use drug policies and to provide a standard method of data for future assessment[9]. Rational drug use is a quality healthcare

service, particularly in the use of antibiotics and also its usage that is cost-effective with increasing drug toxicity, clinical therapeutic effects, and minimising the occurrence of resistance[10]. Irrational use of medicine is the use of too many medicines per patient (polypharmacy), inappropriate use of antibiotics, inadequate dosage for non-bacterial infections, failure to prescribe under clinical guidelines, inappropriate self-medication, and also overuse of prescribed medicines[11]. Hence, the current study was conducted to assess the Drug utilization and ATC/DDD evaluation of antibiotics in specific departments of a tertiary care hospital: a retrospective study in Government General Hospital (GGH) – Kadapa, Andhra Pradesh[12].

EXPERIMENTAL

MATERIAL AND METHODS

Data was collected from treatment charts, prescriptions, and case sheets of the in-patients who are admitted to specific departments such as General Medicine, General Surgery, and Orthopaedics during our ward participation in inpatients departments from September 2017–December 2019.It was a retrospective, observational, cross-sectional type of study was conducted on the in-patients at Government General Hospital, Kadapa with the total sample size was about 900 patients.

The study included the subject based on the following criteria: Patients admitted to the inpatient unit, regardless of gender, Patients who had undergone antibiotic treatment between the ages of 20 and 80 Patients admitted to specific departments such as general medicine, general surgery, and orthopaedics, Antibiotics are available on the G.G.H. Essential Drug List. Antibiotics are prescribed in different dosage forms. All patients who are prescribed at least one antibiotic and are admitted to specific departments such as general medicine, general surgery, and orthopedics. The study excluded watients who are allergic to antibiotics & Paediatric population.

Statistical analysis:

All the data of recruited subjects was entered into a Microsoft excel spreadsheet then Descriptive statistics like mean, standard deviation was used to assess the different demographic parameters. We assigned an ATC code to the antibiotic use and calculation of DDD/100 bed-days the most commonly used antimicrobials were classified using the ATC Classification system, and drug utilization was measured as DDD/100 bed-days. In the ATC

Classification system, drugs are divided into different groups according to the organ or system on which they act and their chemical, pharmacological, and therapeutic properties.

RESULTS

A total of 900 samples were collected from December 2020 to May 2021 in a period of 6 months, among them 300 samples were collected from 2017 medical record department, 300 samples were collected from 2018 medical record department and 300 samples were collected from 2019 medical record department.

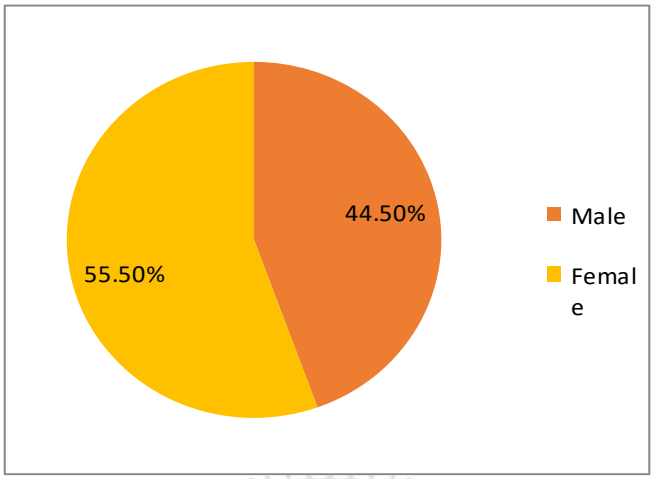

Figure: 1 Gender-wise Distribution

In this study, a total of 900 subjects treated with antibiotics were included. Among them 401 subjects were males (44.5%) and 499 subjects were females (55.5%). (Shown in figure 1)

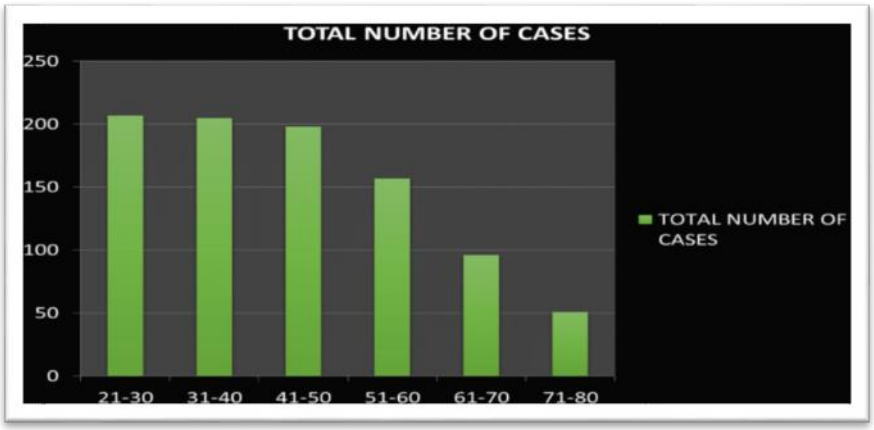

Figure: 2 Age group Categorization

This study included 900 patients and out of them most of the patients was observed from the age group between 21 – 30 years (23%), next from the age group 31 – 40 years (22.9%), next from the age group 41 – 50 years (19.9%), next from the age group 51 – 60 years (17.7%), next from the age group 61 – 70 years (10.7%) and the age group 71 – 80 years (5.8%). (Shown in figure 2)

Table:1 Based on Route of Administration

S. No	Route of administration	Total	Percentage
1	ORAL	531	59 %
2	IV	807	89.7%

In this study reveals the oral route usage of drugs was 59% (531) and the Iv route usage of drugs was 89.7% (807) (shown in the table 1).

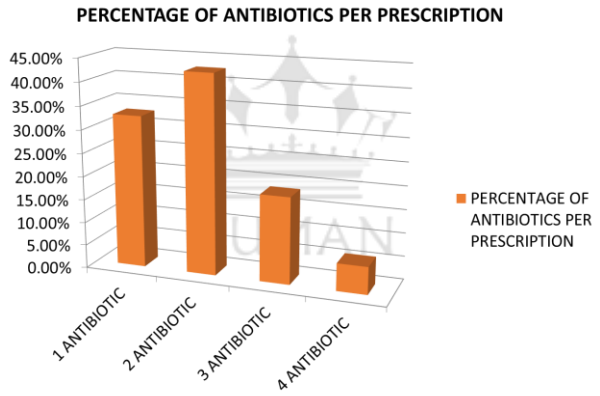

Figure:3 Based on Number of Antibiotics per Prescription

In this study, the antibiotics per prescription per patient of 1 antibiotic 295 (32.8%), 2 antibiotics 385 (42.7%), 3 antibiotics are 167 (18.6%) and 4 number of antibiotics per prescription per patient are 53 (5.9%). (Shown in figure 3).

Table: 2 Based on average length of stay in hospital

S. No	Department	The average length of stay
1	General medicine	3.5 days
2	Orthopedics	4 days
3	General surgery	5 days

In this study the average length of stay in hospital, the General Medicine Department was 3.5 days, orthopaedics was 4 days and General Surgery was 5 days. (Shown in table 2)

Table: 3 commonly Used antibiotics in different disease and department of general Medicine

Department	Disease	Drugs
General Medicine 300(100%)	Pneumonia 15(5%) Pancreatitis 9(3%) Thrombocytopenia 18(6%) Malaria 18(6%) CKD 12(4%) TB 15(5%) Pud 15(5%) COPD 21(7%) Liver Cirrhosis 9(3%) Epilepsy 6(2%) Jaundice 12(4%) Bronchial Asthma 12(4%) Hepatomegaly 6(2%) ALD 12(4%), PID3(1%) Takayasis Arteritis 3(1%) Endocarditis 3(1%) Cad 3 (1%), Oedema 9(3%) Typhoid Fever 27(9%) Uti 15(5%) Parkinsons 9(3%) Gastritis 9(3%) Stroke 3(1%) Jaundice 6(2%) Gastroenteritis 12(4%) Seizures 6(2%), Asthma 6(2%) Anaemia 3(1%) Cholecystitis 3(1%) Hypoalbumunimia 3(1%)	Amoxicillin 63(50%) Ampicillin 24(19%) Piperacillin 39(30%) Tazobactam 39(100%) Clavulanic acid 63(80.7%) Salbactam 15(19.2%) Cefperazone 15(7.69%) Cefotaxime 3(1.5%) Ceftriaxone 165(84.6%) Cefixime 12(6.15%) Amikacin 3(25%) Streptomycin 3(25%) Gentamicin 6(50%) Doxycycline 42(100%) Azithromycin 42(100%) Ciprofloxacin 12(20%) Levofloxacin 9(15%) Ofloxacin 18(13.33%) Norfloxacin 15(25%) Gatifloxacin 6(10%) Metronidazole 48(100%) Co-trimoxazole 27(100%) Nitrofurantoin 15(100%)

Most commonly used antibiotics in general medicine for common diseases are pneumonia, pancreatitis, thrombocytopenia, malaria, CKD, tuberculosis, PUD, COPD, liver cirrhosis, epilepsy, jaundice, bronchial asthma, hepatomegaly, ALD, PID, Takayasis arteritis, endocarditis, cad, oedema, typhoid fever, uti, parkinsons, gastritis, stroke, jaundice,

gastroenteritis, seizures, asthma, anaemia, cholecystitis, hypoalbuminemia. The most commonly used antibiotics are ceftriaxone, amoxicillin with clavulanic acid, ampicillin, piperacillin with tazobactam, cefoperazone with sulbactamm, cefotaxime, cefixime, amikacin, streptomycin, gentamicin, doxycycline, azithromycin, ciprofloxacin, levofloxacin, ofloxacin, norfloxacin, gatifloxacin, metronidazole, cotrimoxazole (sulphamethoxazole + trimethoprim), nitrofurantoin. (Shown in table 3).

Table: 4 Commonly Used antibiotics in different disease and department of general surgery

Department	Diseases	Drugs
General Surgery 300 (100%)	Appendectomy 30(10%) Hernia 11(3.66%) IBD 32(10.66%) Varicose Veins 24(8%) Trauma Ulcer 57(19%) Necrosing Fascitis 36(12%) Synovitis 35(11.66%) Pancreatitis 31(10.33%) Cellulitis 44(14.66%)	Ceftriaxone 129(100%) Gentamicin 24(100%) Amoxicillin 76(71.6%) Amipicillin 14(13.2%) Piperacillin 16(15.1%) Tazobactem 16(16%) Clavulanic Acid 76(76%)

Most commonly used antibiotics in general surgery for common diseases are appendectomy, hernia, IBD, varicose veins, trauma ulcer, necrosing fasciitis, synovitis, pancreatitis, cellulitis. The most commonly used antibiotics are ceftriaxone, gentamicin, amoxicillin with clavulanic acid, ampicillin, and piperacillin with tazobactam. (Shown in table 4).

Table: 5 commonly Used antibiotics in different disease and department of orthopaedics

Department	Diseases	Drugs
Orthopedics 300 (100%)	Rheumatoid Arthritis 74(24.6%) Osteoarthritis 53(17.66%) Arthralgia 37(12.33%) Low Back Pain 70(23.3%) Hip Fracture 26(8.66%) Fractures 29(9.66%) Tennis Elbow 11(3.66%)	Ceftriaxone 69(100%) Gentamicin 51(100%) Amoxicillin 96(100%) Doxycycline 57(100%) Tazobactem 57(100%) Clavulanic Acid 32(32%) Ciprofloxacin 4(4%)

Most commonly used antibiotics in orthopaedics for common diseases are rheumatoid arthritis, osteoarthritis, arthralgia, low backpain, hip fracture, fractures, tennis elbow. The most commonly used antibiotics are ceftriaxone, gentamicin, amoxicillin with clavulanic acid, doxycycline, piperacillin with tazobactam, ciprand ofloxacin. (Shown in table 5).

Table: 6 DDD value of commonly used antibiotics at General Medicine

S. No	Antibiotics	ATC Code	DDD Value/ 1000 Inhabitants (mg)	WHO Code (g)
1.	Ceftriaxone	J01DD04	0.11	2
2.	Amoxicillin With Clavulanic Acid	J01CR02	0.12	1.5
3.	Ampicillin	J01CA01	0.06	2
4.	Piperacillin With Tazobactam	J01CR05	0.0032	14
5.	Cefperazone With Sulbactam	J01DD62	0.005	4
6.	Cefotaxime	J01DD01	0	4
7.	Cefixime	J01DD08	0.12	0.4
8.	Amikacin	J01GB06	0.001	1
9.	Streptomycin	J01GA01	0.003	1
10.	Gentamicin	J01GB03	0.02	0.24
11.	Doxycycline	J01AA02	0.426	0.1
12.	Azithromycin	J01FA10	0.426	0.3
13.	Ciprofloxacin	J01MA02	0.006	1
14.	Levofloxacin	J01MA12	0.095	0.24
15.	Ofloxacin	J01MA01	0.18	0.4
16.	Norfloxacin	J01MA06	0.002	0.8
17.	Metronidazole	J01XD01	0.001	1.5
18.	Cotrimoxazole (Sulphamethoxazole + Trimethoprim)	J01EE01	0.16	1.06
19.	Nitrofurantoin	J01XE01	0.007	0.2

The WHO assigned DDD was mentioned in the table number. Our study results were below the standard DDD, which indicates rational prescribing. All the antibiotics used in In-patient were found to be rational. The observed value of commonly used antibiotics in General Medicine were ceftriaxone (0.11), Amoxicillin and potassium clavulanate/ clavulanic acid (0.12), Ampicillin (0.06), Piperacillin with tazobactam (0.032), Cefperazone with salbactam (0.005), Cefotaxime (0), Cefixime (0.12), Amikacin (0.001), Streptomycin (0.003),

Gentamicin (0.02), Doxycycline (0.426), Azithromycin (0.426), Ciprofloxacin (0.006), Levofloxacin (0.095), Ofloxacin (0.18), Norfloxacin (0.002), Metronidazole (0.001), Cotrimoxazole (0.16), Nitrofurantoin (0.007). (Shown in table 6).

Table: 7 DDD value of commonly used antibiotics at General Surgery

S. No	Antibiotics	ATC Code	DDDValue/ 1000 Inhabitants	WHO DDD Value (G)
1.	Ceftriaxone	J01DD04	0.065	2
2.	Amoxicillin With Clavulanic Acid	J01CR02	0.32	1.5
3.	Piperacillin With Tazobactam	J01CR05	0.005	14
4.	Ampicillin	J01CA01	0.005	2
5.	Gentamicin	J01GB03	0.081	0.24
6.	Ciprofloxacin	J01MA02	0.020	1

The WHO assigned DDD was mentioned in the table number. Our study results were below the standard DDD, which indicates rational prescribing. All the antibiotics used in In-patient were found to be rational. The observed value of commonly used antibiotics in General Surgery were Ceftriaxone (0.065), Amoxicillin with potassium clavulanate/ clavulanic acid (0.32), Piperacillin with tazobactam (0.005), Ampicillin (0.005), Gentamicin (0.081), Ciprofloxacin (0.020). (Shown in table 7)

Table: 8 DDD value of commonly used antibiotics at Orthopaedics

S. No	Antibiotics	ATC Code	DDD Value/ 1000 inhabitants	WHO DDD Value (g)
1.	Ceftriaxone	J01DD04	0.03	2
2.	Amoxicillin With Clavulanic Acid	J01CR02	0.058	1.5
3.	Piperacillin With Tazobactam	J01CR05	0.0086	14
4.	Doxycycline	J01AA02	0.58	0.1
5.	Gentamicin	J01GB03	0.17	0.24
6.	Ciprofloxacin	J01MA02	0.011	1

The WHO assigned DDD was mentioned in the table number. Our study results were below the standard DDD, which indicates rational prescribing. All the antibiotics used in In-patient were found to be rational. The observed value of commonly used antibiotics in Orthopaedics were Ceftriaxone (0.03), Amoxicillin with potassium clavulanate/ clavulanic acid (0.058), Piperacillin with tazobactam (0.0086), Doxycycline (0.58), Gentamicin (0.17), Ciprofloxacin (0.011). This Moderate usage of antibiotics had more ATC/DDD value of antibiotics. (Shown in table 8).

DISCUSSION

Our clinical study was conducted on the drug utilisation and ATC/DDD evaluation of antibiotics in specific departments of a tertiary care hospital. It was found that slightly more female patients were admitted to the various departments in the hospital when compared to male patients. Prescribed drugs by generic names would make it easier for the hospital to have control over its regulatory stock and also lower the cost of treatment. Most patients were involved in IV therapy only.

In this study, we concluded that, according to WHO standards, every drug must be prescribed with a generic name. to avoid this type of confusion between different classes of drugs with nearly similar brand names while dispensing and also to decrease the cost of therapy which is similar to the study of Kanishk Kala et.al., in 2019[3]. Some key indicators, such as the number of drugs prescribed under generic names and the number of drugs on the essential medicine list, should always be close and also mentioned depending on the clinical needs of the patients which is similar to the study of Ajaya Kumar Sahoo et.al., in 2020[4]. In a majority of the 900 cases, a majority of the drugs were purely prescribed based on their generic names (97.33%) which is similar to Nilay Solanki et.al., in 2019[5]. In this study, the prescribing frequency of antibiotics per prescription is mostly one (40.33%) or two (26.11%) was Ceftriaxone and Amoxycillin and potassium clavulanate / clavulanic acid were the most commonly prescribed medications in the general medicine, general surgery, and orthopaedics departments respectively were found to be effective for treating infections both empirically and prophylactically. which is similar to R. Suraj et.al., in 2008[7].

CONCLUSION

This study reports the use of antibiotics in a tertiary care hospital for six months. Antibiotic usage was calculated in both the percentage of antibiotic use and DDD/100 bed-days. ATC-

DDD system which is accepted globally can be used in antibiotic usage studies for better expression and possible cross comparison across similar studies. The use of antibiotics usually broad-spectrum cephalosporins, penicillin was high in the study. A high average number of drugs per prescription along with high use of injections was noted. Generic prescribing is less this shows that all these parameters should be checked and improved to provide quality and rational treatment to the patient.

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