ORIGINAL ARTICLE
FETO-MATERNAL OUTCOMES OF MATERNAL SEPSIS: A SNAPSHOT OF THE ILLNESS

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Background: Maternal sepsis is a life-threatening condition with serious adverse feto-maternal outcomes. This descriptive cross-sectional study aimed to study the incidence of common feto-maternal outcomes of maternal sepsis in our hospital. **Methods:** Pregnant females with singleton pregnancy as per inclusion/exclusion criteria were enrolled in the study. A detailed medical history was taken and physical and obstetrical examination was done. They were investigated for the cause of their febrile illness and managed as per department protocols. Data was recorded in a pre-designed pro forma. **Results:** The most common cause of infection was UTI (32; 42.6%) followed by genital infections (20; 26.7%) and respiratory tract infections (15; 20%). In 8 (10.7%) patients, the cause couldn't be found. Only one patient developed sepsis and was admitted to the medical ICU. That pregnancy resulted in PROM and an infant with low birth weight was delivered. Both the mother and the child survived and were discharged from the hospital. There was no mortality in our study group. **Conclusion:** Though sepsis was associated with adverse feto-maternal outcomes in our study, the study design prevents us from drawing any conclusions from this study concerning maternal sepsis in our region. Further research is needed to determine the true magnitude of the problem.

Keywords: Maternal Sepsis; Septic Shock; PROM, LBW; Intra-uterine death; Abortion; Placenta previa

INTRODUCTION

Sepsis in pregnant women, otherwise known as maternal sepsis, constitutes a severe bacterial infection that can instigate an anomalous reaction to the infection, frequently resulting in organ malfunction.[1] This serious condition is a considerable global health concern due to the intensive feto-maternal morbidity and mortality it carries.

Globally, maternal sepsis substantially influences the rate of maternal mortality. As per the World Health Organization, maternal sepsis was responsible for around 11% of global maternal deaths in 2020.[2] Detailed scrutiny of data from the South Asian region, especially from developing nations like Pakistan, uncovers even more alarming statistics. In 2021, nearly 15% of maternal deaths in this region were attributable to maternal sepsis.[3]

Identification of maternal sepsis typically entails an amalgamation of clinical indications, symptomatic evidence, and laboratory test results. The Third International Consensus Definitions for Sepsis and Septic Shock has embraced the Sepsis-3 criteria, which categorizes sepsis as an organ dysfunction of life-threatening proportions, induced by infection and marked by a total Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score of two or higher.[1]

The impact of maternal sepsis extends beyond the mother, significantly affecting foetal and neonatal health outcomes. The ensuing complications frequently encompass premature birth, underweight neonates, and even neonatal death.[4] In descending order of occurrence frequency, the most frequent feto-maternal complications include preterm labour, inhibited foetal growth, intrauterine death, and neonatal sepsis.[4]

The recent advent of the Sepsis in Obstetrics Score (SOS) has improved our predictive capabilities for these adverse outcomes. A high SOS is an effective tool for identifying pregnant women at an elevated risk of severe sepsis and septic shock, thereby facilitating early intervention strategies to reduce feto-maternal complications.[5]

The objective of the academic paper is to explore the feto-maternal implications of maternal sepsis in our region, thereby contributing a valuable viewpoint to this pressing health concern in the developing world.

MATERIAL AND METHODS

This study employed a prospective, descriptive, cross-sectional research design with the objective of illuminating the feto-maternal consequences of maternal sepsis within Pakistan. The rationale behind choosing this design was to capture a present-day portrayal of the feto-maternal complications associated with maternal sepsis in a developing nation, thereby generating crucial data to guide public health policy. The study's sample size was determined based on the formula typically used for cross-sectional studies. In the absence of an accurate incidence rate of maternal sepsis in Pakistan, we conservatively estimated a prevalence of 5% for our computations, and applied the subsequent formula:

$$n = (Z^2 \times P \times Q)/d^2$$

Here, n represents the sample size, Z corresponds to the Z-score of the confidence level (for instance, 1.96 for 95%), P signifies the anticipated prevalence of the outcome, Q equals 1 - P, and d stands for the margin of error.

With this formula, and adopting a confidence level of 95% and a margin of error of 5%, we derived the sample size as follows:

$$n = (1.96^2 \times 0.05 \times 0.95)/0.05^2$$
$$n = 73.15$$

Considering the potential for drop-outs and incomplete data, we decided to augment this number by 20%, culminating in a total sample size of 88.

The study participants were recruited through convenience sampling, chosen for its practicability within our resource-limited setting. Pregnant women with fever due to any cause attending our antenatal care Out-Patient Department (OPD) were solicited for study participation. The inclusion criteria for the study were pregnant women aged 18 years or older, with a gestational period ranging from 20 to 36 weeks, who were willing to provide informed consent and who presented with a running fever of more than 38 C. To maintain the homogeneity of the study population, we excluded pregnant women with pre-existing medical conditions such as diabetes mellitus, hypertension, or renal disease, those with multiple pregnancies (for example, twins, triplets), patients with a known history of immunosuppression, pregnant women with foetal congenital anomalies, and women with a history of preterm labour, foetal growth restriction, intrauterine death, neonatal sepsis, premature birth, low birth weight, or neonatal mortality. The patients underwent further investigation and received proper management. Patients were informed about the potential need for hospitalization in case of severe infection and/or sepsis.

We collected the following data from the patients: the patient's age, the gestational period in weeks, the type of infection, and the presence of maternal sepsis. Feto-maternal complications such as preterm labour, foetal growth restriction, intrauterine death, neonatal sepsis, premature birth, low birth weight, and neonatal mortality were also documented. The diagnosis of maternal sepsis was made based on the clinical criteria defined by the Sepsis-3 definitions, which include suspected or documented infection and an acute change in total Sequential Organ Failure Assessment (SOFA) score ≥ 2 points due to the infection. The collected data were input into SPSS 25 for statistical analysis. We utilized descriptive statistics to summarize the demographic characteristics and outcomes of the study participants. We assessed the associations between the presence of sepsis and feto-maternal outcomes using the chi-square test, with a *p*-value of less than 0.05 deemed statistically significant. This research design and methodological approach enhanced the reliability and validity of the data obtained, thereby facilitating the identification of patterns, correlations, and trends between maternal sepsis and feto-maternal outcomes in the local context.

Ethical Considerations: The study adhered to ethical guidelines and principles as laid down in COPE guidelines. Ethical approval was obtained from the relevant institutional review board. Informed consent was obtained from all participants prior to their inclusion in the study. The participants' privacy and confidentiality was maintained throughout the data collection and analysis process. All data was de-identified and securely stored to protect the participants' anonymity.

RESULTS

This study involved a cohort of 88 female participants, focusing on maternal and foetal outcomes. Of the original group, 13 individuals did not complete the study due to relocation or delivery at other hospitals. This resulted in a final participant count of 75, whom we observed until the birth of their babies. Standard care was provided throughout their pregnancies, with vigilant monitoring for infection indicators, and immediate treatment administered in case of sepsis identification. Diagnosis of sepsis was carried out using the SEPSIS-3 criteria.[6] The age of participants spanned from 20 to 38 years, with a mean age of 28.4±5.8 years.

Effective management of cases of infection was accomplished through cooperation with the internal medicine department. The most frequent infection source among the 75 patients who presented with fever symptoms and signs was the urinary tract, affecting 32 (42.6%) patients. Genital tract infections and respiratory tract infections were diagnosed in 20 (26.7%) and 15 (20%) patients, respectively. The infection source remained undetermined in 8 (10.7%) patients. Among the patients diagnosed with respiratory tract infections, sepsis occurred in one case. This particular case was further complicated by premature membrane rupture prior to term. Despite these challenges, both mother and newborn survived. The neonate, born with low birth weight, required admittance to the Neonatal Intensive Care Unit for further stabilization. No other case of maternal sepsis was diagnosed in this study.

Our findings indicated a statistically significant relationship between adverse feto-maternal outcomes and the incidence of sepsis within our study population. However, it is important to note that due to the relatively small sample size, we recognize that this significant association warrants further exploration. This is crucial for gaining meaningful insights into the role maternal sepsis plays in contributing to adverse feto-maternal outcomes.

Table-1: summarizing basic details of patients (n=75)

Factor	Number	Percentage
Age	20–38 yrs.	100
BMI	27.5–30.4kg/m²	-----
Hospitalization needed	1	1.33

Table-2: Reasons for the development of sepsis

Cause of Maternal Sepsis	Number	Percentage
Urinary tract infection	32	42.6
Genital tract infection	20	26.7
Respiratory Tract Infection	15	20
Unidentified causes	8	10.7

DISCUSSION

Sepsis represents a critical health concern, characterized by an exaggerated immune response to an infection, which subsequently leads to systemic inflammation across the body. This condition is often described as a systemic inflammatory response syndrome (SIRS) that is instigated by an infection.[7] Among infections in pregnant women, pneumonia stands as the most frequent precursor to sepsis, with reproductive system infections following closely. Incidents of lung inflammation appear to be more prevalent during the birthing process, while infections associated with vaginal delivery or medical procedures often manifest more in the postnatal period.[8]

Infections due to Streptococcus species tend to evolve into septic shock at a quicker pace in comparison to those incited by other pathogens.[9] Thus, it is paramount to promptly identify and address group A streptococcal infections as a preventive measure to curb sepsis-induced maternal mortality. Postpartum women, in particular, exhibit a markedly elevated susceptibility to these infections in comparison to their non-pregnant counterparts.[10,11]

The most common cause of infection in our study was the urinary tract infection. Urinary tract infections are a common occurrence during pregnancy and a recent study from Hyderabad, Pakistan reported tested urine samples of 300 pregnant patients for bacterial growth and sensitivity. They found that 18% of the women had UTI, and the most common causative agents were Escherichia coli and Staphylococcus aureus. They also found that the UTI was more prevalent among women with low socioeconomic status, poor hygiene, and multiple pregnancies.[12] Another study from Karachi, Pakistan reported that the prevalence of asymptomatic bacteriuria in pregnant patients was 17.4% with E. coli being the predominant causative organism for asymptomatic bacteriuria.[13]

Even though urinary tract infections were the commonest cause of infection in our study, they weren't severe enough to warrant a culture & sensitivity testing since we reserved culture & sensitivity testing for patients who did not respond to initial empiric therapy, therefore we cannot comment on the probable infectious aetiology of urinary tract infections or asymptomatic bacteriuria in our study.

Sepsis occurred in a patient diagnosed with community-acquired pneumonia. Blood and respiratory secretions were sent for culture & sensitivity testing which no growth after 48 hours. The patient was started on empiric therapy but didn't respond to outpatient therapy. She was diabetic and she ended up in Medical ICU.

Maternal complications such as empyema (8%), bacteraemia (16%), and mechanical ventilation (10–20%) are more likely to occur in pregnant women who have community-acquired pneumonia.[14,15] However, the incidence of this infection is similar in pregnant and non-pregnant women.[16] Pneumonia causes respiratory failure that requires intubation in 12% of obstetric patients.[17] Other adverse outcomes of this infection during pregnancy are atrial fibrillation,

pneumothorax, and pericardial tamponade (4%).[14] The use of antibiotics has reduced the mortality rate of pregnant women with community-acquired pneumonia from 23 to <4%[14,18,19], but it is still high for those who have pre-existing cardiopulmonary disease.[14]

In our study, of the 15 patients who had respiratory tract infections, 3 patients were diagnosed as having lower respiratory tract infections, and not pneumonia, as they didn't have radiological signs of consolidation, while the rest of them had upper respiratory tract infections. The small sample size of our study and the study design does not truly reflect the prevalence of respiratory disorders during pregnancy in our region.

Lower genital tract infections in our study comprised mostly of birth-canal involvement, cultures were sent to three patients which returned negative. One patient had pelvic inflammatory disease. Although intrauterine infections have been implicated in upto 40% of cases of preterm birth[20], and bacterial involvement of amniotic fluid has been suggested as a probable cause of intrauterine infection and related consequences[21], however, a direct causative link is yet to be established[22].

To sum up, in the presence of study limitations noted below, we found that sepsis during pregnancy was associated with an adverse feto-maternal outcome. Previously published literature points towards the importance of good antenatal care in preventing adverse fetomaternal outcomes, since most infections can be treated and/or prevented with health education and counselling.

Study Limitations: This study had several limitations. First, as a cross-sectional study, it can only demonstrate associations, not causation. Secondly, convenience sampling limits the generalizability of the results. Thirdly, reliance on medical records may lead to information bias if those records are incomplete or inaccurate. Finally, cultural and social factors that might influence feto-maternal outcomes were not thoroughly examined due to the study design.

Shortcomings The use of convenience sampling might have resulted in selection bias, and the findings may not be representative of the entire population. Furthermore, potential recall bias may also have occurred if participants were unable to accurately remember or report their symptoms or treatments. The cross-sectional design also prevents us from making temporal inferences about the relationships between variables. In spite of these limitations and shortcomings, this study will provide valuable insights into the feto-maternal outcomes of maternal sepsis in a developing country setting,

thereby contributing to the evidence base and informing future research and clinical practice in this critical area.

AUTHORS' CONTRIBUTION

HJ: Conceptualization of the study design. AF, IS, SN: Write-up, data analysis, critical review, proofreading. SR, MB: Data collection, data interpretation.

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