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A Comprehensive Review

Urinary Tract Infections and Their Role in Disseminated Intravascular Coagulation and Miscarriages: A Narrative Review with Special Focus on Pakistan

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ABSTRACT

This narrative review synthesizes global and Pakistani evidence regarding the role of urinary tract infections (UTIs) in disseminated intravascular coagulation (DIC) and miscarriages. It explores epidemiology, pathophysiology, clinical cases, and resistance trends with particular emphasis on the Pakistani maternal health landscape. The review highlights the preventable nature of UTI-related complications and calls for strengthening antenatal screening, antimicrobial stewardship, and maternal sepsis management to reduce preventable pregnancy loss and maternal mortality.

Keywords: Urinary Tract Infections, Disseminated Intravascular Coagulation, Miscarriage, Maternal Sepsis, Pregnancy Complications, Infectious; Pakistan

Introduction

Maternal morbidity and mortality remain pressing global health issues, particularly in low- and middle-income countries (LMICs). Despite improvements in obstetric care, infections still account for a large proportion of maternal deaths worldwide, especially in South Asia and sub-Saharan Africa (1,2). Among infections, urinary tract infections (UTIs) occupy a central place because of their high prevalence, propensity to complicate pregnancy, and potential to progress to systemic illness (3,4). One of the most severe downstream complications of UTI in pregnancy is disseminated intravascular coagulation (DIC), a consumptive coagulopathy characterized by widespread activation of coagulation, microvascular thrombosis, and secondary bleeding (5,6). Another key adverse outcome linked with UTIs is miscarriage. Ascending infection, systemic inflammation, fever, and bacteremia are all mechanisms by which UTIs may precipitate early or late pregnancy loss (9,10). Globally, sepsis is among the top five causes of maternal mortality (13). In Pakistan, maternal mortality remains high, estimated at 154–186 per 100,000 live births (14,15).

National surveys identify sepsis and infection as major contributors, yet UTIs are often underdiagnosed or subsumed under other categories (14–16).

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Literature Review

Globally, asymptomatic bacteriuria (ASB) in pregnancy occurs in 2–15% of women, while symptomatic UTIs are reported in 1–10% (19). Pyelonephritis complicates 1–2% of pregnancies and is one of the leading causes of hospitalization during gestation (20,21). The most common causative organism is Escherichia coli (70–90%), followed by Klebsiella pneumoniae, Proteus mirabilis, and Enterococcus faecalis (22). Pregnancy physiology predisposes to UTIs: progesterone-mediated smooth muscle relaxation and ureteral dilatation cause urinary stasis, while glycosuria enhances bacterial growth (23,24).

Pakistan-Specific Epidemiology

Pakistan's maternal mortality ratio (MMR) is estimated at 186 per 100,000 live births. The Pakistan Maternal Mortality Survey (PMMS) 2019 shows obstetric hemorrhage (41%) and hypertensive disorders (29%) as leading causes; pregnancy-related infection (sepsis) contributes ~6% nationally (14). Prevalence of bacteriuria/UTI in pregnancy is reported as high as 14–30% in Pakistan, with E. coli predominance and widespread antimicrobial resistance (11–16).

Methods

This narrative review was conducted to examine the association between urinary tract infections (UTIs), disseminated intravascular coagulation (DIC), and miscarriages, with a special focus on the Pakistani maternal health context.A literature search was performed using electronic databases including PubMed, Google Scholar, Scopus, and PakMediNet. Articles published in English from inception to 2025 were considered. Search terms included combinations of "urinary tract infection," "asymptomatic bacteriuria," "pregnancy," "maternal sepsis," "disseminated intravascular coagulation," "miscarriage," and "Pakistan."Original research articles, systematic reviews, narrative reviews, national surveys, clinical guidelines, and relevant case reports were included if they addressed UTIs in pregnancy and associated maternal or fetal outcomes. Studies focusing on non-pregnant populations or unrelated infections were excluded. Reference lists of selected articles were manually screened to identify additional relevant studies.Data were narratively synthesized and organized into thematic domains, including epidemiology, pathophysiological mechanisms, antimicrobial resistance patterns, and clinical outcomes related to UTIs, sepsis, DIC, and miscarriage. No formal quality assessment or meta-analysis was performed, consistent with the narrative review design.

Results

The reviewed literature demonstrates that urinary tract infections (UTIs) are common during pregnancy and represent an important contributor to maternal morbidity and adverse pregnancy outcomes. Globally, the prevalence of asymptomatic bacteriuria and symptomatic UTIs in pregnancy ranges from 2% to 15%, while studies from Pakistan report a higher burden, with prevalence estimates between 14% and 30% (Table 1). Escherichia coli was consistently identified as the predominant uropathogen across regions. Antimicrobial resistance among uropathogens was widespread in Pakistani studies. High resistance rates were observed against ampicillin, co-trimoxazole, and third-generation cephalosporins, whereas nitrofurantoin and fosfomycin retained relatively good activity (Table 2). Increasing resistance trends in E. coli isolates over time were evident (Figure 1).Several case reports and observational studies documented progression from UTIs to urosepsis, disseminated intravascular coagulation (DIC), and adverse fetal outcomes, including intrauterine fetal death and miscarriage (Table 3). National survey data further indicate that sepsis remains a significant contributor to maternal mortality in Pakistan (Figure 2).

Table 1. Prevalence of UTIs in Pregnant Women: Global vs Pakistan

Region/Study	Prevalence (%)	Dominant Pathogen	Notes
Global (WHO review)	2–15	E. coli	Mostly ASB (19)
Karachi (Pakistan)	21.8	E. coli (75%)	Hospital antenatal clinic (40)
Peshawar (Pakistan)	28.4	E. coli (72%)	Community hospital (41)
Lahore (Pakistan)	14.5	E. coli (68%)	High multidrug resistance (42)
Rural Sindh (Pakistan)	18.0	Mixed	Limited lab support (14)

Table 2. Antibiotic Resistance Patterns of UTI Pathogens in Pakistan

Antibiotic	Resistance % (range)	Notes
Ampicillin	70–90	Not effective empirically (43)
Co-trimoxazole	60–75	Widespread resistance (44)
Cephalosporins	40–60	ESBL common (45)
Nitrofurantoin	5–15	Still effective (43,45)
Fosfomycin	<10	Pregnancy safe (45)

Table 3. Reported Cases of UTI ☐ Sepsis ☐ DIC in Pakistan

Source	Year	Presentation	Outcome
Lahore tertiary center	2015	UTI ☐ Sepsis ☐ DIC at delivery	Maternal
Rawalpindi case	2018	Pyelonephritis, DIC, intrauterine fetal death	Maternal
National survey	2019	Sepsis-related maternal deaths	18% urin

Figure 1. Antibiotic resistance trends in E. coli isolates from pregnant women in Pakistan (2005–2022)

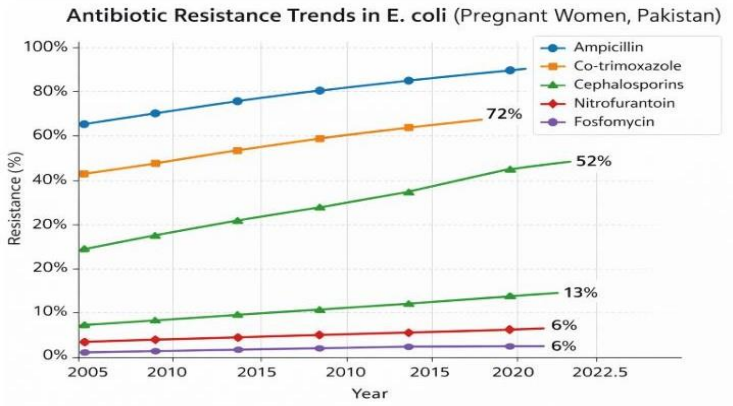
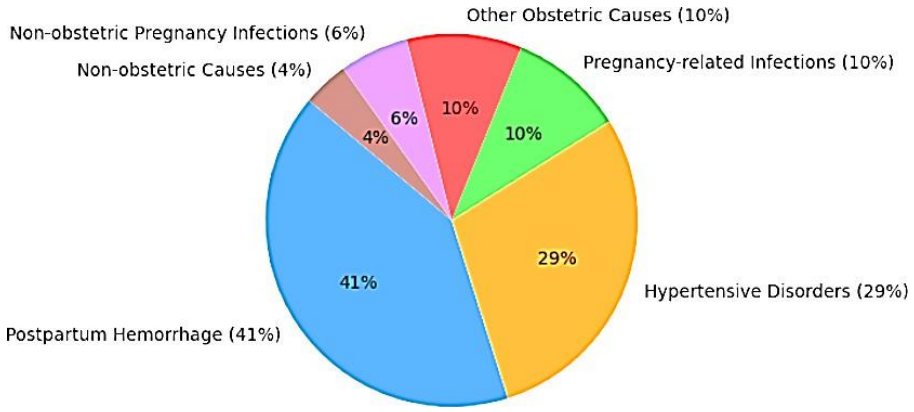


Figure 2. Causes of maternal death in Pakistan (PMMS 2019)



Distribution of causes of maternal deaths in Pakistan based on the Pakistan Maternal Mortality Survey (PMMS) 2019. Postpartum hemorrhage remains the leading cause, followed by hypertensive disorders and pregnancy-related infections, highlighting the significant contribution of preventable infectious causes to maternal mortality.

Discussion

This narrative review underscores the critical but often underappreciated role of urinary tract infections (UTIs) in precipitating severe maternal complications, including sepsis-associated disseminated intravascular coagulation (DIC) and miscarriage, particularly within low- and middle-income countries such as Pakistan. Pregnancy-related physiological changes predispose women to UTIs, and when inadequately diagnosed or treated, these infections may progress to systemic inflammation and life-threatening coagulopathies (24).The pathophysiological link between UTIs and DIC is primarily mediated through maternal sepsis. Uropathogens, especially Escherichia coli, can trigger an exaggerated inflammatory response characterized by cytokine release, endothelial injury, and activation of the coagulation cascade (25). This results in widespread microvascular thrombosis, consumption of clotting factors, and secondary hemorrhage, hallmark features of DIC. Pregnancy itself is a hypercoagulable state, further amplifying susceptibility to sepsis-induced coagulopathy (26). Several clinical reports from South Asia have documented rapid progression from pyelonephritis to septic shock and DIC during pregnancy or at delivery, often with fatal maternal or fetal outcomes (27).Miscarriage is another significant adverse outcome associated with UTIs. Ascending infection, maternal fever, endotoxemia, and placental inflammation can disrupt uteroplacental perfusion and fetal viability . Asymptomatic bacteriuria (ASB), if left untreated, has been consistently associated with increased risks of pyelonephritis, preterm labor, and pregnancy loss. In Pakistan, where routine antenatal screening for ASB is inconsistently implemented, this risk is likely magnified, particularly in rural and resource-limited settings (28).Antimicrobial resistance (AMR) further complicates the management of UTIs in pregnancy. This review highlights alarmingly high resistance rates to commonly used antibiotics such as ampicillin, co-trimoxazole, and cephalosporins in Pakistan. Delayed initiation of effective therapy due to inappropriate empiric treatment increases the risk of progression to sepsis and DIC (29). In contrast, nitrofurantoin and fosfomycin remain relatively effective and safe options during pregnancy, emphasizing the importance of local antibiograms and antimicrobial stewardship programs (30).From a public health perspective, UTI-related maternal sepsis represents a largely preventable cause of maternal morbidity and mortality. Strengthening antenatal care services to include routine screening for ASB, improving access to microbiological diagnostics, ensuring timely and appropriate antibiotic therapy, and enhancing early recognition of sepsis and coagulopathy are critical interventions. Addressing health system barriers, including delayed care-seeking, limited laboratory capacity, and inadequate referral systems, is particularly essential in Pakistan.In summary, UTIs in pregnancy should not be viewed as benign infections. Their potential to precipitate sepsis, DIC, and miscarriage necessitates heightened clinical vigilance and system-level interventions to reduce preventable maternal and fetal loss.

Limitations

This review has several limitations that should be acknowledged. First, as a narrative review, it does not employ a systematic search strategy or formal quality assessment of included studies, which may introduce selection bias and limit reproducibility. Relevant studies may have been missed despite efforts to search multiple databases and manually screen reference lists.Second, much of the available evidence linking urinary tract infections (UTIs) with disseminated intravascular coagulation (DIC) and miscarriage is derived from observational studies, case series, and case reports. These study designs limit the ability to establish causal relationships and are subject to reporting and publication bias, particularly for rare but severe outcomes such as DIC.Third, data from Pakistan are limited in quantity and heterogeneity. Many Pakistani studies are hospital-based, involve small sample sizes, and originate from urban tertiary care centers, which may not accurately reflect the true burden of UTIs, antimicrobial resistance, or pregnancy outcomes in rural and underserved populations. In addition, variations in diagnostic criteria for UTIs, sepsis, and DIC across studies may affect comparability of findings.Fourth, antimicrobial resistance patterns reported in the literature may not represent current trends, as resistance profiles can change rapidly over time and vary by region and healthcare setting. Lack of nationwide surveillance data further limits the generalizability of resistance estimates presented in this review.

Conclusion

UTIs in pregnancy are common, under-recognized drivers of severe maternal morbidity in Pakistan. They contribute to sepsis, DIC, and miscarriages. Routine screening, evidence-based antibiotic therapy tailored to local resistance, and vigilant management of sepsis/DIC can save maternal and fetal lives.

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