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Antimicrobial Utilization in Obstetric Care: A Narrative Review of Peripartum Antibiotic Use

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ABSTRACT :

Background: Maternal infections remain an important concern in peripartum care, despite a 38% global decline since 1990. But excessive use of broad-spectrum and multiple antibiotics continues to contribute to antimicrobial resistance.

Objectives: To evaluate the global patterns of peripartum antibiotic utilization and assess evidence-based strategies for optimizing antibiotic prophylaxis and duration while maintaining maternal safety.

Methodology: A narrative review was conducted by synthesizing clinical evidence, relevant guidelines, and literature retrieved from , focusing on antibiotic use during peripartum care.

Results: Targeted antibiotic prophylaxis for non-elective caesarean deliveries was associated with reduced maternal infections, whereas routine antibiotic use in low-risk vaginal births showed no significant benefit. Evidence from quality-improvement interventions demonstrated that inappropriate antibiotic use could be reduced significantly without compromising clinical outcomes. Prolonged and indiscriminate broad-spectrum antibiotic use remains a major contributor to antimicrobial resistance.

Conclusions: Antibiotic use should be aligned with *verified clinical risk and evidence-based indications* to preserve antimicrobial efficacy without compromising maternal safety. Context-specific hospital policies, multidisciplinary collaboration, antimicrobial stewardship, and continuous staff feedback are essential for optimizing peripartum antibiotic use and improving maternal outcomes.

Keywords: Peripartum infection, Antibiotic utilization, Obstetric prophylaxis, Maternal sepsis, Antimicrobial stewardship

Introduction

Maternal and peripartum infections continue to contribute to maternal morbidity and mortality. Although substantial progress has been made over the last three decades, the burden is not evenly distributed. In the 1990–2019 Global Burden of Disease analysis, incident maternal sepsis and other maternal infections decreased from 23.03 million cases in 1990 to 20.57 million in 2019. The age-standardized incidence rate declined from 787 to 534 per 100,000 population, corresponding to a 38.48% reduction. Deaths fell from 38,027 to 16,840, and the age-standardized death rate declined by 68.96%. [1]

The more recent Global Burden of Disease (GBD) 2021 analysis reinforces the continuing importance of maternal infection. It estimated 19,047,404 incident cases, 2,376,876 prevalent cases, 17,665 deaths and 1,144,233 disability-adjusted life years in 2021. The burden was substantially greater in low-to-medium sociodemographic regions, and the highest age-standardized rates were observed among women aged 20–24 years.[2] These data provide the broader context for antibiotic use in obstetrics: treatment of genuine infection remains essential, but routine or poorly targeted prescribing should not be allowed to become a substitute for clinical assessment.

Antibiotics are used in obstetric practice for several distinct purposes such as: prophylaxis for caesarean delivery, intrapartum prophylaxis for selected women at risk of neonatal group B Streptococcus infection, treatment of suspected intra-amniotic infection and management of postpartum infections such as endometritis, urinary tract infection and wound infection.[6–8] The clinical objective is not simply to reduce the number of prescriptions. Rather, the goal is to ensure that each woman receives an appropriate drug, at an appropriate dose and time, for an appropriate duration.

Methods

A narrative literature review was conducted using PubMed/MEDLINE, Google Scholar and the Cochrane Library, together with relevant WHO and professional society guidance. Search terms included "antibiotic utilization," "antimicrobial use," "pregnancy," "intrapartum antibiotic prophylaxis," "caesarean section," "postpartum infection," "maternal sepsis" and "antimicrobial stewardship." Reference lists were also screened. Peer-reviewed original studies, systematic reviews, meta-analyses and clinical guidelines were prioritized, particularly recent publications relevant to obstetric practice. The evidence was synthesized thematically according to indications, prescribing patterns, duration, outcomes and opportunities for stewardship.

Results

3.1 Burden of maternal and peripartum infection

The epidemiological evidence demonstrates why antibiotics remain necessary in selected obstetric situations. Chen et al. analysed maternal sepsis and other maternal infections across 204 countries and territories using GBD data.[1] The estimated number of incident cases decreased from 23,029,127 in 1990 to 20,569,889 in 2019. Over the same period, the age-standardized incidence rate decreased by 38.48% (EAPC −1.17; 95% UI −1.23 to −1.11). Deaths decreased from 38,027 to 16,840, while the age-standardized death rate declined from 1.38 to 0.43 per 100,000 population. The authors concluded that the global burden had generally improved, but marked regional differences remained and several countries continued to experience an unfavourable trend.[1]

The updated GBD 2021 analysis reported 19,047,404 annual incident cases and 17,665 deaths in 2021.[2] The investigators found that incidence and prevalence rates had generally decreased over time, but mortality and morbidities showed a more complex pattern of peaking around 2001 before declining. The burden remained considerably higher in low- to medium socio-demographic index regions.[2]

3.2 Antibiotic utilization during pregnancy and the peripartum period

Hospital-based studies illustrate how antibiotic exposure differs between settings. Hodoşan et al. retrospectively assessed antibiotic consumption among perinatal patients in a Romanian university hospital over five years, using defined daily doses (DDD) per 100 bed-days.[3] Consumption decreased between 2017 and 2019 but increased during 2020–2021. Ceftriaxone was the most frequently prescribed agent during most of the study period, followed by cefixime, amoxicillin, metronidazole, cefuroxime, ampicillin and ciprofloxacin. Collectively, the major commonly prescribed agents represented 98.17% of antibiotic use, and more than 86% of antibiotics were administered orally.[3]

The Indian prospective observational study by Srinivasa and Kotinatot provides a more direct insights of post-caesarean prescribing.[4] Among 100 post-operative caesarean patients, 332 antibiotics were prescribed. Cefotaxime was the most commonly used antibiotic (92 prescriptions; 27.71%), followed by gentamicin (86; 25.90%) and metronidazole (78; 23.49%). The average number of antibiotics prescribed per patient was 3.32. Combination therapy with cefotaxime, metronidazole and gentamicin was received by 90% of patients who stayed for three days or less. Most patients (97.8%) received parenteral antibiotics, and 66% were switched from parenteral to oral therapy around day four of hospital stay. The study also reported that 92.17% of antibiotics were from the National List of Essential Medicines(NLEM) and all antibiotics were prescribed by their generic name.[4] The authors considered that the prescribing pattern was largely rational, although relatively high number of agents per patient highlights an important opportunity for review of combination therapy and duration.

These findings are relevant to Indian obstetric practice because, the availability of broad-spectrum agents and prescribing habits can influence antibiotic choice even when the clinical indication is prophylactic rather than therapeutic. Therefore, antibiotic utilization should be evaluated not only by whether an agent belongs to an essential-medicine list, but also by indication, timing, spectrum, duration and the presence or absence of documented infection.

3.3 Caesarean delivery and prophylactic antibiotic use

Caesarean delivery is a well-established indication for antimicrobial prophylaxis because post-operative endometritis and surgical-site infection(SSI) occur more frequently than after uncomplicated vaginal birth.[6,7] The evidence supports administration before incision so that effective tissue concentrations are present at the time of surgical contamination. The main stewardship concern arises when prophylaxis is unnecessarily extended after the operation in women who have no evidence of infection.

The randomized Cesarean Section Optimal Antibiotic Prophylaxis (C/SOAP) trial provides an example of how targeted expansion of prophylaxis can be beneficial in a defined high-risk group. Tita et al. enrolled 2,013 women undergoing non-elective caesarean delivery during labour or after membrane rupture and randomized 1,019 to receive 500 mg intravenous azithromycin and 994 to placebo, in addition to standard prophylaxis.[9] The postoperative infectious outcomes occurred in 6.1% of the azithromycin group compared with 12.0% of the placebo group (RR 0.51, 95% CI 0.38–0.68; $p<0.001$). Endometritis occurred in 3.8% versus 6.1% ($p=0.02$), and wound infection in 2.4% versus 6.6% ($p<0.001$). The authors concluded that adjunctive

azithromycin reduced postoperative infection among women undergoing non-elective caesarean delivery.[9] This evidence supports selective extended-spectrum prophylaxis in a defined population rather than it's indiscriminate prophylaxis use for all caesarean deliveries.

3.4 Antibiotic use after uncomplicated vaginal delivery

The evidences are less supportive of routine antibiotic prophylaxis after uncomplicated vaginal birth. Sharma et al. examined antibiotic use after low-risk vaginal deliveries in an Indian hospital.[5] Baseline review showed that antibiotic use varied from 24% to 69%, with an average prophylaxis rate of 42.28%. The quality-improvement programme introduced a departmental antibiotic policy, staff engagement, improved documentation, dual responsibility and team huddles. Within four months, antibiotic use fell to 10% in the target population and the improvement was sustained during subsequent follow-up.[5] The authors emphasized that a hospital/region specific antibiotic policy and continuous feedback could substantially reduce unnecessary prescribing.

Sirilak et al. prospectively followed 909 women who had full term vaginal deliveries in seven hospitals in Chiang Mai.[10] Antibiotics were prescribed to 117 women (12.87%). Postpartum infection occurred in 3/117 women (2.6%) who received prophylaxis and 11/792 (1.4%) who did not. The adjusted risk ratio was 1.04 (95% CI 0.26–4.14; p=0.956), indicating no statistically significant difference in infection between the groups.[10] Third- or fourth-degree perineal tears (adjusted OR 7.72, 95% CI 1.13–52.75; p=0.037) and episiotomy (adjusted OR 2.41, 95% CI 1.24–4.70; p=0.010) were significantly associated with antibiotic prescribing. The study indicated that routine prophylaxis should be restricted and the evidence-based criteria could help keep prescribing at or below the recommended 10% target.[10]

These findings are particularly important for stewardship because they demonstrate that reducing routine prophylaxis does not necessarily increase postpartum infection rates when women are appropriately selected. At the same time, women with major perineal trauma or other recognized risk factors should be screened for antibiotic use.

3.5 Group B Streptococcus and intrapartum prophylaxis

Group B Streptococcus remains an important cause of neonatal infection and early onset neonatal sepsis(EONS). Maternal intrapartum prophylaxis is aimed to reduce vertical transmission patients with risk factors.[11] The evidences therefore support a targeted strategy rather than treating all women in labour. In settings such as India, geographical variation in maternal colonization and limited surveillance data make locally relevant epidemiological studies important.[11]

The distinction between prophylaxis and treatment is clinically important. Intrapartum prophylaxis is designed to reduce neonatal exposure to a specific pathogen, whereas suspected intra-amniotic infection or maternal sepsis requires prompt therapeutic treatment. Stewardship should therefore focus on correct indication and reassessment rather than simply minimizing exposure.

3.6 Treatment of postpartum infection and maternal sepsis

Postpartum endometritis, wound infection, urinary tract infection and systemic infection require treatment based on the suspected pathogens, severity of illness, allergy history, previous antimicrobial exposure and local resistance patterns. Evidence summarized in the Cochrane review indicates that several antibiotic regimens are effective for postpartum endometritis.[12] Broad-spectrum therapy may be appropriate because pelvic infections can be cause by multiple pathogens, but treatment should be reassessed as the patient's clinical course and microbiological results become clearer.

Maternal sepsis requires a different balance between stewardship and immediate treatment. The global burden analysis demonstrates that infection remains an important cause of maternal morbidity and mortality.[1,2] In a patient with suspected sepsis, antibiotics should not be delayed while awaiting culture results. The stewardship opportunity comes after initial treatment: cultures should be obtained whenever necessary, therapy should be narrowed when the organism and susceptibility pattern are known, and duration should be reviewed according to clinical response.

3.7 Antibiotic choice, duration and stewardship

Across the reviewed studies, a recurring pattern is the use of broad-spectrum agents and multiple antibiotics, particularly in postoperative settings.[3,4] A study from Belagavi, Karnataka illustrates this clearly, with a mean of 3.32 antibiotics per patient and 90% of short-stay patients receiving a three-drug combination.[4] The study reported no adverse events and a high proportion of drugs were from the essential-medicines list(NLEM).

A study from Romania demonstrated that ceftriaxone was prescribed predominantly, and antibiotic consumption increased during 2020–2021, after declining in the preceding years.[3] These findings justify the need for regular audit of indication, spectrum and duration and other aspects of antibiotic use.

Stewardship interventions are more effective when they are practical, context-specific and involves multidisciplinary collaborations. An Indian quality-improvement study achieved a reduction from 42.28% to 10% in antibiotic use after uncomplicated vaginal delivery through a combination of policy development, staff engagement, documentation changes and repeated feedback.[5] These findings indicate that along with education, establishing institutional antibiotic use policies, improved documentation and regular feedback systems are more effective in reducing the unnecessary antibiotic use[5].

Hospital-specific antibiotic policies should be used to define the preferred antimicrobial agent, dose, timing, route and duration for common obstetric indications, while allowing modification according to allergies, local resistance patterns and clinical severity. Multi-disciplinary involvement of obstetricians, microbiologists, pharmacists, infection-control personnel and nursing staff can improve consistency and facilitate regular review.

Discussion

The literatures show that antimicrobial use in obstetrics is a balance between preventing serious infection and avoiding unnecessary exposure. The studies demonstrate that maternal infection remains clinically important, particularly in low- to middle income countries.[1,2] The utilization studies show that antibiotic exposure can become substantially higher than what is required for a specific indication.[3–5]

Caesarean delivery, itself is an indication for peripartum antibiotic use, where appropriate antibiotics reduce postoperative infection.[6,9] The C/SOAP trial demonstrates that additional broad-spectrum coverage is most useful when directed at a population with identifiable risk factors.[9] This supports a risk-based antibiotic use rather than a universal escalation of therapy.

Evidences after uncomplicated vaginal birth are different. An Indian quality-improvement study and the Thai prospective cohort both demonstrate that routine prophylaxis can be reduced or avoided without a confirmable increase in postpartum infection, in women with minimal risk.[5,10]

Another consistent finding is that prescribing behaviour is influenced by local practice. Ceftriaxone and other cephalosporins feature prominently in the reviewed studies. The clinical appropriateness of any antibiotic depends on indication, local susceptibility patterns, dose, timing and duration.[3,4] Consequently, utilization studies should not be interpreted simply as lists of frequently used drugs; they should be used to compare prescribing behavior with institutional protocols and evidence-based recommendations.

The literatures also support a practical stewardship pathway: identify the indication, choose the narrowest effective regimen, administer prophylaxis at the appropriate time, document the intended duration, review therapy after clinical and microbiological information becomes available, and discontinue or de-escalate when ongoing treatment is not justified. This approach protects the benefits of antibiotics while limiting avoidable exposure.

Conclusion

Antibiotics remain essential to safe obstetric practice, particularly for caesarean prophylaxis, selected intrapartum indications and treatment of established maternal infection. The reviewed evidences, however, show considerable variations in antimicrobial use across hospitals and countries. Global studies demonstrate a continuing burden of maternal infection, while hospital-based studies show frequent use of broad-spectrum agents, multiple-drug regimens and variable duration of therapy.[1–5]

The most important finding for clinical practice is that rational antibiotic use does not mean using fewer antibiotics regardless of circumstances. It means matching the drug and duration to the woman's actual risk and clinical condition. The reduction in prophylactic prescribing after uncomplicated vaginal delivery from 42.28% to 10% in an Indian quality-improvement programme, together with the absence of a significant difference in postpartum infection in the Thai cohort, supports avoidance of routine prophylaxis in low-risk vaginal births.[5,10] Conversely, evidence from the C/SOAP trial supports targeted adjunctive azithromycin in nonelective caesarean delivery when clinically indicated.[9]

Future research in India should focus on prospective evaluation of antibiotic selection, timing, duration, adherence to prophylaxis guidelines, maternal outcomes and adverse events. Comparative studies of commonly used prophylactic regimens, including ceftriaxone-based versus penicillin/ aminoglycoside-based strategies, may help clarify whether local prescribing practices are associated with differences in infection outcomes, antibiotic exposure and length of hospital stay.

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