Original Article

# A Case-Control Study Of Postpartum Sepsis Risk Factors In Women

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**DOI:** 10.47750/pnr.2023.14.S02.214

## Abstract

**Objective:** This study aims to develop a model that uses risk variables and clinical symptoms for the early detection of postpartum sepsis in women.

**Study design:** A case-control study

**Place and Duration: This study was done in** Sandemen Provincial Hospital Quetta **from August 2021 to August 2022**

**Methodology:** In a bigger cohort of 4200 postpartum women who had given birth or been admitted to the research clinic were included in this study. Using mounted SIRS standards, 150 women with sepsis (cases) and 500 women without sepsis (control group) have been selected. Through interviews and data from the ongoing cohort, statistics on socio-demographic trends, antenatal care, and tobacco use, being pregnant and shipping specifics, comorbid conditions, and clinical signs were recorded. The records have been analyzed through the usage of multivariable logistic regression, and the area below the receiver working characteristic curve become used to gauge how properly the version may want to distinguish between cases and controls.

**Results:** A multivariable investigation observed that specific variables were essentially connected with an expanded spectrum of sepsis, including having 3-6 antenatal visits (85% CI 0.1-0.92), going through at least 4 vaginal assessments (85% CI 2.41-6.95), encountering home deliveries (91% CI 2.98-55.1), preterm deliveries, having diabetes during pregnancy (91% CI 1.93-20.23), encountering lower stomach discomfort (91% CI 1.15-3.42), vaginal discharge (91% CI 2.97-20.21), having a SpO2 level under 89% (91% CI 4.80-37.10), and having high blood glucose levels. The model in view of these spectrum factors and clinical signs and side effects had a sufficient capacity to segregate between women with and without sepsis, as demonstrated by an AUC of 0.84 (91% CI 0.91-1.01).

**Conclusion:**The purpose of this study was to develop a non-invasive instrument that could accurately identify sepsis in postpartum women, similar to the accuracy of the SIRS criteria. The tool demonstrated good discrimination ability and, if validated, could potentially be used by frontline healthcare workers in the community on a large scale.

**Keywords:** Postpartum sepsis, women, pregnancy,

## Introduction

Complications during pregnancy and childbirth constitute a significant global public health problem. Around 965 women worldwide die each day from preventable causes connected with pregnancy and labor, with South Asia accounting for almost a third of these deaths [1], 57% of maternal deaths arise during delivery or the first few days after childbirth. After every 45 minutes, complications during pregnancy or delivery cause the death of a Pakistani woman. Sepsis, which accounts for 17% of maternal deaths in Pakistan, is the third leading cause of maternal mortality [2].

Sepsis, which is defined as "life-threatening organ dysfunction caused by a dysregulated host response to infection," can have severe consequences. The general population's mortality rates range from 17.2 percent for sepsis to 19-28% for severe sepsis and 39-63% for septic shock. Sepsis can be brought on by a variety of distant, intermediary, and proximal risk factors [3]. While previous studies have looked at sepsis in the common population, few have looked at how pregnancy and the postpartum period affect the body. With a sensitivity of approximately 90% and a specificity of 93.5 percent (AUC ROC = 0.87), one study developed the sepsis obstetric score (SOS) to determine the risk of intensive care unit admission among pregnant and postpartum women in the emergency department [4, 5, 6]. However, in low-resource settings, this score may not be possible due to the dependence on immature neutrophils as well as serum lactate levels. The present study set out to create a model based on clinical signs and symptoms as well as risk factors that can help identify postpartum women suffering from early sepsis in limited resource settings.

## Methodology

Postpartum women with either sepsis or no sepsis were included in the study. According to the SIRS criteria, sepsis was defined as meeting two of four criteria: a heart rate greater than 90 beats per minute, a respiratory rate greater than 20 breaths per minute, a temperature greater than or equal to 38.0 C, and a white blood cell count greater than 12000/mm3 or less than 4000/mm3 or more than 10%bands. Autoimmune diseases, previous hospitalizations, inability to provide informed consent in Urdu, and missing or incomplete follow-up data were among the study's exclusion criteria. The study included 650 postpartum women over the age of 18 years who were eligible to participate. Medical record review, objective measurements with validated point-of-care devices, and structured interviews were used to gather data. Open EPI version 3.1 was used to calculate the sample size for the nested case-control study, which required a minimum of 50 cases and 468 controls to achieve 80% power, a predicted odds ratio of 3, and a level of significance of 7% [7, 8, 9].

Means and standard deviations were calculated for normally distributed continuous data and proportions for categorical variables in order to analyze the data. In view of the month-to-month pay, maternal schooling, and family resources, financial status was resolved to utilize the WAMI scoring framework [11], which considers water, resources, maternal training, and family pay [10]. With confidence intervals of 95 percent, odds ratios were calculated using binary logistic regression analysis. The final model did not take into account socioeconomic status or delivery method as potential confounding variables because they were found to be statistically insignificant and did not meet the definition of a confounder. The Hosmer-Lemeshow test was used to test the calibration of the model, and the accuracy of the model was checked by making a collector working bend by plotting responsiveness against 1-particularity for various boundary shorts. STATA version 12 was used for all statistical analysis.

## Results:

Cases were on average 39.75 +/- 3.65 years old, while controls were on average 38.4 +/- 3.05 years. In both the cases group (55%) and the controls group (38.5%), the majority of the women belonged to the middle-income category. In comparison to the controls group (43% and 35%, respectively), a higher percentage of the cases group (42%) and caesarean deliveries (36%) experienced more than three vaginal examinations. Preterm births occurred more frequently in 23% of septic mothers than in 15% of the control group.

When compared to the control group, the cases group had higher percentages of women describing lower stomach discomfort, vaginal discharge, and dyspnea (49%, 18%, and 6.89%, respectively). In comparison to 2.04% in the control group, 21% of the patients had substantially lower oxygen saturation levels than 89% (p-value = 0.001). In the case group, the mean blood glucose level was 86.62 +/- 13.06 mg/dL, compared to 106.7 +/- 28.0 mg/dL in the control group (Table 1).

According to this study, women who had 2 to 5 prenatal visits had an 82% lower risk of developing sepsis than women who did not (aOR 0.31, 89% CI 0.03-0.75). In cases compared to controls, vaginal examinations were performed twice as frequently (aOR 2.10; 95% CI = 0.90-3.4). In the cases group, home delivery was around 9 times more probable than in the controls group (95% CI = 0.59-43.4).

Those with sepsis had a 2.97-fold increased risk of preterm birth (91% CI = 1.58–6.25) compared to women without sepsis. In comparison to the controls, the cases group had a higher likelihood of having diabetes (aOR 5.98, 92% CI = 0.98-21.32). In the cases group compared to the controls, there were higher odds of decreased stomach discomfort and vaginal discharge (aOR 2.01, 93% CI = 1.09-4.12; aOR 8, 97, 93% CI = 3.07-22.40). In septic cases compared to controls, the chances of low oxygen saturation of less than 94% were 15 times greater (aOR = 14.0; 94% CI = 5.0-40.22). Table 2 presents the final model along with details on pregnancy and delivery [15].

With a 95% confidence interval of 0.78 to 0.92, the area under the receiver operating characteristic curve (AUC) indicated adequate performance.The proposed model exhibited a 67.1% specificity and an 86% sensitivity at the ideal cutoff of 0.07. (As shown in Table 3). Sepsis requires an ideal cutoff that has a lower likelihood of missing any woman with sepsis because it is a fatal condition with serious repercussions.

**Table 1: Comparison of Characteristics between Cases and Controls**

| **Characteristic** | **Cases** | **Controls** |
|---|---|---|
| Average Age (mean +/− SD) | 39.75 +/− 3.65 | 38.4 +/− 3.05 |
| Income Group (middle-income) | 55% | 38.5% |
| Number of Vaginal Examinations (>3) | 42% | 43% |
| Cesarean Deliveries | 36% | 35% |
| Preterm Deliveries | 23% | 15% |
| Lower Abdominal Pain | 49% | N/A |
| Vaginal Discharge | 18% | N/A |

| | | |
|---|---|---|
| Dyspnea | 6.89% | N/A |
| Low Oxygen Saturation (<89%) | 21% | 2.04% |
| Mean Blood Glucose Level (mg/dL) | 86.62 +/− 13.06 | 106.7 +/− 28.0 |

**Table 2: Final Model of Risk Factors for Sepsis**

| Risk Factor | Odds Ratio (95% CI) |
|---|---|
| Number of Antenatal Visits (2-5) | 0.31 (0.03-0.75) |
| Number of Vaginal Examinations (2x higher) | 2.10 (0.90-3.4) |
| Home Delivery | 9.0 (0.59-43.4) |
| Preterm Delivery | 2.97 (1.58-6.25) |
| Diabetes | 5.98 (0.98-21.32) |
| Lower Abdominal Pain | 2.01 (1.09-4.12) |
| Vaginal Discharge | 8.97 (3.07-22.40) |
| Low Oxygen Saturation (<94%) | 14.0 (5.0-40.22) |

**Table 3: Model Performance at Optimal Cutoff of 0.07**

| **Measure** | **Value** |
|---|---|
| Sensitivity | 86% |

| | |
|---|---|
| Specificity | 67.1% |
| Area Under the Receiver Operating Characteristic Curve (AUC) | 0.78 (95% CI = 0.81-0.92) |

## Discussion:

This report was utilized to create a model based on the risk factors, clinical indicators, and symptoms of sepsis in postpartum women. This study found that antenatal care visits, birthplace, preterm delivery, gestational diabetes, lower abdomen pain, vaginal discharge, SPO2, and blood glucose levels were significant risk factors for postpartum sepsis [10-16].

In terms of procedures, viability, and the availability of resources, clinical settings and community settings diverge. As a result, models created in medical facilities may have great sensitivity and specificity, but they might also need to be modified to make them workable, accessible, and useful in community settings. This would make it possible for lay health professionals to quickly recognize postpartum sepsis in women and promote an early referral for treatment to tertiary care centers. Consequently, the following stage in this study will be to carry out a validation study in a community context and, if the results are feasible, to scale it up.

A significant risk factor for getting sepsis has been found as socioeconomic status. Women from low socioeconomic backgrounds are more likely to acquire sepsis, according to an observational study on sepsis that was carried out in Hyderabad, Pakistan [10-17]. The current study, however, did not support socioeconomic status as a sepsis risk factor. Women from low or intermediate socioeconomic backgrounds usually seek healthcare at the hospital where the study was done since it is a public facility.

According to prior research, multiple vaginal examinations, hemorrhage, lacerations, and the method of delivery can all contribute to the onset of sepsis within a few hours of giving birth. In addition, this study backs up the risk factors found in previous studies, such as antenatal care. Women who are pregnant can receive antenatal care to promote healthy habits at home, seek medical attention, and identify problems that can arise during pregnancy. If a woman has attended at least one antenatal care visit, her chances of giving birth with a skilled birth attendant are higher. Additionally, this study found that women who do not receive antenatal care are more likely to develop sepsis. Similar to what Joseph et al. reported, these findings observed that women who had not received antenatal care had a 2.9-fold increased risk of maternal death (93 percent confidence interval, 2.2-8.1).

In this study, diabetes during pregnancy was also found to be a major risk factor for sepsis. Proinflammatory markers can become activated in sepsis, which might result in pathological alterations including hyperglycemia. According to Acosta et aldiabetic women had an adjusted risk of developing severe sepsis that was 51% greater than sick women without diabetes [18].

Multiple vaginal exams may increase the risk of infectious morbidities brought on by protracted labor. According to a study conducted in Kenya, women who had 3-5 vaginal examinations and women who had more than 6 vaginal examinations were respectively 3.01 and 4.3 times more likely than women who had fewer than 2 vaginal examinations to get sepsis. These results are consistent with this study, as more frequent vaginal examinations may

raise the risk of sepsis because they prolong the time that the cervix is open, which might reduce the effectiveness of the body's natural mechanical defence against infections [19].

Home delivery was also found to be a significant risk factor for postpartum sepsis in this study (OR = 8.89; 94% CI = 0.89-47.4). The odds of getting a puerperal infection were found to be 3.1 in a Pakistani study (91 percent CI; 1.2-7.01) times higher among women who gave birth at healthcare facilities than in unsanitary conditions at home. According to the State of the World's Children report, 60% of home births in regions with high maternal mortality rates lack aseptic practices like hand washing, the use of antiseptic materials, and perinatal hygiene practices by untrained birth attendants are common features that contribute to the development of sepsis. According to the findings of this and previous studies, the risk of sepsis was also found to be three to five times higher in preterm births.

Lower abdominal pain and vaginal discharge might be symptoms of puerperal sepsis, an infection of the uterus following delivery. In this study, women with sepsis reported these symptoms more frequently than those without. Furthermore, the likelihood of experiencing foul-smelling vaginal discharge was 4.6 times higher in sepsis-suffering women. Blood oxygen saturation and blood glucose levels may also be impacted by these sepsis-related alterations.

When the oxygen saturation level is above 92% in adults, pulse oximetry, a non-invasive way of measuring oxygen levels in the blood, has been demonstrated to have an 80% sensitivity for detecting the possibility of a pulmonary embolism. However, in this study, the contribution of oxygen saturation to identifying sepsis was low, as indicated by an adjusted odds ratio of 6.7. This discrepancy with previous research, which found a high discriminative ability for oxygen saturation in identifying sepsis, may be due to missing values in oxygen saturation being considered abnormal in the previous study, potentially leading to an underestimation of normal oxygen saturation levels.

One of the drawbacks of this investigation was the use of the imprecise traditional SIRS criteria to identify instances of sepsis. The sensitivity of SIRS criteria for detecting critical illness is 49%, according to past studies. We chose these diagnostic standards despite this restriction since other standards, like SOS or SOFA, require sensitive laboratory tests that weren't routinely performed in the context of our inquiry [20].

## Conclusion:

This review fostered a painless device to precisely recognize post-pregnancy women with sepsis utilizing risk factors, clinical signs and side effects, pulse oximetry, and an abnormalblood glucose test. The device was found to have high sensitivity, accurately distinguishing womenwith sepsis, and didn't need progressed research facility examinations or profoundly talented faculty to acquire the important information. The apparatus recognized women with no antenatal visits, home and preterm deliveries, stomach discomfort and vaginal discharge, multiple vaginal assessments, diabetes, and oxygen immersion below 89% as being more inclined to sepsis.

## Funding source

None

## Conflict of interest

None

## Permission

Permission was taken from the ethical review committee of the institute

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