Appropriateness of ceftriaxone prescription: A case of Haramaya hospital Eastern Ethiopia

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ABSTRACT

Background: The irrational use of antibiotics lead to a significant treatment failure, toxicity, drug-drug interaction and increased cost of treatment. Therefore, special attention should be given to antibiotics not only during their development and production, but also during the whole course of time of selection, administration and utilization in the health care system.

Objective: The aim of the study is to assess appropriateness of ceftriaxone prescription at Haramaya Hospital, East Hararghe and Eastern Ethiopia from March 20, 2018 to April 20, 2018 GC.

Methodology: Hospital based retrospective cross sectional study was conducted on 215 Patient's Medical Record Cards (PMRCs) who received ceftriaxone from January 2018 to December 2019 at Haramaya Hospital, Eastern Ethiopia. Simple random sampling technique was used to select medical record cards. The appropriateness of the ceftriaxone usage was evaluated by using world health organization treatment guideline. Data was analyzed using statistical package software SPPS version 20 and presented in tables and figures.

Results: From the total of 215 patient medical history records reviewed, the 86.8% were in line with the standard treatment guideline of world health organization. Pneumonia (61.9%), urinary tract infection (19.6%), congestive heart failure(4.5%) and surgical cite prophylaxis(4.5%) were the most common disease states for which Ceftriaxone injection was used in Haramaya Hospital. In current study, the 87% of Ceftriaxone prescription was used for appropriate indication. The 13% of Ceftriaxone prescription was for inappropriate indication. Incorrect duration (65.6%) and incorrect indication (13%) were the most common drug therapy problems associated with Ceftriaxone prescription.

Conclusion: In the current study the most common disease state for which Ceftriaxone injection used was for treatment of Pneumonia and urinary tract infection. The dose of 1 gm of Ceftriaxone injection was prescribed in majority of the cases. In significant proportion of the cases, Ceftriaxone injection was prescribed for incorrect indication. In the majority of the cases Ceftriaxone injection was used for empiric treatment followed by for kinetic purpose.

Key words: Ceftriaxone; Drug therapy problem; Drug use evaluation; Ethiopia

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INTRODUCTION

Antimicrobial drugs are core for treatment of infectious diseases. The management of infectious disease is extremely threatened by development of resistance to the antimicrobials. Misuse of antimicrobials causes development of antibiotic resistance [1,2].The irrational use of antibiotics leads to a significant treatment failure, toxicity, drug-drug interaction and increased cost of treatment. Therefore, special attention should be given to antibiotics not only during their development and production, but also during the whole course of time of selection, administration and utilization in the health care system [3-6].

Drug Utilization Evaluation (DUE) is a part of pharmaco-epidemiology, which provides insights on the extent, pattern, determinants and outcomes of drug use and prescribing practice. DUE is an on-going systematic quality improvement process, which is designed to review drug use and drugs prescribing patterns. It develops criteria and standards which describe optimal drug use and promote appropriate drug use through education and other interventions [7]. The wide use of Cephalosporin's resulted in the emergence of resistance, which explains the necessity of Drug Utilization Evaluation (DUE). DUE is performed to assess the use of antibiotics which emphasis on improvement of drug use and provides better patient care. According to WHO guidelines, drug utilization was defined as the marketing, distribution, prescription, and use of drugs in a society, with special emphasis on the resulting medical, social and economic consequences [1].

Currently the consumption of antibiotics have increased by 40% with cephalosporin's (60%) being most commonly utilized antibiotic [8]. The wide spread use of cephalosporin's has been associated with emergence of cephalosporin's resistance [9]. Third generation cephalosporin's are the most commonly prescribed broad spectrum antibiotic [7]. Ceftriaxone is one of the most commonly used antibiotics due to its high antibacterial potency, a wide spectrum of activity and its minimal side effects [10].

METHODOLOGY

Study setting and period

The study was conducted in Haramaya Hospital, Haramaya town, East Ethiopia which is found 514 km away from Addis Ababa. Haramaya Hospital is serving 1,143,909 peoples which come from two city administrations; Awaday and Haramaya city, and five woredas from Eastern Hararghe. Haramaya Hospital has four wards and 5 clinics (i.e.

ANC clinic, dental clinics, tuberculosis (TB) clinic, Anti-Retroviral Therapy (ART) clinic and ophthalmologic clinic). The study was conducted from March 20 to April 20, 2019.

Study design

A Hospital based retrospective cross sectional study design was employed by reviewing the patient medication record cards who were taking ceftriaxone from January, 2018 to December, 2019.

Population

Source population: All Patients medical record cards of all patients treated in Haramaya general hospital.

Study population: All patients' medical record cards that were with ceftriaxone in Haramaya general Hospital from January 2018 to December 2019.

Sample Size Determination and Sampling technique: The sample size was determined using the formula:

Where: n_i=The desired sample size

p=Prevalence of substance abuse among community (50%) (Since no study was conducted in the study area as far as the investigator knowledge and searching effort)

Zα/2=critical value at 95% confidence level of certainty (1.96)

d=the margin of error between the sample and the population=5%

n= $((1.96)^2 \times 0.5(1-0.5))/(0.05)^2$ =384

Using the above formula, sample size (n_i)=384, since our sample population (N) is less than 10000(i.e., 440). The finale sample size (nf) was calculated using the formula:

$$384+440$$

With addition of 5% for contingency for non-response, the final sample size of 215 cards was assessed. The cards were selected using simple random sampling.

Data collection method

Data were collected from patient medication record cards containing ceftriaxone by using structured questionnaire. The questionnaire contains all relevant variables based on the objectives of the study, clinical information and pattern of ceftriaxone use. The questionnaire containing the variable was measured carefully developed. The card numbers of the patients who were taking ceftriaxone were found by recording the card number of patients who were admitted to medical ward in one year. After finalizing the work of study materials and obtaining permission to conduct the research, data was collected with the data collection format.

Data quality control

Data collecting formats were checked for its completeness before collecting data. Collected data clearing was done every day for completeness and consistency before data processing and analysis.

Data processing and analysis

The data was processed and analyzed by using the set criteria for drug use evaluation against WHO Guidelines for the management of common illnesses [11]. The data was edited, coded, and analyzed by using SPSS version 20 software package. And the result of the study is presented using tables and figures.

Ethical consideration

A formal letter was obtained from school of pharmacy, college of health and medical science and given to Haramaya Hospital in order to get permission to conduct the study. All the concerned body was informed about the purpose and aim of the study as well as significance of the study. Name and address of the patients as well as of prescribers were omitted from data collection format in order to patient and prescribers' information.

Operational definitions

Course: Administering of at least one dose of drugs.

Drug use evaluation: An ongoing systematic process designed to maintain the appropriate and effective use of drugs.

Empiric treatment: Antibiotics administration without identification of causative agent.

Kinetic treatment: Treatment undertaken after definitive identification of the causative agent.

Rational use of drugs: A process which involves appropriate prescribing, dispensing and patient use of drugs.

Resistance: Refers to irresponsiveness of microorganism to the antibiotics through developing their own mechanism.

Standard treatment guide line: Disease focused document on drugs.

RESULTS

Socio demographic characteristics

From the 215 patient medical record cards reviewed, the 111(51.6%) were female and 104 (48.4%) were male patients medical records. Most of them were adults being in the age range of 18-35(54.4%) (Table 1).

Table 1: Socio-demographic characteristics of study participants in Haramaya Hospital prescribed with ceftriaxone injection from january 2018 to december 2019

Variable	Frequency	Percentage (%)
Age 15-25	66	30.7
26-35	51	23.7
36-45	23	10.7
46-50	30	14
>50	45	20.9
Sex		
Male	104	48.4
Female	111	51.6

Diseases for which ceftriaxone injection prescribed

Pneumonia (61.9%), urinary tract infection (19.6%), congestive heart failure (4.5%) and surgical cite prophylaxis (4.5%) were the most common diseases for which Ceftriaxone injection was prescribed Haramaya Hospital (Table 2).

Table 2: Diseases for which ceftriaxone injection was prescribed in Haramaya Hospital from january 2018 to december 2019. Copd*: chronic obstructive pulmonary disease

S. No.	Diseases	Frequency	Percentage (%)
1	Pneumonia	134	61.2
2	Urinary tract infection	42	19.2
3	Congestive heart failure	10	4.5
4	Surgical cite prophylaxis	10	4.5
5	Sexually transmitted infection	5	2.3
6	Dyspepsia	8	3.7
7	Tuberculosis	7	3.2
8	COPD*	3	1.4

Appropriateness of ceftriaxone prescription

In current study, the 87% of Ceftriaxone prescription was used for appropriate indication. Still significant proportion (13%) of Ceftriaxone prescription was utilized for inappropriate indication (Figure 1).
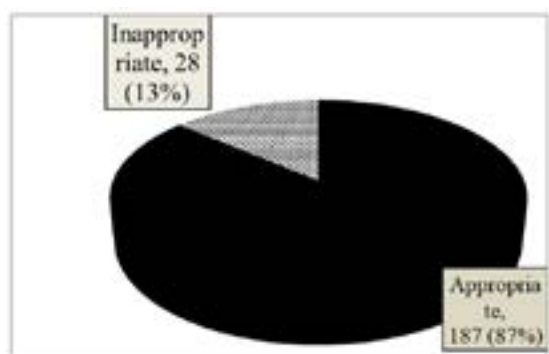

Figure 1: Appropriateness of injection prescription in Haramaya Hospital from January 2018 to December 2019, ceftriaxone

Incorrect indication of ceftriaxone injection

From the total patient medication record cards reviewed, in 28(13%) of the cases Ceftriaxone injection was prescribed for incorrect indication. From this incorrect indication for Ceftriaxone injection, congestive heart failure was the leading one (4.7%) followed by Dyspepsia (3.8%) (Table 3).

Table 3: Use of ceftriaxone for incorrect indication in Haramaya Hospital from january, 2018 to december 2019

S.No	Incorrect indication	Frequency	Percentage (%)
1	CHF/Congestive heart failure	10	35.7
2	Dyspepsia	8	28.6
3	Tuberculosis	7	25
4	COPD*	3	10.7
	Total	28	100

Drug therapy problems associated with ceftriaxone prescription

In the present study incorrect duration (65.6%) and incorrect indication (13%) were the most common drug therapy problems with Ceftriaxone prescription (Table 4).

Table 4: Drug therapy problems associated with ceftriaxone prescription in Haramaya Hospital from january 2018 to december 2019

S. No.	Drug therapy problem	Frequency	Percentage (%)
1.	Incorrect duration	141	65.6
2	Incorrect indication	28	13
3	Incorrect dose	16	7.4%

Dose and duration of ceftriaxone injection prescribed

From 215 patient medical record cards reviewed in Haramaya Hospital, in the 86% of the cases 1 gm of Ceftriaxone injection was prescribed. With respect to frequency of prescription in 98.6% of the cases the drug was prescribed twice per a day. In the majority, 84.2%, of the cases the drug was prescribed for duration of 7-14 days (Table 5).

Table 5: Prescribed dose, frequency and duration of ceftriaxone injection used in Haramaya Hospital from january 2018 to december 2019

College	Frequency	Percentage (%)
Dose of ceftriaxone prescribed		
1gm	185	86
2gm	30	14
Frequency of ceftriaxone prescribed		
BID	212	98.6
QD	3	1.4
Duration of ceftriaxone prescribed		
2-6 days	34	15.8
7-14 days	181	84.2

Drugs co-administered with ceftriaxone injection

Among the drugs co-administered with Ceftriaxone, Azithromycin (28.4%) was the most commonly co-administered drug, followed by maintenance fluids (15.4%) and Tramadol (13.6%) (Table 6).

Table 6: Drugs co-administered with ceftriaxone injection in Haramaya Hospital from january 2018 to december 2019. TB*: Tuberculosis

Drug	Frequency	Percentage (%)
Azithromycin	61	28.4
IV fluids	34	15.8
Tramadol	29	13.6
Doxycycline	28	12.9
Ciprofloxacillin	24	11.2
Paracetamole	21	9.7
Anti-TB*	18	8.4

Objective use of ceftriaxone injection

From 215 patient medical record cards reviewed, the majority of Ceftriaxone used was for empiric treatment (80.5%), followed for kinetic purpose (19.1%) and prophylactic purpose (0.4%) (Table 7).

Table 7: Reason for use of ceftriaxone injection in Haramaya Hospital from january 2017 to december 2017

S.No	Reason	Frequency	Percentage (%)
1	Empiric	173	80.5
2	Kinetic	41	19.1
3	Prophylactic	1	0.4

DISCUSSION

TIn this drug use evaluation study, 215 Patient Medical History Records (PMHRs) of patients treated with Ceftriaxone at Haramaya general Hospital were reviewed. The 79.9% of the study participants were at age range of 18-50 years.

In the current study, 134(62.3%) Ceftriaxone was prescribed for treatment of patients with diagnosed with Pneumonia. Similar to this study result, Pneumonia remains the major disease for which

Ceftriaxone was prescribed in studies done in Dire Dawa, Ethiopia, Mekele, Ethiopia and Tikur Anbessa, Ethiopia [12-14].

The use of ceftriaxone was found to be justifiable in 187 (87%) of the cases, which is higher than the value obtained in a retrospective evaluation of ceftriaxone at Korea and Eritrea, where 65.5% and 27.5% of Ceftriaxone injections was prescribed for justifiable cases. This difference may be perhaps because of high empiric use of ceftriaxone for presumed infections and difference in evaluation period and sample size in the latter studies [15,16].

Concerning the duration ceftriaxone, 84.2% of the patients were treated for duration of 7-14 days. In contrary to this result, research done at private hospital of Nepal the majority (76.11%), of the patients were treated for period of 2-7 days [17]. Treatment of patients with antibiotics as Ceftriaxone for long period of time results in development of antibiotic resistance among the microbes and exposes the patients to adverse effects of the drug. Therefore, appropriate measure should be in place for use of antibiotics for only reasonable treatment period.

In terms of drug therapy problems associated with the use of ceftriaxone, incorrect duration (65.6%) and incorrect indication (13%) were the main therapy problems. In contrary to this study finding, a study done in Ethiopia at Felege Hiwot referral hospital reports that 47.2% and 4.7% of the study participants were exposed to drug therapy problems of incorrect duration (too low or long) and incorrect indication respectively [18]. The high prevalence of drug therapy problems in current study may be due to absence of clinical pharmacy service in Haramaya general hospital.

Concerning objective of prescribing the ceftriaxone, the 80.5% of the patients were prescribed for empiric treatment. In concordance to this study finding, the major objective of ceftriaxone prescription were for empiric treatment in studies done in Gondar (79.5%) and Tikur Anbessa (87.1%) Ethiopia [13,14]. For empiric treatment engenders development of antibiotic resistance, appropriate precaution such as combination therapy should be exercised for such practices prevent development of resistance to Ceftriaxone.

CONCLUSION

In the current study the most common disease state for which Ceftriaxone injection used was for treatment of Pneumonia and urinary tract infection. The dose of 1 gm of Ceftriaxone injection was prescribed in majority of the cases. In significant proportion of the cases, Ceftriaxone injection was prescribed for incorrect indication. In the majority of the cases Ceftriaxone injection was used for empiric treatment followed by for kinetic purpose.

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DECLARATIONS

Author's contribution

Author DT involved in the conception and design of the study, participated in the literature searches, supervised data collection and analyzed data. Author TS, AJ and JA participated in the design of the study, supervised data collection and the overall research, and commented the manuscript. Author EM and FA involved in the conception and design of the study, participated in the literature searches, analyzed data and wrote the manuscript. All the authors approved the final manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AVAILABILITY OF DATA AND MATERIALS

The supporting documents for this study can be available from the corresponding author upon request.

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