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Evaluation of Ceftriaxone use for Hospitalized Patients in Ethiopia: The Case of a Referral Hospital

Negese Sewagegn^{*1}, G/ Mariam Ayichew¹, Amsale Miskir¹, Asmamaw Degarege¹, Omer Mohammed¹, Tenaw Andualem²

¹Felege Hiwot Referral Hospital, Bahir Dar, Ethiopia

²USAID/SIAPS, Addis Ababa, Ethiopia

Corresponding Author: Negese Sewagegn, Felege Hiwot Referral Hospital, Bahir Dar, Ethiopia. **Email:** negese2004@gmail.com

Citation: Negese Sewagegn et al. (2017), Evaluation of Ceftriaxone use for Hospitalized Patients in Ethiopia: The Case of a Referral Hospital. Int J Pharm Sci & Scient Res. 3:2, 27-32. DOH: [10.25141/2471-6782-2017-2.0026](https://doi.org/10.25141/2471-6782-2017-2.0026)

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Received: March 13, 2017; **Accepted:** March 20, 2017; **Published:** May 16, 2017

Abstract

Background: Microorganisms resistance has grown due to frequent and misuse of antimicrobial agents both in humans and animals resulting in global public health and economic threats. We evaluated the prescribing practices of ceftriaxone at inpatients, Felege hiwot referral hospital in Ethiopia.

Methods: We retrospectively reviewed the prescribing practices of ceftriaxone in 127 in patients who received ceftriaxone between April 1, 2005 and June 30, 2015. Ceftriaxone use evaluation was based on standards set by World health organization. The criteria used in this evaluation were indication for use; the dose, frequency, duration, contraindication and interaction. The presence of a single error in either of the individual criteria was considered as inappropriate use.

Results: The overall evaluation of use of ceftriaxone was inappropriate in 88 cases (70.0%) which seems higher than other hospitals in Ethiopia. Inappropriate use of ceftriaxone by diagnosis were, acute abdomen 23 (79.3%), pneumonia 19 (67.9%), sepsis 12 (75.0%), trauma 8 (80.0%), obstructed labor 7 (53.9%), elective surgical cases 6 (75.0%), meningitis 4 (44.4%), lower urinary tract infection 3 (100.0%), upper urinary tract infection 1 (50.0%), and others 5 (55.6%). The inappropriate use of ceftriaxone by the different units of inpatients were surgery 41cases (74.5%), internal medicine 19 cases (65.5%), gynecology and obstetrics 20 (74.1%), and pediatrics 8 (50%). Most of the durations of prescribing showed a high rate of inappropriateness which accounts 60 cases (47.2%) of the total inappropriateness followed by frequency 11 (8.7%), interaction 9 (7.1%), indication 6 (4.7%) and contraindication 2 (1.6%) respectively.

Conclusions: Inappropriate prescribing of ceftriaxone was higher compared to other hospitals in Ethiopia. Antimicrobial stewardship in general and prudent prescribing of ceftriaxone in particular is needed to improve its useful life. This research can be extrapolated to other antimicrobials and health facilities for appropriate interventions.

Keywords: Antimicrobial Resistance, Drug use evaluation, Ceftriaxone, Ethiopia

Introduction:

Antimicrobial resistance is a worldwide concern. (1) Its impact on health and economic outcomes estimated to increase health-care costs to \$30 billion annually. (2) Antibiotics are considered among the most commonly prescribed drug classes in developing countries. Rates of antibiotic prescriptions is high, double the World health organization (WHO) recommendation of 30 %. (3, 4) Frequent and inappropriate prescription of antibiotics is a major public health concern and is related to the development of antimicrobial resistance.(5-8) The most-prescribed antibiotics are the cephalosporins and a high prevalence of inappropriate antibiotic prescriptions.(5, 9)

Drug use evaluation (DUE) is a system of ongoing, systematic;

criteria based evaluation of drug use that will help ensure that medicines are used appropriately. If therapy is not appropriate, interventions will be necessary to optimize drug therapy. A DUE is drug or disease specific and can be structured so that it will assess the actual process of prescribing, dispensing or administering a drug (indications, dose, frequency, duration, contraindication and drug interactions). DUE is the same as drug utilization review and terms can be used synonymously. (10) Previous similar retrospective DUE studies in Ethiopia showed that the use of ceftriaxone is inappropriate. (11-13)

In this study, we will evaluate the use of a specific antibiotic ‘‘ceftriaxone’’ in Felege hiwot referral hospital (FHRH). There

is no a study conducted yet on rational use of ceftriaxone in our hospital. Therefore, this study will be used as a base line for this hospital. The following criteria are used to select ceftriaxone:

- It is most prescribed drug (high volume).
- It is injectable and antimicrobial.
- It is used for high risk patients.

Methods and Materials:

We retrospectively reviewed the prescribing practices of ceftriaxone between April 1, 20015 and June 30, 2015 at FHRH, Bahir Dar town, North-West Ethiopia. FHRH is serving a catchment population of over 5-7 million.

A total of 130 patient medical records were reviewed retrospectively by using systematic random sampling technique and only 127 patient medical records contained complete information for evaluation. We adopted a standard structured data collection tool of World health organization and pretested. The criteria used in this evaluation were indication for use; the dose, frequency, duration, contraindication and interaction. The presence of a single error in either of the individual criteria was considered as inappropriate use. The research team consisted of general practitioners, clinical pharmacists and experts.

Statistical Analysis:

The data was analyzed and processed by SPSS version 19.0 software for Microsoft window using WHO drug use evaluation criteria with standard treatment guideline of Ethiopia 2014 and national drug formulary of Ethiopia 2013.

Six WHO drug use evaluation criteria were used. These are indication for use, dose, frequency, duration, contraindication and drug interaction.

Results:

A total of 127 medical records were reviewed out of these 64(50.4%) were females (Table 1). The majority age groups were 25-34year and 15-24year which accounts 33(26%) and 25(19.7%) respectively and the minority age groups were neonates and infants which accounts 2(1.6%) and 5(3.9%) respectively (Table 2). The most commonly diagnosed diseases were acute abdomen 29(22.8%) followed by pneumonia 28(22.1%) (Table 3).

Most of patients, 89(70.1%) were treated within 2-7 days, followed by 8-14 days which covers 22(17.3%), and the list duration of stay was 15-21days accounts 3(2.4%). The mean stay duration of treatment was 5.6 days.

About 91(71.7%) of ceftriaxone was given 2gm daily followed by < 1gm and 1gm daily. The most common indication of ceftriaxone was acute abdomen as prophylaxis and as treatment in perforated cases of acute abdomen followed by pneumonia and sepsis. (Table 3)

As shown in (Table 6) use of ceftriaxone was high in surgical ward 55(43.3%) followed by medical ward 29(22.8%). Analyzing Table

6, showed that 82.7% of patients prescribed ceftriaxone were given it for predefined criteria—11.5% short of threshold (94.2%). Thresholds (benchmarks) are not met.

Among 127 cases, 89 (70.1%) of them have inappropriate ceftriaxone use at least in one of the six DUE criteria according to Standard treatment guideline (STG) of Ethiopia 2014; and 38 (29.9%) cases have appropriate ceftriaxone use. Most of inappropriate uses of ceftriaxone were because of short duration of treatment.

Discussion:

Inappropriate prescribing of antibiotics perhaps will have a major effect for early-onset emergency of drug-resistant micro-organisms and adversely an increase cost of antibiotics. Aggregated consumption data in our hospital showed that ceftriaxone is one of the highly prescribed ten items, which is estimated to be 80% of the hospital pharmacy budget. Our hospital is under a continuous effort to improve the useful life of antibiotics through judicious prescribing practice while maintaining a quality patient care to bring better treatment outcomes. Establishing a certain quality team and conducting clinical audit specifically on injectable antibiotics having high volume consumption in our hospital may have very important role to alarm the prescribers and curb threats of anti-microbial resistance.

Depending on aggregated data, our major class of interest is to assess the use of third generation cephalosporins which are prone to empiric therapy by physicians for hospitalized patients due to any suspected bacterial infection. In the context of our hospital ceftriaxone is becoming the most widely used drug of empiric treatment for admitted patients who have sign of systemic infection.

We retrospectively evaluated the level of appropriateness for use of ceftriaxone using WHO drug use evaluation criteria at FHRH in Ethiopia. Our study showed that the appropriate use of ceftriaxone was relatively lower (29.9%) as compared to other similar retrospective studies conducted in Tikuranbesa hospital(13) (71.43%), Dessie referral hospital(12) (53.8%) and Ayder referral hospital (11) 35.8% respectively.

This difference may be perhaps because of high empiric use of ceftriaxone for presumed infections (absence of culture and sensitivity test). There might be a variation in intensity of the DTC to implement and monitor anti-microbial policy of restriction for use and enforce the prescribers to comply with the national STG. There may be some variation in operational definition, evaluation period and sample size; and types of services provided. The national STG 2014 is not commonly used as a reference may be it is not available enough in hard copy for all health care providers.

In this study, the inappropriate use of ceftriaxone was high for the treatment of acute abdomen as prophylaxis and treatment 22.8% followed by pneumonia 22.1%, sepsis 12.6%, obstructed labor 10.2%, trauma 7.9%, meningitis 7.1%, elective surgical prophylaxis 6.3, UTI 3.9% and others 7.1%. This pattern is similar in trend obtained in Ayder referral hospital, high in preoperative prophylaxis 38.8% followed by pneumonia 21.28%.

Category	Frequency	Percentage
Gender		
Male	63	49.6
Female	64	50.4
Total	127	100

Table 1: Distribution of patients on ceftriaxone as disaggregated by sex in FHRH, October 2015.

Category	Frequency	%
Age (Years)		
<15(pediatrics)	26	20.5
15-65(adult)	92	72.4
>65(geriatrics)	09	7.1
Total	127	100

Table 2: Distribution of patients on ceftriaxone as disaggregated by age in FHRH, October 2015.

Cases	Total N	Inappropriate n (%)
Pneumonia	28	19 (67.9)
Acute abdomen	29	23 (79.3)
Sepsis	16	12 (75.0)
Obstructed labor	13	7 (53.9)
Meningitis	09	4 (44.4)
Trauma	10	8 (80.0)
Upper UTI	02	1 (50.0)
Lower UTI	03	3 (100.0)
Elective surgical cases	08	6 (75.0)
Others	09	5 (55.6)
Total	127	89

Table 3: Distribution of inappropriate ceftriaxone use as disaggregated by diagnosis in FHRH, October 2015.

* Others: post circumcision phimosis, multiple site abscesses, chronic osteomyelitis (COM), wet gangrene, cellulitis, hydronephrosis, foot abscess, upper GI bleeding

*Sepsis: urosepsis, septic abortion, puerperal sepsis, GI onset sepsis, spontaneous bacterial peritonitis (SBP), neonatal sepsis

*Acute abdomen: perforated appendix, perforated PUD (peptic ulcer disease), ovarian cyst torsion, small bowel obstruction/ large bowel obstruction (SBO/LBO), acute appendicitis, acute cholelithiasis

*Trauma: head injury, any type of fracture and soft tissue injury

*elective surgical cases: bladder cancer, endometrial cancer, BPH, goiter, urethral stricture, PPV, inguinal hernia

Criteria	Frequency		%
Duration of therapy			
Stat	06	4.7	
1 day	07	5.5	
2-7 days	89	70.1	
8-14 days	22	17.3	
15-21 days	03	2.4	
Total	127	100	

Table 4: Distribution of ceftriaxone use by duration of therapy in FHRH, October 2015

Criteria	Frequency		%
Daily dosage (g/day)			
<1g	14	11	
1g	16	12.6	
2g	91	71.7	
3g	01	0.8	
4g	05	3.9	
Total	127	100	

Table 5: Distribution of ceftriaxone by daily dosage in FHRH, October 2015

DUE criteria	No. of error	Error (%)	Appropriateness (%)	Threshold (%)
Indication	6	4.7	95.3	95
Dose	1	0.8	94.5	95
Frequency	11	8.7	86.6	95
Duration	60	47.2	40.2	90
Contraindication	2	1.6	98.4	100
Interaction	9	7.1	81.1	90
Total	89	70.1	Aver. 82.7	Aver. 94.2

Table 6: Distribution of inappropriate use of ceftriaxone based on DUE criteria in FHRH, October 2015.

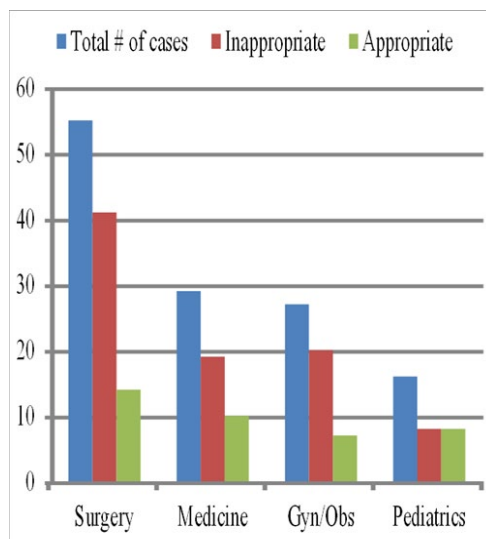


Figure 1: Evaluation of ceftriaxone use by Inpatient Departments

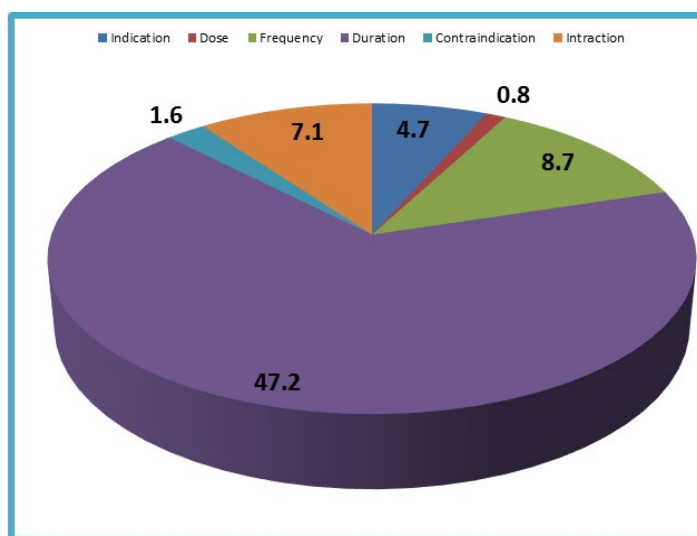


Fig 2: Inappropriate use of Ceftriaxone (%) by individual criteria

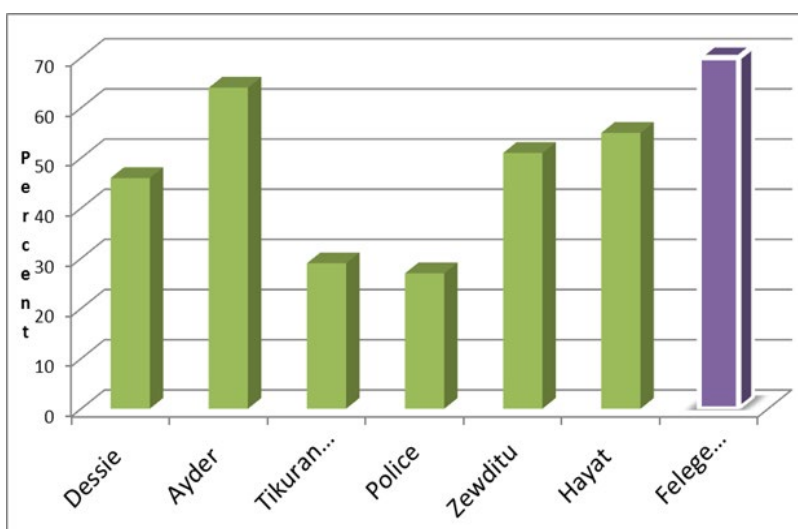


Fig. 3: Overall Inappropriate use of Ceftriaxone (%) in Ethiopian Hospitals

Most of the inappropriate use of ceftriaxone was high in duration 47.2% followed by frequency 8.7%. This result is similar to Dessie referral hospital which was high for duration 43.3% followed by frequency 24%. But in the treatment of upper GI bleeding, missed abortion, lower UTI and electrical burn, ceftriaxone was used 4.7% incorrectly because the STG of Ethiopia don't show use of ceftriaxone in these cases are indicated.

In this study the average mean duration of ceftriaxone use was 5.6 days and in the range of 2-7 days (70.1%) followed by 8-14 days (17.3%) that is relatively lower as compared to Tikuranbesa hospital 9.2 days, Ayder referral hospital 7.2 days and Dessie referral hospital 6.8 days respectively.

This difference may be variation in operational definition, for example, ceftriaxone is not found in oral dosage forms, and therefore in this study early parenteral to oral conversion from other classes of antibiotics was considered as inappropriate.

Conclusion and Recommendation:

Inappropriate prescribing of ceftriaxone was higher compared to other hospitals in Ethiopia. Antimicrobial stewardship in general and prudent prescribing of ceftriaxone in particular is needed to improve its useful life. This research can be extrapolated to other antimicrobials and health facilities for appropriate interventions. There are ongoing interventions. We recommend:

- Adhere to the Ethiopian standard treatment guideline 2014 or prepare hospital-based guidelines on the prescribing and use of ceftriaxone
- Provide audit feedbacks to prescribers and other hospital staff on judicious use of antimicrobial agents in general and ceftriaxone in particular.
- Implement antimicrobial stewardship practices in FHRH
- Involve multidisciplinary team particularly the clinical pharmacists in monitoring of use of ceftriaxone and other antibiotics use.
- Use microbiology lab with culture and sensitivity services and improve health outcomes
- Evaluate post intervention prescribing of ceftriaxone to see the changes and possible scale up.

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