04 - INFECTIONS IN OBSTETRICS AND GYNECOLOGY

GYAN - VAHINI

FROM

FOGSI, FOOD DRUGS & MEDICOSURGICAL EQUIPMENT COMMITTEE

APRIL- 2025

Message From Dr. Sunita Tandulwadkar

Dr. Sunita Tandulwadkar
President FOGSI-2025

April is celebrated worldwide as Infection Prevention Month, reminding us that simple, evidence-based measures can save countless maternal and neonatal lives. This special FDMSE E-Magazine issue on Infections in Obstetrics & Gynaecology arrives at exactly the right moment. Inside, you will find updates on rapid diagnostics, vaccination drives, safe-surgery bundles, and antimicrobial-stewardship tools adapted for Indian practice—from high-volume tertiary centres to the most remote clinics. I urge every FOGSI member to review these protocols, reinforce hand-hygiene and instrument-reprocessing checklists, and advocate for routine antenatal screening packages that include **TORCH**, **HIV**, **hepatitis B**, and **syphilis**. Let April be our springboard for year-long quality-improvement projects: audit caesarean-section infection rates, track local resistance patterns, and insist on antibiotic time-outs in every ward round. Together, we can transform Infection Prevention Month into measurable reductions in sepsis, infertility, and maternal mortality across the nation.

Warm regards,
Dr. Sunita Tandulwadkar
President, FOGSI 2025

Message from Dr Abha Singh

Dr. Abha Singh
Vice President FOGSI-2025

Dear Fogsians, Warm Greetings!

The theme of Infection Prevention Month resonates deeply with frontline clinicians who witness how quickly an avoidable infection can derail pregnancy outcomes or compromise reproductive health. This issue captures the full spectrum of preventive strategies: adolescent HPV vaccination, antenatal group-B-streptococcus screening, post-operative wound-care bundles, and community outreach for menstrual-hygiene education. I invite you to take one concrete step this April—whether launching a hand-rub compliance audit, counselling diabetic women on foot and perineal care, or integrating mental-health checks for patients coping with chronic vaginal infections. Empower your teams with the laminated algorithms and checklists provided here; empower your patients with clear, culturally sensitive education. When prevention becomes a reflex, we reduce antibiotic use, curb resistance, and protect future fertility. Let's harness the momentum of Infection Prevention Month to build clinics that are not only centres of treatment but fortresses of prevention.

Warm Regards,

Dr Abha Singh
Vice President North Zone Fogsi

Message from Dr Suvarna Khadilkar

Dr. Suvarna Khadilkar
Secretary General FOGSI-2025

Prevention is always more effective—and less costly—than cure. In recognition of Infection Prevention Month, this April edition delivers a practical roadmap for tackling the infections that continue to threaten women's health: postpartum sepsis, pelvic inflammatory disease, surgical-site infections, and vaccine-preventable illnesses. Highlights include point-of-care PCR for STIs, evidence on single-dose antibiotic prophylaxis, and step-by-step guides to creating antimicrobial-usage dashboards. I encourage regional and city societies to turn these pages into action: organise workshops on aseptic labour-room technique, promote HPV and influenza vaccination camps, and establish partnerships with microbiology labs for quarterly antibiograand contain resistance. Let's make April the month we recommit to a culture of safety—where every glove change, every steriliser cycle, and every prescription is guided by science and patient-centred care.

With best and warm wishes,
Dr. Suvarna Khadilkar
Secretary General, FOGSI

Dr. Asha Jain
Chairperson
FOGSI FDMSE Committee

FOREWORD

It gives me immense pride to present the April 2025 edition of our E-Magazine by the Food, Drugs, and Medicosurgical Equipment (FDMSE) Committee of FOGSI, dedicated to **"Infections in Obstetrics and Gynecology"** — a theme chosen in line with Infection Prevention Month and the urgent need for education, prevention, and preparedness.

At the outset, I express my heartfelt thanks to our dynamic President **Dr. Sunita Tandulwadkar**, our committed Vice President Incharge **Dr. Abha Singh**, and our ever-supportive Secretary General **Dr. Suvarna Khadilkar**. Their consistent encouragement and visionary leadership have been instrumental in bringing this edition to life.

This magazine brings together the expertise and experience of several FOGSIans who have contributed outstanding chapters covering a wide spectrum — from infection control protocols and genital tuberculosis to viral, fungal, and parasitic infections in clinical gynecology and obstetrics. I sincerely thank each of the following authors for their academic commitment:

Dr. R Jyoti, Dr. Sonal, Dr.Sarita Kumari, Dr. Jyothi GS, Dr. Himleena Gautam, Dr. Sugandha Goel, Dr. Prabhdeep Kaur, Dr. Neetha George, Dr. Sreedevi, Dr. Ruche Bhargava, Dr. Archana Singh, Dr. Vishnupriya KMN, Dr. Vidya Thobbi, Dr. Sujayasri, Dr. Okram Sarda Devi, and Dr. Sandhya Rani Panigrahi.

Their rich insights, clinical tips, and latest updates are sure to help our readers refresh their knowledge and practice more safely.

A special word of appreciation goes to **Mr. Bhupendra Sahu**, the creative force behind the magazine's elegant design. His meticulous effort in visual presentation has enhanced the reading experience significantly.
I hope this edition adds value to your practice and encourages preventive approaches in daily obstetric and gynecologic care.

Warm regards,
Dr Asha Jain
Chairperson, FOGSI FDMSE Committee (2025 – 2027)

"Know Your Numbers" is an ambitious health initiative.

- This project seeks to gather vital health data- Weight, Blood pressure, Blood Sugar Level with HbA1C, and Hemoglobin level -from women across India.
- By focusing on these key health indicators, the project aims to foster a proactive health management culture among women.
- The data collected will be instrumental in identifying prevalent health issues early and promoting interventions that can significantly reduce the incidence of che diseases.
- This initiative not only emphasizes the importance of regular health monitoring but also strives to empower women with the knowledge and tools needed to take charge of their health, ensuring they lead longer, healthier lives.
- Collect key health data: weight, blood pressure, blood sugar, HbA1C, and hemoglobin from women across India.
- Encourage proactive health management for early identification of prevalent health issues.
- Promote timely interventions to reduce chronic disease incidence.
- Empower women with knowledge and tools for better health and longevity.
- Gather vital health data: weight, blood pressure, blood sugar (HbA1C), and haemoglobin levels from women across India.
- Foster proactive health management among women.
- Identify prevalent health issues early and promote timely interventions.
- Reduce the incidence of chronic diseases through regular monitoring.
- Empower women with knowledge and tools for healthier, longer lives.

SURVEY FOR KNOW YOUR NUMBER (KYN) PROJECT

KNOW YOUR NUMBER

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01

Introduction to Infectious Agents in Obstetrics and Gynecology

Author - Dr. Asha Jain
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President Raipur Menopause Society

1. Rationale and Scope

Infections contribute substantially to maternal and perinatal morbidity and mortality and complicate many gynaecological conditions. The World Health Organization (WHO) estimates that infection and sepsis account for almost 10 % of the 287 000 annual maternal deaths worldwide and for countless episodes of neonatal illness[1]. In high-income settings infection-related deaths have fallen, yet post-cesarean wound infections, pelvic inflammatory disease (PID) and rising antimicrobial resistance (AMR) continue to threaten outcomes. In low- and middle-income countries (LMICs) overcrowded wards, limited laboratory capacity and delayed referral magnify these risks. This opening chapter provides a panoramic view of the common pathogens, transmission pathways, risk modifiers, and control strategies that will be explored in detail in subsequent chapters of this E-Magazine.

2. Global Burden and Epidemiologic Trends

The incidence of maternal sepsis varies from < 5 to > 40 per 1 000 live births depending on health-system strength[1]. Sexually transmitted infections (STIs) are also resurgent: the U.S. Centers for Disease Control and Prevention (CDC) reported > 2.5 million cases of chlamydia, gonorrhoea and syphilis in 2022, with untreated infection linked to PID, infertility and adverse pregnancy outcomes[2]. Meanwhile, universal rectovaginal screening has reduced early-onset GBS disease in many countries, but emerging data from Italy show colonisation rates still exceed 10 % and adherence to intrapartum antibiotic prophylaxis (IAP) protocols remains sub-optimal [3].

3. Taxonomy of Relevant Pathogens

Class	Key Obstetric Syndromes	Key Gynaecologic Syndromes	Notes
Bacteria (e.g., Streptococcus agalactiae, Escherichia coli, Mycoplasma genitalium)	Chorio amnionitis, puerperal sepsis, urinary-tract infection	PID, post-operative wound infection	Rising AMR to β-lactams and macrolides[1]
Viruses (HSV-1/2, HPV, HIV, SARS-CoV-2)	Congenital infection, vertical HIV transmission	Genital warts, oncogenic HPV lesions	Vaccines available for HPV & COVID-19

Fungi (Candida albicans, Candida glabrata)	Candidal chorio-amnionitis (rare)	Vulvo-vaginal candidiasis, post-operative fungal infections	Fluconazole resistance emerging
Parasites (Plasmodium falciparum, Toxoplasma gondii)	Malaria in pregnancy, congenital toxoplasmosis	Rare outside pregnancy	IPTp policy in endemic regions[1]

4. Pathways of Materno-Fetal Transmission

1. **Ascending genital tract infection** – predominant for bacterial vaginosis, GBS and E. coli-related sepsis.
2. **Hematogenous spread** – transplacental (e.g., malaria, toxoplasmosis, parvovirus B19).
3. **Peripartum exposure** – contact with maternal blood or genital secretions (HIV, HSV).
4. **Post-partum exposure** – contaminated delivery surfaces, invasive devices.

Understanding these pathways underpins the timing of prophylactic interventions such as IAP for GBS (Section 5) and antiretroviral therapy to prevent mother-to-child HIV transmission[2].

5. Major Clinical Syndromes Across the Reproductive Continuum

Stage	Principal Syndromes	Sentinel Pathogens
Early pregnancy	Septic abortion, listeriosis	*Listeria monocytogenes*
Mid–late pregnancy	Pyelonephritis, malaria, TORCH (toxoplasma, others, rubella, CMV, HSV) infections	Various
Intrapartum	Chorio-amnionitis, GBS-mediated neonatal sepsis	GBS[3]
Post-partum	Endometritis, surgical-site infection, mastitis	E. coli, Staph. aureus
Gynaecology	PID, cervicitis, vulvo-vaginal candidiasis, HPV-related neoplasia	C. trachomatis, N. gonorrhoeae, HPV

6. Determinants and Risk Factors

- **Patient factors:** anaemia, diabetes, immunosuppression, obesity.
- **Obstetric factors:** premature rupture of membranes, prolonged labour, cesarean delivery, invasive fetal procedures.
- **Health-system factors:** delayed antibiotic initiation, limited theatre sterility, shortage of skilled staff.
- **Socio-environmental factors:** poverty, malnutrition, gender inequity, antibiotic self-medication.

7. Antimicrobial Resistance and Stewardship

AMR trends are converging with obstetric infection epidemiology. E. coli isolates from postpartum endometritis now exhibit extended-spectrum β-lactamase production in up to 30 % of LMIC samples[1]. Novel sexually transmitted pathogens such as Mycoplasma genitalium show macrolide resistance > 50 % in some regions[2]. Rational empirical protocols, culture-directed therapy, and confinement of prophylactic regimens to evidence-based indications (e.g., single-dose cefazolin at cesarean, not prolonged courses) are mandatory[1].

8. Prevention and Control Framework

- **Primary prevention**
  - HPV and hepatitis B vaccination; malaria intermittent preventive treatment in pregnancy (IPTp).
  - Universal antenatal syphilis and HIV screening; triple-time syphilis screening now advised in high-incidence areas[2].
- **Secondary prevention**
  - Timely diagnosis via syndromic algorithms, point-of-care tests (e.g., rapid TPHA, nucleic-acid amplification).
  - Routine rectovaginal GBS culture or rapid NAAT at 35–37 weeks and risk-based intrapartum prophylaxis[3]. WHO published a conditional 2024 recommendation favouring programme-level screening where feasible[4].
- **Tertiary prevention**
  - Early recognition of sepsis using obstetric early-warning charts.
  - Bundled management: broad-spectrum antibiotics within 1 h, fluid resuscitation, source control[1].
- **Infection-control practices**
  - Pre-operative chlorhexidine skin prep and single-dose antibiotic prophylaxis for cesarean sections[5].
  - Adherence to hand hygiene, aseptic technique for vaginal examinations, and safe surgery checklists.

9. Positioning Within This E-Magazine

This introductory chapter establishes the conceptual scaffold on which subsequent contributions will build:

- Chapter 2 elaborates infection-control principles and sterilisation.
- Chapters 3–6 dissect specific bacterial, mycobacterial, viral and parasitic diseases.
- Later chapters interrogate AMR, emerging infections and practical checklists, culminating in the concluding synthesis (Chapter 20).

10. Key Messages

1. Infectious agents remain a leading, largely preventable, cause of adverse obstetric and gynaecological outcomes.
2. The spectrum encompasses classical bacteria, viruses, fungi and parasites, each with distinct transmission pathways and syndromes.
3. Rising STI incidence and AMR threaten recent gains, mandating evidence-based screening and stewardship.
4. Prevention spans vaccines, timely antenatal screening, antiseptic surgery, and prompt sepsis management.
5. Integration of global guidelines with contextual health-system realities is essential to achieve the Sustainable Development Goal (SDG) targets for maternal and newborn health.

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02

Infection Control, Sterilization, and Disinfection in Obstetrics and Gynecology

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IGMC, Shimla (Himachal Pradesh)

Introduction

Infection control is paramount in Obstetrics and Gynecology (OB/GYN) to protect both patients and healthcare workers from infectious agents. The nature of OB/GYN practices, involving invasive procedures, contact with bodily fluids, and care of vulnerable populations (pregnant women, newborns) necessitates stringent protocols of infection prevention at various levels. This chapter outlines the basic principles of infection control, sterilization, and disinfection and their specific applications in the OB/GYN setting.

Principles of Infection Control

Infection control is based on the principle of preventing the transmission of microorganisms. Key components include:

- **Standard Precautions:** These are the minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status.
    - **Hand Hygiene:** This is the cornerstone of infection control. It includes handwashing with soap and water and the use of alcohol-based hand rubs.
    - **Personal Protective Equipment (PPE):** Gloves, gowns, masks, and eye protection are used to create a barrier between healthcare workers and infectious materials.
    - **Respiratory Hygiene/Cough Etiquette:** Measures to contain respiratory secretions, such as covering the mouth and nose when coughing or sneezing and the use of masks.
    - **Safe Injection Practices:** Using sterile, single-use needles and syringes for each injection.
    - **Safe Handling of Potentially Contaminated Equipment or Surfaces:** Proper cleaning, disinfection and sterilization of instruments and environmental surfaces.
- **Transmission-Based Precautions:** These are used in addition to standard precautions for patients with known or suspected infections that spread through specific routes:

- **Contact Precautions:** Used for infections spread by direct or indirect contact (e.g., MRSA, C. difficile).
- **Droplet Precautions:** Used for infections spread by large respiratory droplets (e.g., influenza, pertussis).
- **Airborne Precautions:** Used for infections spread by small airborne particles (e.g., tuberculosis, measles).

Sterilization and Disinfection: Definitions

- **Cleaning:** The removal of visible soil (organic and inorganic) from objects and surfaces. Cleaning is a precursor to disinfection and sterilization.
- **Disinfection:** A process that eliminates many or all pathogenic microorganisms, except bacterial spores, from inanimate objects.
- **Sterilization:** A process that eliminates all microorganisms, including bacterial spores.

The Spaulding Classification System

The Spaulding classification system guides the selection of the appropriate level of disinfection or sterilization based on the risk of infection associated with the use of the object:

- **Critical Items:** These enter sterile tissues or the vascular system and pose a high risk of infection if contaminated. They require sterilization. Examples in OB/GYN: Surgical instruments, needles, curettes.
- **Semi-critical Items:** These come into contact with mucous membranes or non-intact skin. They require high-level disinfection. Examples in OB/GYN: Specula, dilators.
- **Non-critical Items:** These come into contact with intact skin. They require low-level disinfection. Examples in OB/GYN: External ultrasound transducers, blood pressure cuffs.

Methods of Sterilization

- **Steam Sterilization (Autoclaving):**
  - Mechanism: Uses saturated steam under pressure to achieve high temperatures, leading to microbial protein denaturation.
  - Advantages: Reliable, relatively inexpensive, non-toxic.
  - Disadvantages: Not suitable for heat-sensitive or moisture-sensitive materials.
  - Application in OB/GYN: Sterilization of surgical instruments, drapes and heat-stable equipment.

Dry Heat Sterilization:

- Mechanism: Uses high temperatures to oxidize cellular components.
- Advantages: Suitable for heat-stable, moisture-sensitive materials.
- Disadvantages: Requires higher temperatures and longer exposure times than steam sterilization.
- Application in OB/GYN: Sterilization of glassware, some metal instruments.

Ethylene Oxide (EtO) Gas Sterilization:

- Mechanism: EtO gas alkylates microbial proteins and DNA.
- Advantages: Can sterilize heat-sensitive and moisture-sensitive items.
- Disadvantages: Toxic, flammable, requires a long aeration time to remove residual gas.
- Application in OB/GYN: Sterilization of certain heat-sensitive medical devices like laparoscopes & Hysteroscopes.

- **Hydrogen Peroxide Gas Plasma Sterilization:**
  - Mechanism: Uses ionized hydrogen peroxide gas to generate free radicals that damage microbial DNA.
  - Advantages: Dry process, shorter cycle time than EtO, less toxic than EtO.
  - Disadvantages: Cannot be used for items with long, narrow lumens or cellulose materials.
  - Application in OB/GYN: Sterilization of heat-sensitive medical devices.

- **Methods of Disinfection**
- **High-Level Disinfection (HLD):** Kills all microorganisms, except for large numbers of bacterial spores.
  - Chemical agents: Glutaraldehyde, orthophthalaldehyde (OPA), hydrogen peroxide, peracetic acid.
  - Application in OB/GYN: Disinfection of semi-critical items like specula, dilators, and endocavitary probes.

- **Intermediate-Level Disinfection (ILD):** Kills vegetative bacteria, most viruses, and fungi, but not bacterial spores.
  - Chemical agents: Alcohol, chlorine-based disinfectants, phenolic compounds.
  - Application in OB/GYN: Disinfection of non-critical items and surfaces.

- **Low-Level Disinfection (LLD):** Kills vegetative bacteria, some viruses, and fungi, but not tubercle bacilli or bacterial spores.
  - Chemical agents: Quaternary ammonium compounds.
  - Application in OB/GYN: Disinfection of non-critical surfaces like exam tables and blood pressure cuffs.

Infection Control in Specific OB/GYN Settings

- **Labor and Delivery:**
  - Hand hygiene before and after patient contact, and after contact with blood or body fluids.
  - Use of sterile gloves for vaginal examinations and delivery.
  - Proper handling and disposal of placenta and other potentially infectious materials.
  - Cleaning and disinfection of delivery beds and equipment between patients.
  - Safe management of sharps (needles, scalpels).
  - Prophylactic antibiotics for Cesarean sections.

- **Operating Room (for Cesarean Sections, Gynecological Surgeries):**
  - Strict adherence to surgical asepsis principles.
  - Preoperative skin preparation with an appropriate antiseptic.
  - Use of sterile gowns, gloves, and drapes.
  - Sterilization of all surgical instruments.
  - Maintenance of a sterile field.
  - Controlled operating room traffic.
  - Postoperative wound care and surveillance for surgical site infections.

- **Postpartum Care:**
  - Hand hygiene before and after contact with the mother and newborn.
  - Proper care of the umbilical cord.
  - Monitoring for postpartum infections (endometritis, wound infections).
  - Patient education on perineal care and hygiene.

- **Outpatient Clinics:**
  - Hand hygiene between patients.
  - Cleaning and disinfection of examination tables and equipment between patients.
  - Proper handling and disposal of speculums and other instruments.
  - Safe injection practices.
  - Management of biohazardous waste.

Special Considerations in OB/GYN

- **Vulnerable Populations:** Pregnant women and newborns are at increased risk of infection.

- **Bloodborne Pathogens:** Hepatitis B, Hepatitis C, and HIV can be transmitted through contact with blood and bodily fluids.

- **Amniotic Fluid and Placental Tissue:** These can harbour infectious agents.

- **Invasive Procedures:** Procedures such as amniocentesis, biopsies and IUCD insertions increase the risk of infection.

- **Antimicrobial Resistance:** The increasing prevalence of drug-resistant organisms necessitates careful antibiotic use policy and adherence to infection control practices.

Conclusion

Infection control, sterilization and disinfection are critical components of quality OB/GYN care. By implementing and adhering to evidence-based practices, healthcare providers can minimize the risk of infections, protect patients and themselves and promote positive outcomes. Continuous education, surveillance and quality improvement initiatives are essential to maintain a safe environment in all OB/GYN settings.

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Bacterial Infections in Obstetrics

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Bacterial Infections in Obstetrics

Pregnancy lowers a woman's ability to fight infections, and obstetricians must be vigilant about bacterial threats to mother and baby. In my 30-year practice in India I've seen complications ranging from preventable sepsis to preterm births linked to seemingly benign infections. Below I review three key areas – Group B Streptococcus (GBS), urinary tract infections (UTIs), and foodborne pathogens (Listeria and Salmonella) – with Indian data and practical insights. I aim to share both evidence and real- world experiences ("vignettes") to guide OB-GYNs and trainees.

Group B Streptococcus (GBS)

Prevalence: Studies from India show widely varying GBS colonization rates. In tertiary centers GBS carriage has ranged from ~3% to over 12%. For example, a Delhi hospital found only 3.3% of pregnant women carried GBS , while a South India study using enrichment media reported 7.6%. A meta- analysis of 36 Indian studies estimated ~7.8% colonization overall . (By contrast, Western rates are often 15–30%.) One analysis even cited a 2–62% range across India , reflecting regional and 2 3 4 methodological differences. In short, GBS is present in India, but often at lower rates than in the West. A review noted: "various studies from India have reported prevalence of GBS between 1.62 and 12%" . (Detection improves with rectal swabs and enrichment.)

Screening and prophylaxis: Unlike the U.S. (which endorses universal culture at 35–37 weeks), India has no national GBS screening policy. Some experts recommend moving toward universal antenatal cultures – for example, Goal et al. (2020) concluded that "low prevalence and no significant association with major risk factors" actually favour universal screening over risk-based protocols. Ashary et al. (ICMR) similarly call for universal screening prior to intrapartum antibiotics in preterm labour. However, in practice we seldom culture every pregnant woman for GBS. The prevailing approach is **risk- based prophylaxis:** giving IV antibiotics intrapartum only when risk factors are present (maternal fever ≥100.4°F, spontaneous labour <37 weeks, rupture of membranes >18 hours, GBS bacteriuria anytime, or a previous baby with GBS disease). A recent Indian review notes that **"screening of GBS is not a routine practice in India and intrapartum antibiotic prophylaxis is limited … to only in risk conditions"**. In short, most Indian OBs follow international criteria for IAP (based on risk factors) rather than universal cultures, largely because routine culture screening isn't yet feasible in many settings

Bacterial Infections in Obstetrics

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Screening and prophylaxis: Unlike the U.S. (which endorses universal culture at 35–37 weeks), India has no national GBS screening policy. Some experts recommend moving toward universal antenatal cultures – for example, Goal et al. (2020) concluded that "low prevalence and no significant association with major risk factors" actually favour universal screening over risk-based protocols. Ashary et al. (ICMR) similarly call for universal screening prior to intrapartum antibiotics in preterm labour. However, in practice we seldom culture every pregnant woman for GBS. The prevailing approach is **risk- based prophylaxis:** giving IV antibiotics intrapartum only when risk factors are present (maternal fever ≥100.4°F, spontaneous labour <37 weeks, rupture of membranes >18 hours, GBS bacteriuria anytime, or a previous baby with GBS disease). A recent Indian review notes that **"screening of GBS is not a routine practice in India and intrapartum antibiotic prophylaxis is limited … to only in risk conditions"**. In short, most Indian OBs follow international criteria for IAP (based on risk factors) rather than universal cultures, largely because routine culture screening isn't yet feasible in many settings

Case vignette: I recall a case in a district hospital: a healthy 28-year-old primigravida with no documented GBS test went into labor. Because her membranes had been ruptured >24 hours, we gave penicillin prophylaxis. Her baby was fine. A week later we learned her blood culture at delivery (done incidentally) grew GBS. This reinforced that risk-based antibiotics worked in that case, but had we known her true GBS status we could have planned more smoothly.

Challenges: Several practical issues complicate GBS management in India. First, **infrastructure:** many rural clinics lack on-site microbiology labs. Turnaround for cultures (48–72 hours) is often considered too slow or too costly. As a result, non-culture methods (Gram stain of urine for ASB) or risk assessment are used in lieu of screening. Financial constraints and heavy workloads also limit screening: a review observes that "high birth rate, poor detection methods, and financial constraints limit routine GBS screening in a developing country such as India". Second, **awareness:** among general practitioners and midwives, GBS may not be on top of the mind, so risk factors can be missed. (Anecdote: "I once heard a village nurse say, 'GBS? Does cow-dung have that?'" — highlighting unfamiliarity.) Third, **regional disparities:** In urban tertiary centres we can more easily obtain cultures or rapid tests, but in rural or small clinics we rely on guidelines and clinical judgment. There's also no official FOGSI/ICMR mandate on GBS screening; we mostly adapt CDC/ACOG-style risk criteria where possible.

Takeaways (GBS): Indian OBs should be aware that, while overall GBS rates are lower than in the West, transmission still causes neonatal sepsis. When feasible, culture screening at 35–37 weeks helps target antibiotics. In all settings, prophylaxis for risk conditions is essential. Key recommendations include: - **Screening:** Follow FOGSI guidance to perform a midstream urine culture at booking (for ASB, see below) and consider a GBS rectovaginal culture at 35–37 weeks in high-risk women (e.g. preterm labor, previous GBS baby). - **Antibiotic prophylaxis:** Give IV penicillin (or ampicillin, or if allergic cefazolin/ clindamycin) during labor if risk factors are present, as per standard protocols. This can drastically cut EOGBS sepsis. - **Education**: Increase awareness among staff that even asymptomatic GBS colonization can harm infants. I remind colleagues: "If a mother tests positive (or has risk factors), we must not skip IAP." - Infrastructure: Advocate for a hub-and-spoke model of screening, where rural centers send swabs to regional labs. (A "model of hub and spoke for GBS" has been suggested to improve rural reach.)

Urinary Tract Infections (UTIs) – mainly E. coli

Scope in pregnancy: UTIs are very common in pregnancy due to urinary stasis and immune changes. We distinguish three forms: asymptomatic bacteriuria (ASB), acute cystitis, and pyelonephritis. In pregnancy, ASB (bacteria in urine without symptoms) is especially important because it often progresses to symptomatic infection. Studies report ASB in ~5–10% of Indian pregnant women. For example, one North Indian study found 7.3% ASB on screening , and another reported an overall UTI prevalence (symptomatic + asymptomatic) of ~9.5% . In rural Haryana, 3.3% of antenatal attendees had culture-positive UTI . (Prevalence varies by region and screening method.) Untreated ASB can lead to pyelonephritis (seen in 20–50% of cases) and adverse outcomes .

Example: I once saw a 24-year-old primigravida with no complaints who had routine urine microscopy at her first visit. It showed 10–20 pus cells, so we cultured her urine. She had >10^5 E. coli. After treatment, she never developed a symptomatic infection. This case underscored that even silent bacteriuria needs detection.

Diagnosis and screening: Current Indian practice, guided by FOGSI recommendations, is to screen for ASB at least once early in pregnancy . FOGSI's 2024 GCPR antenatal guidelines advise a midstream urine culture for all pregnant women at booking. In resource-limited settings, a Gram stain of midstream urine (or at minimum dipstick) is preferred to no test 9 9 . In tertiary urban hospitals this screening is often done, but **in rural/primary centers it is seldom routine.** One study of a sub-district hospital noted "no regular screening for UTI" and lack of diagnostic facilities in peripheral centers. In practice, many rural clinics do either dipstick tests or just treat symptoms.

After culture is obtained, any isolate ≥10^5 CFU/mL is significant (even without symptoms). If ASB is found, guidelines say **treat it** to prevent pyelonephritis. Likewise, any symptomatic UTI (cystitis/ pyelo) needs prompt culture and antibiotics. Referral to hospital is needed if there are systemic signs (fever >38°C, flank pain, vomiting) suggesting pyelonephritis.

Bacteria and resistance: In India, E. coli is the dominant uropathogen (often ~45–75% of isolates). Other bugs include Klebsiella, Group B strep, Enterococcus, Staph. aureus. Importantly, antibiotic resistance is a growing problem. Indian studies show many uropathogens are resistant to older oral drugs: one study found 56–83% of Gram-negative isolates were resistant to trimethoprim-sulfamethoxazole and ampicillin. E. coli sensitivity to ampicillin was only ~61%, and a Klebsiella strain was 11% sensitive to ampicillin (intrinsically resistant). In contrast, nitrofurantoin remained active against ~80– 87% of isolates. Third-generation cephalosporins (ceftriaxone, cefixime) also show high efficacy (~86–100% susceptibility). Notably, quinolones (ciprofloxacin) are best avoided in pregnancy despite occasional use; plus high fluoroquinolone resistance is reported. We even see ESBL-producing strains: a Kanpur study detected an ESBL-positive E. coli (still carbapenem-sensitive) among ASB cases

Treatment practices: Based on these patterns, the usual empiric choices in India are nitrofurantoin (100 mg BD) or a safe cephalosporin (e.g. oral cefixime or IV ceftriaxone for pyelo). We generally avoid ampicillin/amoxicillin and co-trimoxazole unless sensitivities warrant it. If the culture shows resistance, we switch accordingly. For pyelonephritis, hospitalization and IV antibiotics (ceftriaxone or gentamicin, plus hydration) are standard. Throughout, patient education is key. I tell my patients: "Finish the full course, even if you feel better – UTIs in pregnancy can sneak back."

Urban vs rural: In urban centers, culture-guided treatment and follow-up are routine; patients are often re-checked each trimester and counseled. In rural practice, constraints mean many women are only screened if they report symptoms or risk factors (anemia, diabetes). Antibiotics may be given empirically for any burning/urgency since lab access is limited. Adherence can be a challenge if drug supply or follow-up is inconsistent.

Public health challenges and risks: Untreated UTIs pose serious risks. As mentioned, pyelonephritis in pregnancy can cause dehydration, sepsis, renal failure, and can trigger preterm labor. ASB is linked with anemia and pre-eclampsia. One Indian review warns that ASB "could lead to acute pyelonephritis in 20– 50% of cases and to adverse obstetric outcomes such as prematurity, postpartum hypertensive disease, anemia… and higher fetal mortality rates" . Moreover, high levels of drug resistance mean ineffective treatment and complications. Data suggest India's Gram-negative uropathogens increasingly carry plasmid-mediated ESBLs and quinolone resistance .

This necessitates strengthening antibiotic stewardship – using narrowest effective drug – and updating empiric choices based on local antibiograms.

Actionable steps (UTIs):
Screen all pregnant women (as FOGSI recommends) with a urine culture at the first visit . If culture isn't possible, use dipstick/Gram stain as a proxy.
- **Treat all ASB:** Any culture-positive ASB should be treated (usually 5–7 days of antibiotic) to prevent progression .
- **Choose antibiotics wisely:** Start with nitrofurantoin or a cephalosporin; avoid drugs with high resistance or teratogenic risk. Use culture results to de-escalate therapy.
- **Educate patients:** Encourage hydration, front-to-back toileting, and reporting symptoms early. Advise follow-up urine tests each trimester if high-risk.
- **Strengthen labs in rural areas:** Even simple microscopy or dipstick available at primary centers can aid diagnosis. We must also train community health workers to recognize UTI signs.

Other Foodborne Bacterial Risks (Listeria, Salmonella)
Pregnant women are uniquely vulnerable to certain foodborne infections. In India, awareness of these is low, so obstetricians should counsel on diet and hygiene.

Listeria monocytogenes: Listeriosis in pregnancy is relatively uncommon, but its consequences are dire (miscarriage, stillbirth, neonatal sepsis). In India Listeria is known mainly as a cause of **abortions and fetal loss.** Reports show L. monocytogenes isolated from 3–14% of women with bad obstetric histories or spontaneous abortions . For example, in one series 3.3% of spontaneous abortion cases yielded pathogenic Listeria . Listeria is widely present in the environment and food chain: studies found L. monocytogenes in ~5–7% of raw milk and dairy products in India , and in meat (goat 6–7%, beef ~3 6%) . Traditional Indian foods such as unpasteurized milk, homemade cheeses (paneer), raw sprouts, and deli meats can harbor Listeria. Worryingly, Listeria often causes no symptoms in the mother until pregnancy loss occurs.

Practical advice: I always warn my patients: **"Never drink raw milk or eat soft cheese from outside the home,"** citing Listeria risk. Handwashing after handling raw vegetables (which can carry Listeria in soil) is also essential. Though laboratory testing is rare in routine care, any febrile pregnant woman with gastrointestinal or flu-like illness should raise suspicion.

Salmonella (foodborne): In India we face two issues: enteric fever (Salmonella Typhi/Paratyphi) and nontyphoidal Salmonella (from contaminated food). Enteric fever in pregnancy is serious – maternal fevers can cause dehydration and shock, and **fetal loss rates are extremely high** if untreated. In fact, one review estimated that fetal loss from untreated typhoid in pregnancy "could be as high as 80%". We have seen cases where asymptomatic carriage of S. Typhi ended in second-trimester miscarriage. Non-typhoidal Salmonella (from poultry, eggs, etc.) can also cause severe gastroenteritis with high fever. Although not studied extensively in Indian pregnancy, Salmonella enteritidis and others have been isolated in foodborne outbreaks in India. For instance, Salmonella was found on ~8% of eggs and 29 7% of egg trays in one market survey, and outbreaks from contaminated chicken and fish have been documented in Mangalore. Such infections in pregnant women can trigger preterm labor.

Recipe for risk: A typical street snack like pani puri uses raw vegetables and tamarind water that may be contaminated with Salmonella or E. coli. Cravings for **raw eggs in lassi or mayonnaise** can introduce Salmonella. Uncooked or undercooked meat dishes (e.g. "raw fish curry", underdone kebabs) harbor Salmonella.

Food safety measures: To reduce Listeria/Salmonella risk, we advise pregnant women to: - **Avoid unpasteurized dairy products:** No raw milk, lassi or homemade cheeses unless boiled first . - **Cook foods thoroughly:** Ensure eggs are fully cooked (yolks firm) and meat/fish are well done . - **Avoid raw sprouts and salads from vendors:** Sprouts (mung, alfalfa, etc.) are notorious Salmonella/E. coli carriers. Only eat salad/fruit you've washed yourself. - **Skip deli meats** and cold cuts: These can carry Listeria. If eaten, heat them well. - **Wash produce and hands**: Fruits/vegetables should be washed under running water. Hand hygiene after bathroom use or before food prep is essential.

Cultural barriers: In practice, many women struggle to follow these rules. Dietary customs are deeply ingrained: e.g. eating "kachche aam" (raw mangoes), homemade papaya salad, or raw chutneys made from unwashed vegetables can conflict with safety advice. I once counseled a pregnant woman who loved sprouted moong salad ("mothh dal"), only to have her aunt insist it's "healing hot food." Many rural women prefer fresh cow's milk from a village well, believing "Dudh waala jo kharid ke deta hai usmein paani mila leta hai". Convincing them to boil it first takes tact. A colleague noted: "One patient said, 'My mother drank raw milk through five pregnancies – why should my baby be sick?'" These cultural beliefs mean we must educate families, not just patients.

Public-health context: Food safety infrastructure is still developing in India. Street food is ubiquitous and often unregulated. Many homes lack refrigerators or clean water, so leftovers sit at room temperature. All this increases bacterial proliferation. The Government of India has issued general food safety guidelines, but there is no pregnancy-specific law on what pregnant women must avoid. We as clinicians must fill that gap in our counseling.

Recommendations (Listeria/Salmonella):

- **Education:** Clearly explain to expectant mothers which foods are high-risk (raw milk, deli meats, undercooked eggs/meat, unwashed produce, raw sprouts) and why . Use simple language: 25 "Listeria hides in milk and cheese," "Salmonella hides in raw eggs and chicken."
- **Promote safe substitutes:** Recommend pasteurized milk, fully cooked dairy products, and well-washed fruit. Encourage home cooking whenever possible.
- **Family involvement:** Involve husbands and elders in dietary discussions, since they often make food choices. Dr. Gupta often schedules a small group talk in the village on "what foods to avoid in pregnancy."
- **Liaise with public health:** Push for better pasteurization coverage and street food hygiene enforcement. At a community level, clean water and toilets reduce Salmonella transmission.
- **Monitoring:** Any pregnant patient with unexplained high fever (even without obvious gastroenteritis) warrants evaluation for Salmonella or Listeria, especially if cultures of blood/fluids can be obtained. Timely IV antibiotics (ampicillin or ceftriaxone for Salmonella; ampicillin + gentamicin for Listeria) can save lives.

Conclusion and Takeaways

Infection-related complications in pregnancy are preventable with vigilance. The key points for Indian obstetric care are:

• **For GBS:** Consider screening strategies (universal if possible, or risk-based IAP). Intrapartum penicillin for at-risk mothers dramatically cuts neonatal sepsis.
• **For UTIs:** Screen at least once early in pregnancy (urine culture or Gram stain). Treat ASB promptly to prevent pyelonephritis and its consequences. Use local antibiograms – in India, nitrofurantoin and cephalosporins are usually best.
• **For foodborne bacteria:** Explicitly advise avoidance of raw/unpasteurized foods (milk, cheeses, eggs, meat) and insist on thorough washing and cooking. Educate families so cultural food practices don't jeopardize the pregnancy.
• **System-level:** Advocate for better lab support in rural areas (for both GBS and UTI cultures), and integrate these infection-prevention messages into national antenatal programs (MOHFW, Janani Suraksha).
By combining sound science (cited above) with the patient-centered insights we've gathered, we can reduce morbidity from these common bacterial infections. As I often tell junior doctors: "Our greatest ally is prevention – whether it's giving the right antibiotic or just boiling that glass of milk." Following these guidelines and addressing practical challenges will improve outcomes for mothers and babies across India

Sources: Key Indian studies and guidelines have been cited above (e.g., Patil et al. 2013; Ashary et al. 2020; Kanpur ASB study 2014; Kishanganj UTI 2019; FOGSI GCPR 2024; Ghia & Rambhad 2021; Kant et al. 2017; regional food safety data). Each provides evidence supporting the recommendations given here.

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04

Mycobacterial Infections: Genital Tuberculosis

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Abstract

Tuberculosis (TB) is an infectious disease primarily affecting the lungs, but it can spread to other organs through hematogenous or lymphatic dissemination. One of the lesser-known forms is female genital tuberculosis (FGTB). Although relatively rare compared to pulmonary TB, FGTB poses significant consequences, particularly regarding women's reproductive health. It often remains silent for years and is commonly diagnosed when women present with infertility or menstrual irregularities.

Despite advances in diagnostic modalities and treatment, FGTB remains a significant public health challenge in developing countries where TB is endemic. This article explores the epidemiology, pathogenesis, clinical features, diagnosis, management, and prognosis of FGTB, emphasizing the need for increased awareness and research.

Keywords: Anti-tuberculosis treatment, conception, fallopian tubes, genital tuberculosis, infertility, laparoscopy

Introduction

Despite a downward trend in mortality, tuberculosis (TB) remains a significant global public health concern despite efficient identification and treatment. The World Health Organisation (WHO) estimates that tuberculosis kills 1.3 million people annually, making it the most common infectious illness and the 13th leading cause of death globally. In women, genital TB typically manifests as a latent illness and is identified during an infertility assessment. In areas where tuberculosis is common, screening for the disease should always be done before considering in-vitro fertilisation for infertile women. Women with urogenital TB may exhibit irregular menstruation, pelvic or lower abdominal discomfort, an adnexal mass, ascites, abdominal distension, atypical vaginal discharge, dyspareunia, and unexplained vaginal bleeding when they are symptomatic.

Pyometra, leucorrhoea, and postmenopausal bleeding are signs of genital involvement in postmenopausal women. Increased Ca-125 values may indicate ovarian involvement and resemble ovarian cancer. Another typical misdiagnosis for female genital TB is chronic pelvic inflammatory illness (PID). Concern for genital TB should be raised when a patient at epidemiologic risk does not show a clinical response to broad-spectrum antibiotics for PID. Genital fistulas to surrounding tissues and infertility that cannot be explained are complications.

Epidemiology

Approximately 5–19% of all extrapulmonary TB cases are FGTB. In nations where tuberculosis is common, its prevalence among infertile women varies from 1% to 19%.[1] In contrast, because of improved public health efforts, it is far less prevalent in wealthy countries.

According to research conducted in infertility clinics, the prevalence of genital tuberculosis (TB) in India varies, ranging from 3% to 16%. According to some statistics, the prevalence in apex institutes might reach 26%, which may be the result of referrals from regions with a greater TB incidence. According to estimates, genital TB may be responsible for 5–10% of infertility cases in subfertility clinics around the globe, making it a significant cause in female infertility.

It commonly affects women between 20–40 years i.e, the reproductive age group. Common risk factors are: pulmonary or extrapulmonary TB history, HIV infection (due to immunosuppression), low socioeconomic status, malnutrition, close contact with TB patients. Because FGTB often has an insidious onset and non-specific symptoms, true prevalence is likely underreported.

Pathogenesis

FGTB usually occurs secondary to a primary TB infection elsewhere in the body, notably the lungs. The spread to genital organs occurs by:

- Hematogenous dissemination (most common route)
- Lymphatic spread from abdominal or mesenteric lymph nodes
- Direct spread from neigh boring organs such as intestines
- Sexual transmission (rare) from a male partner with genitourinary TB

Once the Mycobacterium tuberculosis bacilli reach the genital tract, they incite a granulomatous inflammatory response, leading to tissue destruction, fibrosis, and scarring.

Organs Involved

The infection may involve any part of the female genital tract:

- Fallopian Tubes (95–100%): The primary site; tubal blockage, beading, and hydrosalpinx are common.
- Endometrium (50–60%): Leads to Asherman's syndrome (intrauterine adhesions).
- Ovaries (20–30%): Oophoritis or tubo-ovarian masses.
- Cervix (5–15%): Mimicking cervical cancer sometimes.
- Vagina and Vulva (<1%): Extremely rare; often secondary to cervical involvement.

Clinical Features

FGTB is a "great masquerader," often presenting subtly or mimicking other gynaecological conditions.

Common Symptoms

- Infertility (most frequent presenting symptom)
- Menstrual disturbances:
  - Amenorrhea
  - Oligomenorrhea
  - Menorrhagia

    - Irregular bleeding
- Pelvic pain
- General constitutional symptoms:
    - Low-grade fever
    - Weight loss
    - Night sweats
    - Fatigue

Other Presentations

- Chronic pelvic inflammatory disease (PID)
- Ectopic pregnancy
- Pelvic mass (sometimes misdiagnosed as ovarian malignancy)
- Vaginal discharge (rare)
- Postmenopausal bleeding (rare)

Because the symptoms are non-specific, high clinical suspicion is essential, especially in endemic regions.

Diagnosis

Diagnosis of FGTB is challenging due to the paucibacillary nature (low number of bacteria) of the infection. A combination of clinical, radiological, microbiological, and histopathological evidence is required.

1. Clinical Suspicion

- Infertility evaluation
- Menstrual disturbances
- Chronic pelvic pain

2. Imaging Studies

Ultrasound (USG):

- The fallopian tubes may seem enlarged and dilated, and they may contain thick caseous material termed pyosalpinx or a clear fluid called hydrosalpinx. In 60–90% of genital TB cases, the endometrium is impacted, and the uterine enlargement may result from caseous material filling. With hyperechoic regions signifying intrauterine adhesions, a deformed uterine cavity, and foci of calcification or fibrosis, the endometrium may seem heterogeneous. The results can range from a normal scan to abnormalities like cornual obliteration, thin or thickened endometrium, calcification of the sub-endometrium, change in the uterine artery flow during midcycle in stimulated menstrual cycles, tubal fluid, free and loculated peritoneal fluid, heterogeneous enlargement of ovaries, and adnexal fixation.

- More specific observations include the presence of endometrial fluid and a hydrosalpinx, oligemic myometrial cysts, and follicles with echogenic rims. When an abdominal or pelvic mass is present, FGTB is treated with computed tomography and magnetic resonance imaging.

- **Hysterosalpingography (HSG):**
  - HSG is a helpful tool for visualising the abnormalities, because genital TB is linked to distinctive structural alterations in the affected organs. The presentation of tubal TB in HSG can range from non-specific changes like diverticular outpouching (salpingitis isthmica nodose), hydrosalpinx, tubal dilatation, and tubal occlusion to specific patterns like "**cotton wool plug**," "**pipestem tube**," "golf club tube," "**cobblestone tube**," "**beaded tube**," "**leopard skin tube**," tubal occlusion, and adhesions in the peri tubal region that can manifest as a straight spill, corkscrew appearance, or peri tubal halo. The presence of synechiae, tubal blockage in the area where the isthmus and ampulla meet, numerous constrictions, calcified lymph nodes, and irregular linear or nodular calcifications in the adnexal region should raise serious suspicions of tuberculosis.

  - TB-related uterine abnormalities can be classified as either non-specific (such as the formation of synechiae, uterine contour distortion, obliteration of the uterine cavity, and venous and lymphatic intravasation) or specific (such as "**collar-stud abscess**," "**T-shaped**," and "**pseudounicornuate**" uterus). Netter syndrome is a condition in which the uterine cavity completely narrows as a result of widespread endometrial and myometrial damage brought on by a chronic infection. It shows up in the HSG as a gloved finger made up of the tiny portion of the uterus and the cervical canal. Because the stratified epithelium of the ectocervix is inherently resistant to bacterial penetration, cervical TB is uncommon and typically occurs as a subsequent condition to TB of the endometrium and fallopian tubes.

  - In HSG, irregularities in contours, feathery diverticular outpouching, cervical deformation, and a serrated endocervical canal are indicative of cervical involvement. Cervical cancer is sometimes misdiagnosed as TB of the cervix, thus it is crucial to rule it out right away in the therapeutic process.

Magnetic Resonance Imaging (MRI): Helpful in complicated cases.
Chest X-ray: May reveal evidence of past or active pulmonary TB.

3. Microbiological Studies

- Endometrial biopsy:
  - Ziehl-Neelsen (ZN) staining for acid-fast bacilli (AFB)
  - Culture for Mycobacterium tuberculosis (Lowenstein-Jensen medium or liquid media like MGIT)
  - Nucleic Acid Amplification Tests (NAATs) such as CBNAAT/ GeneXpert for rapid diagnosis
- Polymerase Chain Reaction (PCR): High sensitivity and specificity.
- Histopathology: Granulomatous inflammation with caseous necrosis is suggestive.

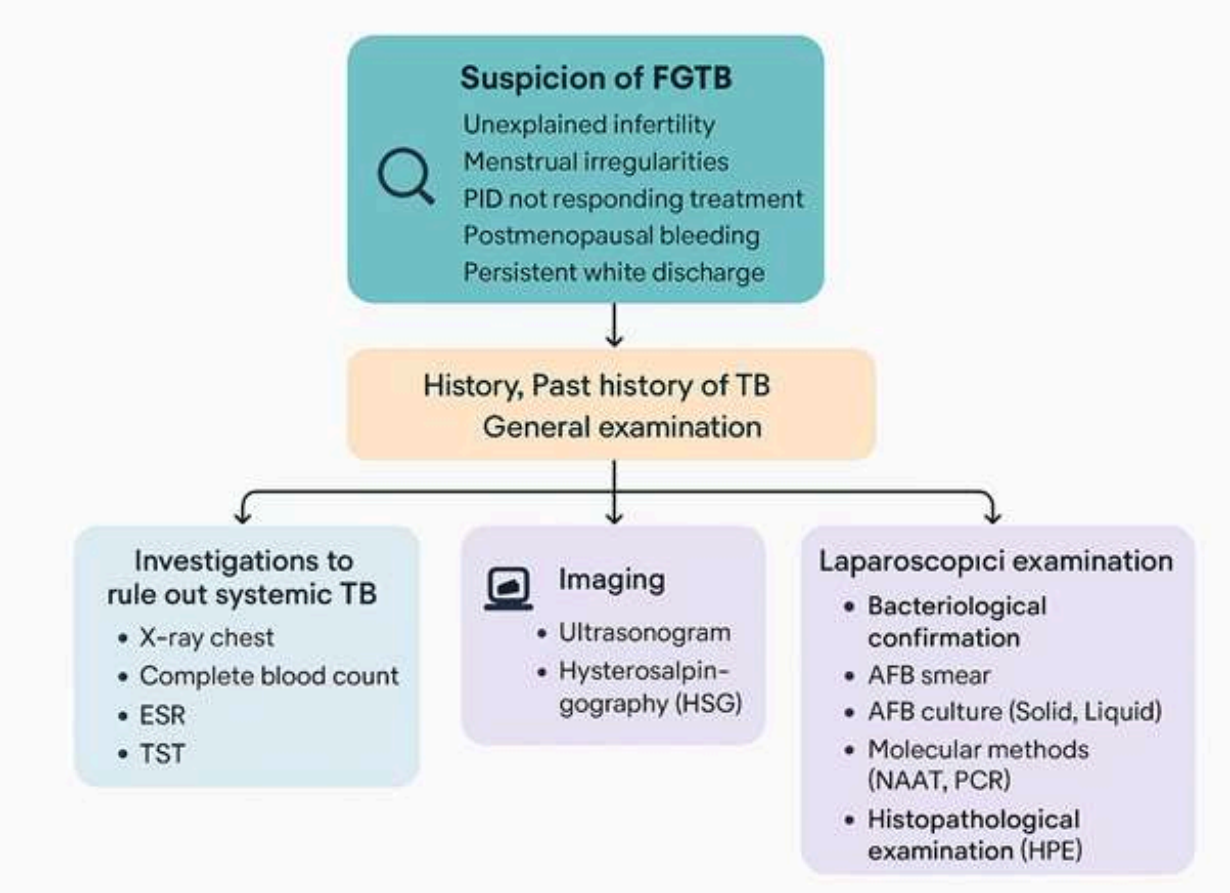
- **4. Laparoscopy**

Despite being an invasive procedure, laparoscopy helps with biopsy of the tuberculous lesions and visual assessment of the ovaries, fallopian tubes, and peritoneal cavity. The benefits of combining hysteroscopy and laparoscopy include the ability to do procedures like endometrial priming with oestrogen or lysis of synechiae in addition to ruling out endometrial involvement [22].Normal appearance, tubercles on the surface, fimbrial block, fimbrial phimosis, tubal beading, peritubal adhesions, periovarian adhesions, tubo-ovarian mass, hydrosalpinx, and stiff tubes are some of the laparoscopic findings that may indicate genital TB. Comparing endoscopic assessments to polymerase chain reaction (PCR), Baxi et al. demonstrated that the sensitivity, specificity, and negative predictive value were 85.7, 22.2, and 77 percent, respectively

5. Serological Tests

- Adenosine deaminase (ADA) levels in ascitic fluid (if ascites present).
- Mantoux test (limited value).

Figure 1: Algorithm for evaluation of patient with Genital Tuberculosis



- **Differential Diagnosis**

Site of Involvement	Differential Diagnosis
Tuberculous salpingitis	• Pelvic inflammatory disease • Ectopic pregnancy • Ovarian cyst • Endometriosis • Carcinoma of the colon • Diverticulitis
Endometrial tuberculosis	
Ovarian tuberculosis	• Dysfunctional uterine bleeding • Endometrial carcinoma
Cervical tuberculosis	• Ovarian malignancy
Vulval tuberculosis	• Carcinoma of the cervix
Vulval tuberculosis	• Elephantiasis vulva

Management

Management of FGTB requires a combination of anti-tubercular therapy (ATT) and, in some cases, surgical intervention.

1. Medical Management

- First-line therapy: Anti-tubercular therapy (ATT) as per WHO guidelines:
  - Intensive phase (2 months): Isoniazid, Rifampicin, Pyrazinamide, Ethambutol
  - Continuation phase (4 months): Isoniazid, Rifampicin
- Duration may extend to 9 months based on clinical response.

Monitoring includes regular clinical follow-up, liver function tests, and sputum smear (if pulmonary TB co-exists).

2. Surgical Management

Indicated in:

- Persistent pelvic masses
- Non-resolving symptoms after ATT
- Tubo-ovarian abscess
- Severe adhesions causing bowel obstruction
- Cases requiring infertility surgery (e.g., adhesiolysis)

Procedures may include salpingectomy, oophorectomy, adhesiolysis, or hysterectomy (rarely).

3. Management of Infertility

- ATT may restore fertility in early cases.
- Assisted Reproductive Techniques (ART) like IVF-ET are often required due to irreversible tubal/endometrial damage.
- Surrogacy or adoption may be discussed if uterus damage is extensive.

Prognosis

The prognosis for general health post-treatment is good with proper ATT. However, the reproductive prognosis remains guarded, primarily if diagnosed late or if extensive pelvic adhesions and tubal blockages exist.

Early diagnosis and prompt treatment significantly improve outcomes, including partial restoration of fertility in some cases.

Prevention

- Early detection and treatment of primary TB
- Public health education about TB transmission
- Screening programs for high-risk women (especially infertile patients)
- Contact tracing and prophylactic treatment
- BCG vaccination (though its role in preventing FGTB specifically is unclear)

Challenges and Future Directions

Several challenges remain in the management of FGTB:

- Delay in diagnosis due to asymptomatic nature
- Lack of awareness among patients and healthcare providers
- Paucibacillary infection making laboratory confirmation difficult
- Socioeconomic factors: Poverty, illiteracy, stigma
- Drug-resistant TB: Emerging as a global threat

Future Needs:

- Development of more sensitive diagnostic tests.
- Research into new treatment regimens, especially for drug-resistant TB.
- Public health strategies to include FGTB screening in infertility workups routinely.

Conclusion

Female genital tuberculosis, though often overshadowed by its pulmonary counterpart, significantly affects women's reproductive health, particularly in endemic areas. Due to its insidious nature and non-specific symptoms, high suspicion, comprehensive diagnostic approaches, and prompt treatment are vital. Awareness among healthcare providers and patients, improved diagnostic modalities, and strong public health initiatives are crucial in addressing the burden of FGTB. Research efforts must continue to refine strategies for early detection, effective treatment, and fertility restoration, ultimately improving the quality of life for affected women.

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Viral Infections in Ob-Gyn

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HSV: Maternal Infection, Neonatal Risk, and Intrapartum Management

Herpes Simplex Virus (HSV), which includes HSV-1 and HSV-2, has significant DNA similarities, leading to cross-immunity that can reduce the severity of primary infections. Traditionally, HSV-1 is associated with oral herpes, while HSV-2 is linked to genital herpes; however, both types can infect either location. The rise in genital HSV-1 infections is attributed to increased oral-genital sexual practices and decreased childhood HSV-1 prevalence due to better hygiene.

Seroprevalence and Transmission Dynamics

HSV-2 seroprevalence in India ranges from 2.7% to 15%, with studies in Northeast India showing rates up to 15%. Once a person is infected, the virus remains latent in sensory or cranial nerves, with recurrences being common. Maternal HSV status influences neonatal risk, particularly during late pregnancy, due to the possibility of vertical transmission primarily during delivery.

Maternal Infection & Neonatal Risk

Neonates have a higher risk than mothers for HSV infection, mainly during the peripartum period. About 85% of neonatal cases result from vertical transmission during delivery, while intrauterine (5%) and postnatal (10%) transmissions are less common. There is no significant evidence linking HSV to miscarriage. Neonatal herpes can present in three forms:

- SEM Disease: Vesicular lesions on skin, eyes, mouth.
- CNS Disease:Neurological impairment, seizures, developmental delays.
- Disseminated Disease: Multi-organ failure with high mortality.

Timing of Maternal Infection & Transmission Risk

·Primary Infection: The highest risk occurs if maternal infection happens late in pregnancy, especially if active lesions or viral shedding are present, due to the absence of maternal antibodies.

·Recurrent Infection: Lower transmission risk (<1%) if there are no active lesions or shedding at delivery.

·Asymptomatic Viral Shedding: Occurs in recurrent cases, increasing transmission risk even without lesions.

Intrapartum Management

- Active Lesions: Caesarean delivery is recommended to prevent neonatal exposure.
- Recurrent Infection & No Lesions: Vaginal delivery is generally safe, with continuous monitoring.
- Viral Shedding: Precautions are necessary despite the absence of lesions.

Post-Delivery: Infants should be monitored; prompt antiviral therapy is critical if infection signs appear.

Drug Therapy

- Nonpregnant: Acyclovir, valacyclovir, famciclovir treat acute episodes and suppress recurrences.

- Pregnant Women: Acyclovir and valacyclovir are safe. For primary outbreaks, antiviral therapy starting at 36 weeks reduces outbreaks and shedding. Severe cases involve IV acyclovir (5-10 mg/kg every 8 hours) until improvement, followed by oral therapy for at least 10 days. Topical anaesthetics may alleviate discomfort.

Precautions & Interventions

- Procedures: Amniocentesis and CVS can be performed with caution; transcervical procedures should be delayed until lesions resolve.
- Monitoring & Management: Continuous foetal monitoring and neonatal observation are essential, especially if maternal HSV is active or recent.

Conclusion

Maternal HSV infection, particularly near term, presents significant neonatal risks. Effective intrapartum management, antiviral therapy, and vigilant fetal and neonatal monitoring are essential for minimizing transmission and ensuring neonatal health.

References: Key sources include Williams Obstetrics, studies on HSV seroprevalence, and guidelines from ACOG and CDC.

HUMAN PAPILLOMA VIRUS

HPV is a DNA virus causing epithelial lesions and cancers. It includes over 200 subtypes, with high-risk types like 16, 18, 31, and 33 linked to cervical and oropharyngeal cancers, while low-risk types like 6 and 11 usually cause warts. The virus integrates into the host genome, disrupting tumor suppressor genes (p53 and Rb), leading to cell immortalization and cancer.

Risk factors include sexual activity, smoking, long-term contraceptive use, radiation exposure, and UV light. HPV prevalence in India is about 6.6%, varying by region. Infection often remains asymptomatic, but cervical cancer symptoms can include abnormal bleeding and discharge.

Screening methods for cervical cancer include Pap smear, LBC, HPV testing, VIA, and colposcopy, enabling early detection and treatment.
Several HPV detection tests have unique characteristics:

Hybrid Capture 2 (HC2): Detects high-risk types, allows semi-quantitative viral load estimation, but may cross-react with non-oncogenic types and lacks genotype information.

• **Care HPV:** Targets the same types as HC2, requires minimal infrastructure and training, runs in 2.5 hours, is less expensive, but also lacks genotype information.

• **Gene Expert:** Detects high-risk types, provides genotype information for HPV 16, 18, and 45, results in 1-2 hours, but is relatively expensive.

Cervista HPV: Less cross-reactivity with low-risk types, includes an internal control for DNA integrity, lacks genotype information.

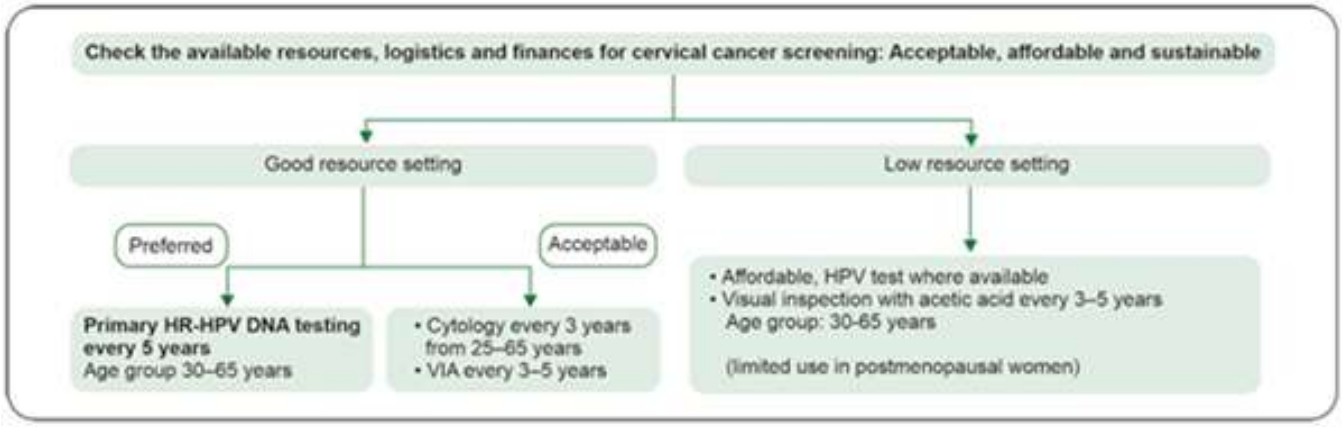
• **Abbott and Cobas HPV HR:** Simultaneously detect types 16/18 and pooled high-risk types, facilitating triaging with high sensitivity, but may cause unnecessary referrals.

• **Pre Tect HPV:** Focuses on mRNA from types 16, 18, 31, 33, and 45, better predictive value for lesions, stringent storage conditions.

• **Aptima HPV:** Detects mRNA from several high-risk types, offers high sensitivity and specificity, does not provide specific type identification, stringent sample storage requirements.
These tests vary in operational requirements, costs, and specificity, affecting their suitability for clinical settings.

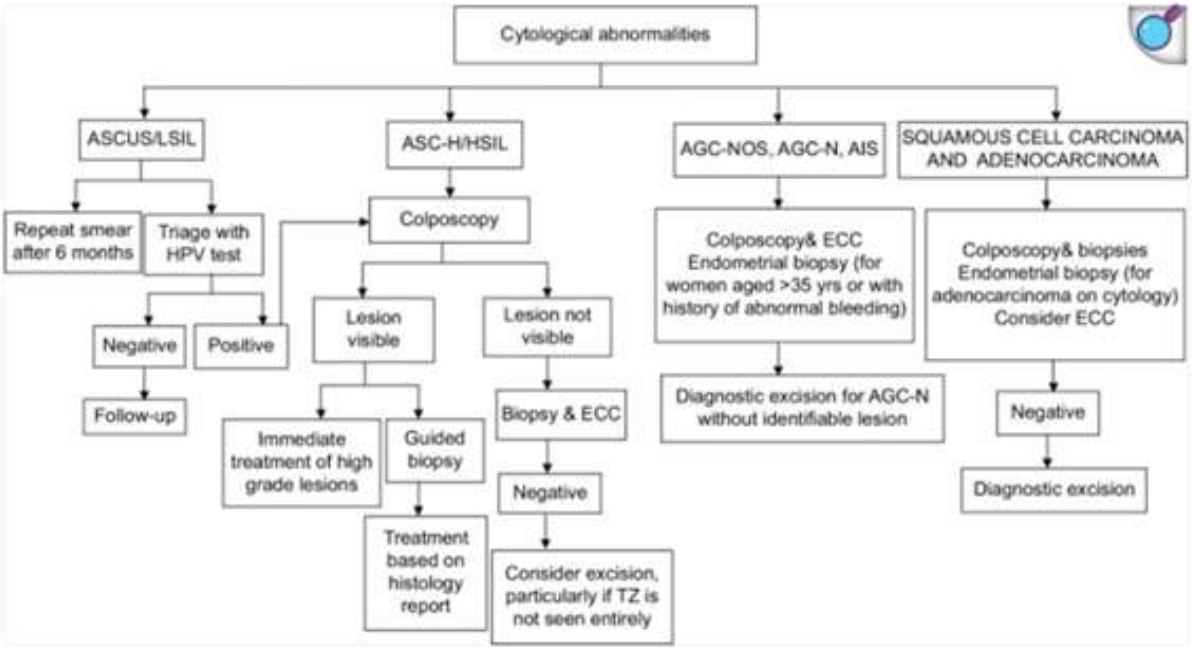
In India, the ICMR advises HPV-DNA testing for cervical cancer from age 30 every 5-10 years. In low-resource areas, Pap smears are recommended every 3 years for women aged 30 and above. FOGSI suggests screening at 25 in well-resourced settings and at 30 in low-resource areas.

Algorithm 1: Screening recommendations according to resource settings

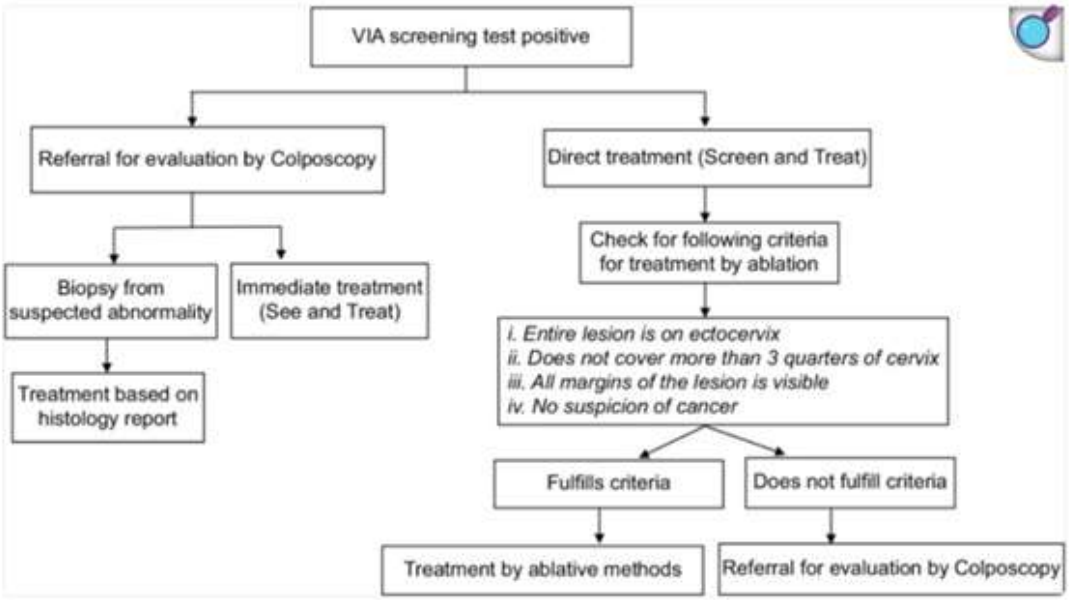


Management of women with positive screening tests aims to reduce cervical cancer incidence by identifying precancerous lesions early and treating them appropriately. Treatment objectives include eliminating or excising areas of the cervix identified as pre-cancerous. Treatment options can be ablative (destroying abnormal tissues through burning or freezing) or excisional (surgically removing abnormal tissues). Ablative methods do not provide tissue samples for further histopathological examination.

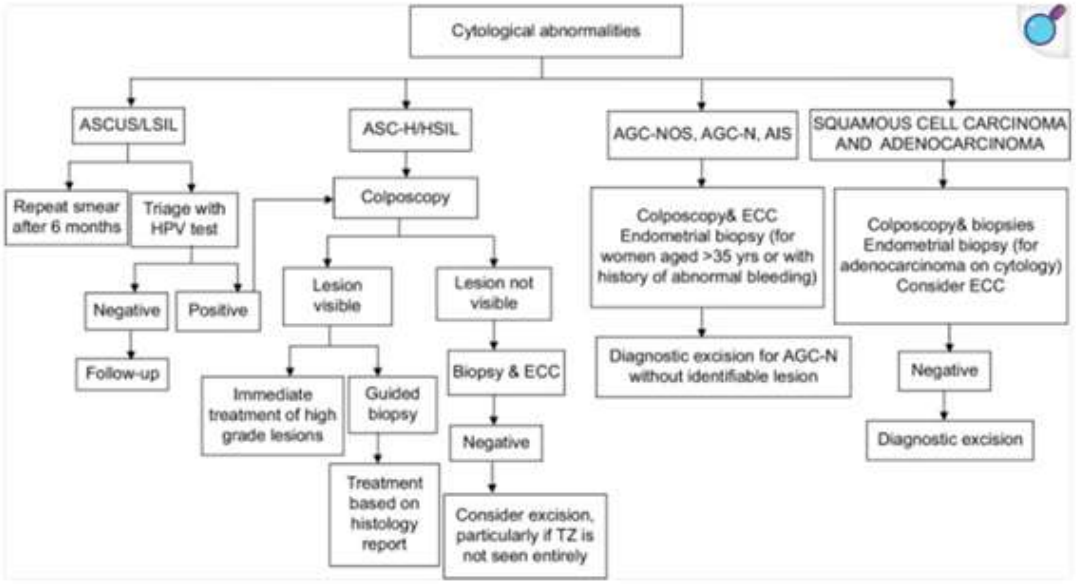
Eligibility criteria must be met before proceeding with treatments such as cryotherapy, loop electrosurgical excision procedure (LEEP), cold knife conization (CKC), laser excision, or ablation.



Flowchart on management of women positive on HPV test



Flowchart on management of women positive on VIA test.



Flowchart on management of women with cytological abnormalities

HPV vaccines are highly effective in preventing HPV infections and related cancers, including cervical cancer. Vaccination is recommended for girls and boys aged 9–14 years, ideally before sexual activity, with up to 3 doses required if initiated after age 15 or for individuals with weakened immune systems.

	Schedule	*Evidence level and grade of recommendation*
Optimal dose	• Two doses 9–14 years at least 6 months apart • Three doses above 15–26 years (0, 1–2 months, 6 months) • Three doses for older women till 45 years Regular screening as per guidelines has to be followed in this age group	Level I, Grade A Level II, Grade B
Reduced dose* A. Two doses WHO SAGE Recommendation B. Alternative single dose (Off label)	• One or two doses for 9–14 years • One or two doses for 15–20 years • Two doses for 21 years and above • Single dose schedule can be used for girls and boys aged 9–20 years	Level II, Grade B Level II, Grade B
Boys	Boys can be vaccinated from 9–26 years • 9–14 years 2 doses 0, 6 months • 15–26 years 3 doses 0, 2, 6 months	Level II, Grade C

*Reduced dose schedule of HPV vaccine awaits Drug Controller General of India (DCGI) approval.

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HIV in Pregnancy

Introduction

The first HIV case was reported in Los Angeles in June 1981, with India identifying its initial case in 1986 among female sex workers in Chennai. By 1987, 135 cases were reported, 14 of which progressed to AIDS. The epidemic spread rapidly, with an estimated 5.6 million people living with HIV by 2006. Refined estimates revised this number to 2.3 million in 2009.

To combat the epidemic, India formed the National AIDS Committee in 1986 and the National AIDS Control Organization (NACO) in 1992. The National AIDS Control Programme (NACP) has been implemented in five phases, with the ongoing NACP-V overlapping the National Strategic Plan on HIV/AIDS and STIs (2017–2024). By 2020, adult HIV prevalence among individuals aged 15–49 years had declined to 0.22%, a 33.3% reduction over the last decade.

Parent-to-Child Transmission (PTCT)

PTCT accounts for about 4% of new infections among children. The Prevention of Parent-to-Child Transmission (PPTCT) program under NACP aims to eliminate mother-to-child transmission (EMTCT) of HIV through lifelong antiretroviral therapy (ART) for mothers and prophylaxis for infants. As of 2020, 81,430 children in India were living with HIV, comprising 3.5% of the total people living with HIV.

EMTCT Process Indicators

The following indicators must be maintained for at least 2 years to validate EMTCT:

- Pregnant women registered for antenatal care: >95%
- Pregnant women tested for HIV: >95%
- HIV-positive pregnant women on ART: >95%

Essential PPTCT Services

- Routine HIV counselling and testing with an opt-out approach
- Family-centric approach involving spouses
- Lifelong ART for all HIV-infected pregnant/breastfeeding women
- Management of STIs, TB, and other infections
- Institutional deliveries for HIV-infected women
- Plasma viral load testing at 32–36 weeks gestation
- ARV prophylaxis for infants
- Nutrition counselling and psychosocial support
- Exclusive breastfeeding within the first hour, continued up to 24 months
- Integration of infant follow-up with routine healthcare
- Early Infant Diagnosis (EID) using HIV-TNA PCR from 6 weeks
- Community outreach and follow-up

Four-Pronged Strategy to Reduce PTCT

- Primary prevention of HIV among women of childbearing age
- Prevention of unintended pregnancies among HIV-positive women
- Prevention of HIV transmission from mothers to children
- Care and support for HIV-positive mothers and children.

Risk Factors

Maternal risks include high viral load, recent infection, malnutrition, and obstetric procedures. Infant risks include preterm birth, low weight, and mixed feeding.

Interventions

During pregnancy, women receive ART, viral load testing, and institutional delivery counseling. During labor, safe practices such as aseptic techniques are emphasized. Exclusive breastfeeding (EBF) or exclusive replacement feeding (ERF) is recommended, with mixed feeding discouraged.

ART Regimen

Pregnant and breastfeeding women are prescribed TDF + 3TC + DTG (TLD), a fixed-dose combination taken once daily.

Infant ARV Prophylaxis

Low-risk infants receive syrup Nevirapine or Zidovudine for 6 weeks. High-risk breastfed infants receive dual therapy for 12 weeks, while formula-fed high-risk infants receive it for 6 weeks.

Conclusion

Immediate initiation of infant prophylaxis, adherence to ART, and comprehensive antenatal care are critical steps for EMTCT. India's progress represents substantial achievements aimed at ensuring no child is born with HIV and providing necessary care to affected mothers.

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Hepatitis B in Pregnancy: A Critical Opportunity for Prevention and Intervention

Introduction

Hepatitis B virus (HBV) infection poses a significant global health risk, especially for pregnant women due to vertical transmission risks. Effective prophylactic measures and antiviral therapies make early identification and management crucial to protect maternal and neonatal health.

Epidemiology

Around 296 million people globally have chronic hepatitis B, with over 1.5 million new cases each year [1]. In highly affected regions like sub-Saharan Africa and East Asia, more than 10% of pregnant women are infected [2]. In contrast, the prevalence in the United States and other low-endemic countries is about 0.5–1.5%, though immigration from high-prevalence areas keeps it relevant. Vertical transmission is the main infection route in high-prevalence regions, causing most chronic infections worldwide. Without intervention, the perinatal transmission risk is 10–20% for HBsAg-positive, HBeAg-negative mothers and up to 90% for HBeAg-positive mothers.

Pathophysiology and Natural History

HBV is a DNA virus transmitted through blood and bodily fluids. Acute infections may become chronic if HBsAg remains positive for over six months. Chronic HBV can lead to cirrhosis, liver failure, or hepatocellular carcinoma. The risk of chronic infection decreases with age at the time of infection; perinatal infections have a 90% chance of becoming chronic, highlighting the need to prevent vertical transmission.

Screening and Diagnosis

Universal screening for HBsAg during the first trimester is recommended for all pregnant women. If positive, further evaluation should include:

- Hepatitis B e-antigen (HBeAg)
- Hepatitis B virus DNA (HBV DNA) levels
- Liver function tests (LFTs)
- Co-infection screening (HIV, HCV, HDV)

These assessments inform the risk of perinatal transmission and the need for antiviral therapy.

Risk of Perinatal Transmission

HBV is primarily transmitted from mother to child during delivery through exposure to infected blood and secretions. Though less common, intrauterine transmission can occur with high viral loads or placental leakage. Neonates may develop chronic HBV, face higher long-term liver disease risks, or rarely, experience fulminant hepatitis in infancy.

Prevention of Transmission

Neonatal Immunoprophylaxis

The cornerstone of prevention involves timely Immunoprophylaxis at birth, including:

- Hepatitis B vaccine within 12 hours of birth

- Hepatitis B immune globulin (HBIG) administered concurrently for infants born to HBsAg-positive mothers

This combination is over 90% effective in preventing vertical transmission [6]. The infant should complete the vaccine series (at 1 and 6 months) and undergo post-vaccination serologic testing (anti-HBs and HBsAg) between 9–12 months.

Maternal Antiviral Therapy

For mothers with high viral loads (HBV DNA >200,000 IU/mL), antivirals administered during the third trimester significantly reduce transmission risk, even with immunoprophylaxis. First-line agents include:

- Tenofovir disoproxil fumarate (TDF) – Category B; preferred for potency and resistance profile
- Lamivudine or telbivudine – Alternatives if TDF is contraindicated

Treatment typically begins at 28–32 weeks and continues until delivery or 4–12 weeks postpartum, dependent on liver disease status and risk of flare.

Delivery Mode

Elective cesarean section does not significantly reduce HBV transmission risk when proper neonatal prophylaxis is administered and is not routinely recommended. Decisions should be based on obstetric indications.

Breastfeeding

Although HBV is present in breast milk, breastfeeding is safe with appropriate neonatal Immunoprophylaxis. Antiviral therapy during breastfeeding is considered safe, particularly with TDF, which has low levels of secretion into breast milk.

Maternal Monitoring and Postpartum Care

Women with HBV should be monitored for hepatic complications during and after pregnancy, particularly if antivirals are discontinued postpartum. Hepatitis flares may occur due to immune reconstitution. Postpartum considerations include the continuation of antiviral therapy if indicated for maternal health, regular liver function tests and HBV DNA testing, as well as testing and vaccination of family and household contacts.

Co-infections

Testing for HIV, HCV, and hepatitis D (HDV) is essential in all HBV-infected pregnant women. Co-infections can exacerbate liver disease and influence treatment decisions. For instance, HIV co-infection necessitates lifelong antiviral therapy.

Public Health and Global Implications

The World Health Organization's goal to eliminate viral hepatitis by 2030 includes reducing HBV transmission via universal childhood vaccination and perinatal prevention strategies. Maternal screening and prophylaxis are critical for achieving this objective, particularly in resource-limited settings where HBV prevalence is high.

Conclusion

Hepatitis B during pregnancy is a preventable cause of chronic liver disease in infants and a manageable condition for mothers. Effective strategies to prevent mother-to-child transmission include universal screening, timely neonatal immunoprophylaxis, and targeted antiviral therapy. By implementing these protocols, obstetricians can significantly reduce the global burden of chronic hepatitis B.

Key Recommendations:

- Screen all pregnant women for HBsAg early in pregnancy.
- Assess HBV DNA and HBeAg in HBsAg-positive women to guide therapy.
- Initiate antiviral therapy in the third trimester for high viral load.
- Ensure timely neonatal HBV vaccine and HBIG administration.
- Continue maternal follow-up postpartum for liver health and treatment evaluation.

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06

Fungal Infections: Vulvovaginal Candidiasis

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Introduction

Vulvovaginitis, characterized by inflammation of the vulva and vagina, is a common gynecological condition predominantly affecting women of reproductive age. Among its various etiologies, vulvovaginal candidiasis (VVC) is one of the most prevalent, accounting for approximately one-third of all cases. VVC is a mucosal fungal infection predominantly caused by Candida albicans, a polymorphic opportunistic yeast commonly found in the normal vaginal flora. Clinical manifestations include vulvar and vaginal erythema, edema, excoriation, and a thick, adherent white discharge. Diagnosis is primarily clinical but may be supported by adjunctive methods such as saline and potassium hydroxide (KOH) wet mounts, vaginal pH testing, and microbial cultures, primarily to exclude bacterial vaginosis (BV) and sexually transmitted infections (STIs) like Neisseria gonorrhoeae and Chlamydia trachomatis [1,2].

Etiology

VVC arises from an exaggerated inflammatory response of the vaginal and vulvar epithelium to Candida overgrowth, particularly C. albicans. While Candida species colonize the vagina asymptomatically in approximately 10% of healthy women, symptomatic infection requires both clinical signs—such as pruritus, irritation, and dysuria—and microbiological confirmation [3]. Although C. albicans accounts for 80–90% of acute VVC cases, the role of non-albicans Candida (NCAC) species, such as C. glabrata, is increasingly recognized, particularly among pregnant and immunocompromised women [4–6]. In adolescents and non-pregnant women with compromised immunity, VVC commonly presents with abnormal discharge, vulvovaginal irritation, and pruritus. STIs and BV are also prevalent in this population and should be ruled out due to overlapping symptomatology [7–9].

Risk Factors

VVC is typically triggered by an imbalance between Candida colonization and host defences. Host-related risk factors include pregnancy, hormone therapy, uncontrolled diabetes mellitus, immunosuppression, genetic predisposition, and use of broad-spectrum antibiotics or corticosteroids [3,4]. Behavioural and environmental factors such as oral contraceptive use, spermicides, certain hygiene practices, synthetic clothing, and sexual activity also contribute to the condition [4,6,10]. Despite extensive research, the precise mechanisms underlying host-pathogen interactions in recurrent or severe VVC remain unclear [11].

Clinical Presentation and Diagnosis

The clinical hallmark of VVC is intense vulvar itching and burning, which may lead to dysuria and dyspareunia in advanced cases. On physical examination, findings typically include erythema, edema, and a thick, clumpy white discharge with a cottage cheese-like appearance [1,2]. Diagnosis is largely clinical but can be substantiated by microscopic examination. Wet mounts with saline or KOH reveal budding yeast or pseudohyphae in 50–80% of cases [2]. A negative "whiff test" helps distinguish VVC from BV. Vaginal pH typically remains below 4.5 in VVC, whereas elevated pH levels are indicative of infections like Trichomonas vaginalis [4]. When diagnostic uncertainty persists, fungal cultures are recommended. Empirical antifungal therapy is discouraged in the absence of definitive clinical or laboratory confirmation [8].

Treatment

Uncomplicated VVC

Most cases of uncomplicated VVC respond well to short-term antifungal therapy, achieving symptom resolution in 80–90% of patients [4,10]. Commonly used topical azoles include clotrimazole, butoconazole, and miconazole. Standard treatment duration is three days, with symptom relief typically observed within 48–72 hours [10,12]. A combination of vaginal suppositories and external clotrimazole cream has been shown to enhance therapeutic outcomes compared to internal treatment alone [12].

Oral fluconazole (150 mg, single dose) is another widely accepted treatment. A study by Sekhavat et al. demonstrated equivalent efficacy between single-dose oral fluconazole and a 7-day course of clotrimazole vaginal suppositories [13]. Current Infectious Diseases Society of America (IDSA) guidelines support both oral and topical agents for uncomplicated cases [10].

Probiotics in Recurrent Vulvovaginal Candidiasis

Probiotics, defined as live microorganisms that confer health benefits when administered in adequate quantities, have garnered attention for their potential role in managing recurrent VVC (RVVC) by restoring the Lactobacillus-dominated vaginal microbiota [14]. Falagas et al. reviewed clinical trials assessing probiotics like Lactobacillus rhamnoses GR-1, Lactobacillus fermentum RC-14, and Lactobacillus acidophilus. While some studies demonstrated benefits in preventing RVVC, others yielded inconclusive results due to small sample sizes, lack of placebo control, and variation in probiotic strains and regimens [14].

In a randomized Croatian study, 61.5% of women treated with a six-week course of L. reuteri RC-14 and L. rhamnosus GR-1 achieved restoration of normal vaginal flora, compared to 26.9% in the placebo group [15]. Martinez et al. found that combining probiotics with fluconazole significantly improved culture-negativity rates at four weeks compared to fluconazole alone (38.5% vs. 10.3%) [16]. However, Witt et al. observed no significant benefit when combining local lactobacilli with itraconazole [17]. A more recent study by De Seta et al. supported the adjunctive use of L. plantarum P17630 following clotrimazole therapy, reporting enhanced symptom resolution and vaginal flora restoration [18]. Despite these promising findings, inconsistent methodologies limit definitive conclusions. More robust, standardized randomized controlled trials are needed to confirm the clinical utility of probiotics in RVVC.

Complicated and Recurrent VVC

Complicated cases—including severe symptoms, NCAC species, or recurrence (≥4 episodes/year)—require extended antifungal regimens. Oral fluconazole (150 mg every 72 hours for three doses) or daily topical azoles for at least seven days are commonly prescribed [4,19]. Sobel et al. demonstrated superior outcomes with a multi-dose fluconazole regimen in complicated VVC [19].

For recurrent cases, long-term suppressive therapy is recommended. In a large trial involving 387 women, weekly fluconazole (150 mg) following a three-dose induction phase maintained disease-free status in 90.8% of patients at six months, compared to 35.9% in the placebo group [20]. Alternative treatments for resistant cases include monthly two-week courses of intravaginal nystatin, which proved effective even against fluconazole-resistant strains in a Chinese cohort [21]. Persistent colonization has also been implicated in recurrence [22].

Conclusion

Vulvovaginal candidiasis remains a significant gynecological concern, particularly among women of reproductive age. While C. albicans is the primary pathogen, the increasing incidence of NCAC species and recurrent infections necessitates more nuanced diagnostic and therapeutic approaches. Although uncomplicated VVC generally responds well to short-course antifungal therapy, complicated and recurrent cases require prolonged and individualized regimens. Probiotics show potential as adjunctive therapy, but further research is needed to standardize treatment protocols and verify their clinical benefits. Enhanced awareness, targeted therapies, and ongoing investigation into host-pathogen dynamics and antifungal resistance are essential for optimizing care and reducing disease recurrence.

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07

Parasitic & Protozoal Infections (Trichomoniasis, Toxoplasmosis)

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Imphal Obstetrics and Gynecological Society

Introduction

Protozoal and parasitic infections are significant health concerns for women worldwide. These infections can lead to various complications, affecting reproductive health, pregnancy outcomes, and overall well-being. (1,2)Understanding the causes, symptoms, transmission, diagnosis, and treatment of these infections is crucial for effective prevention and management.

Protozoal infections, such as trichomoniasis, amoebiasis, and giardiasis, are caused by single-celled organisms. These infections can result in symptoms ranging from mild discomfort to severe gastrointestinal issues. Parasitic infections, including toxoplasmosis and helminthic infestations, are caused by multicellular organisms and can lead to serious health problems, especially during pregnancy.

Women are particularly vulnerable to these infections due to anatomical and physiological factors. Pregnancy further increases the risk, as some infections can have severe implications for fetal health. Regular screening, safe practices, and proper hygiene are essential to prevent and manage these infections effectively.

This chapter will delve into the various protozoal and parasitic infections affecting women, exploring their impact on reproductive health and pregnancy, and highlighting the importance of prevention and treatment.

Common Protozoal Infections in Women

1. Trichomoniasis

Trichomoniasis, caused by the protozoan parasite Trichomonas vaginalis, is recognized as the most common non-viral sexually transmitted infection worldwide.(3) It primarily affects the urogenital tract and is transmitted through vaginal, oral, or anal sex. Clinically, it presents with symptoms such as frothy greenish vaginal discharge, itching, burning sensation, and discomfort during urination or sexual intercourse. Diagnosis is typically made through wet mount microscopy, the nucleic acid amplification test (NAAT), or a positive whiff test. Treatment involves administering metronidazole or tinidazole, either as a single dose or a prescribed course. Preventive measures include practicing safe sex, consistent condom use, regular screening for sexually transmitted infections, maintaining personal hygiene, avoiding douching and sharing of personal items, and ensuring treatment of both sexual partners to prevent reinfection. Trichomoniasis during pregnancy is of particular concern as it has been associated with adverse outcomes such as preterm delivery, premature rupture of membranes, low birth weight, preeclampsia, eclampsia, and an increased risk of neonatal infections.

2. Amoebiasis:

Among parasitic infections affecting pregnant women, Entamoeba histolytica, the causative agent of amoebiasis, remains the most frequently encountered protozoan.(4,5) This infection typically spreads through the fecal-oral route, primarily via the consumption of contaminated food or water. Clinical symptoms include abdominal cramps, diarrhea—often with the presence of blood—and generalized fatigue. Diagnosis is confirmed through stool examination, serological tests, and ELISA for detecting specific antigens and antibodies. The standard treatment regimen involves metronidazole followed by a luminal agent such as paromomycin to eradicate residual intestinal cysts. Preventive strategies emphasize strict hygiene practices, including thorough handwashing with soap and water, especially before meals and after using the toilet, as well as avoiding raw or undercooked food and ensuring the consumption of safe, boiled, or bottled water. In pregnancy, untreated amoebiasis poses significant risks, potentially leading to complications such as preterm delivery, low birth weight, and an increased risk of neonatal infections, thereby highlighting the importance of early detection and treatment.

3. Giardiasis:

Giardiasis is a protozoal infection caused by Giardia lamblia, primarily transmitted through the ingestion of food or water contaminated with mature cysts. The hallmark symptom is fatty diarrhea (steatorrhea), accompanied by bloating, flatulence, abdominal discomfort, and weight loss. In some cases, extraintestinal manifestations such as urticaria, arthritis, uveitis, and characteristic "salt and pepper" retinal changes may occur. Diagnosis is typically established through stool antigen testing or stool microscopy, with the detection of cysts and trophozoites considered the gold standard. Treatment options include metronidazole, tinidazole, or nitazoxanide. Preventive measures focus on maintaining proper hygiene, particularly frequent handwashing with soap and water before meals and after using the toilet, as well as treating asymptomatic carriers to curb transmission. Although limited data exist on the specific effects of giardiasis during pregnancy, untreated infection can contribute to nutritional deficiencies and general maternal ill-health, which may negatively impact fetal growth and pregnancy outcomes.

Common Parasitic Infections in Women

1. Toxoplasmosis -

Toxoplasmosis is caused by the protozoan parasite Toxoplasma gondii and is commonly transmitted through the consumption of undercooked meat, contaminated water, or contact with cat feces. While the infection is often asymptomatic, it may present with mild flu-like symptoms and lymphadenopathy, particularly in the suboccipital and cervical regions. Diagnosis typically involves serologic testing for IgG and IgM antibodies, and in some cases, direct microscopic identification of tachyzoites in peripheral blood. The primary treatment is cotrimoxazole, though other medications such as pyrimethamine and sulfadiazine may also be used. During pregnancy, spiramycin is the drug of choice to reduce the risk of fetal transmission. Preventive strategies include maintaining proper hygiene, especially handwashing after handling cats or raw meat. Toxoplasmosis poses serious risks during pregnancy, potentially leading to congenital infections such as chorioretinitis, hydrocephalus, and intracranial calcifications.(6) The incidence of congenital toxoplasmosis ranges from 1 in 1,000 to 1 in 10,000 births, with the risk of maternal-fetal transmission increasing with gestational age.

1. Helminthic Infections (e.g., Hookworm, Roundworm, Tapeworm):

Helminthic infections during pregnancy can present with symptoms such as anemia, abdominal pain, and nutritional deficiencies. These infections are typically transmitted through soil contaminated with helminth eggs or larvae, often due to poor sanitation. In the case of schistosomiasis, transmission occurs through contact with freshwater contaminated by parasitic larvae released by infected individuals. Diagnosis is primarily done through stool examinations to detect the presence of helminths. Treatment usually involves antiparasitic medications such as albendazole or mebendazole. Preventive measures include avoiding consumption of contaminated food and water, steering clear of contact with potentially infected freshwater, improving sanitation infrastructure, and promoting public health education. If left untreated, helminthic infections can lead to significant anemia and malnutrition in pregnant women, adversely affecting fetal development and increasing the risk of pregnancy complications.

2. Malaria:

Malaria during pregnancy is caused by Plasmodium parasites and is primarily transmitted through the bites of infected Anopheles mosquitoes. While the infection may be asymptomatic in some cases, it can manifest as a flu-like illness and poses significant risks during pregnancy, including congenital infections. Diagnosis is typically done through a peripheral smear test. However, placental malaria is particularly challenging to detect during pregnancy, with placental histology considered the gold standard for diagnosis, using Rogerson criteria for confirmation. Treatment involves antimalarial medications such as chloroquine, quinine, or artemisinin-based combination therapies. Preventive strategies include the use of insecticide-treated bed nets and intermittent preventive treatment with antimalarial drugs. If left untreated, malaria can result in severe maternal anemia, low birth weight, preterm delivery, and even stillbirth.(7)

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08

Sexually Transmitted Infections (STIs) & Cervicitis

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Introduction

Sexually transmitted infections (STIs) represent a significant global health burden, with over 1 million new infections acquired daily worldwide. Among the various clinical manifestations of STIs, cervicitis- a condition characterized by inflammation of the cervix is particularly concerning in sexually active women of reproductive age. Cervicitis is frequently caused by pathogens such as Chlamydia trachomatis and Neisseria gonorrhoeae, which are also among the most prevalent bacterial STIs. If left untreated, cervicitis can lead to pelvic inflammatory disease (PID), infertility, ectopic pregnancy, and increased susceptibility to HIV acquisition. The interplay between STIs and cervicitis underscores the necessity for timely diagnosis, evidence-based treatment, and robust public health strategies to curb transmission and protect reproductive health.

Gonorrhoea & Chlamydia

Epidemiology and Screening

C. trachomatis and N. gonorrhoeae are responsible for more than 50% of infectious cervicitis cases. Both infections are often asymptomatic, especially in women, making routine screening critical. The Centres for Disease Control and Prevention (CDC) recommends annual screening for all sexually active women under the age of 25 and for older women with risk factors such as new or multiple sex partners or a history of STIs.

Diagnostic Methods

Nucleic acid amplification tests (NAATs) are the gold standard for diagnosis due to their high sensitivity and specificity. These tests can be performed on vaginal swabs or urine samples, facilitating both clinic-based and home-based testing models.

Drug Resistance Patterns

Drug resistance in N. gonorrhoeae is a growing concern globally. Over the last two decades, this pathogen has developed resistance to multiple antibiotic classes, including penicillin's, tetracyclines, fluoroquinolones, and macrolides. The emergence of strains resistant to cephalosporins—the last-line treatment—poses a significant public health threat. According to the World Health Organization (WHO), treatment failures with ceftriaxone and azithromycin have been reported in several countries, emphasizing the urgent need for surveillance and new antimicrobial options.

Table 1: Recommended Treatment Regimens for Chlamydia and Gonorrhoea

Infection	First-Line Treatment	Alternative Treatment
Chlamydia	Doxycycline 100 mg orally twice daily for 7 days	Azithromycin 1 g orally in a single dose
Gonorrhoea	Ceftriaxone 500 mg IM in a single dose	If cephalosporin allergy: Gentamicin 240 mg IM plus Azithromycin 2 g orally

Partner Notification

Effective STI management also hinges on partner notification and treatment. Failure to treat sexual partners can lead to reinfection and ongoing community transmission. Patient delivered partner therapy (PDPT), where patients are given medication to deliver to their partners, is an evidence-based strategy shown to increase partner treatment rates and reduce reinfection, particularly for chlamydia and gonorrhoea.

Syphilis

Clinical Significance

Syphilis, caused by Treponema pallidum, is a systemic infection with diverse clinical presentations. Of particular concern is congenital syphilis, which occurs when a pregnant woman transmits the infection to her fetus. Congenital syphilis can lead to stillbirth, neonatal death, prematurity, and severe neonatal infections, many of which are preventable with timely diagnosis and treatment.

Screening Recommendations

The global incidence of congenital syphilis remains high, particularly in low-resource settings where antenatal screening coverage is suboptimal. The WHO estimates that approximately 661,000 congenital syphilis cases occurred globally in 2016, making it a leading cause of preventable perinatal morbidity and mortality.

Screening for syphilis during the first antenatal visit is recommended universally. In high-prevalence settings, repeat screening during the third trimester and at delivery is also advised. The rapid plasma reagin (RPR) test and Venereal Disease Research Laboratory (VDRL) test is commonly used for initial screening, followed by confirmatory treponemal tests. Penicillin G remains the treatment of choice, with no documented resistance to date, making it a cornerstone of prevention strategies.

Public Health Strategies

Health Education and Behaviour Change

Comprehensive sexual education, particularly targeting adolescents and young adults, has been shown to delay sexual initiation, increase condom use, and reduce the number of sexual partners. Peer-led programs and digital platforms are increasingly being employed to reach at-risk populations.

Barrier Methods

Consistent and correct use of male and female condoms remains one of the most effective strategies for preventing the transmission of bacterial and viral STIs. Condom promotion campaigns, free distribution in high-risk communities, and destigmatization of condom use are essential components of national STI prevention policies.

Vaccination

Vaccination plays a crucial role in preventing viral STIs. The human papillomavirus (HPV) vaccine, in particular, has demonstrated tremendous success in reducing the incidence of cervical dysplasia and genital warts caused by HPV types 6, 11, 16, and 18. WHO recommends routine HPV vaccination for girls aged 9–14 years, prior to sexual debut. Widespread adoption of HPV vaccination is expected to significantly reduce the incidence of HPV-related cervicitis and cervical cancer in the coming decades.

Additionally, hepatitis B vaccination, which is part of routine immunization schedules in many countries, has effectively reduced the burden of sexually transmitted hepatitis B.

Table 2: Vaccination Strategies for STI Prevention

Vaccine	Target Population	Impact
HPV Vaccine	Girls aged 9–14 years	Reduces cervical cancer and genital warts
Hepatitis B Vaccine	Newborns and unvaccinated individuals	Prevents hepatitis B infection and transmission

Integrated STI Services

A public health approach must also focus on increasing access to integrated, stigma-free STI services, particularly for marginalized populations. Integration of STI screening with HIV services, maternal health services, and adolescent health platforms ensures early detection and management. Mobile clinics, telehealth services, and home-testing kits are innovative solutions bridging the gap in hard-to-reach areas.

Conclusion

The control of STIs and cervicitis requires a combination of individual-level behavioral changes and systemic public health interventions. Enhanced screening, vigilant surveillance of drug resistance, prompt treatment, partner management, and universal access to vaccination are critical pillars. With focused investment in education, diagnostics, and preventive services, we can move towards a future where STI-related complications, including cervicitis and congenital syphilis, are significantly reduced.

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09

Pelvic Inflammatory Disease (PID)

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Introduction

Pelvic inflammatory disease (PID) is a serious infection in the uterus, fallopian tubes and/or ovaries. It affects females and develops when certain types of bacteria spread from the vagina to reproductive organs. Bacteria from untreated sexually transmitted infections (STIs) are the most common cause of PID. However, bacteria normally found in the vagina can also cause PID. Most people get PID through unprotected sex, which allows bacteria to enter the reproductive system and infect organs.

Epidemiology

Each year, more than 1 million females in the U.S. get PID, and over 100,000 become infertile because of it. PID occurs most frequently in females between 15 and 25 years old. In 2001, there were more than 750,000 cases in the United States. Though rates have decreased over the past decade, PID remains common in outpatient and emergency settings.

Types of Pelvic Inflammatory Disease

- **Acute PID**: Sudden onset inflammation, typically due to bacterial infections like gonorrhea or chlamydia.
- **Chronic PID**: Persistent inflammation due to untreated or recurrent acute PID.
- **Subclinical PID**: Asymptomatic but potentially harmful.
- **Fitz-Hugh**-Curtis Syndrome: Rare extension to the liver, causing right upper quadrant pain.

Symptoms

Symptoms may be absent or mild. When present, they can include:

1. Pain or tenderness in the lower abdomen (most common).
2. Abnormal vaginal discharge (yellow or green, with odor).
3. Chills or fever.
4. Nausea and vomiting.
5. Pain during sex.
6. Burning during urination.
7. Irregular periods, spotting or cramping.

Pain is primarily in the lower abdomen or pelvis, possibly during sex.

Etiology

PID is usually caused by an ascending infection from the cervix.

- 85% of cases are due to sexually transmitted bacteria, primarily Neisseria gonorrhoeae and Chlamydia trachomatis.
- 10–15% of women with cervical gonorrhea or chlamydia develop PID.
- Gonorrheal PID tends to be more severe.
- Chlamydial PID is often asymptomatic (subclinical) but damaging.
- Other contributing microbes: Mycoplasma genitalium, Peptostreptococcus, Bacteroides, Haemophilus influenzae, Streptococcus pneumoniae, Staphylococcus aureus, Escherichia coli, Bacteroides fragilis, and Group B Streptococci (15% of cases).

Pathophysiology

Infection leads to inflammation of the upper genital tract, causing:

- Scarring and adhesions.
- Fallopian tube damage, loss of ciliated cells, ovum transport issues.
- Chronic pelvic pain, infertility, and ectopic pregnancy risk.

Histopathology

Endometrial biopsy may show inflammation but typically does not identify organisms. It's rarely needed unless diagnosis is unclear.

History and Physical Examination

PID should be suspected in any young female with:

- Lower abdominal or pelvic pain.
- Vaginal discharge, dyspareunia, abnormal bleeding.

Risk Factors:

- Multiple sexual partners.
- Previous PID.
- IUD placement.
- Tubal ligation.

Pelvic Exam Findings:

- Cervical discharge.
- Cervical motion tenderness.
- Uterine/adnexal tenderness or mass.
- Cervical friability, WBCs on wet mount.

Evaluation

- Pregnancy test: Rule out ectopic pregnancy.
- Microscopy: Vaginal/cervical discharge if present.
- NAAT: C. trachomatis and N. gonorrhoeae.
- Other STI testing: HIV, syphilis.
- Pelvic ultrasound: If tubo-ovarian abscess suspected.

Management and Treatment

Clinical diagnosis is key—do not delay treatment while awaiting lab confirmation**.**

Hospitalization Indications:

- Pregnancy.
- Severe illness.
- Failed outpatient treatment.
- Pelvic abscess.
- Possible surgery.

Inpatient Treatment

- Cefotetan 2 g IV every 12 hrs + Doxycycline 100 mg orally every 12 hrs.
- OR Cefoxitin 2 g IV every 6 hrs + Doxycycline 100 mg orally every 12 hrs.
- OR Clindamycin 900 mg IV every 8 hrs + Gentamicin 3–5 mg/kg IV daily.

Outpatient Treatment (CDC Recommended)

- Doxycycline 100 mg orally twice daily for 14 days +
- Ceftriaxone 500 mg IM single dose.
- OR Cefoxitin 2 g IM + Probenecid 1 g orally.
- Add Metronidazole 500 mg orally twice daily for 14 days if trichomonas or recent instrumentation suspected.

Differential Diagnosis

- Ectopic pregnancy
- Ovarian torsion
- Ovarian cyst rupture
- Endometriosis
- Appendicitis
- Diverticulitis
- Cystitis
- Pyelonephritis
- Traumatic injury

Complications

Even with treatment, complications may occur:

- **Chronic pelvic pain**: Seen in up to 33% of cases.
- **Infertility**: 5-fold higher risk; especially with chlamydia, recurrent or delayed PID.
- **Ectopic pregnancy**: 7.8% post-PID vs 1.3% baseline.
- **Other risks**: Stroke, ovarian cancer (reported).

Statistics:

- 18% chronic pain
- 8.5% ectopic pregnancy
- 16.8% infertility (in women aged 20–24 years with PID)

Enhancing Healthcare Team Outcomes

- **Patient education:**
  - Safe sex, condom use, fewer sexual partners.
  - Delay sexual activity until age 16+.

- **Pharmacist role:**
  - Encourage partner testing and treatment to break infection cycle.

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10

Intrapartum & Postpartum Bacterial Infections

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Peripartum infections remain a significant cause of maternal morbidity and mortality. Sepsis accounts for 10-15% maternal deaths, mostly in the postpartum period[1]. The burden of these infections is now compounded by the alarming increase in antibiotic resistance.

INTRAPARTUM INFECTIONS

Intrapartum infections mainly include isolated maternal fever, suspected or confirmed chorioamnionitis. However, a woman in labour can have other systemic infections like urinary tract infections(UTI), respiratory tract infections, vaginal infections, dengue, malaria etc; but those are not discussed in this chapter.

Intraamniotic infection also called chorioamnionitis is an infection with resultant inflammation of any combination of the amniotic fluid, placenta, fetus, fetal membranes or decidua. Such infection is usually polymicrobial, involving both aerobic and anaerobic bacteria, mostly originating from lower genital tract or vaginal flora. However hematogenous spread secondary to maternal infection is also seen. Intraamniotic infections can be divided into 3 categories[2,3].

[i] Isolated maternal fever - ACOG has defined it as maternal temperature between 38-38.9°C (100.4-102.1°F) with no additional risk factors present, and with or without persistence of elevated temperature[2,4]. The NICE Guideline on intrapartum care for healthy women and babies (CG 190, 2014) uses the definition of pyrexia as 38°C or above on a single reading or 37.5°C on two consecutive readings (1 hour apart)[5]. The RCOG guideline on Bacterial Sepsis in Pregnancy (64a, 2012) uses this definition, but with the two 37.5°C measurements being 2 hours apart[6]. However, epidural analgesia can also cause maternal fever, which should be kept in mind.

[ii] Suspected intraamniotic infection – It is defined as maternal temperature more than or equal to 39°C (102.2°F) or maternal temperature between 38-38.9°C (100.4-102.1°F) with presence of 1 additional clinical risk factor (maternal leukocytocis, purulent cervical discharge or fetal tachycardia).

[iii] Confirmed intraamniotic infection - Diagnosis of intraamniotic infection is confirmed by amniotic fluid culture or gram staining or both or histopathological evidence of placental infection or inflammation.

As per ACOG recommendation, isolated maternal fever with no obvious source of infection should be included in suspected chorioamnionitis group. Also, there is no practical distinction between suspected and confirmed chorioamnionitis; thus, the care provided to the suspected chorioamnionitis group should be same as confirmed chorioamnionitis[2].

As per ACOG recommendation, isolated maternal fever with no obvious source of infection should be included in suspected chorioamnionitis group. Also, there is no practical distinction between suspected and confirmed chorioamnionitis; thus, the care provided to the suspected chorioamnionitis group should be same as confirmed chorioamnionitis[3,7].

RISK FACTORS OF INTRAPARTUM INFECTIONS-[11-14]

- Low parity
- Prolonged rupture of membranes
- Prolonged labor
- Multiple digital examinations
- Use of internal fetal monitors
- Meconium-stained liquor
- Induction of labour
- Use of prostaglandins.

CLINICAL SYMPTOMS AND SIGNS-

Most cases of intraamniotic infection are seen in term patients in labour. Incidence varies from 2-5% in term deliveries. The risk of these infections is seen to rise after 40 completed weeks[1,2]. These women usually present with fever, maternal and fetal tachycardia, pain, foul smelling discharge per vagina, hypotension. Complete blood count(CBC), serum electrolytes, lactate, C-reactive protein(CRP) must be sent. Blood analysis may show leucocytosis with raised CRP. Various maternal and neonatal risks are given in the table below[2,7-9]

Maternal risks-	**Neonatal risks-**
Maternal morbidity increases significantly in these infections. These include- • Dysfunctional labour, leading to increased interventions • Uterine atony • Postpartum haemorrhage(PPH) • Endometritis • Peritonitis • Sepsis • ARDS • Death	• These infections are associated with acute neonatal morbidity including neonatal pneumonia, meningitis, sepsis and death. • Isolated maternal fever is also associated with poor short term and long-term neonatal outcomes like bronchopulmonary dysplasia, cerebral palsy etc

TREATMENT OF INTRAPARTUM INFECTIONS-

[i] Intrapartum antibiotics are preferred for all of the above 3 definitions. This has shown to reduce maternal febrile morbidity and duration of hospital stay. Maternal intrapartum antibiotics use has shown decreased incidence of neonatal bacteremia, pneumonia and sepsis[2]. Even in cases of isolated maternal pyrexia, antibiotics should be considered because of the potential benefit to both mother and neonate as compared to the possible risks.

Such cases have also been associated with poor neonatal outcome[9]. Thus, empirically treating these cases will possibly benefit. RCOG GTG has also recommended to start antibiotics. The decision to prescribe antibiotics is a balance between the benefits against maternal and neonatal sepsis against the risks of the antibiotics administration which include anaphylaxis, disruption of newborn microbiota, obesity, allergic disease and antimicrobial resistance[6]. More trials are needed to guide in management of these cases.

[ii] Antipyretics should also be used to treat the fever.

[iii] Augmentation of labour should be considered in absence of adequate uterine contractions and prolonged labour. Vigilant monitoring of labour is must using Partograph. Continuous electronic fetal monitoring is recommended by NICE[5,10]. MEWS chart may be used for the maternal monitoring. RCOG recommends use of an 'early warning chart modified for obstetrics' e.g., MEWs chart if sepsis is suspected[6]. However plotting the maternal parameters in partograph also will guide in taking timely intervention. Caesarean section should be done for proper indications and not for intraamniotic infection alone.

[iv] Neonatal care team should be informed about the medical condition of the mother prior to delivery as these infants will need more surveillance.

Recommended antibiotics [2,10]

- Ampicillin 2gm IV 6 hourly and Gentamicin 2mg/kg IV loading dose, followed by 1.5mg/kg 8 hourly or 5mg/kg IV 24hourly
- If penicillin allergy- Cefazolin 2gm IV 8 hourly plus Gentamicin or Ceftriaxone 2gm IV 24hourly
- In severe penicillin allergy- Clindamycin 900mg IV 8hourly or Vancomycin 1gm IV 12hourly plus Gentamicin
- If caesarean section planned- Clindamycin 900mg IV single dose or Metronidazole 500mg IV 8hourly should be added
- After caesarean section- at least one additional dose of the agents should be given; which is not required after vaginal delivery.
- Further continuation of antibiotics will be guided by the maternal condition, presence of fever and presence of risk factors like diabetes, immunodeficiency

POSTPARTUM INFECTIONS

Postpartum period is traditionally defined as period from childbirth to 6 weeks. Postpartum infections are a reason of significant but preventable maternal morbidities and mortalities worldwide. Puerperal sepsis accounts for 10-15% deaths in postpartum period[1]. These infections are mostly caused by microflora of genitourinary tract and skin. These include Group A or B streptococci, Enterococci, Escherichia coli, Klebshiella, Urea plasma, Staphylococcus etc, varying as per the site of infection.

Burden of postpartum infections- Along with increasing deaths and physical morbidities, these infections increase maternal anxiety, depression, hamper proper bonding and breastfeeding.

Risk factors-[1,11]

- Caesarean section- infections are more common after caesarean deliveries; risk is further increased in women who underwent labour before caesarean section
- Extremes of maternal age
- High BMI
- Co-morbidities- Diabetes, hypertension, anaemia, immunocompromised states
- Existing infections- bacterial vaginosis, group B streptococcal infection, STIs
- Intrapartum causes- prolonged labour, prolonged membrane rupture, thick meconium staining, internal fetal monitoring, operative vaginal deliveries, manual removal of placenta, bladder catheterisation, PPH

POST PARTUM INFECTIONS INCLUDE-

[i] Endometritis- This is the infection of endomyometrium. Patients present with fever, chills, pain abdomen with uterine tenderness and/or foul-smelling lochia[1,4]. Some cases may present with features of septicemia or shock. Postpartum fever is defined as oral temperature of >=38C (100.4F) on any two of the first 10days after delivery, excluding the first 24 hours. However, temperature >38.4C or persistent fever in first 24hours is highly predictive of infections.

[ii] Surgical site infections(SSI)- This complicates 2-7% of caesarean deliveries. Episiotomy wound infection are also seen. SSI are of 2 types- superficial (skin and subcutaneous tissue) and deep (fascia and muscle) [1,4].
Patients present with fever, malaise, purulent discharge with erythematous, tender, indurated wound. Most of these present 4-7days after delivery[1]. Deep infections present with much severe pain, persistent fever, skin colour changes, wound crepitus, hemodynamic instability and lack of response to treatment.

[iii] Mastitis, breast abscess – Breast engorgement can lead to fever. However, hot wet fomentation and frequent milk expression is helpful. High fever, chills, myalgia, erythema with hot, tender, swollen, erythematous wedge-shaped segment of breast suggests mastitis. Breast abscess manifests as fluctuant, indurated area, usually peripherally with/without axillary lymphadenitis.

[iv] Other infections – These include UTI, respiratory tract infections, GI infections, which can be diagnosed by history, physical examination and if needed, specific laboratory investigations like urine routine examination, chest X-ray etc. Out of these infections, UTI is quite common.

Complications of puerperal infections- These include septicemia, shock, peritonitis, septic pelvic thrombophlebitis, pelvic abscess[1,4]. When patients do not respond to broad spectrum antibiotics with deterioration of clinical features, hemodynamic compromise and worsening laboratory parameters like increasing total count, CRP, lactic acidosis, dyselectrolytemia etc. such complications are to be suspected.

INVESTIGATIONS- CBC, CRP, urinalysis, urine culture should be done in all. Blood cultures should be sent in patients with signs of sepsis. ABG, USG or CT scan may be needed in cases with complications. Endometrial or cervical culture may be sent.

TREATMENT OF ENDOMETRITIS-

Patients with mild symptoms can be given outpatient treatment, after shared decision making. All danger signs and symptoms and need of hospitalisation in worsening conditions should be explained. explained.

Various regimens that can be given in OPD care, can be given for 14days in endometritis[12]. These include-

- Oral therapy of Clindamycin 600mg 6 hourly plus gentamycin 4.5mg/kg once daily IM
- Amoxicillin-clavulanate 625mg 8 hourly
- Cefotetan 2gm IM 8hourly
- Amoxicillin 500mg plus metronidazole 500mg 8 hourly

In patients who needs hospitalisation, broad spectrum antibiotics should be started, after taking blood culture samples. Maintaining hemodynamic stability using IV crystalloids with or without vasopressors is important.

Antibiotics suggested in hospitalised postpartum infections/endometritis include the following, which are continued till 48hours of improvement[12,13]

- Clindamycin 900mg 8hourly or 600mg 6hourly IV and gentamicin 5mg/kg once daily or 1.5mg/kg 8hourly with or without ampicillin 2gm IV 6hourly
- Clindamycin(as above) plus Aztreonam 2gm IV 6-8hourly
- Metronidazole 500mg IV 6hourly plus Gentamicin(as above) plus Ampicillin(as above)
- For vaginal deliveries- Ampicillin plus Gentamicin

- After completing the regimen, oral antibiotics are generally not recommended after discharge.
- Late postpartum endometritis, which occurs between 7 to 42days postpartum is usually mild. However, with above mentioned antibiotics given for outpatient treatment, Doxycycline 100mg 12hourly for 7days or Erythromycin 500mg 6hourly for 7days or Azithromycin 1gm stat dose should be added to treat chlamydial infection, which is common this period.

TREATMENT OF SSI-[1,4,6]

- In superficial and uncomplicated SSIs, oral cephalosporins like cephalexin or cefuroxime are sufficient.
- In those with deep infections or abscess, surgical exploration is needed, followed by dressing twice daily.
- In wound dehiscence, secondary closure, negative pressure therapy using vacuum or healing by secondary intention with moist dressings are included.
- In necrotising fasciitis- piperacillin-tazobactum plus vancomycin and clindamycin may be considered with extensive surgical debridement.
- In staphylococcal infection- Cefazolin 2gm IV 8hourly or Vancomycin 1gm IV 12 hourly are recommended. In severe deep infections, high dose penicillin may be given to cover clostridial infections.

TREATMENT OF MASTITIS – [1]

- This includes frequent breast emptying, avoiding weaning and appropriate antibiotics.
- Dicloxacillin 250-500mg orally 6hourly or Amoxicillin-clavulanate 625mg 8hourly or cephalexin 500mg 6hourly should be given for at least 10days. In penicillin allergy, erythromycin or azithromycin are used.
- If no improvement seen in 48hours, breast abscess needs to be ruled out. In these cases, ultrasound is used for diagnosis as well as helps in drainage in many cases. Serial aspiration and irrigation every 2-4days can help in some cases. But incision and drainage is the standard treatment, with proper antibiotics coverage. Milk stasis should be avoided in that breast, but feeding from that breast is not recommended.

TREATMENT OF COMPLICATIONS- IV Ampicillin 1gm 4hourly plus Gentamicin 5mg/kg daily and Clindamycin 900mg 8hourly can be started. However, choice of antibiotics will depend on presentations and availability as well as the antibiogram of the hospital. In sepsis, cephalosporins are also considered in most hospitals. Early diagnosis, prompt and adequate antibiotics coverage, volume restoration, cardiopulmonary support are essential to treat these complications. Use of heparin in septic pelvic thrombophlebitis is controversial, but may be considered. Surgical interventions are needed in cases with abscess, infected hematoma or wounds.

HOW TO PREVENT POSTPARTUM INFECTIONS-[14,15,16]

- Adequate treatment of intrapartum fever and infections
- Limiting vaginal examinations
- Maintaining hand hygiene
- Pre-operative showering and antibiotics 15-60mins before skin incision in caesarean sections
- Avoid shaving just before delivery. Trimming of hair is advocated.
- Maintaining blood sugar <200mg/dl
- Screening and treatment of bacterial vaginosis, UTI in antenatal period
- Using alcohol-based agents for skin preparation. Vagina can also be cleaned with 4% chlorhexidine solution or povidone iodine

Conclusion

Intrapartum and postpartum infections increase maternal and neonatal morbidity and mortality. As clinicians we should identify the risk factors and take up preventive measures. Early identification of clinical signs and symptoms, prompt prophylaxis and adequate treatment is needed to prevent these infections and complications.

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Sepsis and Septicemia in Obstetrics and Gynecology

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Introduction

Maternal sepsis is defined as a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion,or postpartum period. Maternal sepsis is responsible for 10.7% of global maternal deaths.[1]

Sepsis in Gynaecology which occurs as complications of Pelvic Inflammatory Disease (PID) and tubo-ovarian abscess, post-abortion sepsis, IUD-related infection, SSIs, pelvic abscess, endometritis are managed on similar lines as other principles of Sepsis management. This article focuses more on sepsis in maternal settings.

Epidemiology

If we look at the western scenario (UK), in two years (2019–21), 241 of 2066997 delivered women had mortality, and out of these 78 women were attributable to sepsis. Though there are many individual studies in the Indian scenario, authentic sources like NFHS do not carry about sepsis related maternal mortality in India. Individually, sepsis ranks third after postpartum hemorrhage and hypertensive disorders for maternal mortality. [2]

Classification

Initial definitions of sepsis were characterized by an excessive focus around the concept of inflammation without having a continuum model from sepsis to shock. Hence, it was concluded that sepsis should be defined as life-threatening organ dysfunction caused by a dysregulated host response to an infection [3]

Risk factors for maternal sepsis: These are summarized in figure 2.

Figure 1. Sepsis definitions

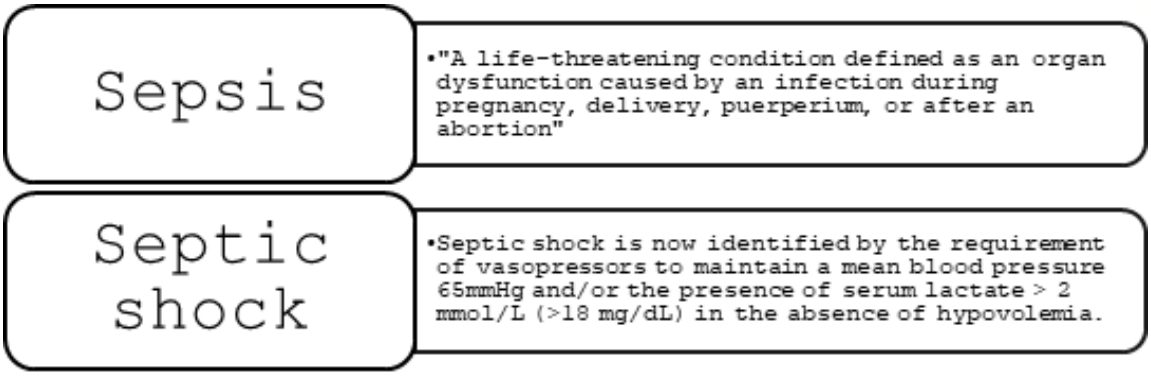


Figure 2. Risk factors for maternal sepsis.

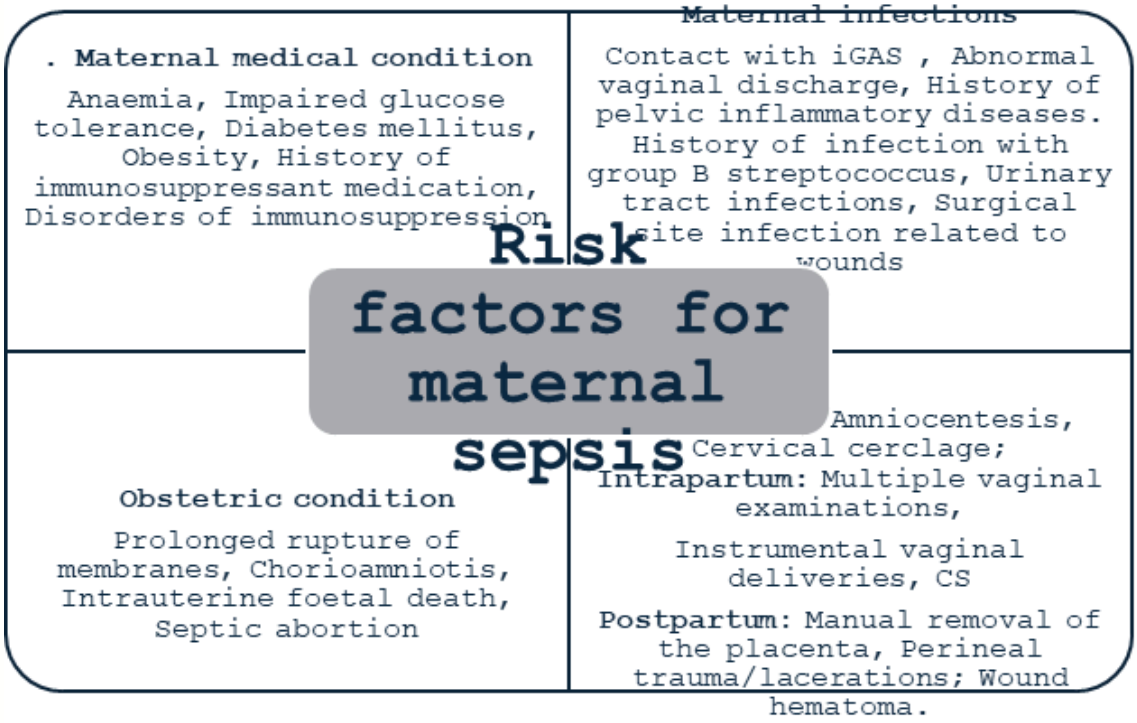


Figure 2. Risk factors for maternal sepsis.

Microbiological profile: [4]

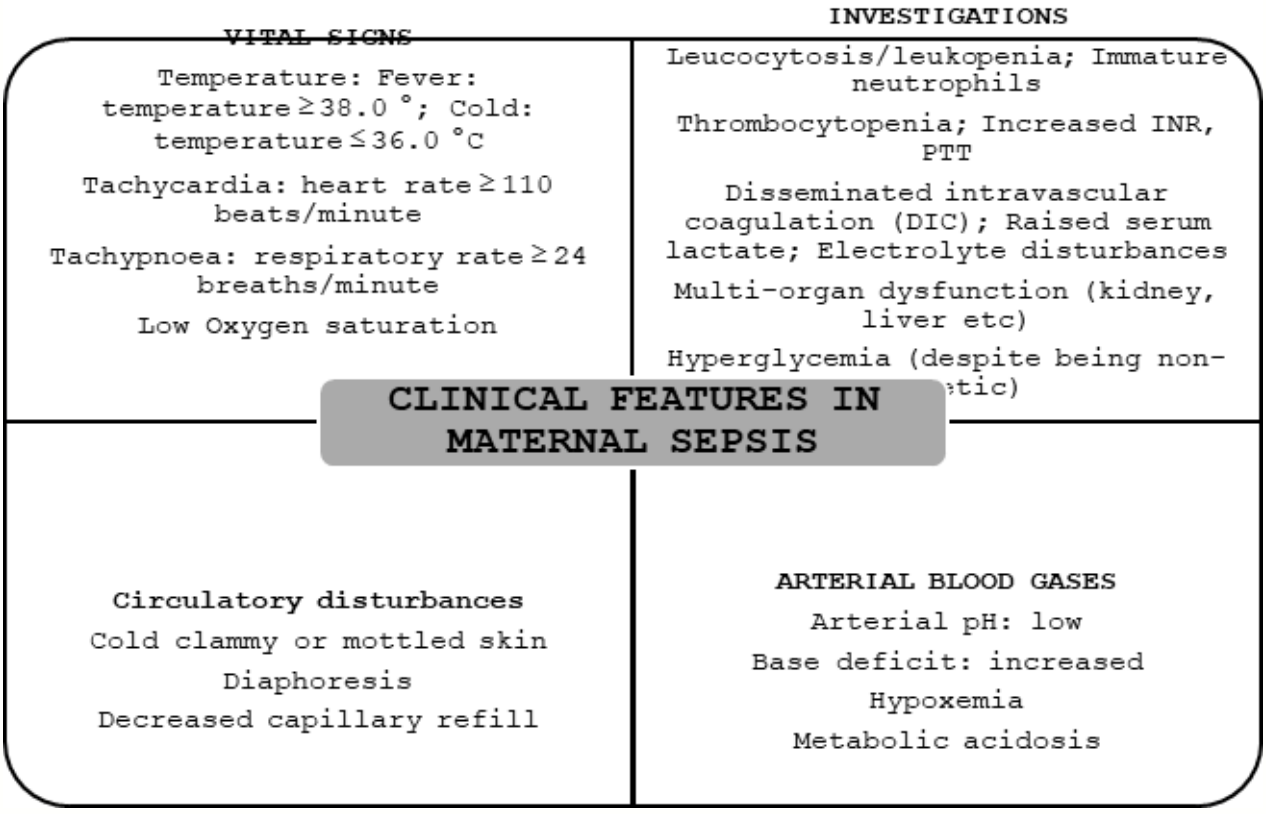
The common organisms causing sepsis are as follows.

- Escherichia coli 37%,
- Group B beta-haemolytic streptococcus (GBS) 20%
- Anaerobes 10%
- Staphylococcus aureus 8%

This distribution varies according to local patterns.

Clinical features: The prominent clinical features of maternal sepsis are summarized in Figure 3. Lactate is well-established as a marker for sepsis. CRP, owing to its non-specific nature is no longer used. Procalcitonin appears to be showing a lot of promise. Further studies into the role of procalcitonin in monitoring sepsis are needed.

Figure 3. Clinical features in maternal sepsis



Assessment of severity: A variety of scores are used for assessment of severity. Few are summarized in the table below. [5]

Scoring system	Parameters used	Advantages	Disadvantages
Modified Obstetric Early Warning system	HR, RR, SpO2, SBP, Temp, Mental status	Simple to use.	Overdetects severe sepsis (high false positive)
qSOFA (quick sepsis organ related failure assessment)	SBP, RR, altered mental status	Much simpler to use. Non-specific to OBG	Some positive scores actually reflect non-sepsis obstetric deterioration
SOS score (sepsis in Obstetrics score) (see QR code)	Temp, HR, RR, SpO2, Leukocyte count, % immature neutrophils, Lactic acid	Excellent Negative predictive value. Overall accuracy very high.	Slightly complex to use. Involves specific investigation (% immature neutrophils) which may not be reported everywhere.

Figure 4. QR code for Sepsis calculator

MANAGEMENT

The main principles of management include

- Early recognition: Scoring systems – as described above.
- Initial resuscitation (1-hour bundle): fluids, oxygen, cultures, antibiotics
- Source control: evacuation, drainage, hysterectomy if needed
- Role of ICU: vasopressors, organ support
- Antibiotic stewardship
- Multidisciplinary team involvement

These are elaborated in tables below.

The Figure 5 helps remember these better

The Sepsis Six	
Take 3	Give 3
1. Blood Cultures	4. O2 to keep sats > 92% * > 88% in COPD
2. Blood tests including lactate	5. IV Fluids
3. Measure Urine Output	6. IV Antibiotics as per local guidelines

Figure 5. Three-in-Three-Out in Sepsis.

Table 2. Initial management

a. Sepsis or septic shock patients should be admitted to ICU within six hours.

b. Intravenous fluid management: At least 30 millilitre/kilogram of intravenous crystalloid fluid should be given within the initial three hours of sepsis-induced hypoperfusion. For adults with septic shock on vasopressors, an initial target mean arterial pressure (MAP) of 65 mmHg over higher MAP targets.

- Intravenous crystalloids are recommended as first-line fluid for resuscitation over gelatine and starch.
- Norepinephrine is used as the first-line vasopressor of choice over other agents.
- Dobutamine can be additive
- Invasive arterial blood pressure measurement should be done.

c.Use of dynamic measures to monitor resuscitation such as serum lactate levels and capillary refill time.

d. Intravenous antimicrobials should be started as early as after recognition of sepsis and within 1 h for both with empiric broad-spectrum therapy with one or more antimicrobials to cover all suspected microorganisms (including bacterial/viruses or fungus). In high-risk multidrug resistant infection, two antibiotics should be used to give gram negative coverage.

e. Ventilation: In a sepsis-induced acute respiratory distress syndrome (ARDS), use a low tidal volume (6 mL/kg) over a high tidal volume (> 10 mL/kg) ventilation strategy.

f. Identify and eliminate sources of infection such as specific anatomical sites such as surgical sites, urinary catheter, or intravenous access to curtail sources of infection.

g. Use established protocols for monitoring recovery (eg procalcitonin measurement)

Table 3. Additional therapy:

- Use a restrictive blood transfusion strategy.
- Use of prophylaxis for stress ulcer in patients who have a high risk of gastrointestinal tract bleeding.
- For venous thromboprophylaxis low molecular weight heparin is preferred.
- Initiating insulin therapy: at a blood glucose level of (≥ 180 mg/dL), 10 mmol/L use of insulin is advised.
- Sodium bicarbonate treatment is recommended in septic shock with severe metabolic acidemia (pH 7.2) and acute kidney injury (AKI) grade 2 or 3.
- Initiation of parenteral nutrition within 72 h if indicated

SUMMARY

Table 4. Ten Pearls for Managing Maternal Sepsis

Recognition is key

- Pearl 1. Always maintain a high index of suspicion for sepsis.
- Pearl 2. Implement a rapid bedside tool for detection of maternal deterioration.

Move fast during the golden hour to save lives

- Pearl 3. Implement sepsis bundles to facilitate rapid escalation of care.
- Pearl 4. Laboratory and radiologic studies are keys to search for etiology and source control.
- Pearl 5. Know your "bugs," their likely origin, and that group A streptococcus can kill quickly.
- Pearl 6. Choose antimicrobials tailored to the most likely diagnosis.
- Pearl 7. Fluid resuscitation should be initiated rapidly for patients with a blood lactate greater than 4 mmol/L or mean arterial pressure less than 65 mm Hg.

Beyond the golden hour

- Pearl 8. Escalation of care is critical to survival.
- Pearl 9. Once the patient is stabilized, get to the source of the problem.
- Pearl 10. Anticipate and prevent adverse pregnancy outcomes.

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12

TORC Hand Other Congenital Infections: A Clinical Overview

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Introduction

Congenital infections, acquired in utero or during the birth process, represent a significant cause of neonatal morbidity and mortality. Among these, the acronym TORCH refers to a group of perinatal infections capable of cross the placenta and adversely affect fetal development. The term traditionally includes Toxoplasmosis, Other (typically syphilis), Rubella, Cytomegalovirus (CMV), and Herpes simplex virus (HSV). With evolving medical understanding, "Other" has come to include a broader spectrum of pathogens such as HIV, varicella-zoster virus (VZV), parvovirus B19, and Zika virus. These infections may lead to a wide array of clinical manifestations, including miscarriage, intrauterine growth restriction, congenital anomalies, and long-term-l neurodevelopmental impairment.

Toxoplasmosis

Toxoplasmosis is caused by the protozoan Toxoplasma gondii. Transmission occurs through ingestion of oocysts from contaminated food or water, or undercooked meat, and vertical transmission may occur if maternal infection is acquired during pregnancy. The risk of fetal infection increases with gestational age, but the severity of fetal damage is inversely related , with first-trimester infections causing the most significant effects such as chorioretinitis, hydrocephalus, and intracranial calcifications — which constitute the classic triad of congenital toxoplasmosis [1].

Diagnosis in the mother is made by serological testing for IgM and IgG antibodies. while fetal infection can be confirmed via PCR analysis of amniotic fluid. Treatment during pregnancy with spiramycin (in early pregnancy) or a combination of pyrimethamine, sulfadiazine, and folinic acid (in later stages) can reduce transmission and severity of fatal diseases [2].

Syphilis

Syphilis, caused by Treponema pallidum, is part of the "Other" category in TORCH and remains a preventable yet persistent global health concern. Congenital syphilis results from transplacental transmission, particularly during the secondary or early latent stages of maternal disease.

Clinical manifestations in neonates include snuffles, hepatosplenomegaly, jaundice, anemia, and skeletal abnormalities. Late congenital syphilis can cause Hutchinson teeth, sensorineural hearing loss, and saddle nose deformity [3]. Universal screening in pregnancy and penicillin therapy can effectively prevent congenital syphilis. Despite being preventable, the World Health Organization(WHO) reported over 661,000 cases globally in 2016, underscoring gaps in maternal care access [4].

Rubella

The rubella virus, a togavirus, causes mild illness in children and adults but is highly teratogenic during pregnancy. Congenital Rubella Syndrome (CRS) can result if maternal infection occurs during the first trimester, with the risk significantly decreasing after 20 weeks of gestation. Classic features of CRS include cataracts, sensorineural deafness, and cardiac defects (most commonly patent ductus arteriosus) [5].

Prevention through MMR (measles, mumps, rubella) vaccination at least 4 weeks before conception. The vaccine is contraindicated during pregnancy, and serological testing for rubella immunity is a routine part of prenatal care ,(Congenital Rubella Syndro)meCRS is now rare in countries with successful vaccination programs but persists in regions with poor immunization coverage [6].

Cytomegalovirus (CMV)

CMV, amemberof the herpesvirus family, is the most common congenital viral infection, affecting 0.5–2% of all live births globally. Primary maternal infection during pregnancy carries the highest risk of vertical transmission. CMV can cause a spectrum of clinical outcomes, ranging from asymptomatic infection to severe disease, including microcephaly, periventricular calcifications, hepatosplenomegaly, and sensorineural hearing loss—the most common long-term sequela [7].

Diagnosis includes maternal serology, while fetal infection can be confirmed through PCR testing of amniotic fluid. Although no vaccine is currently available, preventive strategies focus on hygiene education, particularly for pregnant women who work with young children. Antiviral therapy with valganciclovir may reduce the severity of disease in symptomatic neonates [8]

Herpes Simplex Virus (HSV)

Neonatal HSV infections are most commonly acquired perinatally, through exposure to infected genital secretions during vaginal delivery. HSV-2 is more frequently implicated than HSV-1. Neonatal herpes can present in three major forms: localized disease (affecting the skin, eyes, or mouth), central nervous system (CNS) disease, or disseminated infection.

Diagnosis is typically made via PCR testing of blood or cerebrospinal fluid (CSF). Intravenous acyclovir is the treatment of choice and can significantly improve outcomes, though early recognition is critical [9]. Cesarean delivery is recommended for women with active genital lesions at the time of delivery to reduce the risk of neonatal transmission.

Other Congenital Infections

1. **Human Immunodeficiency Virus (HIV):** Mother-to-child transmission of HIV can occur during pregnancy, labor, delivery, or breastfeeding. Antiretroviral therapy (ART) during pregnancy, elective cesarean delivery, and avoidance of breastfeeding (where formula is safely available) can reduce transmission risk to less than 1% [10].

2. Varicella-Zoster Virus (VZV):
Congenital varicella syndrome occurs if maternal infection happens during the first or early second trimester and may cause limb hypoplasia, skin scarring, ocular defects, and neurological abnormalities. Maternal varicella close to delivery may lead to neonatal varicella, which can be severe or fatal. Prevention includes varicella vaccination before pregnancy and varicella-zoster immune globulin (VZIG) for exposed susceptible pregnant women [11].

3. Parvovirus B19: which causing "fifth disease" or erythema infectiosum in children, parvovirus B19 can lead to hydrops fetalis due to fetal anemia when transmitted in utero. Diagnosis is via serology and PCR testing .Intrauterine transfusion may be necessary for affected fetuses [12].

4. Zika Virus: Zika virus, which emerged prominently in the mid-2010s, was linked to outbreaks of microcephaly and other severe brain anomalies in neonates. It is transmitted by Aedes mosquitoes and also through sexual contact. Infection during pregnancy is associated with congenital Zika syndrome, which includes microcephaly, cerebral calcifications, ocular abnormalities, and arthrogryposis [13]. Prevention focuses on vector control and issuing travel advisories for pregnant women.

Diagnosis and Screening Routine screening during pregnancy typically includes testing for syphilis, rubella immunity, hepatitis B, and HIV. Screening for CMV and toxoplasmosis varies by region and risk factors. Amniocentesis and ultrasound can aid in detecting fetal infections.

Early recognition of maternal infection, coupled with appropriate interventions — such as antiviral therapy, intrauterine transfusions, or altered delivery planning — can significantly reduce adverse outcomes.

Prevention and Public Health Measures
The key to reducing congenital infections lies in:
Universal screening programs for high-risk infections (e.g., syphilis, HIV, hepatitis B).
Vaccination for rubella and varicella.
Education on hygiene to prevent CMV and toxoplasmosis.
Timely prenatal care and access to treatment. Global surveillance and outbreak preparedness, especially for emerging pathogens like Zika.

Conclusion
TORCH and other congenital infections present a wide range of clinical challenges, from asymptomatic cases to severe developmental disorders or perinatal death. Timely prenatal screening, accurate diagnosis, targeted therapies, and public health interventions are vital in mitigating their impact. Continued investment in vaccine development, maternal education, and access to prenatal care is essential to reduce the global burden of these preventable infections.

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13

Surgical Site Infections (SSIs) and Device-Related Infections

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Surgical site infections (SSIs) are defined as infections occurring up to 30 days after surgery (or up to one year after surgery in patients receiving implants) and affecting either the incision or deep tissue at the operation site.

Incidence : incidence of SSIs 0.5 to 2% ,but may be as high as 20%.Many factors in a patient's journey through surgery have been identified as contributing to the risk of SSI. The prevention of these infections is complex and requires the integration of a range of measures before, during and after surgery.

Types of surgical site infections

An SSI typically occurs within 30 days after surgery. The CDC describes 3 types of surgical site infections:

- Superficial incisional SSI. This infection occurs just in the area of the skin where the incision was made.
- Deep incisional SSI. This infection occurs beneath the incision area in muscle and the tissues surrounding the muscles.
- Organ or space SSI. This type of infection can be in any area of the body other than skin, muscle, and surrounding tissue that was involved in the surgery. This includes a body organ or a space between organs.

Signs and symptoms of surgical site infections

Any SSI may cause redness, delayed healing, fever, pain, tenderness, warmth, or swelling. These are the other signs and symptoms for specific types of SSI:

- A superficial incisional SSI may produce pus from the wound site. Samples of the pus may be grown in a culture to find out the types of germs that are causing the infection.
- A deep incisional SSI may also produce pus. The wound site may reopen on its own, or a surgeon may reopen the wound and find pus inside the wound.
- An organ or space SSI may show a discharge of pus coming from a drain placed through the skin into a body space or organ. A collection of pus, called an abscess, is an enclosed area of pus and disintegrating tissue surrounded by inflammation. An abscess may be seen when the surgeon reopens the wound or by special X-ray studies.

Pathogens:

Percentage of pathogens associated with SSI : Staph. aureus 30%, Coagulase -ve Staph 11%, E.coli 9%, E. feacalis 6%, Pseudomonas aeruginosa 5.5%, Enterobacter sps 4%, Klebsiella 4%.

These are other risk factors for SSIs:

- Having surgery that lasts more than 2 hours
- Having other medical problems or diseases
- Being an elderly adult
- Being overweight
- Smoking
- Having cancer
- Having a weak immune system
- Having diabetes
- Having emergency surgery
- Having abdominal surgery

These include patient-related (endogenous) and process/procedural-related (exogenous) variables that affect a patient's risk of developing an SSI.

PREVENTIVE MEASURES

1 Preoperative bathing.2. the administration of SAP within 120 minutes before incision.3. hair should either not be removed or, if absolutely necessary, it should be removed only with a clipper.4. preoperative oral antibiotics combined with mechanical bowel preparation (MBP) should be used to reduce the risk of SSI in adult patients undergoing colorectal surgery.5. Recommendations on surgical site skin preparation .Use a dual agent skin preparation containing alcohol, unless contraindications exist. CHG 2% in isopropyl 70% alcohol solution; PVP-I with alcohol for patients who are allergic to CHG.6. Surgical hand preparation must be performed either by scrubbing with a suitable antimicrobial soap and water or using a suitable ABHR before donning sterile gloves.7. Adult patients undergoing general anaesthesia with endotracheal intubation for surgical procedures should receive an 80% fraction of inspired oxygen (FiO2) intraoperatively and, if feasible, in the immediate postoperative period for 2-6 hours to reduce the risk of SSI.8. It is recommended to use protocols for intensive perioperative blood glucose control for both diabetic and non-diabetic adult patients undergoing surgical procedures to reduce the risk of SSI.9. Goal-directed fluid therapy (GDFT) must be used intraoperatively .10. Either sterile, disposable, non-woven or sterile, reusable woven drapes and surgical gowns can be used during surgical operations.11. Wound protector (WP) devices in clean-contaminated, contaminated and dirty abdominal surgical procedures must be used.12. irrigation of the incisional wound with an aqueous PVP-I solution before closure for the purpose of preventing SSI, particularly in clean and clean contaminated wounds. 13. Use prophylactic negative pressure wound therapy (pNPWT) in adult patients on primarily closed surgical incisions in high-risk wounds.14. use of sterile gloves by the surgical team during the operation. During the operation, glove decontamination with alcohol or other products for the purpose of reuse should never be performed.15.Postop Antibiotic: Stop agent within 24 hours after the procedure for all

procedures.16. Removing the wound drain when clinically indicated. No evidence was found to recommend an optimal timing of wound drain removal for the purpose of preventing SSI.
Decontamination and reprocessing of medical devices for health-care facilities: Decontamination of medical devices plays an important role in the prevention of health care-associated infections. It includes cleaning, disinfection and/or sterilization.
Spaulding's classification is a system of classifying the potential risk of reusable medical equipment/devices into High [critical], Intermediate [semicritical] & Low [non critical].It recommends an appropriate method of decontamination before using the device on another patient .

Treatment of Surgical Site Infections

Treatment decisions are influenced by factors such as the specific procedure performed, the types of microbes involved, anatomical considerations, and the patient's characteristics. In cases involving foreign bodies such as mesh, implants, stents, or metalwork, removal may be necessary due to contamination and the formation of biofilms. Cultures are indicated for open wounds and drainage, especially if purulent, as the results will affect antibiotic selection. A negative wound culture might suggest an unusual infection with acid-fast bacteria or fungal organisms, particularly in immunocompromised patients. In such scenarios, specific cultures for these organisms should be obtained.

Systemic antibiotics are required for cases with systemic signs of infection such as fever, significant skin erythema, cellulitis, or if evidence of deeper soft tissue involvement is found. In cases where patients exhibit systemic signs of infection, obtaining blood cultures should be considered. Timely interventions in patients diagnosed with sepsis have been demonstrated to be life-saving. If the infection is superficial, treatment may be limited to local wound care. The primary treatment for superficial wound infections involves opening the incision, examining the wound, draining any infected fluid collections, and debriding (removing) all necrotic tissue. This procedure is typically performed at the bedside or in the office setting. If evidence suggests deeper involvement, drainage may be conducted via interventional radiology or, if needed, in the operating room.

Once a wound has been opened, dressings must create a clean, moisture-balanced environment while ensuring tissue is appropriately debrided and maintained at an optimal temperature to facilitate healing. A balanced wound matrix prevents tissue necrosis caused by desiccation and contains growth factors that support healing, epithelial regeneration, and autolysis of dead tissue. Wound dressings tailored to specific wound environments are available. The choice of dressing type and frequency of changes depend on the wound's condition and stage of healing. Topical antiseptics such as hydrogen peroxide, dilute sodium hypochlorite, and povidone-iodine solutions may be sparingly used in infected, open wounds, but their application should be limited due to the cytotoxicity they pose to the wound matrix.
In cases where mechanical debridement cannot be performed, enzymatic agents are used. Cleaning and debridement should be repeated until no necrotic or devitalized material remains and healthy granulation tissue forms. Removing any infected foreign material or implants is prioritized.

Vacuum-assisted wound therapy utilizes negative pressure to minimize dressing changes, avoid excess fluid accumulation, and promote granulation. Vacuum-assisted wound therapy has been successfully used after major trauma, orthopaedic procedures, burn surgeries, and open abdominal wounds.

Wounds managed with VAC dressings may necessitate intermittent mechanical debridement. Deep surgical site infections, especially in abdominal wounds, present unique challenges due to the risk of wound dehiscence. Consequently, exploring these wounds may be more safely conducted in the operating room. Percutaneous drainage may be considered for some cases of infected fluid collections. Notably, organ/space surgical site infections are associated with higher morbidity and mortality rates compared to other types of surgical site infections. Ultrasound and/or CT scans can facilitate the percutaneous placement of closed drains into infected fluid collections and abscesses, which may be linked to anastomotic leaks following bowel surgery. The presence of air or contrast within an intrabdominal abscess strongly suggests a bowel perforation or anastomotic leak.

Special Situations

Infections associated with the mesh, such as those occurring in hernias, typically necessitate drainage (potentially percutaneously), administration of antibiotics, wound debridement, and potential removal of the mesh. If no improvement is observed within 10 to 14 days, more aggressive intervention may be required, including surgical exploration in the operating room with likely removal of the foreign body.

Using absorbable meshes that provide a structural matrix and can be designed to release factors that promote healing and tissue growth holds promise as an adjunct treatment for patients with impaired wound healing, particularly those with diabetes. Additionally, hyperbaric oxygen therapy may be used for complex, non-healing postoperative wounds, with reported success rates of approximately 75% in such cases.

Differential Diagnosis

Generally, the presence of an incisional infection is visibly apparent. Moreover, the emergence of systemic symptoms following recent surgery should consistently prompt consideration for a postoperative issue, such as infection, leakage, or ongoing bleeding. Nevertheless, it is important to recognize that other factors can cause similar symptomatology unrelated to the wound or procedure. For instance, the patient may develop cellulitis in an area unrelated to the surgical site, exhibit an allergic reaction to antibiotics or other substances, or present with an infection only loosely connected to the surgery, such as a urinary tract infection, pneumonia, or pulmonary embolus.

Prognosis

Early recognition and prompt treatment of all surgical wounds are crucial for achieving the most favorable prognosis. However, prioritizing strict adherence to a prevention protocol represents the most prudent approach. Additionally, surgical factors such as the type of procedure, emergency surgery, wound class (dirty-infected), placement of surgical drains, surgeon experience, prolonged operating time, and certain postoperative factors like extended hospital stays and the need for intraoperative transfusions are independent risk factors for surgical site infections.

Complications

Complications arising from surgical wound infections can manifest locally or systemically. Local complications include delayed wound healing, which can progress to chronic wounds and result in local tissue damage. Furthermore, superimposed infections, abscess formation, and osteomyelitis may also occur as additional local complications. On the other hand, systemic complications involve bacteraemia, potentially leading to distant hematogenous spread and sepsis. In severe cases of infection, organ failure may develop, or existing comorbid conditions may be exacerbated.

Postoperative and Rehabilitation Care

Postoperative wound care is key to any postoperative hospital or rehabilitation stay, as the wound may be the primary reason for the patient's in-house care. Effective wound care and healing are essential for the patient's overall well-being and, in certain situations, their survival. The field of wound care is continuously evolving into a more sophisticated specialty. Providing adequate care for postoperative wounds demands timely evaluation and deliberate interventions to achieve the most favourable outcomes for patients.

Management of postoperative wound infections may occasionally necessitate the expertise of various specialists, including infectious disease, plastic surgery, and critical care specialists.

Enhancing Healthcare Team Outcomes

During the perioperative period, patients interact with numerous healthcare professionals who are directly or indirectly engaged in mitigating factors associated with the risk of postoperative wound infections. Preoperatively, it is imperative to identify and address modifiable risk factors and provide the patient with appropriate counselling regarding potential risks. Although discussions about risks are primarily conducted by the nursing staff, anaesthesiologist's, and surgeons, the interprofessional healthcare team members must educate patients and reinforce preventive measures.

It is essential to take all reasonable measures to maintain cleanliness in the operating room, particularly around the operating table. Items such as anaesthesia units, personal staff belongings like pens and cell phones, and medical equipment such as suction machines, blood pressure cuffs, Bovies, phones, intercoms, ventilation portals, and x-ray machines should be regarded as contaminated and cleaned regularly. Intraoperatively, all operating room personnel must uphold sterility and ensure an optimal surgical environment. Postoperatively, all involved clinicians influence recovery of patient.

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14

Antibiotic Prophylaxis & Stewardship in Ob-Gyn

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Skin preparation

- Night prior – Preoperatively, the CDC advise that the entire body be washed (shower or tub)

with either soap (antimicrobial or non-antimicrobial) or an antiseptic agent on the night prior to surgery .Some practices give patients chlorhexidine gluconate solution at their preoperative evaluation to facilitate appropriate preoperative skin cleansing

Intraoperative – Intraoperatively, we use 4% chlorhexidine gluconate solution with 70% isopropyl alcohol for preoperative skin preparation because alcohol-based chlorhexidine is more effective, for some procedures compared with iodine solutions . Alcohol-based chlorhexidine is associated with reduced infection risk for open surgeries, including open abdominal hysterectomy and cesarean delivery . For gynaecologic laparoscopy, the type of skin preparation does not appear to impact infection risk.

Vaginal preparation — Either povidone-iodine (PVP-I) or chlorhexidine gluconate with a low (4%) concentration of isopropyl alcohol is acceptable for vaginal preparation as both significantly reduce rates of postoperative infectious morbidity . Chlorhexidine is also commonly used because it may provide a greater reduction in skin flora than PVP-I and is not inactivated in the presence of blood.

Generalized allergic reactions, irritation, sensitivity , vaginal desquamation after application of chlorhexidine gluconate.

Gynaecologic surgery: use of chlorhexidine with 4 percent isopropyl alcohol for vaginal preparation, although both PVP-I and chlorhexidine are reasonable options

PROPHYLACTIC ANTIBIOTICS IN OBSTETRICS

- Antibiotic prophylaxis should be given for all caesarean sections.
- Antibiotics administered prior to skin incision will minimise the risk of post-operative infectious morbidity, but consideration should be given to how the fetus could be delivered expeditiously in the rare event of maternal anaphylaxis.
- Surgical data suggests that for antimicrobial prophylaxis to be effective, ideally it should be administered at least 30 minutes before caesarean section, to ensure a bactericidal concentration is reached by the time of incision. This could occur at time of intravenous cannulation.

- Narrow-spectrum antibiotics that are effective against gram-positive and gram- negative bacteria with some anti-anaerobic activity are the most appropriate choice. • A first-generation cephalosporin is recommended, such as 2g intravenous cefazolin. The dose should be increased to 3g for women weighing over 120kg. Consideration should also be given to a repeat dose if the procedure is prolonged (over 3 hours). • For women with a history of immediate or delayed no severe hypersensitivity to penicillin's, cefazolin, as above, remains appropriate. • For women with a history of immediate or delayed severe hypersensitivity to penicillin's, use Clindamycin 600mg iv plus Gentamicin 2mg/kg iv.

- For women colonised with Methicillin-resistant Staphylococcus aureus (MRSA) or at increased risk of being colonised with MRSA, add Vancomycin 15mg/kg iv.

- Azithromycin may be considered at caesarean sections performed during labour or at least four hours after rupture of membranes . Administration of azithromycin 500mg has been shown to reduce a composite outcome of endometritis, wound infection or other infection . However, a strong recommendation in favour of routine use is not yet warranted given the concerns around inducing resistance to azithromycin and possible effects on the establishment of the indigenous microbiome.

- Surgical prophylaxis should still be administered even if the patient is receiving antibiotics for prolonged rupture of the membranes.

- Operative delivery, much like caesarean section, is a risk factor for maternal sepsis. Historically insufficient evidence existed to recommend antibiotics prophylaxis for women undergoing operative vaginal birth. This changed in 2019 with the publication of the ANODE trial. The ANODE trial demonstrated that prophylaxis with a single dose of intravenous amoxicillin and clavulanic acid resulted in significantly fewer confirmed or suspected infections when compared to placebo. The dose given was 1g amoxycillin and 200mg clavulanic acid once intravenously

Group B streptococcus All women with known carriage or risk factors for Group B streptococcus should be treated with prophylactic antibiotics in labour
Preterm prelabour rupture of membranes (PPROM) to 36+6 weeks gestation -There are two rationales for administering antibiotics in PPROM-For GBS chemoprophylaxis due to the high risk of spontaneous preterm labour (a known risk factor for early onset GBS disease); and To prolong gestation (increase latency period). The antibiotic of choice and optimal duration of treatment are not clear: • Erythromycin 250 mg four times a day for 10 days or until the woman is in established labour (whichever is sooner) OR • Amoxicillin/ampicillin 2 g IV every 6 hours for 48 hours, followed by amoxicillin 250 mg oral every 8 hours for 5 days (for seven days total), PLUS erythromycin 250 mg oral every 6 hours for 10 days.

Azithromycin can be considered in lieu of a multiple-day course of erythromycin because of its ease of administration, improved gastrointestinal tolerance, favourable cost profile, and similar efficacy; this substitution is also endorsed by ACOG . In retrospective studies of women with PPROM given prophylaxis with erythromycin versus azithromycin as part of the antibiotic regimen, both drugs had similar pregnancy and neonatal outcomes (latency length; mean birth weight; rates of chorioamnionitis, low Apgar score, neonatal sepsis, and neonatal respiratory distress syndrome)

The choice of prophylactic antibiotics in PPROM will also depend on whether clinical signs of chorioamnionitis are present. Therapies may be modified based on the results of investigations.

Women with pre-exisiting heart disease require additional consideration as prophylaxis is often required to reduce the risk of infective endocarditis.

Prophylactic antibiotics in gynaecology

There are no recommendations for routine prophylactic antibiotics for the following gynaecological procedures in healthy women with no risk factors:

• Insertion of intrauterine contraceptive device (IUCD) • Patients undergoing diagnostic laparoscopy; • Patients having hysteroscopic surgery; • Hysterosalpingography (HSG) without a prior history of pelvic inflammatory disease ; and • Large Loop Excision of Transformation Zone (LLETZ). However, antibiotic therapy should be instituted in any of the procedures listed above if there is reason to suspect infection risk or if the findings at the procedure indicate risk of infection e.g. dilated fallopian tubes at HSG.

Antimicrobial prophylaxis should be used during major abdominal, laparoscopic or vaginal procedures. This includes synthetic mid-urethral sling procedures. Antibiotic prophylaxis should also be considered for surgical termination of pregnancy where STIs have not been excluded. The choice of antibiotics should be guided by local guidelines and also reflect local antimicrobial susceptibilities. • In general, cefazolin 2g iv PLUS metronidazole 500mg iv prior to surgical incision is appropriate. • For women with a history of immediate or delayed no severe hypersensitivity to penicillin's, the above regimen remains appropriate • For women with a history of immediate or delayed severe hypersensitivity to penicillin's, use Clindamycin 600mg iv plus Gentamicin 2mg/kg iv. • For prophylaxis of patients who have not been appropriately investigated before surgical termination of pregnancy use doxycycline 100mg orally prior to the procedure and 200mg orally after the procedure OR doxycycline 400mg orally with food 10-12 hours prior to the procedure. An alternative regimen is metronidazole 2g orally prior to the procedure PLUS 1g azithromycin orally prior to the procedure for patients at a high risk of infection

Antimicrobial prophylaxis for gynecologic and obstetric surgery in adults*

Procedure	ACOG preferred regimen[¶ 1,2]	Dose	Alternative regimens[Δ 3,4]	Dose
Hysterectomy (abdominal, including supracervical, vaginal, laparoscopic, or robotic) Pelvic reconstruction procedures, including colporrhaphy or those involving mesh or vaginal sling placement	Cefazolin, cefoxitin or cefotetan	Cefazolin: <120 kg: 2 g IV ≥120 kg: 3 g IV Cefoxitin or cefotetan: 2 g IV	**Regimen:**	
			Ampicillin-sulbactam	3 g IV
			Regimen:	
			Clindamycin **OR**	900 mg IV◇
			Vancomycin[¶]	15 mg/kg IV (not to exceed 2 g per dose)
			PLUS one of the following:	
			Gentamicin **OR**	5 mg/kg IV (if overweight or obese, based on adjusted body weight)[§]
			Aztreonam **OR**	2 g IV
			Fluoroquinolone[¶ ∨]	
			Regimen:	
			Metronidazole	500 mg IV
			PLUS one of the following:	
			Gentamicin **OR**	5 mg/kg IV (if overweight or obese, based on adjusted body weight)[§]
			Fluoroquinolone[¶ ∨]	
Cesarean delivery (intact membranes, not in labor)	Cefazolin	<120 kg: 2 g IV ≥120 kg: 3 g IV	Clindamycin	900 mg IV◇
			PLUS	
			Gentamicin	5 mg/kg IV (if overweight or obese, based on adjusted body weight)[§]

membrane)	**PLUS**		**PLUS**	
	Azithromycin	500 mg IV	Gentamicin	5 mg/kg IV (if overweight, or obese, based on adjusted body weight)
			PLUS	
			Azithromycin	500 mg IV
Uterine evacuation (including surgical abortion, suction D&C, and D&E)	Doxycycline	200 mg orally		
Hysterosalpingogram, including chromotubation or saline infusion sonography	Not recommended[‡]			
Laparotomy without entry into bowel or vagina	Consider cefazolin	<120 kg: 2 g IV ≥120 kg: 3 g IV		
Hysterosalpingogram, including chromotubation or saline infusion sonography	Not recommended[‡]			
Laparotomy without entry into bowel or vagina	Consider cefazolin	<120 kg: 2 g IV ≥120 kg: 3 g IV		
Laparoscopy (diagnostic, tubal sterilization, operative except for hysterectomy) Other transcervical procedures: ▪ Cystoscopy[†] ▪ Hysteroscopy (diagnostic or operative) ▪ Intrauterine device insertion ▪ Endometrial biopsy ▪ Oocyte retrieval ▪ D&C for non-pregnancy indication ▪ Cervical tissue biopsy, including LEEP or endocervical curettage	Not recommended			

Other measures — Additional measures for prevention of surgical site infection include skin antisepsis, hair removal, drapes, surgical hand hygiene, surgical technique, and negative pressure wound therapy.

ANTIBIOTIC STEWARDSHIP

Antimicrobial stewardship refers to systematic measurement and coordinated interventions designed to promote optimal use of antimicrobial agents, by advocating selection of appropriate antimicrobial drug regimens (including dosing, duration of therapy, and route of administration).

The primary goal of antimicrobial stewardship is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use (including toxicity, selection of pathogenic organisms such as Clostridioides difficile, and the emergence of antimicrobial resistance).

Initiation and tailoring of antimicrobial therapy – management of patients with suspected or proven bacterial infection consists of initiation of empiric therapy (ie, prior to availability of definitive microbiology data), followed by adjustment once microbiology data become available.

Antimicrobial oversight – Antimicrobial oversight should include prospective audit and feedback (PAF), preauthorization, or both. In programs that use PAF, trained staff review antimicrobial orders and advise regarding optimization of antimicrobial use. In programs that use preauthorization, approval is required before certain agents may be administered.
Local protocols – Antimicrobial stewardship programs should develop facility-specific clinical practice guidelines for common infections based on local epidemiology, susceptibility patterns, and drug availability or preferences.

Role of pharmacy – Pharmacy-led interventions can be used by pharmacists to optimize antimicrobial therapy, including dose optimization (eg, vancomycin dosing) and systematic conversion of intravenous to oral antimicrobial therapy

Antimicrobial stewardship in hospital settings

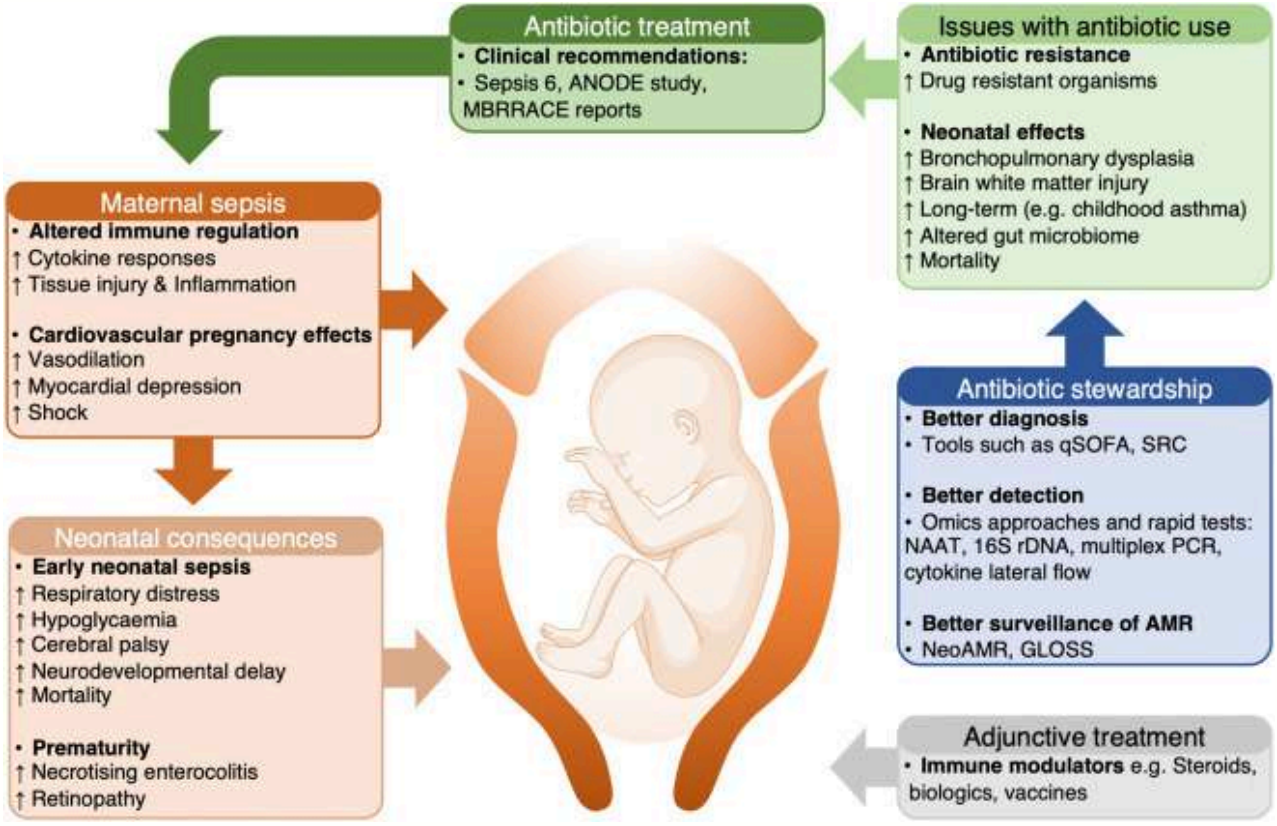
Antimicrobial allergies – Correcting an inaccurate antimicrobial allergy history in the medical record can be very useful for guiding subsequent decisions regarding a patient's antimicrobial therapy

Role of microbiology laboratory – The clinical microbiology laboratory has an integral role in promoting appropriate antimicrobial use, by providing ongoing culture results and susceptibility data, preparing an annual antibiogram, and providing guidance regarding implementation and interpretation of rapid diagnostic tests.

Monitoring progress – The optimal metrics for monitoring stewardship programs are uncertain. Traditionally, programs have focused on antimicrobial use and cost savings; focusing on outcome and process measures may better illustrate a program's value and sustainability

To foster a culture of continuous improvement, experts have recommended the 5 R approach to AMS:

Antimicrobial stewardship describes the practice of promoting the selection of the right drug, dosage, delivery and duration of antimicrobial therapy (the 4Ds) in order to curtail the emergence of resistant organisms.



Key strategies for the management of sepsis in pregnancy. This flowchart summaries the maternal neonatal complications, the importance of prompt antibiotic use but the potential issues with the current usage, how antibiotic stewardship can be achieved and the potential for adjunctive treatments.

Antibiotic stewardship is required to optimize antibiotic usage, including rationalizing and de-escalating or stopping agents, to maintain their effectiveness. This is important because the incidence of AMR and healthcare-associated infections (HCAIs) is rising. In Europe, the AMR in 2018 as reported by the European AMR Surveillance Network (EARS-Net) indicated more than half of the E. coli and more than a third of the Klebsiella pneumonia isolates were resistant to at least one antibiotic class. In LMIC these figures are much higher. AMR is estimated to result in 700,000 deaths each year globally. In 2015 the WHO endorsed a Global Action Plan on Antimicrobial Resistance (GAP) to address the global problem, and in the UK a government document was published in 2019 with the country's 5-year action plan, which amongst other goals, was aimed at reducing antibiotic use by 15% and specified drug-resistant infections by 10% over 5 years. In the maternity setting, patients with peripartum infection have been shown to have resistance to a number of common organisms encountered in obstetrics such as E. coli, GBS and GAS, with resistance rates as high as 62% to 81% for E. coli. Cohort-specific antibiograms with isolates and their sensitivities may provide a better way to determine resistance patterns to guide antibiotic prescribing in maternity.

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15

Food and Nutrition Guidelines for Infection Prevention

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Introduction

Nutrition and infectious diseases are related to each other Nutrition affects the development of human body immune system. Nutrition can influence emerge of infectious diseases (e.g., gastrointestinal infections), food poisoning, intestinal diseases, and systemic infectious diseases.. the relationship between malnutrition and infectious diseases, nutrition in patients with severe combined immunodeficiency and relationship between overeating and infection are studied .

Overall, some factors can weaken the body's ability to fight infection and cause malnutrition. The factors include anorexia, traditional behaviors, reduction of intestinal absorption, metabolic damage, disorder metabolism of lipids and carbohydrates, reduction of vitamins, iron, zinc, and copper. In the case of the relationship between malnutrition and infection, a large number of studies have illustrated a bidirectional interaction of malnutrition and infection. In this aspect, to treat serious acute malnutrition and limit the rate of death, some preventive studies applied antibiotics, probiotic bacteria, and prebiotic foods. For which , studies may be conducted on intestinal or systematic immunomodulation.

The relationship between nutrition and infectious diseases can be divided into five groups as follows

1. The effect of nutrition on the development of human immune system;
2. The effect of nutrition on emerge of infectious diseases (e.g., gastrointestinal infections), food poisoning (e.g., botulism), intestinal diseases (e.g., microbial diarrhea), and systemic infectious diseases (e.g., brucellosis and typhoid);
3. Relationship between malnutrition and infectious diseases;
4. Nutrition in patients with severe combined immunodeficiency;
5. Relationship between overeating and infection.

These five groups of balance between nutrition and infection are discussed below

1. The effect of nutrition on the development of human body immune system.

The effect of diet on the development of human immune system begins from the embryonic stage. If during pregnancy, the mother receives enough protein, vitamins, and minerals, the embryonic tissues will develop very well.. Fetal malnutrition has unfavourable effects on the development of immune system. If the immune system does not efficiently develop in this period, it cannot defence against pathogens in the future. After birth, breast milk provides sufficient vitamins and minerals Breastfeeding helps to develop a vigorous immune system. A malnourished baby who does not receive enough protein and vitamins is prone to infectious diseases and does not respond well to vaccines. Therefore, nutrition is critical to provide high immunity in humans against environmental pathogens.

2 Nutrition effects on emergence of infections

Food, if has microbial contamination, it can cause various diseases including digestive diseases and food poisoning. Intestinal diseases are very common of , which the most dangerous is cholera. Food poisoning is usually caused by the consumption of contaminated foods. In many cases, eating the spoiled canned foods is also dangerous. Typhoid fever, caused by Salmonella species, diseases transmitted through contaminated water and food.. Besides, microbial contaminations transmitted through water and food can cause severe diarrhea and infectious diseases in children. Brucellosis is an infectious disease caused by the ingestion of contaminated food and water. Brucellosis is a common disease between humans and animals. Humans become infected with Brucella by consuming unpasteurized milk or undercooked meat from infected animals. Amoebiasis is a major disease caused by consumption of contaminated water and food. Toxoplasmosis is caused through ingestion of raw or undercooked meat. Pinworm infection is another parasitic disease transmitted through food. The infection is prevalent in all countries with more prevalence in children compared to adults. Parasitic worm infections such as tennis's and hookworm infection are also caused by inappropriate nutrition

3 Malnutrition and infectious diseases

Effects of malnutrition on emergence the infectious diseases

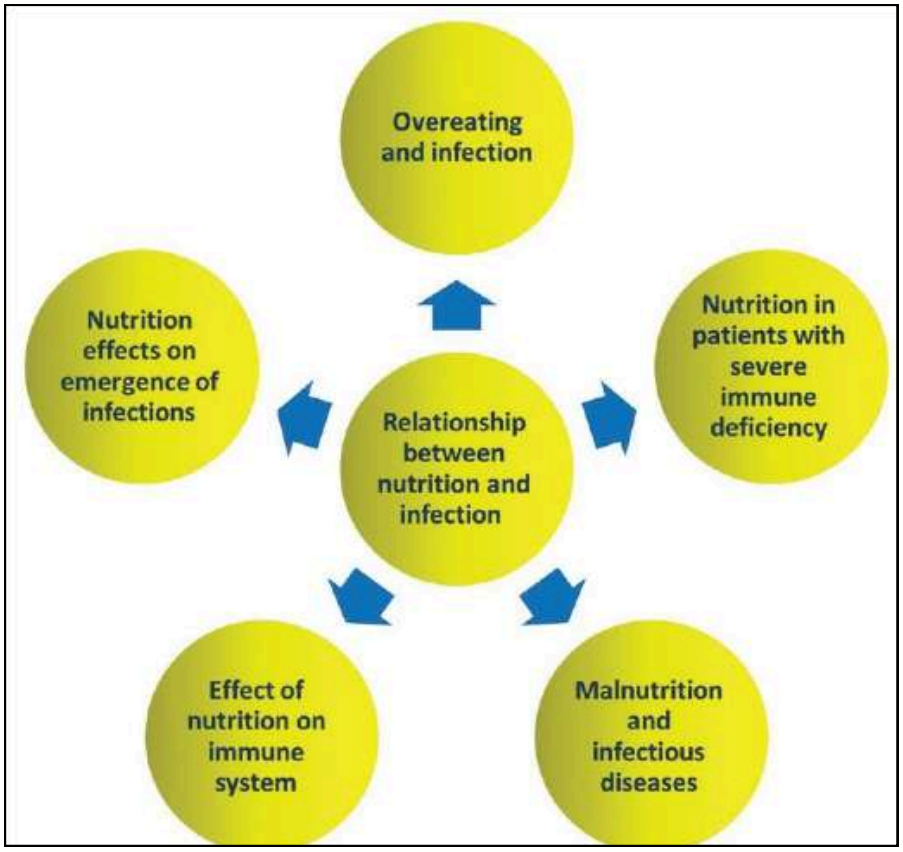
The effect of protein-energy malnutrition on the increase of infectious diseases has been studied extensively. In regions that there is malnutrition of proteins, microbial contamination is a health problem and affects the entire community.

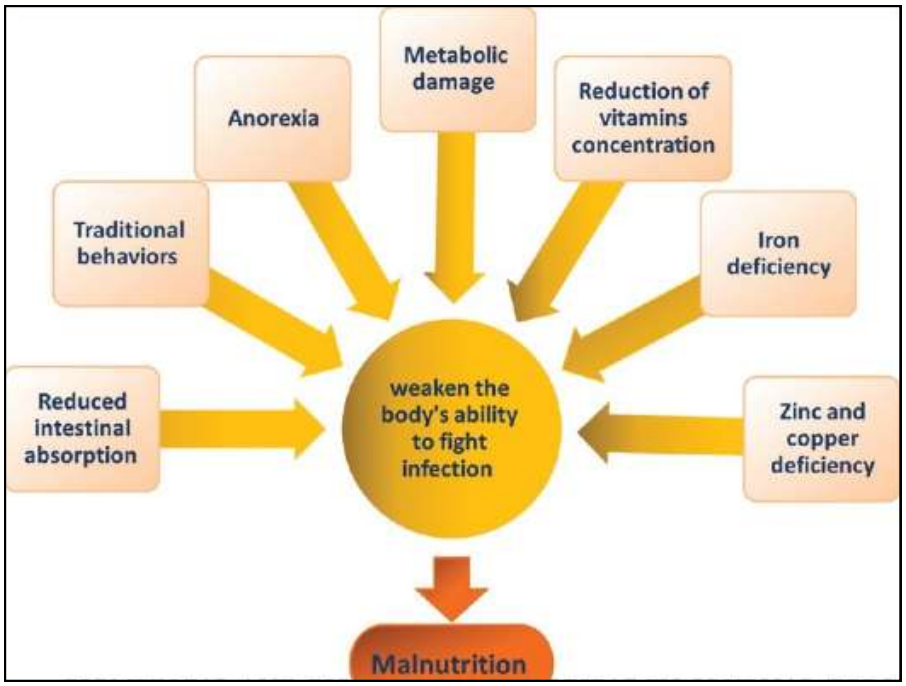
In such poor societies, the Vitamin A deficiency, which is one of the important immune system boosters, should be added to diet. The lack of the mentioned nutrients, protein, and Vitamin A has caused prevalent infections in the world's poorest areas.

This kind of enhancement relationship is called synergy. It is believed that the infection can negatively influence the subjects' nutritional status that results in reduction the body's ability to fight infection. Consequently, infection can cause malnutrition and malnutrition may increase the infection. Some factors can weaken the body's ability to fight infection and cause malnutrition . First, anorexia can cause malnutrition and weaken the body's immune system against infection. The traditional behaviors can also exacerbate malnutrition and infection. For example, in some societies, people who have fever or diarrhea are banned from eating. Reduced intestinal absorption due to intestinal infections can reduce protein, carbohydrate, and fat absorption by 43%, 42%, and 72%, respectively. Metabolic damage such as losing proteins during the infection can increase the need for dietary protein. Disorder metabolism of lipids and carbohydrates (e.g., disorder in fatty acid self-assembled structure, ketone bodies, and triglycerides) may be observed in various infections. In addition, the infection can transmit amino acids to carbohydrates via gluconeogenesis pathway that makes new glucose from no carbohydrate precursors. The concentration of Vitamin A may be reduced in blood during respiratory infections. Diseases such as hepatitis, acute tonsillitis, and rheumatoid arthritis can also reduce serum Vitamin A concentration. The concentration of Vitamin C is reduced in patients' blood with infections. As a result, the concentration of Vitamin C increases in the urine.

Amount of Vitamin B2 (riboflavin) in the body decreases following infection. Reduction of Vitamin B2 due to infection is statistically significant.

Iron is another nutrient that is reduced in the body due to infection. Iron efficiency can help to reduce the activity of pathogens and aid to treat infections. Zinc and copper are other elements whose concentration decreases when infections occur. Overall, nutrition is critical in the treatment of malnutrition caused by infection





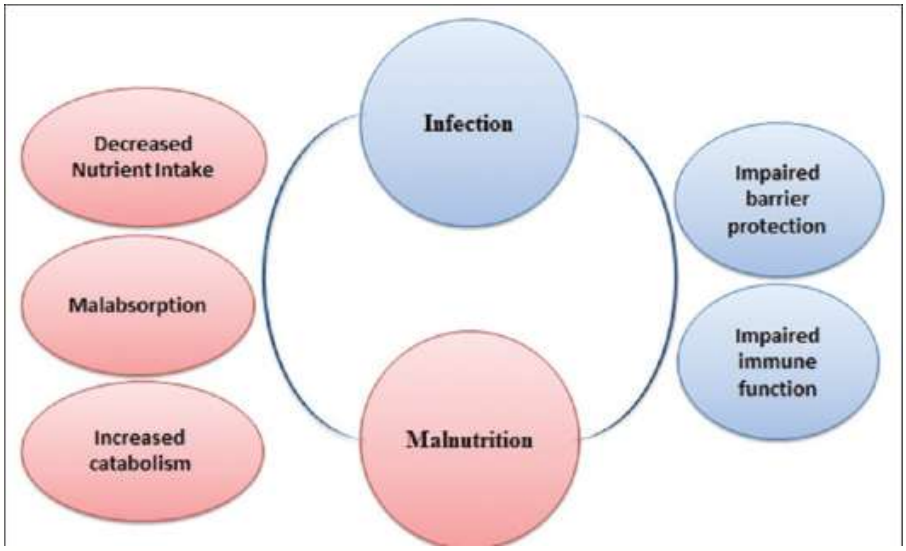
4. Nutrition in patients with severe immune deficiency

In severe immune deficiency, the susceptibility to infection can occur. A healthy person may not get infection. However, patients with severe immune deficiency may develop disease if they eat the same. Physicians emphasize that patients with severe immune deficiency, especially those with white blood cells low should not use raw foods and fruits.
Such foods may transmit pathogens. It is also recommended that the patients avoid eating dried fruit when the white blood cells are low.

5. Overeating and infection

The relationship between overeating and infection is not vastly investigated. However, in some studies, it is shown that overweight persons are at more risk for respiratory tract infections. In addition, obese people have potential for get diabetes and all diabetic people are sensitive to infections.

Relationship between Malnutrition and Infection



Nutritional requirement in infections

Carbohydrates:

The increased metabolic rate of the body during fever increases the calorie requirements. Also, due to fever, the patient's appetite is poor and digestion may be hampered, hence consuming more amounts of carbohydrates may be advisable. If a person suffers from high fever for a long time, the energy intake needs increase by almost 50%. Fruits juices and liquids with added sugar can be given to the patient as it is easily used up by the body.[2] Easily digestible carbohydrates like rice, simple porridges, fruit juices, and nutritional supplements are recommended.

Proteins:

During recovery from most infections, consuming about 20-25% more protein is recommended. A high protein diet supplying about 1.25-1.5g protein per kg of body weight per day should be given to such patients. The protein requirement increases to an even larger extent during serious infections.

Good quality protein can be obtained from fish, poultry, lean red meat, eggs, dairy products, nuts, dried beans, peas, lentils, and soy. Protein supplements may also help meet the increased demand of proteins by the body.[2,4]

Vitamins:

Vitamin requirements are increased in infections. In conditions like tuberculosis, vitamins A (retinol) and C (ascorbic acid) are advised for faster recovery and quicker tissue regeneration. B-complex vitamins, especially vitamin B_9 (folic acid), should be consumed in larger amounts. Eating a wide variety of fruits and vegetables can meet the increased vitamin demands.[2]

Minerals:

During infections, two minerals, sodium and potassium are lost in large amounts and need to be replaced. Sodium can be obtained in the form of salt in soups, curries, or broths. Potassium is present in fruits juices and milk.[2]

Tips for managing nutrition during and after infections:

- Smaller meals containing fresh vegetables and fruits should be consumed more frequently throughout the day.
- Soft, bland foods with lesser spices should be preferred.
- Protein supplements can help replace the protein lost due to infections.
- Since, body fluids are lost during infection, drinking plenty of fluids like water, coconut water, fruits and vegetable juices, and soups is advisable.

How can a nutritional supplement help?

In certain infections, particularly gastrointestinal infections, a person may be unable to eat and digest solid food. Hence, a liquid diet with all the essential nutrients can provide faster recovery and may protect from further infections.

Conclusion

Infectious diseases and malnutrition, including protein, energy, and micronutrient deficiency, are closely interrelated, leading to a vicious circle. Common to occur in children, pregnant/nursing women, elderly, people suffering from chronic infections (tuberculosis, HIV, etc.)

Effective and safe nutritional support vary depending on infectious diseases, age, and nutritional status, etc. It is recommended to select suitable measures according to the latest recommendations and guidelines of WHO on individual infectious diseases, such as dietary consultation for appropriate intake of major nutrients, intensive nutritional supplementation (ready to use therapeutic food (RUTF), etc.), and specific micronutrient supplementation.

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Noninfectious Factors That Influence Infection Susceptibility

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Noninfectious factors that influence infection susceptibility are diverse and can be broadly categorized into

1. Host-related factors
2. Environmental and lifestyle factors
3. Medical/Iatrogenic factors
4.Socioeconomic and behavorial factors

These factors modulate the immune system, alter physical barriers, or affect pathogen exposure.

1. Host-Related Factors

a) Age: Susceptibility to infections varies throughout life. Infants and the elderly are more prone to infections.
Infants/elderly: Immature or declining immune function increases susceptibility.
Pregnancy: Immunomodulation raises vulnerability to certain infections.

b) Genetics: Inherited genetic variations can influence how well the immune system functions. Some individuals have a genetic predisposition to certain infections and diseases making them more vulnerable
Primary immune deficiencies (e.g., chronic granulomatous disease). HLA haplo types affecting pathogen recognition. Polymorphisms in immune-related genes (e.g., TLRs, cytokines).

c) Chronic Diseases: Diabetes: Hyperglycemia impairs neutrophil function and wound healing.
Chronic kidney/liver disease: Uremia or reduced detoxification weakens immunity.
Autoimmune disorders (e.g., lupus, rheumatoid arthritis): There is dysregulation of immune response.
Cancer: Tumor-induced immune suppression.

d) Nutritional Status: Malnutrition (protein-energy, micronutrient deficiencies like zinc, vitamin D, vitamin C).
Obesity: Adipose tissue inflammation and impaired immune cell function.

2. Environmental & Lifestyle Factors

a) Stress: Habits such as smoking, excessive alcohol consumption and physical inactivity can negatively affect immune function and overall health. Chronic stress elevates cortisol, suppressing Th1 responses and cytotoxic T cells. Psychological stress alters gut microbiota and barrier integrity.

b) Sleep Deprivation: Reduces NK cell activity and antibody production.

c**) Smoking & Alcohol:** Smoking damages respiratory cilia and mucosal barriers.
Alcohol: Disrupts gut microbiota and impairs macrophage/neutrophil function.

d) Diet & Gut Microbiota: High-sugar/fat diets promote dysbiosis, reducing colonization resistance. Fiber-deficient diets lower short-chain fatty acid production which is critical for immune regulation.

e) Physical Activity: Moderate exercise: Enhances immunity.
Overtraining: Increases susceptibility (e.g., "open window" theory post-marathon).

f) Environmental Toxins: Exposure to environmental toxins and pollutants can also compromise immune function, increasing the risk of infections. Air pollution (e.g., PM2.5) impairs respiratory defences. Pesticides/heavy metals (e.g., lead, arsenic) disrupt immune function.

3. Medical & Iatrogenic Factors

a) Immunosuppressive Therapies:

- Corticosteroids: Reduce neutrophil/monocyte migration.
- Chemotherapy: Myelosuppression
- Biologics (e.g., anti-TNF,JAK inhibitors):These dampen the immune responses.
- Antibiotic Overuse: - Depletes commensal microbiota, increasing the risk of C. difficile and fungal infections.

b)Medical Devices & Procedures:
Catheters/implants: Biofilm formation (e.g., Staph. aureus, Candida).
Surgery: Breaks skin/mucosal barriers; anaesthesia may transiently suppress immunity.

4. Socioeconomic & Behavioral Factors

a)Low socioeconomic status: Poor sanitation, overcrowding,
limited healthcare access increase susceptibility infections.

b)Vaccination status: Incomplete immunization increases vulnerability to vaccine-preventable diseases.

Key Mechanisms of Susceptibility :- The various ways in which non infectious factors affect susceptibility to infections are :

1) Barrier disruption (skin, gut, respiratory epithelium).
2)Immune dysfunction (reduced phagocytosis, antibody production, or T-cell responses).
3) Microbiome imbalance (loss of protective commensals).

Understanding these factors helps tailor preventive strategies as in optimizing nutrition, stress management, vaccination in high-risk groups, etc.

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Emerging & Re-emerging Infections

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Introduction

Emerging and re-emerging infections represent a dynamic challenge in the field of obstetrics and gynaecology (OBG). These infections can significantly affect maternal and fetal outcomes, as well as gynaecologic health. Factors such as globalization, climate change, antimicrobial resistance, and changes in human behaviour contribute to the appearance and resurgence of infectious diseases. This chapter reviews key pathogens, their impact on pregnancy and gynaecologic health, and current approaches to management and prevention.

Definitions

- **Emerging infections:** Diseases caused by newly identified pathogens or known pathogens appearing in new geographical areas or populations.

- **Re-emerging infections:** Previously controlled or declining infections that are reappearing due to various factors such as resistance, public health breakdown or decreased vaccination.

Etiological Agents

Viral Infections

1. **Zika Virus**
   - **Transmission**: Aedes mosquitoes, sexual transmission, vertical transmission.
   - **OBG Impact**: Congenital Zika syndrome including microcephaly and neurological abnormalities.
   - **Management**: No specific treatment; emphasis on prevention, vector control and travel advisories.

2. **COVID-19 (SARS-CoV-2)**

   - Transmission: Respiratory droplets, vertical transmission (very rare).
   - OBG Impact: Increased risk of preterm labour, preeclampsia, caesarean delivery.
   - Management: Vaccination during pregnancy, infection control protocols, supportive treatment.

3. **Monkeypox (Mpox)**
   - Transmission: Direct contact, rarely vertical.
   - OBG Impact: Limited data; risks include fetal loss, preterm labour.
   - Management: Isolation, supportive care, and possible use of antivirals like Tecovirimat in high-risk cases.

4. **Hepatitis E Virus (HEV)**
   - Transmission: Feco-oral route.
   - OBG Impact: High maternal mortality in the third trimester, risk of fulminant hepatitis.
   - Management: Supportive care; prevention via improved sanitation, safe drinking water.

5. Dengue and Chikungunya

Transmission: Aedes aegypti mosquito.

OBG Impact: High fever, thrombocytopenia, risk of haemorrhage, preterm labour, fetal death. Endemic with seasonal outbreaks; increasing cases in urban areas.

Management: Supportive care, platelet monitoring, fluid balance, mosquito control.

6. HIV and Opportunistic Infections

Transmission: Sexual, vertical, blood transfusion.

OBG Impact: Vertical transmission without ART is ~30–40%. National PPTCT (Prevention of Parent-to-Child Transmission) program significantly reduces transmission.

Management: Lifelong ART, routine antenatal HIV testing, nevirapine to newborns, elective C-section when indicated.

Bacterial Infections

1. **Group B Streptococcus (GBS)**
   - **Re-emerging Concern:** Increasing incidence despite screening protocols.
   - **OBG Impact:** Neonatal sepsis, preterm labour.
   - **Management:** Universal screening, intrapartum antibiotic prophylaxis.

2. **Mycoplasma genitalium**
   - **Emerging Pathogen:** Increasingly recognized cause of cervicitis, pelvic inflammatory disease (PID).
   - **OBG Impact:** Infertility, Early pregnancy loss.
   - **Management:** Antibiotics (Azithromycin, clarithromycin or erythromycin) Tetracyclines & Fluoroquinolones are contra indicated in pregnancy; concern over resistance.

3. Neisseria gonorrhoeae (Drug-Resistant Strains)

- Re-emerging: Due to antimicrobial resistance.
- OBG Impact: PID, infertility, neonatal conjunctivitis.
- Management: Surveillance and treatment guided by resistance patterns. (Ceftriaxone, Cefixime, Azithromycin)

4. Tuberculosis (TB)

- Re-emerging due to MDR-TB (Multi-Drug-Resistant Tuberculosis).
- OBG Impact: Infertility (genital TB), adverse pregnancy outcomes (low birth weight, preterm). India has the highest TB burden globally.
- Management: DOTS strategy, adherence to treatment, screening in high-risk women (e.g., infertility work-up).

Parasitic Infections

1. Malaria (Plasmodium falciparum)

- Re-emerging in Endemic Regions
- OBG Impact: Maternal anaemia, foetal growth restriction, stillbirth.
- Management: Intermittent preventive treatment (IPTp) with Sulfadoxine+pyraimethamine / Mefloquine, insecticide-treated nets & repellents, wearing protective clothing, antimalarials.

2. Toxoplasma gondii

- Reactivation: In immunocompromised or previously exposed women.
- OBG Impact: Congenital toxoplasmosis.
- Management: Serologic screening, spiramycin or pyrimethamine-sulfadiazine.

2.Syphilis

- Re-emerging due to decreased screening and awareness.
- Transmission: Sexual, vertical.
- OBG Impact: Stillbirth, hydrops fetalis, congenital syphilis.
- Management: Universal antenatal screening (RPR/VDRL), penicillin treatment, partner screening.

Risk Factors in OBG Context

- Immunosuppression (e.g., HIV, corticosteroid use)
- Pregnancy-related immune modulation
- Travel to endemic areas
- Unsafe sexual practices
- Lack of prenatal care
- Climate change and urbanization

Diagnostic Challenges

- Overlapping symptoms with common obstetric conditions
- Limited access to diagnostic tools in resource-poor settings
- Serologic cross-reactivity
- Need for timely, point-of-care testing

Prevention Strategies

- **Vaccination:** Influenza, COVID-19, Hepatitis B, HPV.
- **Screening Programs:** GBS, Syphilis, HIV, Hepatitis B, Hepatitis C.
- **Vector Control:** For Zika and malaria.
- **Health Education:** Safe sex practices, hygiene, travel precautions.
- **Infection Control in Healthcare Settings**

Challenges Unique to India

- **Variable healthcare access:** Disparities between rural and urban care.
- **Overcrowding and poor sanitation:** Contribute to transmission of water- and vector-borne diseases.
- **Delayed antenatal care:** Leads to missed opportunities for screening and prevention.
- **Antimicrobial resistance:** Rising due to over-the-counter availability and misuse.

Underreporting: Infections like syphilis and Zika are underdiagnosed due to limited surveillance and awareness.

Management Principles

- Multidisciplinary approach: Collaboration between obstetricians, infectious disease specialists, intensivist and neonatologists.
- Tailored treatment: Based on gestational age, pathogen and maternal condition.
- Monitoring and follow-up: For both mother and fetus.
- Reporting and surveillance: Mandatory for notifiable diseases.

Future Perspectives

- Improved diagnostic technology (e.g., PCR, multiplex assays)
- Vaccine development (Zika, RSV, GBS)
- Strengthening global surveillance networks
- Integration of infectious disease management in routine prenatal care

National Programs in India

- Janani Suraksha Yojana (JSY) – Promotes institutional deliveries.
- Rastriya Kishor Swasthya Karyakram (RKSK) – Adolescent health and STI awareness.
- Revised National Tuberculosis Control Programme (RNTCP) – TB screening and DOTS.
- National AIDS Control Program (NACP) – HIV screening and ART access.
- Integrated Disease Surveillance Programme (IDSP) – Monitors outbreaks including emerging infections.

Conclusion

Emerging and re-emerging infections pose serious risks in the field of obstetrics and gynaecology. Prompt identification, vigilant surveillance, preventive strategies and effective management are crucial to mitigating their impact. Ongoing research, public health preparedness and global collaboration are essential to respond to these evolving threats.

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Future directions and research in infection control

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The fight against infectious diseases is constant in all medical fields, and obstetrics and gynaecology is no exception. It is now harder because of antimicrobial resistance (AMR) – when germs stop responding to medicines. This is a major concern when treating conditions like urinary tract infections (UTIs) in pregnancy, sexually transmitted infections (STIs), or surgical site infections (SSIs) after Caesarean sections. This means we always need new and better ways for infection prevention and control (IPC). Old methods are still important, but we are now adding new technologies that are more precise and personal. The future of infection control will use many approaches together: new testing methods, new treatments, smart hospital environments, and using data to make decisions. This article looks at important new ideas and research areas in infection control, with a focus on what they mean for obstetricians and gynaecologists, based on recent science.

Better Testing: Finding Infections Faster and More Accurately

Quick and correct testing is key to controlling infections. For OB-GYNs, this means faster diagnosis of STIs, early detection of maternal sepsis or chorioamnionitis, and timely screening for organisms like Group B Streptococcus (GBS). Future testing methods aim to be fast, exact, and usable anywhere, even at the patient's bedside.

A big step forward is Point-of-Care Testing (POCT). This means testing done near the patient, perhaps in the clinic or labour room, not in a distant lab. New tools like electrochemical biosensors and microfluidic (tiny fluid-handling) systems are leading this change. They promise quick detection of germs and signs of sepsis [2]. For example, small electronic devices can give quick results with high accuracy. They are good for finding infections early, which is very important for serious conditions like maternal sepsis or neonatal infections. These tools can check different samples, like dried blood or vaginal swabs, to find germs without needing to grow them in a lab. Microfluidic systems, often called "lab-on-a-chip," put all testing steps onto one small device. This is useful in busy OPDs, emergency rooms, and places with fewer resources, allowing for rapid STI screening or GBS detection [2].

We are also learning more from 'omics' technologies. These include genomics (study of all genes), transcriptomics (study of RNA), proteomics (study of proteins), and metabolomics (study of small molecules called metabolites). They help us understand how a pregnant woman's body fights germs, identify why some women are more prone to infections, or find new biomarkers (signs of disease). For sepsis, 'omics' can help group patients based on how their body is reacting, guess how the illness will go, and choose personal treatments [5]. This could be vital for managing severe maternal infections or predicting preterm birth linked to underlying infections. Finding a few good 'omic' biomarkers is a major research aim.

Smart Hospitals and Robots for Infection Control

Technology can help make hospitals, including labour and delivery units and neonatal ICUs, **"smarter"** and safer, playing an active part in stopping infections.

The Internet of Things (IoT) uses connected sensors to watch IPC practices all the time. For example, it can track if healthcare workers in the labour room are washing their hands properly and check how clean delivery areas or operating rooms are [4]. This information can give instant tips to staff and help target cleaning efforts. Smart systems can also check air quality and control automatic cleaning machines.

Robots are being used more for IPC jobs. Robots can automatically clean patient rooms and operation theatres using UV light or disinfectant sprays. This ensures thorough cleaning and protects humans (both patients and staff) from germs and strong chemicals [4]. While not directly involved in patient care, their role in maintaining a sterile environment is crucial.

Better data systems and tracking, often using AI, are important for finding outbreaks early (e.g., an increase in neonatal sepsis cases) and watching AMR trends within the hospital or community [4]. These systems can collect information from labs, medicine records, and hospital admissions. This gives a full picture of infections, allowing quick action and good use of resources. New tools will also be developed to check how well infection control is working, going beyond simple things like hand wash counts [4].

Personalised Medicine: Treating Infections Based on the Individual

The idea that one treatment fits everyone is changing. Personalised medicine aims to control infections by choosing treatments based on each patient (e.g., a pregnant woman or a woman with recurrent infections) and the specific germ causing the infection.

For conditions like sepsis in pregnancy or severe pelvic inflammatory disease, doctors want to use biomarkers and 'omic' information to group patients and choose the best therapy [5]. This includes picking the right antibiotic, the best dose, and any extra treatments, while considering fetal safety. Understanding how the patient's own body is fighting the infection (the immune response) is vital. Future research will likely look at immunomodulatory therapies or host-directed therapies. These treatments aim to help the patient's immune system work better. The aim is not just to kill the germ, but also to help the patient's body recover.

For infections caused by very resistant germs, like certain STIs or complicated UTIs in pregnancy, quickly checking the germ's genetic makeup can help choose the best drug and stop it from spreading [1]. This can also apply to personalized GBS management strategies.

Artificial Intelligence (AI) and Machine Learning (ML) are also changing how we find infections. AI programs can study large amounts of information from patient records (like antenatal history), lab tests, and ultrasound scans. They can find patterns that show an infection (e.g., early signs of chorioamnionitis), guess if a patient might get sepsis after delivery or surgery, and even predict when and where disease outbreaks (like a hospital-based infection) might happen [4, 5]. For instance, AI can help study single cells to understand how they react to infection [5], potentially leading to better understanding of the maternal-fetal immune response.

New Ways to Treat and Prevent Infections

We have fewer working antibiotics, and many germs are becoming resistant. This is a serious problem when treating common OB-GYN infections. So, we urgently need new treatments and ways to prevent infections.

A main goal is to fight Antimicrobial Resistance (AMR). This means finding and making new antibiotics and different treatment plans. For difficult germs like Neisseria gonorrhoeae (which causes gonorrhoea and is becoming very resistant), research is looking at new drug combinations and completely new types of drugs [1]. This is directly relevant for managing STIs. Using antibiotics wisely (antimicrobial stewardship), for example, by following guidelines for C-section prophylaxis and being guided by quick tests, is also very important to keep current and future drugs working.
Another important area is targeting biofilms. Biofilms are communities of germs stuck together in a slimy layer. They are hard for antibiotics to kill and cause many long-lasting infections. In gynaecology, biofilms can be an issue with intrauterine devices (IUDs), vaginal meshes, or recurrent pelvic infections. They are also implicated in surgical site infections (SSIs). Future research wants to find ways to stop biofilms from forming, break them up if they do form, and help antibiotics get inside them.

Nanomedicine and smart biomaterials offer new treatment and prevention tools. Tiny particles (nanoparticles), special gels (hydrogels), and thin sheets (scaffolds) can be designed to deliver drugs right where they are needed, for instance, directly to the vagina or cervix. This makes drugs work better and reduces side effects, which is especially important during pregnancy [3]. Smart dressings for wounds are a good example, very relevant for post-Caesarean wound care. They can have tiny sensors that detect early signs of infection (like changes in wound temperature or acidity) and release medicine when needed. These dressings, which might contain natural germ-killers like honey, aim to help wounds heal better and lower SSI rates [3]. Research is also looking at printable hydrogels made with nanotechnology for custom wound care [3].

To prevent SSIs after obstetric or gynaecological surgeries, doctors also need to be careful about risk factors, give the right preventive antibiotics, and use new methods like negative pressure wound therapy on closed surgical cuts.

Challenges and Future Research Needs

The future of infection control looks good, but there are challenges. Using new technologies needs money, new equipment, and training for hospital staff. Whether these new methods are worth the cost will decide if they are used widely, especially in places with fewer resources [4]. We also need to think about ethics, like keeping patient data private and secure, especially with AI and IoT devices used in maternity care.

Future research must involve many types of experts working together, including obstetricians and gynaecologists. Important research areas relevant to the field include:

- Finding more new antibiotics safe for use in pregnancy and ways to fight biofilms on medical devices used in OB-GYN.
- Making POCT devices that are quick, accurate, and cheap for STIs, GBS, and early markers of maternal infection.
- Improving AI programs for predicting pregnancy-related infections or complications.
- Testing new smart materials (like C-section dressings) and robotic systems in real hospital settings, including maternity units.
- Finding ways to make these new technologies available to all women, everywhere, to improve maternal and neonatal health.

Conclusion

Infection control is definitely moving towards smarter, more connected, and more intelligent systems. By using new developments in testing, treatment, smart technology, and personalised medicine, obstetricians and gynaecologists can better protect their patients from infectious diseases. We need to keep researching, working together, and putting these new ideas into practice to improve maternal and child health outcomes.

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Practical Checklists & Protocols (Optional Chapter/Appendix)

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A. Antenatal Infections: Screening and Management

INFECTION	SCREENING TIME	DIAGNOSTIC TEST	MANAGEMENT	NOTES
HIV [1,2]	First trimester	ELISA, confirmed by Western blot or PCR	ART as per national guidelines	Repeat in 3rd trimester if high risk
Hepatitis B [3,4]	First trimester	HBsAg	HBIG + vaccine for newborn if mother is HBsAg+	Check maternal viral load for treatment
Syphilis [5]	First trimester	VDRL/RPR, confirm with TPHA	Benzathine Penicillin G IM	Rescreen in 3rd trimester if high risk
Rubella [6]	First trimester	Rubella IgG	No treatment; vaccinate postpartum	Avoid pregnancy f
Toxoplasmosis [7]	As indicated	IgM/IgG, PCR on amniotic fluid	Spiramycin or Pyrimethamine + Sulfadiazine	Avoid raw meat and cat litter
Group B Streptococcus (GBS) [8]	35–37 weeks	Vaginal-rectal swab	Intrapartum IV Penicillin G	Universal screening recommended

B. Common Puerperal Infections: Prevention and Care

CONDITION	RISK FACTORS	PREVENTION	TREATMENT
Puerperal Sepsis [9,10]	Prolonged labor, PROM, C-section	Aseptic delivery, timely antibiotics	Broad-spectrum IV antibiotics
Endometritis [10]	C-section, retained placenta	Antibiotic prophylaxis in C-section	Clindamycin + Gentamicin
Urinary Tract Infection [11]	Catheter use, poor hygiene	Limit catheter use, encourage fluids	Nitrofurantoin, Cephalexin

C. Sexually Transmitted Infections (STIs)

STI	SYMPTOMS	DIAGNOSIS	TREATMENT	PREGNANCY CO
Chlamydia [12]	Asymptomatic, discharge	NAAT	Azithromycin 1g PO single dose	Test of cure in pregnancy
Gonorrhea [13]	Purulent discharge	NAAT, culture	Ceftriaxone + Azithromycin	Neonatal prophylaxis
Trichomoniasis [14]	Frothy discharge	Wet mount, NAAT	Metronidazole 2g PO single dose	Avoid alcohol during treatment

D. Fungal and Opportunistic Infections

INFECTION	COMMON SCENARIO	DIAGNOSIS	TREATMENT
Candidiasis (Vaginal) [15]	Antibiotic use, diabetes	KOH prep, culture	Clotrimazole cream or Fluconazole
Tuberculosis (Genital) [16]	Infertility, pelvic pain	Endometrial biopsy, PCR	ATT (6 months standard regimen)
CMV, HSV in Pregnancy [17]	Immunocompromised or maternal primary infection	Serology, PCR	Symptomatic + neonatal management

E. Infection Control in Gynaecologic Procedures

PROCEDURE	INFECTION RISK	PROPHYLAXIS
Hysterectomy [18]	High	Cefazolin 1g IV pre-op
D&C / D&E [18]	Moderate	Doxycycline pre-op or Metronidazole
Laparoscopy [18]	Low	Aseptic precautions usually adequate

F. General Preventive Strategies [19,20]

- Educate patients on personal hygiene and STI prevention
- Encourage complete vaccination (HPV, Hep B, Rubella)
- Strict asepsis in all obstetric and surgical procedures
- Early diagnosis and management of PROM and prolonged labor
- Multidisciplinary approach in immunocompromised patients

Clinical Infection Prevention Checklist

Hand Hygiene Protocol[21]

- □ Perform hand hygiene before touching a patient
- □ Perform hand hygiene before clean/aseptic procedures
- □ Perform hand hygiene after body fluid exposure risk
- □ Perform hand hygiene after touching a patient
- □ Perform hand hygiene after touching patient surroundings

Personal Protective Equipment (PPE) Use[22]

- □ Wear gloves before contact with blood/body fluids
- □ Wear gown/apron for procedures with splash risk
- □ Wear surgical mask and goggles for aerosol-generating procedures
- □ Remove PPE in correct order: gloves → gown → mask → hand hygiene

Preoperative Protocol for Caesarean Section[23]

- □ Verify indication for surgery and obtain patient consent
- □ Ensure surgical site is clean; avoid shaving—use clippers if needed
- □ Administer prophylactic antibiotics 30–60 minutes prior to incision
- □ Prepare surgical field with antiseptic solution
- □ Perform surgical scrub and use sterile drapes/instruments

Labour and Delivery Aseptic Measures[24]

- □ Limit vaginal examinations to reduce infection risk
- □ Use clean delivery kits with sterile gloves and instruments
- □ Clean perineum with antiseptic prior to any procedure
- □ Use sterile tools for cutting and clamping the umbilical cord
- □ Ensure a clean environment for both mother and new-born

Postpartum Monitoring and Care[25]

- □ Check for fever, uterine tenderness, or abnormal discharge
- □ Inspect perineal and C-section wounds daily
- □ Educate patient on perineal hygiene and wound care
- □ Encourage ambulation and hydration to reduce infection risk
- □ Continue antibiotic course if prescribed

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Conclusion & Summary of Key Messages

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1. Why this conclusion matters

This E-Magazine set out to provide a comprehensive, practice-oriented review of infections in obstetrics and gynaecology for Indian clinicians. Across nineteen preceding chapters our contributors examined microbiology, pathophysiology, diagnostics, therapeutics, prevention, medico-legal duties and equipment. The final task is to distil the dominant themes, highlight consensus, and chart a forward-looking agenda that aligns with the World Health Organization (WHO) 2030 maternal-and-newborn targets.

2. Over-arching epidemiological insights

Domain	Salient trend	Clinical implication	Evidence
Maternal sepsis	Incidence plateauing in high-income settings but rising in low- and middle-income countries (LMICs)	Earlier recognition via obstetric early-warning charts and bundle therapy	WHO 2021 guideline[1]
Sexually transmitted infections (STIs) & pelvic inflammatory disease (PID)	Resurgence of *Chlamydia trachomatis*, *Neisseria gonorrhoeae* and syphilis; macrolide-resistant *Mycoplasma genitalium*	Dual nucleic-acid amplification testing and syndromic management	Centers for Disease Control and Prevention (CDC) 2024 update[2]
Group B Streptococcus (GBS) & early-onset neonatal sepsis	Colonisation ≥ 20 % in Indian cohorts; gaps in intrapartum antibiotic prophylaxis (IAP)	Universal culture or rapid molecular testing at 35–37 weeks or risk-based IAP	Royal College of Obstetricians & Gynaecologists (RCOG) Green-top 36 (2022)[5]

Domain	Salient trend	Clinical implication	Evidence
Viral threats	Human papillomavirus, herpes simplex virus and peripartum severe acute respiratory syndrome coronavirus 2 remain endemic; dengue outbreaks complicate pregnancy	Vaccination, triage protocols, and antenatal monitoring algorithms	International Federation of Gynecology and Obstetrics (FIGO) statements[3]
Antimicrobial resistance (AMR)	Up to 30 % extended-spectrum β-lactamase *Escherichia coli* in post-caesarean endometritis; rising azithromycin resistance	Stewardship, de-escalation, narrow-spectrum prophylaxis	Lancet global synthesis[4]

3. Cross-cutting preventive principles

1. **Pathogen-specific vaccination** – National rollout of human papillomavirus vaccine, birth-dose hepatitis B vaccine, and coronavirus disease boosters during pregnancy.
2. **Antenatal screening envelope** – Integrate human immunodeficiency virus, syphilis and hepatitis B at booking; GBS at 35–37 weeks; repeat syphilis at 28 weeks in high-incidence zones.
3. **Standardised surgical prophylaxis** – Single-dose cefazolin 30 minutes before skin incision for caesarean or myomectomy, avoiding postoperative continuation.
4. **Infection-control bundles** – Chlorhexidine skin preparation, sterile gloves for all vaginal examinations after rupture of membranes, and "five-moment" hand-hygiene audits.
5. **Early-warning systems** – Track temperature, heart rate, respiratory rate and mental status during and twenty-four hours post-delivery; trigger a "Code Sepsis" within one hour of red-flag signs.

4. Integrating diagnostics and stewardship

- Rapid molecular point-of-care testing (POCT) platforms (for example, GeneXpert®) now deliver GBS or chlamydia results in under thirty minutes, enabling real-time decisions.
- Bedside C-reactive protein helps discriminate labour-associated inflammation from true chorioamnionitis; specificity is moderate and must be paired with clinical signs.
- Culture-directed therapy remains the gold standard for late-onset or postoperative infections; microbiology liaison is essential to curb empirical broad-spectrum use.
- Antibiotic "time-outs" at forty-eight to seventy-two hours ensure de-escalation when cultures are negative or sensitivities permit narrow agents, aligning with the WHO Access–Watch–Reserve (AWaRe) classification[1].

5. Systems and equipment perspectives – the Food, Drugs and Medicosurgical Equipment Committee lens

- **Sterilisation hierarchies –** Steam autoclaves validated by Bowie–Dick tests; low-temperature hydrogen-peroxide plasma sterilisers for heat-sensitive laparoscopes.
- **Point-of-use high-level disinfection –** 0.55 % ortho-phthalaldehyde for transvaginal probes, contact time twelve minutes, followed by a sterile sheath.
- **Smart infusion pumps –** Closed-loop antibiotic infusion avoids peri-operative dosing errors.
- **Digital dashboards** – Real-time theatre air-quality and antibiotic-dispensing metrics facilitate National Accreditation Board for Hospitals audits.

6. Equity & context: Indian and LMIC realities

- **Task-sharing** – Train nurses and midwives in Active Management of the Third Stage of Labour (AMTSL), sepsis screening, and syndromic STI management to offset workforce gaps.
- **Supply-chain resilience** – Buffer stocks of first-line antibiotics, rapid tests and personal protective equipment in district warehouses mitigate festival-season shortages.
- **Community engagement** – Village health volunteers disseminate messages on tetanus toxoid, malaria Intermittent Preventive Treatment in pregnancy (IPTp) and early danger-sign referral.
- **Tele-mentoring using the Extension for Community Healthcare Outcomes (ECHO) model** – Connects peripheral centres with tertiary infection experts for case-based learning and antimicrobial guidance.

7. Special note on Genital Tuberculosis

Genital tuberculosis, a manifestation of Mycobacterium tuberculosis infection of the reproductive tract, is an under-diagnosed but significant cause of infertility and chronic pelvic pain in Indian women. Studies from tertiary centres report endometrial or tubal involvement in 3 % to 16 % of women investigated for infertility. Early detection with nucleic-acid amplification, hystero-laparoscopy when indicated, and prompt initiation of a six-month rifampicin-based regimen integrated into the National Tuberculosis Elimination Programme are critical to preventing long-term sequelae and to reducing disease transmission[1].

8. Future horizons

1. **Doxycycline post-exposure prophylaxis for STI prevention in high-risk groups**—Indian feasibility data pending, but phase-three trials show a 60 % reduction in C. trachomatis.
2. **Messenger-RNA vaccine platforms** – Trials are underway for herpes simplex virus-2 and cytomegalovirus, with possible pregnancy use by 2030.
3. **Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)-based diagnostics** – Paper-strip tests detecting Ureaplasma or human papillomavirus serotypes within fifteen minutes could transform outreach camps.
4. **One-Health AMR surveillance** – Integration of animal, environmental and human pathogen data will refine empirical obstetric antibiotic guidelines.
5. **Artificial intelligence (AI) sepsis prediction** – A pilot project in Kerala demonstrated 85 % sensitivity four hours before clinical deterioration; multicentric validation is required.

9. Ten take-home messages

No.	Message
1	Infection prevention is the cheapest, safest and most scalable intervention to reduce maternal and neonatal deaths.
2	Universal vaccination and screening save more lives than any single antibiotic.
3	Prompt recognition and one-hour antibiotic-fluid bundles cut sepsis mortality by thirty per cent.
4	Culture-directed, shortest-effective-duration therapy curbs antimicrobial resistance without sacrificing outcomes.
5	Antenatal, intrapartum and postpartum periods each have unique risk profiles—protocols must be period-specific.
6	Equipment sterility and facility hygiene are as pivotal as pharmacology.
7	Multidisciplinary teamwork—obstetrician, microbiologist, nurse and pharmacist—drives stewardship success.
8	Digital tools (molecular POCT, dashboards, AI alerts) enhance but never replace clinical vigilance.
9	Health-system strengthening and community education deliver exponential returns in LMICs.
10	Continuous professional development keeps practice aligned with evolving evidence and emerging pathogens.

10. Closing reflection

This E-Magazine began by framing infections as an age-old foe that adapts as rapidly as medicine advances. It ends with optimism: when evidence-based guidelines, context-aware implementation and relentless vigilance converge, the circle of infection can be broken. As clinicians, educators, researchers and policymakers, we each hold a spoke in that wheel. Let us keep turning it—towards safer pregnancies, healthier women, and resilient health systems.

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