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Comprehensive Measures for Preventing Obstetric Surgical Site Infections: An Evidence-Based Narrative Review

Onah Livinus Nnanyereugo *

Department of Obstetrics and Gynaecology, Enugu State University Teaching Hospital, Parklane, Enugu, Nigeria.

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Abstract

Background: Surgical site infections remain a significant cause of postpartum morbidity, especially following cesarean section—the most frequently performed obstetric surgery worldwide. Despite advances in perioperative care, the incidence of obstetric surgical site infection remains high in many settings, particularly in low- and middle-income countries.

Objective: To synthesize current evidence on comprehensive strategies for preventing obstetric, surgical site infection focusing on pre-operative, intra-operative, post-operative, and institutional measures.

Methods: A narrative review of literature published between 2010 and 2025 was conducted through PubMed, Cochrane Library, Embase, and Google Scholar. Keywords included "obstetric," "cesarean," "surgical site infection," and "prevention." Guidelines, randomized controlled trials, cohort studies, and reviews related to surgical site infection prevention in obstetrics were included.

Findings: Evidence demonstrates that a multifaceted approach—incorporating optimized timing of antibiotic prophylaxis, proper skin preparation, adherence to aseptic protocols, surgical technique refinement, postoperative wound care, and robust institutional surveillance—significantly reduces surgical site infection incidence. Timely antibiotic prophylaxis (within 30–60 minutes before incision) and the use of alcohol-based chlorhexidine skin antisepsis have the strongest evidence base.

Conclusion: Preventing obstetric of surgical site infection requires coordinated interventions across the entire perioperative timeline. Implementing standardized protocols, strengthening infection-control systems, and promoting continuous training can substantially reduce postoperative morbidity and improve maternal outcomes.

Keywords: Obstetric Infection; Surgical Site Infection; Cesarean Section; Prevention; Perioperative Care

1. Introduction

Surgical site infections (SSIs) are among the most common postoperative complications in obstetric practice, accounting for substantial maternal morbidity, prolonged hospitalization, increased healthcare costs, and reduced postpartum quality of life. A surgical site infection (SSI) is defined as infection in the incision or organ/space at the operation site occurring up to 30 days after surgery. Cesarean section (CS), which is now performed globally at rates exceeding 20–30% in some regions(1,2), carries a 3–20% risk of postoperative wound infection depending on population risk profiles and healthcare resources. In low-resource settings, incidence rates can exceed 25%(2,3).

* Corresponding author: Onah Livinus Nnanyereugo

Obstetric patients are uniquely vulnerable to SSIs due to physiological changes in pregnancy, immunologic modulation, emergency surgical indications, and increased tissue vascularity. Moreover, factors such as obesity, prolonged labor, premature rupture of membranes, repeated vaginal examinations, and intrapartum fever increase susceptibility to postoperative infection.

Despite the availability of evidence-based protocols, variation in clinical practice and resource constraints contribute to preventable infection rates(4). A comprehensive understanding of SSI risk factors and effective prevention strategies is essential for improving maternal outcomes.

This review synthesizes the multidimensional strategies for preventing obstetric SSIs across pre-operative, intra-operative, post-operative, and institutional domains.

2. Methods

A narrative review approach was used to summarize existing evidence on obstetric SSI prevention.

2.1. Databases

Searches were conducted in:

- PubMed/MEDLINE
- Cochrane Library
- Google Scholar

2.2. Search Terms

Keywords and MeSH terms included:

"Obstetric," "cesarean section," "postpartum," "surgical site infection," "wound infection," "prevention," "prophylaxis," "infection control." Boolean operators were used to combine concepts.

2.3. Inclusion Criteria

- Studies published 2015–2025
- English language
- Human studies
- RCTs, cohort studies, case-control studies, systematic reviews, guidelines
- Studies focusing on SSI prevention in obstetric populations

2.4. Exclusion Criteria

- Non-obstetric surgical infections
- Studies lacking relevance to preventive strategies
- Case reports unless highly informative
- Data were extracted on preventive interventions, effectiveness, and recommendations.

3. Epidemiology of Obstetric SSI

Globally, surgical site infections (SSIs) remain a significant cause of maternal morbidity following cesarean delivery, with pooled incidence estimates around 5–6% worldwide, though reported rates vary widely depending on surveillance methods and health-system capacity. High-income countries such as the United Kingdom and the United States consistently report lower rates—generally under 10%(4,5)—reflecting stronger perioperative systems, standardized antibiotic protocols, and robust postoperative follow-up.

By contrast, low- and middle-income countries, particularly in Asia and Africa, experience substantially higher burdens. A recent African meta-analysis estimated a pooled post-cesarean SSI prevalence of approximately 11%, with some East and Central African centers reporting rates as high as 15–34%(2,3,6–10). These regional differences highlight persistent gaps in resource availability, surgical infrastructure, and infection-prevention practices across global healthcare settings.

Within sub-Saharan Africa, West African countries demonstrate considerable heterogeneity in reported SSI rates. Pooled estimates suggest an incidence of roughly 10% in the subregioned studies often vary due to differences in methodology, follow-up duration, and definitions of SSI(1,11). Nigeria reflects this broader trend, with post-cesarean infection rates frequently reported between 9% and 16% in tertiary hospitals. Importantly, most Nigerian studies rely on in-hospital data alone and therefore likely underestimate true SSI incidence, as many infections develop after discharge. Nevertheless, available evidence indicates that Nigeria's burden of post-cesarean SSI may exceed global averages, underscoring the need for improved surveillance systems and standardization of postoperative monitoring.

At subnational level, the epidemiology becomes more difficult to characterize due to scarce data. Few studies distinguish northern from southern regions of Nigeria, and even fewer provide state-level estimates. Emerging evidence from the southeastern zone, particularly from tertiary hospitals in Enugu State, suggests SSI incidence rates around 13–17% (8,9) when 30-day follow-up is included. These localized findings imply a substantial burden that may be under-recognized in routine clinical reporting. The limited availability of regional and state-specific data highlights a critical gap in obstetric infection surveillance, particularly given Nigeria's geographic, infrastructural, and socio-demographic diversity. Strengthening data systems at these lower levels would greatly enhance understanding of the true epidemiological state and guide targeted prevention strategies(6,12).

Common pathogens include Staphylococcus aureus, Streptococcus species, Escherichia coli, anaerobes, and polymicrobial flora(13–15).

High rates in low-resource regions are driven by inadequate sterilization, limited antibiotic stewardship, and poor wound care practices(10,14,16).

4. Risk Factors for Obstetric SSI

4.1. Maternal Factors

Obesity (BMI ≥ 30)(11,17), Diabetes mellitus or hyperglycemia (3,10), Anaemia(7,9), Immunosuppression(7), Malnutrition(7–9), Poor personal hygiene(3,15).

4.2. Pregnancy-Related and Intrapartum Factors

Prolonged rupture of membranes (> 18 hours)(3,18,19), Chorioamnionitis (17,20), Multiple vaginal examinations, Internal fetal monitoring, Prolonged labor(6,10,17,21,22).

4.3. Procedure-Related Factors

Emergency cesarean section(17), Long operative duration (> 60 minutes) (4,5,21), Excess tissue trauma(9,22), Hematoma formation, Inappropriate or over-diluted skin antisepsis, Incorrect antibiotic timing (5,11,12,23,24).

4.4. Hospital-Related Factors

Poor theatre ventilation, High traffic flow, Suboptimal sterilization, Inadequate staffing, Poor infection control culture(4)

5. Prevention Measures

5.1. Pre-operative Measures

5.1.1. Preoperative Antibiotic Prophylaxis

- Administer 30–60 minutes before skin incision.
- First-generation cephalosporins (e.g., cefazolin) are standard.
- Add azithromycin for unscheduled/emergency CS in high-risk patients.

5.1.2. Maternal Optimization

- Screen and treat urinary tract infection and bacterial vaginosis.
- Optimize glycemic control.
- Correct maternal anemia where possible.

5.1.3. Skin Preparation

- Use chlorhexidine–alcohol for preoperative skin antisepsis.
- Preoperative bathing with chlorhexidine reduces skin flora.
- Pre-operative vaginal cleansing with povidone-iodine(3,18,25)

5.1.4. Hair Removal

If required, use electric clippers, not razors.

5.2. Intra-operative Measures

5.2.1. Aseptic Technique

- Strict adherence to WHO surgical checklist
- Limiting theatre traffic
- Proper sterilization and surgical attire use

5.2.2. Surgical Technique

Gentle tissue handling, Minimizing operative duration, Ensuring hemostasis to prevent hematoma(21,26), Using appropriate suture materials (e.g., delayed absorbable for fascia)(27,28).

5.2.3. Maintaining Normothermia

Warm IV fluids and blankets and use of intraoperative warming devices.

5.2.4. Antibiotic Redosing

Redose if procedure exceeds 3 hours or if blood loss > 1,500 mL(29,30)

5.2.5. Negative Pressure Wound Therapy

For high-risk obese patients, prophylactic NPWT reduces wound complications.(31)

5.3. Post-operative Measures

5.3.1. Wound Care

Most advocated measures here included “Clean, dry dressings for 24–48 hours”, avoid unnecessary dressing changes, “proper hand hygiene before wound handling”(21,27,30,32).

5.3.2. Postoperative Antibiotic Stewardship

Routine continuation of antibiotics is not recommended unless clinically indicated, according to some literature, but others insist that in obese women, extended prophylaxis with additional Azithromycin is essential. Also, at risk patients should receive post-operative antibiotics for at least 72 hours(11,12,21,27).

5.3.3. Early Mobilization and Nutrition

According to literature, this improves circulation and healing, reduces risk of infection and venous thromboembolism (21,27,30).

5.3.4. Patient Education

According to study done by Halwani et al, post-op follow up e.g via telephone calls can teach women signs of infection and encourage prompt reporting of fever, wound discharge, redness, or pain. It helped identify additional 26% of caesarean section post-operative surgical site infection in the cohort. This aids early diagnosis and forestall further complication(33). It is also essential to train patients on wound care(8–10).

6. Institutional and System-Level Strategies

Several studies insisted that every hospital must have a protocol they follow and a standardized system of reporting to ensure surveillance and continuous effort to limit prevalence. Some of the best strategies include:

- Development of standardized SSI prevention bundles
- Continuous staff training in infection prevention
- Surveillance systems with regular audits
- Adequate supply chain for sterile equipment
- Strengthening sterilization units
- Leadership engagement in quality improvement
- Feedback to admin or surveillance team on SSI rates

7. Discussion

Preventing obstetric SSI requires a multifaceted, evidence-driven approach. Among all preventive strategies, timely antibiotic prophylaxis has the strongest proof of effectiveness in addition to pre-operative vaginal cleansing and optimizing of at-risk patients. Randomized trials and guidelines consistently support administration before incision rather than after cord clamping. Intraoperative interventions such as minimizing operative time, controlling theatre traffic, and maintaining normothermia also show meaningful reductions in SSI.

However, challenges persist in low-resource settings, where inconsistent guideline adherence, limited surgical supplies, inadequate sterilization practices and abundance of remain major contributors to high infection rates. Institutional commitment to surveillance, training, and protocol implementation is therefore critical.

8. Conclusion

Obstetric SSI prevention is achievable through coordinated pre-operative, intra-operative, post-operative, and institutional measures. Adoption of evidence-based protocols—including timely antibiotic prophylaxis, optimal skin antisepsis, standardized surgical technique, and robust infection control systems—can substantially reduce postoperative morbidity and improve maternal health outcomes.

Recommendations

- **For Clinicians**
  - Administer antibiotics 30–60 minutes before incision.
  - Use chlorhexidine–alcohol for skin antisepsis.
  - Do pre-operative vaginal cleansing with povidone iodine.
  - Treat all predisposing maternal illnesses like urinary tract infection and chorioamnionitis.
  - Ensure excellent surgical skills.
  - Follow up at-risk patients especially obese and diabetic patients.
- **For Hospitals**
  - Establish SSI prevention protocol.
  - Ensure steady supply of sterile consumables.
  - Train staff regularly in infection prevention.
- **For Policymakers**
  - Support national guidelines on obstetric surgical care.
  - Invest in infection prevention infrastructure.

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