Antibiotics Prescribing in Labor and Delivery Patients in a Tertiary Care Hospital: Bangladesh Perspective

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Abstract

Background: Among the most important risk factors for post-partum maternal infection, cesarean infection ranks at the top which increases risks for infections up to 20 folds. The study was conducted to identify the rational and appropriate use of antibiotics among the labor and delivery patients, to find out the ways of minimizing the misuse of antibiotics and to determine the antibiotics related drug interactions occur in the context of delivery patients.

Methods: The present study was a prospective, observational and cross sectional one carried out over a period of one month (September, 2014) in the Gynecology and Obstetrics Department of Mymensingh Medical College Hospital (MMCH), Bangladesh comprising of a total of 152 prescriptions sheets of the respective patients. Data was analyzed manually.

Result: Mostly used antibiotics found in the study were cephradine (56.58%), flucloxacillin (37.5%), and gentamicin (21.1%) respectively. Cefuroxime and ceftriaxone were the most significant antibiotics that were found to be administered as overdosed during lactation. Drug interactions of the respective antibiotics might be with NSAIDs, PPIs, H_2 receptor blockers and antibiotics amongst themselves. Cefixime, nitrofurantoin and ciprofloxacin might to be harmful for the fetus during administration to the lactating mother.

Conclusion: The study showed a clear knowledge about the antibiotics used in labour and delivery patients in the context of Bangladesh. In most of the prescriptions enrolled in our survey, antibiotics have been used properly. But still, there are some misuses/overdoses found in some of the prescriptions.

Key words: Misuse, interaction, prescription, overdose, cephradine

Introduction

Among the most important risk factors for post-partum maternal infection, cesarean infection ranks at the top [1]. When women undergo cesarean section, they have a five to 20 fold greater risk for infection compared with a vaginal delivery [2]. Infectious complications that follow cesarean delivery include fever, wound infection, endometritis and bacteremia. Other serious infections include pelvic abscess, septic shock, necrotizing fasciitis, septic pelvic vein thrombophlebitis and urinary tract infection [1, 3 and 4]. Factors that have been associated with an increased risk of infection among women having a cesarean delivery include emergency cesarean section, labor and its duration, ruptured membranes and the duration of rupture, the socioeconomic status of the woman, number of prenatal visits, vaginal examinations during labor and internal fetal monitoring, urinary tract infection, anemia, blood loss, obesity, diabetes, general anesthesia, the skill of the operator and the operative technique [1-7]. It has been found that the most important source of post-cesarean section infection is the genital tract, particularly when the membranes are ruptured [8]. There are some general principles for the prevention of any surgical infection which include sound surgical technique, skin antisepsis and anti-microbial prophylaxis [9]. Prevention is the ultimate goal of prophylaxis, not to treat or cure disease. In contrast to the therapeutic use of antibiotics, prophylaxis has to be administered before the potential exposure, and usually for a short duration [10]. During the administration of prophylactic antibiotic therapy, its proper uses should be ensured. The main focus of the study is to identify the rational and appropriate use of antibiotics among the labor and delivery patients, to find out the ways of minimizing the misuse of antibiotics and to determine the antibiotics related drug interactions occur in the context of delivery patients.

Materials and Methods

Study design

A prospective, observational, cross sectional based study was conducted.

Study area and period

The study was carried out over a period of one month (September, 2014) in the Gynecology and Obstetrics Department of Mymensingh Medical College Hospital (MMCH), Bangladesh. It was established in the year of 1962. It is located in the eastern part of the town beside Mymensingh-Dhaka highway. The medical college consists of 8 preliminary and 35 clinical departments. It has in total 910 beds. Gynecology and Obstetrics department is consisted of 75 beds. In addition to these, there are some temporary facilities through which patients can take treatments on the floor when no bed is available. This department consists of 1 Professor, 2 Associate Professors and 4 Assistant Professors.

Source and study population

The source population was all delivery patients who came to the hospital and the target population was those delivery patients who took the treatments in the gynecology and obstetrics department during the study period.

Methods of data collection

Prescriptions were photographed using Digital camera.

Sample size and sampling technique

A total of 152 prescriptions which met all inclusion criteria and none of the exclusion criteria were sampled by using purposive sampling technique. The inclusion criterion was: no age range. The exclusion criterion was: patients whose guardians and doctors unwilling to participate.

Data analysis

Data generated from the prescription sheets were analyzed manually. Tables produced from the analysis were: uses of prescribed antibiotics in lactation; misuse/ overdose of prescribed antibiotics; percentage of prescriptions having chances of drug interactions.

Ethical considerations

Ethical clearance was obtained from both the administrations of the department of Pharmaceutical Sciences of North South University and Mymensingh Medical College Hospital. Verbal consent was also obtained from the respective patients' doctors and guardians by explaining the objective and anticipated benefits of the study.

Results and Discussion

Antibiotics prescribed in lactation

Of all the prescription sheets only 11 antibiotics have been extracted that were prescribed to 152 different delivery patients (table 1). Amongst these, cephradine, flucloxacillin, gentamicin and ceftriaxone have been prescribed extensively. Antibiotic which was administered at the highest percentage was Cephradine. It was written in more than 56% of the prescriptions. Cephradine is a Cephalosporin group of broad spectrum first generation antibiotics which is used in infections owing to sensitive Gram-negative or Gram positive bacteria which includes the urinary tract infections, respiratory tract infections, otitis media, sinusitis, and skin and soft-tissue infections [11]. Flucloxacillin was the second most prescribed antibiotic covering up to 37.5% of the total prescriptions studied. It is a penicillin group of antibiotic indicated to the infections (due to beta-lactamase-producing *staphylococci)* including otitis externa; adjunct in pneumonia, impetigo, cellulitis, osteomyelitis and in staphylococcal endocarditis [12]. Gentamicin Sulfate (salt of gentamicin) is the 3rd most administered antibiotics to the respective patients. Gentamicin being an antibiotic included in the aminoglycoside group is widely used in serious infections. Being a bactericidal, this is active against some Gram-positive and many Gram-negative organisms. Gentamicin is also found to be active against *Pseudomonas aeruginosa* [13]. Ceftriaxone is indicated for serious infections such as septicemia, pneumonia, and meningitis. Having greater activity against *Haemophilus influenza*, cefuroxime is active against certain bacteria which are resistant to the other drugs [11]. It has been prescribed to 7.89% of the studied patients. Being an ester of cefuroxime, cefuroxime axetil has the same antibacterial spectrum as the parent compound. It is effective against respiratory-tract infections, otitis media, sinusitis, and skin and soft-tissue infections [11]. Cefixime, nitrofurantoin and ciprofloxacin; each of these antibiotics were prescribed to only 2 patients (1.32%) whereas cloxacillin was prescribed to 4% of the total patients. Amongst all antibiotics prescribed, cefixime, nitrofurantoin and ciprofloxacin were found to be harmful for the fetus during administration to the lactating mother.

Table 1: percentage of prescribed antibiotics in lactation

Antibiotics Prescribed	% of Prescriptions Share
Cefuroxime	7.89%
Cefuroxime Axetil	9.2%
Flucloxacillin	37.5%
Ceftriaxone	16.45%
Cloxacillin	3.95%
Cephradine	56.58%
Gentamicin Sulfate	21.1%
Cefixime	1.32%
Nitrofurantoin	1.32%
Amoxicillin + Clavulanic Acid	0.66%
Ciprofloxacin	1.32%

A correspondent graph was established from table 1 in which major antibiotics were represented according to their percentage of share where antibiotics were placed in the X axis and their share of prescriptions were placed in the Y axis.

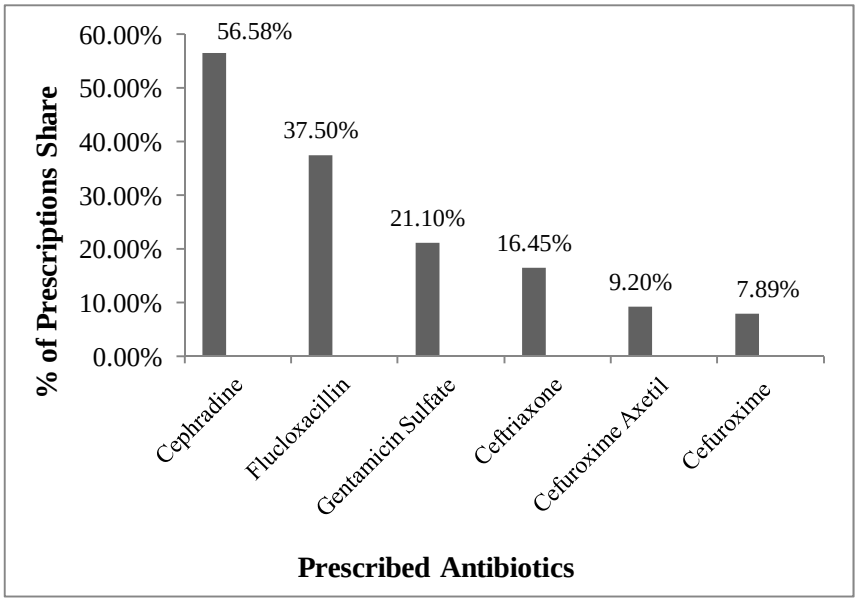

Figure 1: Majorly prescribed antibiotics in lactation

Misuse/ overdose of prescribed antibiotics

To determine the misuse or overdose of the prescribed antibiotics, table 2 was produced in which prescribed dose and maximum prescribed dose were extracted from the prescription sheets and maximum recommended dose and maximum recommended dose for lactation were calculated with the help of British National Formulary 67 and according to these information, percentage of misuse / overdose of antibiotics and percentage of prescriptions having overdose for lactation were calculated. Cefuroxime (25%) and ceftriaxone (100%) were significantly found to be overdosing from lactation point of view since their maximum prescribed doses crossed the limit of doses recommended for lactation [14]. Cefixime, nitrofurantoin and ciprofloxacin also showed overdoses [15-17].

Table 2: Overdose found in the majorly prescribed antibiotics

Antibiotics Prescribed	% of overdose of antibiotics	% of Prescriptions having Overdose for Lactation
Ceftriaxone	Nil	**100%** [14]
Cefuroxime	Nil	**25%** [14]
Flucolxacillin	Nil	Nil
Gentamicin Sulfate	Nil	Nil
Cephradine	Nil	Nil
Cefuroxime axetil	Nil	Nil

Percentage of prescriptions having chances of drug interactions

Four types of Concomitant drugs were isolated from the prescription sheets which were significantly present. Table 3 was constructed to identify the drug interactions of the prescribed antibiotics with those concomitant drugs.

In our present study we found 3 non-steroidal anti-inflammatory drugs (NSAIDs) that were prescribed. These were: paracetamol (acetaminophen), diclofenac and ketorolac. Amongst 11 respective antibiotics used, only ceftriaxone and gentamicin were found to be interacting with them [18-26]. Ceftriaxone interacts with diclofenac and amongst the prescription sheets containing this antibiotic, 88% of them also contained diclofenac. Thus, the chances of drug interaction is 88%. Diclofenac enhances biliary excretion and also decreases renal elimination of ceftriaxone in patients with bile duct drains. The mechanism as well as the clinical significance of this interaction are still not known [19]. Gentamicin also does not have any kind of interaction with acetaminophen, but it interacts with other two NSAIDs prescribed in the prescription sheets. Out of all the prescription sheets containing gentamicin, more than ninety percentage also possessed any of this two antibiotics. Hence, the chances of drug interaction is calculated as 90.63%. Non-steroidal anti-inflammatory drugs (NSAIDs) may potentiate the nephrotoxic effects of aminoglycosides. Particularly if the latter is given in high doses for prolonged period [21-26].

In the present survey, proton pump inhibitors were prescribed by the physicians extensively as concomitant drugs. Specifically three PPIs were found to be used. These are omeprazole, esomeprazole and pantoprazole. Most of the antibiotics prescribed in the prescription sheets do not interact with them. But cefuroxime (75%) and combination of amoxicillin and clavulanic acid did interact with these [27-32]. The co-administration with proton pump inhibitors, or other agents that has the ability to increase gastric pH may reduce the oral bioavailability of cefpodoxime proxetil and cefuroxime axetil. The proposed mechanism indicates pH-dependent reduction in drug dissolution and absorption. It was found on a study that co-administration of these drugs reduces the peak plasma concentration (Cmax) and area under the concentration-time curve (AUC) up to 40% compared to when the drug was given alone [27-30].

In a number of prescriptions, ranitidine was prescribed as a H_2 receptor blocker. Ranitidine is given with cefuroxime, cefuroxime axetil, ceftriaxone, gentamicin and ciprofloxacin and from all of these, only cefuroxime axetil shows interaction with ranitidine [27-28, 30, 33-37].

Apart from other concomitant drugs, antibiotics can interact amongst themselves. Our study has also evaluated the chances of this type of interactions. And there are some incidents found that complimented our evaluation. Interaction between cefuroxime and gentamicin; cefuroxime axetil and gentamicin; ceftriaxone and gentamicin were found. When aminoglycosides and cephalosporins are co-administered, it may increase the risk of nephrotoxicity [38-54].

Table 3: Percentage of majorly prescribed antibiotics having chances of drug interactions with concomitant major drugs

Prescribed antibiotics	NSAIDs	PPIs	H_2 receptor blockers	Concomitant antibiotics
Ceftriaxone	**88%** [18-20]	Nil	Nil	**44%** [48]
Cefuroxime	Nil	**75%** [27-29]	Nil	**100%** [38-54]
Flucloxacillin	Nil	Nil	Nil	Nil
Gentamicin Sulfate	**91%** [21-26]	Nil	Nil	**91%** [38-54]
Cephradine	Nil	Nil	Nil	Nil
Cefuroxime axetil	Nil	Nil	**33%** [30, 33-37]	**100%** [38-54]

Conclusion

The main motive of this study was that towards the end of the research, we might be able to draw a clear knowledge about the antibiotics used in delivery patients during labor and the uses of theses antibiotics in those patients in the context of Bangladesh. In Bangladesh, antibiotics are being used randomly, sometimes without being prescribed by the physicians especially in the rural areas. The intention of the study was to find out the actual scenario of antibiotic use in one of the most important sectors of the healthcare system in Bangladesh. It is comforting to see most of the antibiotics in our survey have been used properly. But still, there are some misuses which should be monitored accurately. More work should be performed like this focusing on different branches of the healthcare scheme so that we may get the whole idea of antibiotic uses in Bangladesh.

Finally in future more study can be done periodically on the source of various drug interactions that were found in the study in the molecular levels.

Limitation

This study was carried out on a small group of population and did not occupy the entire delivery patients who are given prophylactic antibiotics. More accurate reflection of the use of antibiotics on delivery patients can be achieved if it can include the maximum population prevailing in the country.

Declaration of Conflict of interest: No conflicts

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