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Drug Utilization and Evaluation of Antibiotics in Pre & Post-Operative Obstetrics Ward at a Tertiary Care Hospital

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Abstract

Introduction: Antibiotics are especially used in obstetric practice during c-section as there is greater chance of postoperative infection. However, appropriate use is also important to minimize maternal complications and also minimize the problem of antimicrobial resistance. The current study was aimed to understand the pattern of antibiotic use among obstetric patients in a tertiary care center.

Methodology: In the Department of Obstetrics and Gynaecology (OBG) at Geetanjali Hospital, Udaipur, an observational cohort study was conducted over six months during which 120 pregnant women aged 18-45 who delivered via cesarean section were recruited for participation. A structured proforma was utilized to collect relevant clinical information and prescription data. Drug utilization was evaluated using WHO prescribing indicators and Defined Daily Dose (DDD) methodology. Summary statistics were performed on the data to analyze results.

Results: The mean age of participants was 29.32 ± 4.86 years, and the average BMI of participants was also significant at 27.04 ± 2.67 kg/m². The procedure that occurred most often was LSCS. Each patient had an average of 5.57 medications per prescription, with antibiotics comprising 2.93 medications per prescription and indicating a pattern of polypharmacy. A higher percentage of antibiotics had been prescribed by brand than generic; of the antibiotics prescribed, ceftriaxone-sulbactam was the most commonly utilized on a DDD/100 bed day basis. Supportive medications such as antihistamines and analgesics were frequently co-prescribed with the other medications.

Conclusion: The results show that there is a high use of preventive antibiotics among patients in obstetrics, especially those undergoing Caesarean sections. Although the prescriptions mostly followed the hospital guidelines, the common practice of using several antibiotics at once and prescribing by brand names indicates an urgent necessity for better management of antibiotics and more logical prescribing methods.

Keywords: Antibiotic Utilization; Caesarean Section; Drug Utilization; WHO Indicators; DDD; Obstetrics; Polypharmacy

Introduction

Antibiotics mainly used for various infectious diseases or as prophylaxis treatment. They can be of broad and narrow spectrum. In Obstetrics and Gynaecology, antimicrobials are most prescribed as prophylactic for pre and post-operative procedures such as caesarean section, episiotomy, abortion procedures, hysterectomy, laparoscopy treatment, tubectomy, Dilation & Curettage, Urinary Tract Infection (UTI), Pelvic Inflammatory Disease (PID), Sexually Transmitted Diseases (STDs) and endometriosis. The most occurring risk factor for post-partum infections is in caesarean section delivery, hence antibiotic use is more often [1].

The primary goal of antibiotic prophylaxis in any surgical tactics is to lessen or decrease the colonization stress of microorganisms throughout the operation to a particular stage in an order that the affected patient's immune system is capable to overcome. Mainly, antibiotic prophylaxis is intended for elective procedures when the incision will be closed in operating room [2].

According to World Health Organization (WHO), the Drug Utilization is defined as the marketing, distribution, prescription and use of drugs in society, with special emphasis on the resulting medical, social, and economic outcome [3]. The study designed to describe the significance of drug quantitatively and qualitatively which include class of drugs, indications, duration of treatment, dosage, pharmacokinetic data, previous or associated treatments and compliance [1]. Periodic evaluation of drug utilization patterns needs to be done to enable suitable modifications in the prescription of drugs to increase the therapeutic benefit and decrease the adverse effects [4]. Drug utilization studies are used to analyse prescribing trends of medicines and to detect the rational or irrational prescribing patterns.

Maternal morbidity and mortality related to infections has been decreasing nowadays, due to use of antimicrobials [5]. If an infection remains untreated, it can lead to severe complications such as chronic pelvic inflammatory disease, ectopic pregnancy, and infertility.

During pregnancy, infections may occur which can be asymptomatic and can complicate further pregnancy, leading to maternal morbidity [6]. For infection control, regular basis of infections surveillance should be prioritizing among obstetric patients. The most commonly major abdominal operation done is Caesarean section [7]. Over the past deliveries, the delivery by Caesarean section have been increased in both developed as well as developing countries. Caesarean section delivery is most recommended procedure to be under surveillance to improve the patient's as well as baby's health and to ensure the safety of patients [8].

Even prolonged prelabour rupture of membranes, multiple vaginal examinations, manual removal of the placenta, severe perineal trauma, operative vaginal birth and caesarean section have also been associated with increased risk of infections. With higher risk of infection in Caesarean section than in vaginal birth, Caesarean section is particularly the most significant risk factor for infections in the early postpartum period [8].

Peripartum infections associated with caesarean section include infections at the wound/incision site, endometritis and UTI.

Rarer, more serious complications include pelvic abscesses, bacteraemia, septic shock, necrotizing fasciitis and septic pelvic vein thrombophlebitis, which can lead to death [2]. Serious peripartum infections mainly require therapeutic antibiotics, prolonged hospital stays and potentially additional surgical procedures [6].

Worldwide, the incidence of post-caesarean infections varies from 2.5% to 20.5%. The risk of infection can be decreased through sound surgical techniques, accurate use of topical antiseptic agents and antibiotic prophylaxis [2]. In United Kingdom, Surgical Site Infections (SSI) results in maternal mortality in 1 per 10 lakhs of deliveries [9]. The SSI frequency after Caesarean section deliveries in developed countries is about 0.5%, whereas in developing countries it is >40%. SSI is one of the multiple types of infection that occur in post-partum period and is the most superficial infection following Caesarean section [4].

Sepsis is an important cause of maternal death in pregnancy, and patients with sepsis and other complications are at greater risk which may cause death [9]. Other common infections like UTI (up to 20%), endometritis (up to 1.0%), and breast abscess or mastitis (up to 3.0%) may cause risk for women in labour [6]. The challenge in quantifying the incidence of pregnancy-related infection is the variety of terms, such as definitions, time periods, sites, and severity of infections used [9].

As per the standard sources of information like national centre for health statistics and the national hospital discharge survey, nearly 40% and above of SSI are preventable with appropriate use of prophylaxis treatment of antibiotics [4].

The inappropriate use of antibiotics by pregnant women of childbearing age could harm both the mother and their progeny. Random use of antimicrobials can lead to the emergence of drug-resistant organisms [1]. Evidence suggests that the use of prophylactic antibiotics reduces postoperative infections, and the agent used needs to be safe, inexpensive, and effective against organisms encountered in surgical procedures [2, 10]. A single dose of first-generation cephalosporin or penicillin is often preferred due to its effectiveness, availability, and broad-spectrum activity [10].

However, the worldwide use of prophylactic antibiotics for caesarean births varies largely among hospitals, partly due to lack of institutional protocols and uncertainties regarding the antibiotic regimen of choice and accurate timing of administration [8].

Methodology

This research utilized the documented records of in-patient female patients at Geetanjali Hospital, Udaipur, as well as the consent forms of patients written in both English and Hindi, to collect the demographic information of patients. Selection criteria for subject eligibility were established and utilized to select eligible subjects for this observational non-interventional study. This study took place within the Department of Obstetrics and Gynaecology at Geetanjali Hospital, that provides obstetric care to patients within the district of Udaipur and the surrounding area. The duration of this study was from February 2022 to July 2022, and involved an estimated 120 subjects who were admitted for labour and delivery. Data was collected from patients' consent and demographic data through pre-designed data collection tools as well as abstracted from the inpatient medical records of eligible subjects. After obtaining consent, investigators identified and screened women from the obstetric ward using specific inclusion and exclusion criteria. Once a participant's mother could provide consent for her daughter but not herself, the study staff explained the purpose and methodology of the proposed study using an appropriate language (Hindi or English), and obtained written informed consent from all eligible participants. Data was collected, including participant demographics as well as data related to the participant's obstetric history, previous and concurrent medications, and current medications. More clinical data was recorded including laboratory tests, vital parameters, physical examinations, and anthropometry. Clinical data sources were primarily individual patient record information.

The inclusion criteria included all pregnant women between the ages of 18 and 45 years who were delivering via (elective or emergency) C-sections and were having their pregnancies confirmed by ultrasound and were being administered pre-op and

post-op antibiotics, and who signed informed consent documents. The exclusion criteria were as follows: Pregnant women below 18 years of age, patients suffering from chronic illness or significant co-morbidities, and patients undergoing another gynaecological procedure (i.e. hysterectomy and/or oophorectomy), and those who refused to sign consent.

All data collected was analysed using IBM SPSS Statistical Software, descriptive analysis was then used to evaluate demographic characteristics, with categorical variables being presented as percentages and continuous variables as mean ± SD. Prior to statistical testing on data, data was assessed for normality, and a Pearson chi-square test was performed for all applicable categorical variables, at an alpha level of less than 0.05, to determine statistical significance.

The eligible study patients enrolled during the study period, 120 women, received analysis of their prescriptions while under the care of the inpatient department during the evaluation period. The Institutional Ethics Committee (Ref: GU/HREC/EC/2022/2030) provided their prior approval for initiating the study. WHO core drug utilization indicators were used to analyze prescriptions in terms of mean number of drugs per encounter, percentage of drugs prescribed by generic name, percentage of drugs that are on the essential drug list, patient care indicators for availability of drugs, and other drug-related parameters such as the patient's age, gravidity, type (elective or emergency) of caesarean section surgery, number of different drugs per prescription, type and duration of antibiotic therapy, average number of antibiotics prescribed per patient, polypharmacy, fixed dose combinations (FDCs), generic vs. brand name prescribing, and failure of prophylaxis.

One hundred forty-five (145) pregnant women were initially screened with 25 excluded for the following reasons: fifteen (15) did not consent to participate; five (5) had a chronic illness; and five (5) were anaemic. Ultimately, there were an even one hundred twenty (120) participants who met all inclusion criteria and were enrolled into the study upon completing a data extraction process via a standardised data extraction instrument by two independent reviewers. Data collection was completed in two phases: recruitment of patients/subjects and collection of data, followed by analysis and interpretation of collected data.

Results

Demographic Characteristic of Study Participants

The demographic characteristics of the study participants are listed in the TABLE: 1. the average mean age of subjects were found to be 29 years while standard deviation was 4.861 and the average mean BMI was found to be 27.0439 with standard deviation of 2.67086.

Table 1: Demographic Characteristic of Study Participants

Sr. No.	Total Participants – 120	Mean	Std. Deviation
1	Age	29.32	4.861
2	Height	2.7869	13.7358
3	Weight	63.3667	4.892
4	Map	92.85	6.08619
5	Pulse	76.6417	5.04233
6	Resp. Rate	20.2	7.65276
7	BMI	27.0439	2.67086

Age Distribution of Antibiotics to Patients

The table represents the age distribution of antibiotics among the patients recruited. The age groups of 26-32 years were pre-

scribed with the maximum number of antibiotics i.e., 76% and the age groups of 40-60 years were prescribed with the minimum number of antibiotics i.e. 2%. While patients with age group 33-40 years and 18-25 years were prescribed with 19% and 23% antibiotics respectively.

Table 2: Age Distribution of Antibiotics to Patients

Sr. No.	Age Group	n (%)
1	18-25	23
2	26-32	76
3	33-40	19
4	40-60	2

Types of Surgery

The study results showed that LSCS was performed majorly among the subjects i.e. in 85 patients and elective surgery was performed in minimum number of the patients i.e. in 11 patients while emergency surgery was done in 24 patients from the study.

Table 3: Types of Surgery

Sr. No.	Types of Surgery	Patient Count
1	ELECTIVE	11
2	EMERGENCY	24
3	LSCS	85

Number of Drugs Used Along with Antibiotics

The study results showed that maximum number of the drugs prescribed to the patients along with antibiotics were antihistamines (35.2%), narcotics (33%) followed by proton pump inhibitors (12.25%), multivitamins (7.92%), antihypertensive (5.23%), antithyroid (3.13%), antiplatelet (2.43%), and benzodiazepine (0.29%) respectively. The data is illustrated in table-4.

Table 4: Concomitant Drug Use with Antibiotics

Sr. No.	Classification	No. of Drugs Used Along with Antibiotics	% of Drugs Used Along with Antibiotics
1	Narcotics	223	33.33
2	Anti-Histamine	237	35.42
3	Anti-Hypertensive	35	5.23
4	Anti-Thyroid	21	3.13
5	Multivitamins	53	7.92
6	PPI	82	12.25
7	Benzodiazepine	2	0.29
8	Anti-Platelet	16	2.43

Surgery-Wise Distribution of Antibiotic Prescriptions

Table -5 represents the number of antibiotics prescribed among various surgeries performed in obstetric department. In LSCS maximum number of the patients were prescribed with more than 1 or more than 2 antibiotics. While minimum number of the

patients received more than 2 antibiotics in elective surgery and more than 1 antibiotic received minimally in patients with emergency surgery.

Table 5: Surgery-Wise Distribution of Antibiotic Prescriptions

Sr. No.	Number of antibiotics prescribed	Elective	Emergency	LSCS
1	One Antibiotics	1	3	4
2	More than One Antibiotics	5	2	23
3	More than Two Antibiotics	5	19	58

Diet status of the participants

Table -6 illustrates that maximum number of the vegetarians received LSCS surgery i.e. 67 while patients with emergency surgeries showed equal number in both vegetarians as well as non- vegetarians. While in elective surgery the patient with veg diet had highest number i.e. 7.

Table 6: Diet Status of the Participants

Sr. No.	Diet	Elective	Emergency	LSCS
1	Vegetarian	7	12	67
2	Non-Vegetarian	4	12	18

Who Prescribing Indicators

Table: 7 represents drug used based on WHO indicator, and most of the drugs were prescribed by brand name. Majority of the drugs were used by hospital formulary.

Table7: WHO PRESCRIBING INDICATORS

Sr. No.	Indicators Assessed	Data Value
1	Average number of drugs per prescription	5.57
2	Average number of antibiotics per prescription	2.93
3	Percentage of antibiotics prescribed with generic name	30.54
4	Percentage of antibiotics prescribed with brand name	69.46
5	Percentage of drug prescribed from the hospital formulary	100

Antibiotic Utilization Based on DDD/100 Bed Days

Below table : 8 represents that, Ceftriaxone & salbactum was used in the maximum amount i.e. 302 grams whose DDD was found to be 151 grams and DDD/100 BED DAYS was found to be 83.88 grams followed by Ceftriaxone 56.5 grams and 31.38 grams, Amikacin 113 grams and 62.77 grams, Piperacillin & tazobactum 25.07 grams and 14.27 grams, Cefoperazone & salbactum 22.5 grams & 12.5 grams, Metronidazole 23 grams and 12.77 grams, Amoxicillin & beta-lactamase 17.91 grams and 9.95 grams whereas cefuroxime axetil was used in the minimum amount i.e. 1 gram whose DDD was found to be 0.5 gram and DDD/100 BED DAYS was 1.11 gram respectively.

Table 8: Antibiotic Utilization Based on DDD/100 Bed Days

Sr. No.	Name of the Drug	ATC CODE	WHO DDD	Route	Net Dose in Grams	DDD	DDD/100 BED DAYS

1	CEFTRIAXONE	J01DD04	2 g	PARENTERAL	113	56.5	31.38
2	CEFTRIAXONE & SALBACTUM	J01DD63	2 g	PARENTERAL	302	151	83.88
3	AMIKACIN	J01GB06	1 g	PARENTERAL	113	113	62.77
4	CEFUROXIME AXETIL	J01DC02	0.5 g	ORAL	1	0.5	1.11
5	CEFOPERAZONE & SALBACTUM	J01DD62	4 g	PARENTERAL	90	22.5	12.5
6	AMOXICILLIN & BETA-LACTAMAS	J01CR02	1.5 g	ORAL	26.87	17.91	9.95
7	METRONIDAZOLE	J01XD01	1.5 g	PARENTERAL	34.5	23	12.77
8	PIPERACILLIN & TAZOBACTUM	J01CR05	14 g	PARENTERAL	351	25.07	14.27

Discussion

Women undergoing caesarean section have a five-to-twenty-fold greater chances of getting an infection compared to women who give birth vaginally, and the routine use of antibiotics at caesarean section reduces the risk of infection. In caesarean section, post-operative infections are likely to be caused by Staphylococcus epidermidis, Staphylococcus aureus, group B Streptococci or Enterococcus [3].

Studies which demonstrate that women in labour prior to the procedure are at a greater risk for post-operative complications to those who are not in labour before the time of caesarean section. This is particularly the case for Caesarean section, due to the direct anatomical connection of the vagina with the operation site, allowing normal vaginal and bowel flora and pathogens to ascend intera and postoperatively and colonize in both the placental and the wound site [5].

The age distribution is a reflection of the demographic status of the community as the majority of women tend to complete their families during this period [1].

The purpose of antibiotic usage in post-operative was prophylactic to prevent post-operative infection at the surgical site. The higher number of antibiotics per patient indicated that more and more antibiotics were used for prophylaxis purpose rather than definitive treatment purpose [3].

LSCS were performed under antibiotic prophylaxis to avoid postoperative complications. This reflects that, in general, the practice in the audit setting is evidence-based [1].

We have compared our study with other study i.e. Liu et al, S Nazrina et al, Agrawal et al and Srinivasa B et al.

We have collected data of total 120 patients who underwent surgery in obstetric department of Geetanjali Medical College and Hospital.

The mean age, weight, BMI reported by our study was found to be 29.32 ± 4.861 years, 63.36 ± 4.89 kg and 27.04 ± 2.67 m [2] respectively. A study conducted by S Nazrina et al reported that mean age, weight of 24.9 ± 4.8 years and 61.1 ± 6.3 kg. Another study performed by Agrawal et al only reported mean as 24.5 ± 3.95 years. Liu et al and Srinivasa B et al showed the participants with mean age group of 20-35 years and 18-40 years respectively.

We have reported finding regarding education, diet, types of surgery. S. Nazrina et al only reported the findings regarding type

of C-section performed and also socio-economic status and there was no Level of Significance reported by author. Similarly, Srinivasa B et al, Liu et al and Agrawal et al reported only about LSCS.

Additionally, we included categorical variables such as diet and education status of participants which was found that patient with primary education were present in the maximum number in the study and vegetarians had majority of LSCS surgery.

The majority of surgery performed in our study was LSCS followed by emergency surgery and elective surgery and all those findings were similar with the study conducted by Agrawal et al reported the LSCS as most common surgery but their findings were not compared by the author, although the study conducted by S Nazrina et al and Liu et al. did not report such findings.

In our study the maximum numbers of antibiotics were prescribed in the age group of 26-32 years which was not mentioned by the existing literatures. In our study, the most commonly prescribed drugs along with antibiotics were anti-histamines, Narcotic analgesics, Proton Pump Inhibitors, Multivitamins, Anti-hypertensive, Anti-thyroid, Anti-platelet, Benzodiazepines which were similar with the findings of study conducted by Agrawal et al (Antibiotics, Proton Pump Inhibitor, Narcotics) and Srinivasa B et al (Antibiotics, Analgesics, Proton Pump Inhibitors, miscellaneous).

Majority of antibiotics prescribed was in LSCS surgery which was similar with the study conducted by Srinivasa B et al and Agrawal et al.

In our study we found that the most commonly prescribed antibiotic was the combination of ceftriaxone – sulbactam (1gm IV B.D.) and the similar findings were reported by Liu et al; however, the dose was not mentioned by the author. On the other hand, the study conducted by Srinivasa B et al and S Nazrina et al concluded the most commonly used antibiotic was Cefotaxime and Ceftriaxone respectively.

Conclusion

Our study shows the drug utilization pattern of antibiotics in pregnant women. Multiple doses were given to the patient. 3rd generation ceftriaxone was the most frequently prescribed antibiotics and every antibiotic given was of brand name. This shows that all women who underwent caesarean section have received prophylactic antibiotics. This suggests that obstetricians should utilize antibiotic regimens that are clinically effective. In our study all the antibiotics were prescribed according to essential drug list. Unwanted prescription of antibiotics was not found. Regular educational interventions needed to improve prescribing practices of doctors at different levels may further promote rational prescribing. In all hospitals there is a need for careful surveillance of antibiotic use to prevent emergence of drug-resistant strains of bacteria. All though the present study provides valuable insight about the overall pattern of drug use profile in pre and post-operative patients in the obstetrics unit of a tertiary care hospital.

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