Drug use evaluation (DUE) of Ceftriaxone injection in the in-patient wards of Felege Hiwot Referral Hospital (FHRH), Bahir Dar, North Ethiopia

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ABSTRACT

The use of drugs help millions of people live longer, healthier lives than other wise has been impossible. Drug utilization is determined by prescribers, dispensers and by patients who are ultimate consumers of drugs. The prescribing practices, as studies have shown for many countries, are frequently illogical, irrational, and even dangerous. The study aimed at assessing the drug use pattern of Ceftriaxone injection in the in-patient wards of FHRH. Cross-sectional retrospective study was applied and all the necessary data were collected from in-patient ward department patient record cards using the pre-developed data collection formats by trained data collectors. A total of 264 patients, 100 female and 164 male have been given ceftriaxone injection. 244 (92%) of the patients took the drug for correct indications. Pneumonia (30%), preoperative prophylaxis (15%) and meningitis (13%) are the 3 most common indications for the use of ceftriaxone. Considering indication, dose and duration together, about 61% of ceftriaxone use is appropriate. 20 (8%) of the patients received ceftriaxone for wrong indication. 34 (14%) of the patients took ceftriaxone with incorrect dose and duration, respectively. A total of 37 drugs were prescribed along with ceftriaxone injection. Normal saline (189), metronidazole (92) and azithromycin (32) are the three most commonly co-prescribed drugs. 13% of the patients were prescribed with one or more potentially interacting drug with ceftriaxone. Furosemide, ringer lactate, warfarin, gentamicin and chloramphenicol are the interacting drugs prescribed with ceftriaxone. No patients were given ceftriaxone against contraindications. From the study it was concluded that the practice regarding indications and contraindications is appropriate with regard to the set threshold. The problems in dosing, duration and co-administration of drugs need important attention.

Keywords: Ceftriaxone injection, irrational drug use, Drug use evaluation, Antibiotic drug resistance, standard treatment guideline.

INTRODUCTION

The use of drugs help millions of people live longer, healthier lives than other wise has been impossible. Drug utilization is determined by prescribers, dispensers and by patients who are ultimate consumers of drugs. The prescribing practices, as studies have shown for many countries, are frequently illogical, irrational, and even dangerous [1]. Many prescriptions are inappropriate, given unnecessarily, prescription drugs are brought over the counter without prescription and patient who cannot afford to buy all the drugs prescribed tried to buy a proportion only, indicating a failure of a part of the prescribers as well as on that of the consumer [1]. The consequences of excessive and inappropriate prescribing are many; wastage of public and private money, drug resistance, adverse reactions and increase in iatrogenic diseases. Irrational prescribing is a global problem. Numerous studies, both from the developing and developed countries, describe a pattern that includes polypharmacy, unrelated prescriptions, unnecessarily expensive prescriptions, inappropriate drugs and irrational self medications [2]. The problem is worsened by the global shift from public to private sector spending, which in many developing countries, results in a large portion of drug being purchased without any prescription at all.
Pharmacies, presence of large amount of drug in irregular places like shops, resistant attitude of medical professionals to make a change in their practice and poor cooperation among the care givers like physicians, nurses, laboratories, pharmacists and soon [3].

Since the introduction of penicillin in the 1940s antimicrobial medicines, have become essential for the treatment of many microbial infections in humans and animals. In addition to the treatment of infectious diseases, antimicrobials are vital for reducing the risk of complications in relation to complex medical interventions, such as hip replacements, organ transplants, cancer chemotherapy and the care of premature babies. In addition, antimicrobials are used in veterinary medicine. The continuing use or rather abuse of antibiotics favors emergence and spread of resistance. Microorganisms are not restricted by borders; do not care whether they are in the hospital or outside. They thrive wherever they have an opportunity to do so and we, as humans, have created that environment for resistant bacteria [4].

None prudent use of antibiotics has contributed to antibiotic resistance among common bacterial species. The extent and rate of antibiotic resistance is largely influenced by interplay of the knowledge, expectations of prescribers and patients, economic incentives, characteristics of a country's health system and the regulatory environment. Patient-related factors such as believe and perception towards medication and non adherence are major drive of inappropriate antibiotic use. In addition, poor education, absence of drug information, lack of resources, poor training, patient load and inaccessibility of antibiotics can cause irrational use of antibiotics. Inappropriate antibiotic use and the resulting antibiotic resistances can result in unnecessary health care expenditure, treatment failures and/or adverse drug effects [5].

Drug use evaluation (DUE) is systematic approach designed to maintain rational use of drugs. DUE can identify problems in drug use, reduce adverse reactions, optimize drug therapy and patient adherence and minimize pharmaceuticals related expenditure [6]. Both retrospective and prospective drug use evaluations can be utilized. If appropriately executed, both retrospective and prospective drug use evaluations can be valuable in identifying problems in drug use, optimizing drug therapy, reducing rate of drug resistance, reducing adverse drug reactions and increasing patient adherence [7].

**MATERIALS AND METHODS**

**Study area and period**

The study was conducted at FHRH, Bahir Dar, North-West of Ethiopia. It is referral hospital for Amhara Regional state and is found in Bahir Dar; the capital city of Amhara national regional state. It was founded in 1963. Since that time it is serving about 20,000,000 people being as the only referral hospital for many decades. At present FHRH, gives its services through its departments: pediatrics, gynecology and obstetrics, dermatology, ophthalmology, surgery, internal medicine, emergency management, laboratory, radiography and pharmacy. The study was conducted from March to May, 2013.

**Study design**

A cross sectional retrospective study was conducted and data was collected from patient information cards using the already formulated data collection paper. Data was evaluated against the pre-formulated drug use evaluation indicators of ceftriaxone injections.

**Population**

**Source population**

All the patient information cards in the inpatient wards of FHRH from March to May, 2013

**Study population**

All patient information cards in the inpatient wards of FHRH that contained ceftriaxone injections in the study period.

**Study variables**

*Independent variables*

- Patient characteristics: age, sex, pregnancy, lactation
- Diagnosis

*Dependent variables*

- Indications
- Contraindications
- Drug interactions
- Dosage regimen (dose and duration)

**Data collection**

**Data collection instruments**

Data collection format containing the variables to be measured was utilized.

**Data collection**

Data was collected with the data collection format by trained data collectors from in-patient patient information cards. The data collectors were medical interns who were trained for three days by the principal investigator about the data collection.

**Data processing and analysis**

The data collected was sorted; categorized and analyzed using Microsoft Excel and the results were interpreted and presented using tables and graphs.

**Ethical consideration**

Formal letter was written from Bahir Dar University post graduate, research and community service coordinator office to FHRH and proper clearance was sought so as to conduct the study. All the data taken from the patient information cards were used only for the purpose of this study.
RESULTS AND DISCUSSION
Socio demographic Characteristics
A total of 264 patient medical records containing ceftriaxone injection were analyzed in the study. 100 females and 164 males have used ceftriaxone injections. 38, 38, 171 and 17 of the patients using ceftriaxone injection were in the age group of ≤5, (5-15), (15-65) and >65 years of age respectively. Among the females 11 (4%), 8 (3%) that have used ceftriaxone injection, were pregnant and lactating mothers, respectively (Table 1).

Indications of ceftriaxone injection use
Ceftriaxone injection was prescribed for the appropriate diseases in 244 (92%) of the patients. 73 (30%), 38 (15%), 32 (13%), 28 (11%) and 18 (7%) of patients received ceftriaxone injection for the treatment of Pneumonia, Post-operative prophylaxis, Meningitis, Pre-operative prophylaxis and Bacterial abdominal infections, respectively (Figure 1). 20 (8%) of the patients received ceftriaxone injection for wrong diseases (Figure 2).

Table 1. Socio demographic characteristics of patients that have used Ceftriaxone injection in the in-patient wards of FHRH from March to May, 2013

<table>
<thead>
<tr>
<th>Socio demographic characteristics</th>
<th>Frequency (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>100 (38%)</td>
</tr>
<tr>
<td>Male</td>
<td>164 (62%)</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
</tr>
<tr>
<td>Age Groups</td>
<td></td>
</tr>
<tr>
<td>≤5 years</td>
<td>38 (14%)</td>
</tr>
<tr>
<td>5 – 15</td>
<td>38 (14%)</td>
</tr>
<tr>
<td>&gt;65</td>
<td>17 (7%)</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
</tr>
</tbody>
</table>

Figure 1. Disease conditions for using Ceftriaxone injection in the inpatient wards of FHRH from March to May, 2013

Figure 2. Wrong indications of Ceftriaxone injection use in the inpatient wards of FHRH from March to May, 2013
Dose and duration of ceftriaxone injection use
210 (86%) of the patients were provided with the appropriate dose of Ceftriaxone injection. 34 (14%) of patients were given ceftriaxone with incorrect dose, of which 20 (8%) and 14 (6%) were given over and under doses of ceftriaxone, respectively. 200 (82%) patients received the drug for the appropriate duration. 44 (18%) of the patients received the drug for wrong duration, of which 18 (7%) and 26 (11%) took the drug for shorter and longer duration, respectively (Table 2).

Co-administered drugs
A total of 37 drugs were prescribed along with ceftriaxone injection. The five most commonly co-prescribed drugs with ceftriaxone were Normal saline (189), Metronidazole (92), Azithromycin (32), Cloxacillin (27) and Dexamethasone (21) with their respective frequency (Figure 3). 13% of patients were prescribed with one or more potentially interacting drug with Ceftriaxone. Furosemide, Ringer Lactate, Warfarin, Gentamicin and Chloramphenicol were the interacting drugs prescribed with Ceftriaxone (Figure 4).

Table 2. Dose and duration of ceftriaxone therapy used in the inpatient wards of FHRH from March to May, 2013

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Variables</th>
<th>Frequency (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose</td>
<td>Correct Dose</td>
<td>210 (86%)</td>
</tr>
<tr>
<td></td>
<td>Under Dose</td>
<td>14 (6%)</td>
</tr>
<tr>
<td></td>
<td>Over Dose</td>
<td>20 (8%)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>244</td>
</tr>
<tr>
<td>Duration</td>
<td>Correct Duration</td>
<td>200 (82%)</td>
</tr>
<tr>
<td></td>
<td>Shorter Duration</td>
<td>18 (7%)</td>
</tr>
<tr>
<td></td>
<td>Longer Duration</td>
<td>26 (11%)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>244</td>
</tr>
</tbody>
</table>

Figure 3. Co-administered drugs with Ceftriaxone injection in the inpatient wards of FHRH from March to May, 2013

Figure 4. Potentially significant drug-drug interactions with Ceftriaxone injection in the inpatient wards of FHRH from March to May, 2013
Pharmaceutical care is the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve patients' quality of life [8]. Any suboptimum therapy leads to medication error. The adverse drug events and medication errors are most common types of injuries experienced by hospitalized patients. Such events may be related to professional practice, healthcare products, procedures and systems [9]. The rational use of drugs requires that patient receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them [10].

A total of 264 patients received ceftriaxone injection in FHRH inpatient wards during the study period. 38% and 62% of the patients were females and males, respectively, of which about 65% were adults. 14% were pediatrics while 7% were geriatrics. The average age of the patients was 48 years.

Prescribers must adhere to the standard treatment guideline while prescribing drugs to patients so as to ensure treatment uniformity and promote rational drug use. This study revealed that 92% of the indications of ceftriaxone injection were appropriate as per the standard treatment guideline of Ethiopia. The most commonly encountered indication of ceftriaxone is pneumonia (30%) followed by post operative prophylaxis (15%) and bacterial meningitis (13%). 20 (8%) of the patients received ceftriaxone injection for wrong indications of which Osteomyelitis, bronchitis and Otitis media were the three commonly encountered wrong indications respectively. The study has shown that the result (92%) is somewhat below the set threshold of the study (95%) pertaining to indications of ceftriaxone injection which indicates that the prescribers should better stick to the standard treatment guideline.

The study also 82% and 82% of the patients received the correct dose and duration of ceftriaxone injection respectively. 34 (14%) of patients were given ceftriaxone with incorrect dose, of which 20 (8%) and 14 (6%) were given over and under doses of ceftriaxone, respectively. 200 (82%) patients received the drug for the appropriate duration. 44 (18%) of the patients received the drug for wrong duration, of which 18 (7%) and 26 (11%) took the drug for shorter and longer duration, respectively. The study findings revealed that the result of dose (86%) and duration (75%) was significantly different from the set threshold for ceftriaxone injection (95%) which shows improper use of correctly indicated drugs, which increases the development of drug resistance, cost and rate of adverse effects and complications.

The overall appropriateness of ceftriaxone use (indications, dose and duration considered) is 61% which is lower than the value obtained in a retrospective evaluations conducted in Black Lion Hospital, Addis Ababa (71.43%), Police Hospital, Addis Ababa (73.03) but higher than Ayder referral hospital, Mekele Ethiopia (35.8%) and Dessie referral hospital (53.8) [11]. This difference might be ascribed to the fact that Black Lion and Police hospitals are well established, have drug and therapeutic committee (DTC) and are equipped with sufficient and experienced professionals.

Drug interactions are some of the commonest cases of adverse effects. When two or more drugs are administered to a patient they may act independently of each other or interact with each other. Interactions may increase or decrease the effects of the drugs concerned and may cause unexpected toxicity. It is important to remember that interactions which modify the effects of a drug may involve non prescription drugs, non medicinal agents, social drugs and certain types of foods [12, 13]. A total of 37 drugs were prescribed along with ceftriaxone injection from which normal saline (189), metronidazole (92) and azithromycin (32) were three most frequently prescribed drugs. 13% of the patients were given ceftriaxone with one or more of potentially interacting drug of which furosemide, ringer lactate, and warfarin the three most commonly encountered interacting drugs, respectively. Drug interaction result (13%) is different from the threshold (95%) for ceftriaxone injection. This difference might be due to the fact that most of the therapies in FHRH are empirical, the prescribers use to prescribe multiple drugs hoping that one of the drugs can meet the therapeutic need of the patient. This prescribing of multiple drugs can cause many of the drug-drug interactions.

In prescribing drugs the prescribers should strictly avoid contraindications, unless the benefit to the patient from using the medication out ways the risks. This study has shown that none of the patients has received ceftriaxone injection against the contraindication and this result is very encouraging.

CONCLUSION

In the study it was indicated that there was inappropriate usage of antibiotics. The prescribers prescribed against contradictions which is not appropriate as to WHO DUE criteria. There were many potentially and actually hazardous drug-drug interactions indicating the failure of the prescribers and pharmacists to consider drug-drug interactions and to involve in the patient centered activities respectively. Most of the indications are almost appropriate as per the set criteria of this study. There was also poor drug history taking by the prescribers which makes DUE incomplete.

The present study has revealed better use of antibiotics pertaining to indications and contraindications. The use of drugs with potential drug interactions and dose and duration problems had shown deviations from the pre-set threshold and are areas of improvement.
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