

Retrospective Drug Use Evaluation of Gentamycin Use in Ambo Hospital, Oromia Region State, West Showa, Ethiopia

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ABSTRACT

Drug should be used appropriately, safely and only when needed 50% or more of drug expenditure may be wasted through irrational prescribing, dispensing and patient use of drugs. Drug use evaluation is one of the useful methods to evaluate the rational use of drug in health institution and has performance of improved method that focus evaluation and improving medication use process with the goal of patient outcome. The objective of this study will to evaluate the rational use of gentamycin in Ambo Hospital. Retrospective systematic study was used to assess rational use of Gentamicin. The study was conducted by reviewing medication records of 400 patients, who received Gentamicin during hospitalization in Ambo general Hospital from Jan.1, 2013-Jan, 1, 2014. A systematic sampling method was used to select prescriptions in this hospital with Gentamicinand patient cards were located based on the medical record number on the prescription papers. Data was collected by using structured format and evaluated against WHO criteria for drug use evaluation as per standard treatment guideline of Ethiopia. Most patients were dosed as 5mg/kg/day (59%). The duration of therapy was found to be high in the range 2-7 days (64.25%). Gentamicin was mainly used as pneumonia treatment (36%). Maintenance fluids were the most commonly co-administered medications with a frequency of 67.75%. The use of Gentamicin was appropriate only in 189 cases (47.25%) for the justification of use. Most of inappropriate uses were seen in terms of duration during treatment of pneumonia followed by frequency for the treatment of AGE. Consistency of prescriber to the national standard treatment guideline was found to be low. To improve rational use and prevent the development of resistance; prescribers should adhere to the national standard treatment guideline. Intensification of short-term trainings and antibiotic control systems are some of the possible solutions the hospital has to do. Gentamicin therapy does not meet the current STG of Ethiopia.

Keywords: Drug Use Evaluation, Gentamicin, Ambo

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INTRODUCTION

Drugs are among the most expensive input of the health service. Drugs should be used appropriately, safely and only when needed. Good drugs use management is compulsory in health care system as drugs are the input that saves life. Most leading

courses of death and disability in developing countries can be prevented. Treated or at least alleviated with cost effective essential drugs. 50% or more of drugs expenditure may be wasted though irrational prescribing, Dispensing and patient use of drugs.¹

Pharmaceuticals can constitute up to 40% of the health care budget in a developing



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country. Yet large proportion of the population often lack essential medication. Because of its considerable impact on the quality of care and the cost of treatment, the selection of medicine is one of the most cost effective approaches to improving access to health care both in developing and developed countries.¹ Anti biotic represent approximately 30% of acute care hospitals drug expenditure they are prescribed for 20–50% of inpatients and their irrational use contribute to the emergency of resistant micro-organisms. Survey done in Switzerland has shown that 22–65% antibiotic prescriptions are either inappropriate or incorrect.²

Drug use evaluation (DUE) is an ongoing systematic process designed to maintain the appropriate and medication data before. During and after dispensing in order to assure appropriatetherapeutic decision making and positive patient outcome.³

Drug use evaluation is one of the useful methods to evaluate the rational drugs use in health institution and has a performance of improvement methods that focuses on evaluation and improving medication use processes with the goal of optimal patient outcome. Of medication use processes (prescribing preparing dispensing administering and monitoring) or specific outcome.⁴

The discovery and use of antimicrobial agents have brought a major break through in therapy. A lot of previously intractable infectious conditions have now become amenable to antimicrobial therapy. Various classes of antibiotics have been discovered and used with varying degrees of success. Among these are the Aminoglycoside. Older members of this group, like the gentamicin, have been available for the treatment of urinary tract infections. However, the limited use of this drug coupled with the rapid development of resistant strains became a problem.⁵

Aminoglycoside antibiotics are frequently used as empirical antibiotics in critically ill patients against suspected gram-negative sepsis or in combination with others to cover some gram positive species. They bind to ribosomal subunits within bacteria, preventing protein synthesis, but the exact mechanism of action remains unclear.⁶

Gentamicin is synthesized by *Micromonospora*, a genus of Gram-positive bacteria widely present in the environment (water and soil). To highlight their specific biological origins, gentamicin and other related antibiotics produced by this genus (*verdamicin*, *mutamicin*, *sisomicin*, *netilmicin*, *retymicin*) generally have their spellings ending in ~micin and not in ~mycin. Gentamicin is a bactericidal antibiotic that works by binding the 30S subunit of the bacterial ribosome, interrupting protein synthesis.

Gentamicin is an aminoglycoside antibiotic composed of a mixture of related gentamicin components and fractions and is used to treat many types of bacterial infections, particularly those caused by Gram-negative organisms.² However, gentamicin is not used for *Neisseria gonorrhoeae*, *Neisseria meningitidis* or *Legionella pneumophila*. Gentamicin is also ototoxic and nephrotoxic, with this toxicity remaining a major problem in clinical use.⁷

Like all aminoglycosides, when gentamicin is given orally, it is not systemically active. This is because it is not absorbed to any appreciable extent from the small intestine. It is administered intravenously, intramuscularly or topically to treat infections. It appears to be completely eliminated unchanged in the urine. Urine must be collected for many days to recover all of a given dose because the drug binds avidly to certain tissues. *E. coli* has shown some resistance to gentamicin, despite being Gram-negative. Reluctance to use gentamicin for empirical therapy has led to increased use of alternative broad-spectrum antibiotics, which some experts suggest has led to the prevalence of antibiotic-resistant bacterial infections by MRSA and other so-called “superbugs”.⁶

Gentamicin is one of the few heat-stable antibiotics that remain active even after autoclaving, which makes it particularly useful in the preparation of some microbiological growth media. It is used during orthopedic surgery when high temperatures are required for the setting of cements (e.g. hip replacements).⁷

Evaluation of gentamicin use is therefore critical to controlling the emergence of resistant strains as well as cutting down of unnecessary expenditures and also ensuring that patients derive maximum benefit from its use.

Statement of the Problem

Drug use evaluation (DUE) is an authorized. Structured ongoing review of physicians prescribing Pharmacist dispensing and patient use of medications. It involves a comprehensive and after the mediation is dispensed. In managed health care system in identifying and integrating problem and making medication.³ In a retrospective analysis of 1,578 antimicrobial prescriptions at the institution’s emergency room complex in 1989, prescribed antibiotics were considered inappropriate in 65.2% of cases and 61% were given prophylactic ally.⁸

In most developing countries governments spend about 20–50% of their national budget on drugs and medical sundries (World Bank, 1994). This makes the financial impact of pharmaceuticals on their economies to be substantial. Governments are thus concerned about the rational use of this drugs.⁴

Furthermore, the World Health Organization Policy Perspective on Medicine (2002) also indicates that even when drugs are made available, more than fifty percent are prescribed, dispensed or sold inappropriately while 50% of patients fail to take the medicines correctly resulting in harmful consequences.

One of the major consequences of such inappropriate use of antibiotics is the development of resistance strains of the hitherto susceptible organism. Inappropriate treatment could also lead to the ultimate; death of the patient. Indeed the WHO report on infectious diseases 2000 indicates that “without proper treatment gastro enteritis is a serious and frequently occurring disease that kills majority of the infected individuals.”²

Significance of the study

Dealing with health problem like in appropriate use of drug that has impact on economy of the county, implementation of drug use evaluation program has useful to monitor in health care system.

The most challenging in our world today is the development resistance to most drugs specially antibiotic due to inappropriate use of drug which may leads treatment failure and impossible to treatment infection disease. To avoid such problem drug use evaluation is the most important. Drug has been used irrationally that reduce quality of patient care, was the resource and cause harm to patient. Because this due avoid medication related problem and increase the patient outcome.

The study design was to evaluate the use of gentamycin in ambo hospital to provide an overview of gentamycin use in hospital and to promote the rational prescribing, dispensing and administration of gentamycin. Hence, to reduce the emergency of antibiotic resistance. Moreover the study contribute in identifying medication related problem and areas of inappropriate use by that it help in identifying areas in which further information and education may be needed by health providers.

OBJECTIVES

General objectives

The general aim of this study was to evaluate gentamycin use at Ambo Hospital.

Specific objectives

- To analyses the pattern of gentamycin use among patient categories identified by age.
- To identify the illnesses most frequently treated with gentamycin.

- To determine whether gentamycin was appropriately prescribed in respect of dose, dose frequency, and dose duration.
- To identify areas in which further information and education was needed by health care provider.
- To evaluate reason for stopping (discontinuous) the gentamycin is based on guide line or not.
- To assess whether the indication of gentamycin as standard guideline or not.

MATERIAL AND METHODS

Study Area and period

A study was conducted from February to April 2014 in Ambo general hospital. Ambo is the capital city of west shewa zone of Oromia region state and bordered on the south by Gosokora, on the West by Awaro, on the north by Dobi and on the East by Awaro. The North Ambo is one of the Fastest growing towns in the region and has a total population of 64,513; male are 32,275 and female 32,238 living in 3 kebeles the total area of the town is 858,753 hectors the town has one referral hospital one MCH Special clinic and two health centres in addition to many other private facility

Study Design

Retrospective study design was conducted to evaluate the use of gentamycin in Ambo General Hospital. The criteria used for antibiotic selection include the following gentamycin with risk those that were not being controlled by antibiotic prescribing restriction system. Drug use evaluation was performed by reviewing patient medication records.

Source of Population

Medication records of patients who received gentamycin during hospitalization in Ambo General Hospital from Jan 1, 2013 to Jan 1, 2014.

Sampling Techniques

The study population was sampled by using systematic sampling to select representatives of the population. Sampling was started from separating prescription for the period of March to May 2014 then the patient prescriptions containing gentamycin for this period were counted. Then the card number of patients from prescriptions containing gentamycin was randomly chosen. Then from the card number every some calculated number was taken to sample the study populations. The card number was used to locate the patient medication records.

Sample Size determination

It was suspected that 95% confidence interval was desired to estimate the proportion within 5% and the sample size drawn as(18).

$$N = Z^2 \times p(1-p) / W^2 = 1.96^2 (0.5 \times 0.5) / 0.05^2$$

$$N = 384$$

Where,

N= required sample size

Z=is multiplier for 95% confidence interval based on the normal distribution

p=expected prevalence

W= desired absolute precision (5%)

The above sample was going to be taken from a relatively small population (<10,000), then the sample size has been adjusted as;

$$NF = n / (1 + (n/N)),$$

$$= 384 / (1 + (384/4000)) = 351$$

Data collection Instrument

The data was collected by using open filling in structured format and the data were recorded in the format from the patient medication records. Four WHO criteria's for drug use evaluation (DUE) was used in this study; namely,

- Indication for use
- Dosage
- Frequency
- Duration to evaluate gentamicin use.

Variable

Dependent variable

- Indication of gentamycin
- Drug -drug interaction with gentamycin

- Side effect of gentamycin
- Dose frequency of gentamycin
- Gentamycin contra indication
- Duration of treatment

Independent Variable

- Age
- Sex
- Diagnosis

Data Processing and Analysis

The data collected was checked, coded and entered into Microsoft Excel and descriptive statistic was utilized to summarize the data. For this analysis p-value less than 0.05 considered as significant whereas p-value greater than 0.05 considered as non-significant. All statistical analyses were done manually using scientific calculator.

Data quality Control

The clarity and completeness checking of data collection format were under taken before the actual data collection and data clearing was done every day. Format without full information was excluded from the study.

Ethical Consideration

Formal letter written by department of pharmacy was given to ambo hospital in order to get permission to conduct the study. The confidentiality of the patient in patient medical record was maintained throughout the study time

RESULTS

A total of 400 patient's card were reviewed and analyzed for the use of gentamicin in Ambo general hospital. Among 400 patients, 191(47.7%) were female and 209 (52.25%) male. Most of them were under the age of less than five years (Table 1).

Age (years)	Numbers of patient card	%
<5	276	69
6 – 16	83	20.75
>16	41	10.25
Total	400	100%

Age distribution was biological classification neonatal, infant, child and adults

Table 2: Demographic (sex) distribution of patient included in the study

SEX	Number	%
Male	209	52.25
Female	191	47.75
Total	400	100

Table 3: Gentamycin daily dosing distribution

DAILY Dosage(gm\day)	5mg/kg day	7.5mg/kg	8mg/kg
Frequency	236	127	37
Percent	59	31.75	9.25

Mostly, gentamycin was given 5 mg/kg day which covered 59% and the rest were 7.5 mg/kg and 8 mg/kg (Table 3).

Table 4: Duration of gentamycin therapy distribution

Duration in days	Numbers of patient	%
Stat	14	3.5
1	18	4.5
2-7	257	64.25
8-14	3	0.75
No duration	108	27
Total	400	100%

About 64.25% was given for patients for the period of 2-7 days, followed by no duration. But the list percentage was 0.75% which showed gentamycin was administered for long times for few cases.

Table 5: Frequently co-administered drugs with gentamycin

DRUG	FREQUENCY	%
MF	271	67.75
Ampicillin	223	55.75
Metronidazole	1	0.25
Ceftriaxzone	48	12
Procin-pencillin	123	30.75
Cry-pencillin	3	0.75
CAF	2	0.50
Total	400	

Table 6: The most common disease for which gentamycin was prescribed

Assessment	Total	Appropriate	%	Inappropriate	%
Sepsis	114	94	82.4	20	17.5
pneumonia	144	50	34.7	94	65.5
SAM	50	-	-	-	100
UTI	8	5	62.5	3	37.5
Pertenats	14	-	-	14	100
Meningitis	10	10	100	-	-
AGE	30	-	-	30	100
Joint Infancy	10	10	100	-	-
Appendicitis	20	20	100	-	-
Total	400	189	47.25	211	52.75

Gentamycin is the most prescribed appropriately for meningitis (100%) and the least is for UTI (62.5%)

Table 7: Distribution of in appropriate use of gentamycin based on due criteria

DUE-CRITERIA	Number of error	%
Duration	94	44.5
Frequency	47	22.27
Dose	40	18.95
Indication	30	14.2
Total	211	100

In Ambo Hospital the duration, frequency, dose and indication of gentamycin was evaluated retrospectively. The most common indication of gentamycin was sepsis and pneumonia followed by SAM, appendicitis, age and others are showed in table 6.

DISCUSSION

In this study 59% of patient took 5mg/kg daily and 31.75%, 9.25%, 7.5mg/kg and 80mg/kg daily according to standard treatment guide line for different cases it is better.

In this study the mean duration of gentamycin therapy was found to be 7 days and high in the range 2–7 days (64.25%) followed by 1 days (4.5%) which is better than the study done in Bahrain over extended duration of treatment (2.7%) were encountered irrational drug therapy in infant with prescribing error is apparent in primary care practices which may be related to a lack of drug information (9, 11).

This study is showed that 52.75% of gentamycin is prescribed inappropriately. From this error duration (44.5%), frequency (22.27%) accounts high percentage. It is close to the study done on antibiotic in Holland that show 22 - 65% antibiotic prescriptions were either inappropriate or in correct. (3, 10)

Among the medication co administered with gentamycin fluid took first place with frequency of 271 (71.5%) followed by ampicillin injection 223 (58.1), procaine penicillin 123 (32%), ceftriaxone 48 (12.5), crystalline penicillin 3 (0.78%) and metronidazole 1 (0.3). In this study drug-drug interaction was not occurred b/c the prescribed the drugs as STG. In contrast the study done in Bahrain showed that 2.4% interaction with drugs.

In this finding majority of the patients use gentamycin for SAM (100%), joint infection (100%) appendicitis (100%), meningitis (100%), sepsis (82.4%), pneumonia (65.5%), UTI (62.5%) which is in line of with standard treatment guideline of Ethiopia but patients use for acute gastritis 30 (100%), UTI (37.5%) were used inappropriately related to indication, dose, frequency. It is comparable with the study done in Nigeria and presented to WHO in 2002 by surveyors, 60% of antibiotics were presented unnecessary.¹⁰

Most of the in appropriate use was involved during prescription of gentamycin for pneumonia 65.3% and

sepsis 17.5% with duration and frequency, respectively. It is comparable with the study undertaken in Nigeria and presented to WHO in 2000 by surveyors, 60% of antibiotic were prescribed unnecessary.^{10,12}

Inappropriate use of medicine results waste of resources for the patient, and result significant patient harm in term of poor patient out come and adverse drug reaction. In this finding the dosing pattern of gentamycin as therapy in the hospital was found that the dose prescribed was in appropriate in the patient of 30.85% and frequency of the drug prescribed 39.4%. This show that dose error is not a common problem regarding to gentamycin prescribed in ambo hospital when it compares with the study done in Bahrain 54.1% of prescription with omission error length of therapy was not states, in 43.5% of prescription with omission error dosing frequency (20.8%) and dose strength (17.7%) related error were most common regarding to irrational prescribing drug.^{11,13}

In this study the use of gentamycin was found to be appropriate for the justification of use in 189 (47.25%) and in appropriate in 211 (52.75%). The value which is appropriate use of gentamycin in the study area is in line with the value obtained in Nepal which is 50%.⁹

The appropriate use of gentamycin in the current study is not in agreement with the retrospective study done in Sudan, 20%.¹²

The differences might be due to the fact that Ambo general hospital may how lack of controlling agents like drug therapeutic committee and lack of equipped with sufficient professionals as well as shortage of in service training for health professionals.

The use of gentamycin was found to be high for the treatment of pneumonia 144 (36%) followed by sepsis, SAM, AGE, appendicitis, perforates, meningitis & UTI in descending orders.

The mean duration of gentamycin therapy is 7 days and high in the range of 2-7 days followed by no duration, staff dose, one day and 8-14 days in descending orders.

This is lower than the study done in Khartoum. This is an important factor as the number of days in which gentamicin used correlates with resistance prevalence. Additionally, this may indicate the prevalence of diseases in which gentamicin was used in the range mentioned above.¹¹

CONCLUSION

Drug use evaluation of gentamycin with respect to indication, duration of therapy and frequency of administration manipulates correct prescription practice.

In Ambo general hospital as to WHO set criteria prescribers were not sticking to Ethiopian national STG.

The majority of inappropriateness was seen with duration of therapy. Results of the present study showed that inappropriate use of gentamycin was high which paves for the emergency of bacterial strains that are resistant to the available antimicrobial agent which in turn lead to increase in cost of therapy and treatment failure.

RECOMMENDATIONS

To improve the correct use of gentamycin in ambo hospital, the following recommendations were given:

- In a few patients, inappropriate dose and frequency needs to be prescribed, so the prescriber should give attention when prescribing the gentamycin in Ambo Hospital.
- Easy access of the national STG to all health professionals setting continuous drug use evaluation programs.
- Hospital should have drug therapeutic committee (DTC) that can evaluate in correct prescription.

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Acronym and abbreviation

DTC: Drug Therapeutic Committee

DUE: Drug use evaluation

DUR; Drug utilization review

UTIS; Urinary tract infection

HIV; Human immune virus

STG: Standard treatment guideline

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Conflict of interest: None declared

Ethical approval: Approval and permission was sought from Ethical Review Board of College of Medicine and Health Sciences of Ambo University

REFERENCES

1. Olt A.J, Suttentfield J.L, Benzen C.S. MSH managing drug supply second edition, USA Kumarian, 1997; 4 (11): 122
2. Gunton V, Troillet N, Beney J, Boubaker K, Liithi C.J, Taffe P, et al. Impact of inter disciplinary strategies on antibiotic use in three hospitals. Switzerland. J. antimicrobial chemo therapy. 2004;55 (3): 362–66.
3. The academy of managed care pharmacy; concept in managed care pharmacy Drug use evaluation Was hing on Accessed online at [http://depts.washington.edu/lexpharmd/ExpPharmD DUE. HTML ON 6/2/2010](http://depts.washington.edu/lexpharmd/ExpPharmD%20DUE.html)
4. American society of hospital pharmacist. ASHP guidelines on the pharmacist's role in drug use evaluation .AMJ. Hospital. 1988: 45; 103–04.
5. Threlfall, E.J., Ward, LR. Decreased Susceptibility to ciprofloxacin in *Salmonella enterica* serotype Typhi, United Kingdom. Emerg Infect Dis. 2001; 7: 448–50
6. Gopal. V, Keane. M and Ail. D. Survey on the use of gentamicin and vancomycin in adult intensive care units. JICS. 2013: 14 (3).
7. Moulds, Robert and Jeyasingham, Melanie. Gentamicin: a great way to start. Australian Prescriber. 2010; (33): 134–35.
8. Goljan, Edward F. Rapid Review Pathology 3rd ed. Philadelphia, PA: Elsevier. 2011: p. 241. ISBN 978-0-323-08438-3
9. Akande M.T, Ologe, O.M. Prescription pattern at a secondary health care facility in Ilorin, Nigeria. Journal of Africa medicine. 2007; 4; 186–89.
10. Nicholas Z, Gordon J. Influencing antibiotic prescribing in general practice. Africa of prescriber feedback and management guideline. 1999.
11. Alkhaja K, Alansari T, Damanhori A, Sequeira R. Evaluation of drug utilization and prescribing error in infant; a primary care prescription based on study. Middle East J. health policy 2007. 8; 350–57.
12. Abdelmumin IA. Investigation of drug use in health center in Khartoum Sudan medical J. 1999. 37; 21–26.
13. Gentamicin spectrum of bacterial susceptibility and Resistance. Retrieved 15 May, 2012.