

## Article

# Prediction of morbidity in antenatal and postnatal women using sepsis in obstetrics score

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**Abstract: Background:** Maternal deaths predominate (99%) in low- and middle-income nations. Postpartum haemorrhage, pre-eclampsia, and puerperal sepsis are identified as the three primary factors contributing to maternal mortality in the aforementioned regions. Various diagnostic criteria are employed to identify sepsis, with one of the frequently utilised criteria being the systematic inflammatory response syndrome (SIRS). Nevertheless, these criteria necessitate laboratory investigations that may not be viable in settings with limited resources. The objective of this study was to devise a model that utilises clinical indicators and risk factors to promptly detect sepsis in postpartum females.

**Material and Methods:** This is an observational study conducted in the Department of Obstetrics and Gynaecology, Gandhi Medical College, Bhopal, after institutional ethical committee approval, from January 2021 to June 2022. All antenatal and postnatal women (within 42 days of delivery) reporting to the emergency department in the Department of Obstetrics and Gynaecology, Gandhi Medical College, Bhopal were included. All antenatal and postnatal cases meeting 2 or more SIRS criteria at admission during the study period and willing to give written consent were included in the study. Patients who did not meet the SIRS criteria were excluded.

**Results:** Out of the total included patients, 450 (1.26%) was the total burden of sepsis. Sepsis among antenatal cases was 217 out of 18085, giving a burden of 1.19%. Sepsis among puerperal cases was 233 out of 17354, giving a burden of 1.34%. Unbooked cases had a higher sepsis score of > 6. A significant association was found between maternal outcome and SOS scores. 22 cases were transferred out to other departments (for needed medical interventions) and mortalities were seen in 6 mothers in the present study. Among the mothers who died, 5 had SOS scores of more than 6. Fetal outcome: In the present study, 361 were live births, 29 were stillbirths, and 9 were IUFD.

**Conclusion:** Sepsis now causes the most preventable maternal deaths worldwide. Prioritising maternal sepsis and septic shock tool development and validation. Early sepsis screening of high-risk obstetric patients uses the SOS score. Pregnancy-associated sepsis and complications have few emergency room scoring systems. This study confirmed the SOS score's ability to distinguish severe pregnancy-associated sepsis. It may help prioritise and distribute critical care beds in low-resource countries due to high sepsis-related maternal morbidity and mortality. We strongly recommend further validation and demonstration of SOS efficacy in obstetric sepsis.

**Keywords:** Sepsis; Risk factors; Postpartum women; Lower-middle income country.

## 1. Introduction

**M**aternal sepsis is life-threatening, and its complications are major global public health issues. Sepsis is rising in developed and developing countries, posing a health risk. The World Health Organisation (WHO) estimates that 15% of the 500,000 maternal deaths per year are due to puerperal sepsis, the third leading cause of maternal mortality [1]. 60% of childbirth deaths occur during delivery and postpartum [2]. 4.4% of mothers worldwide develop sepsis. Despite the lack of data from low- and low-middle-income

countries like India, sepsis kills one in ten mothers. Obstetric haemorrhage (47%; higher in poorer states), pregnancy-related infection (12%), and hypertensive disorders of pregnancy (7%) were the leading causes of maternal mortality in India in 2021 [3]. India's second-leading cause of obstetric mortality is infection. International Consensus defines sepsis as "life-threatening organ dysfunction caused by a dysregulated host response to infection" [4]. Maternal sepsis is a life-threatening infection that causes organ dysfunction during pregnancy, childbirth, post-abortion, or postpartum, from rupture of membranes or labour to the 42nd day postpartum [5]. Proximal risk factors, which can cause sepsis within hours, are crucial for identifying high-risk women [6]. Pregnancy's immunological changes may impair the mother's ability to fight infections. The physiological changes of typical pregnancy may mimic those of sepsis, delaying diagnosis. Streptococci, staphylococci, Escherichia coli (E. coli), clostridium tetani, clostridium welchii, chlamydia, and gonococci cause puerperal sepsis. Endogenous, exogenous, or nosocomial bacteria can also be involved. Fever, chills, lower abdominal pain, suboptimal uterine involution, purulent and malodorous lochia, mild vaginal bleeding, and shock are the presenting features [5]. The perineum, vagina, cervix, or uterus may be the site of infection. In extreme cases, the infection may spread from the uterus to the ovaries, fallopian tubes, pelvic cellular tissue, pelvic peritoneum, and bloodstream, causing parametritis, peritonitis, and septicemia. Puerperal sepsis can cause infertility and pelvic inflammatory disease [5]. Effective sepsis management relies on support, early detection, minimizing complications, and improving the quality of life. The Sepsis in Obstetrics score (SOS) is one of the scoring systems to predict sepsis early. Albright et al. developed it for triaging patients with sepsis in pregnancy. It predicts critical care admission for pregnant and postpartum women with sepsis.

The score includes various clinical parameters and laboratory parameters.

Variable	High abnormal range				Normal	Low abnormal range			
	+4	+3	+2	+1		+1	+2	+3	+4
Score					0				
Temperature (°C)	>40.9	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	<30
SBP (mmHg)					>90		70-90		<70
Heart rate (bpm)	>179	150-179	130-149	120-129	≤119				
Respiratory rate (bpm)	>49	35-49		25-34	12-24	10-11	6-9		≤5
SpO <sub>2</sub> (%)					≥92%	90-91%		85-89%	<85%
WBC (10 <sup>3</sup> /mm <sup>3</sup> )	>39.9		25-39.9	17-24.9	5.7-16.9	3-5.6	1-2.9		<1
% immature neutrophils			≥10%		<10%				
Lactate (mmol/l)*			≥4		<4				

\*Venous samples.

Figure 1. Sepsis in obstetrics score [7]

In the original study, an SOS (maximum score 28) had an area under the curve of 0.92 (sensitivity 88.9%, specificity 99.2%, positive predictive value 16.7%, negative predictive value 99.9%) for critical care admission [7]. It had a positive predictive value. By 2030, the UN's Sustainable Development Goals (SDGs) aim to reduce maternal mortality to 70 deaths per 100,000 live births [8]. It's crucial to measure maternal mortality rates and understand the subnational factors that cause them. India, like other resource-strained countries with high maternal mortality, records a small percentage of births, deaths, and other significant events [9,10]. Given its many comorbidities, economic burden, and financial costs, maternal sepsis's rising incidence over the last decade is concerning. Few retrospective studies have examined SOS implementation in affluent contexts [11]. Annually, our Obstetrics and Gynecology department facilitates the delivery of approximately 2500 pregnancies, encompassing both high-risk and low-risk cases. As a hospital specializing in tertiary care, our institution possesses the necessary resources such as blood bank facilities, high dependency units, and intensive care units. Our medical facility possesses a specialized high dependency unit that is exclusively designated for managing obstetric cases. Over the course of a year, we have conducted an audit of maternal sepsis cases. This is due to the fact that we receive a significant number of referrals from both internal and neighboring regions and possess the necessary resources to effectively manage them. The objective of this study was to determine the burden of sepsis in antenatal and postnatal women, studying the association between sepsis in obstetric score and the severity of morbidity, as well as the risk factors associated with sepsis.

## 2. Material and methods

The present observational study was conducted in the Department of Obstetrics and Gynaecology, Gandhi Medical College, Bhopal. After approval from the institutional ethical committee for a period of 18 months from January 2021 to June 2022. All antenatal and postnatal women (within 42 days of delivery) reporting to the emergency department in the Department of Obstetrics and Gynaecology, Gandhi Medical College, Bhopal, were included in this study. All antenatal and postnatal cases fulfilling 2 or more SIRS criteria at the time of admission during the study period and ready to give written consent were included in the study. Patients who do not fit into the SIRS criteria or are not ready to give consent were excluded. The patients were provided with the study information sheet and consent form and were explained about the relevant details about the study in a language best understood by them. Informed written consent was obtained after explaining the purpose, nature, and process of the study, and then data collection was started. All antenatal and postnatal women (within 42 days of delivery) reporting to the ED will be screened using SIRS criteria at the time of admission.

### 3. The SIRS criteria include following parameters

1. Mean arterial blood pressure < 65 mmHg
2. Systolic blood pressure < 90 mmHg
3. Heart rate  $\geq$  110/min
4. Respiratory rate  $\geq$  22/min
5. Temperature  $\geq$  38°C or  $\leq$  36°C
6. Leucocyte counts  $\geq$  14000/mm<sup>3</sup> or  $\leq$  4000/mm<sup>3</sup>

Patients meeting more than 2 of the above criteria were enrolled in the study. Demographic profile, detailed history, risk factors, physical and obstetrics examination were noted in a preformed proforma. Investigations including haemoglobin level, total WBC count, % of immature neutrophils, and venous lactic acid. Each case was evaluated in terms of management, ICU admission, duration of Hospital stay, any complication, and further maternal outcome of antenatal and puerperal patients. Maternal and fetal monitoring was performed according to standard guidelines. Maternal and fetal outcome in terms of morbidity and mortality were noted.

## 4. Results

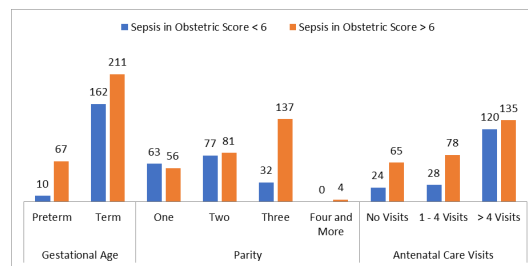
The present study was a prospective study entitled "Prediction of Morbidity in Antenatal and Postnatal Women Using 'Sepsis in Obstetrics Score'," which was carried out in the Department of Obstetrics and Gynaecology, Gandhi Medical College, Bhopal. The study encompassed antenatal and postnatal cases that satisfied a minimum of two SIRS criteria upon admission. The statistical analysis was conducted with the aims and objectives in consideration. The findings derived from the investigation are delineated as follows:

**Table 1.** Burden of sepsis in patients included in study as per inclusion criteria

1	Total obstetric patients admitted in the institute	43,142
2	Total cases of sepsis	450
3	Total sepsis burden	1.04%
4	Patients included in study as per inclusion criteria	35,439
5	Burden of sepsis in patients included in study as per inclusion criteria	1.26%
6	Total ANC cases	18085
7	Sepsis among ANC	217
8	Burden of sepsis in ANC	1.19%
9	Total Puerperal cases	17354
10	Sepsis among Puerperal cases	233
11	Burden of sepsis in Puerperal cases	1.34%

Table 1 indicates that a total of 35,439 patients were included in the study based on the established criteria for enrollment. The total burden of sepsis was observed in 450 patients, representing 1.26% of the population

under study. The study found that sepsis burden was observed in 1.19% of antenatal cases and 1.34% of puerperal cases.



**Figure 2.** Distribution of patients according to Risk factors (Antepartum Period)

Table 2 explains distribution of patients according to Risk factors (Ante-partum Period). It was found that patients with preterm, higher parity (four or more) and > 4 ANC visits were associated with a higher sepsis score (> 6), and it was found to be statistically significant. It was found that patients with more number of PV examination (> 3), PROM, Rupture of membrane (> 24 hours), Prolonged Labour (> 12 hours) and presence of chorioamnionitis were more associated with the > 6 sepsis score and it was found to be statistically significant. It was found that patients with bad breast conditions were more associated with the > 6 sepsis score. Although no statistical significance was found.

**Table 3.** Distribution of patients according to Clinical Features

Clinical Features	Frequency	Column N %
Fever	241	53.6%
Abdominal Pain	89	19.8%
Dyspnoea	59	13.1%
Abdominal Distention	49	10.9%
Wound Infection	118	26.2%
Wound Gap	37	8.2%
Foul smelling Vaginal Discharge	75	16.7%
MODS	24	5.3%

Table 3 provides an overview of the distribution of patients based on their clinical features. The study revealed that fever was the predominant clinical manifestation, accounting for 241 cases (53.6%), while wound infection was the second most frequently observed symptom, with 118 cases (26.2%). The study also revealed that a significant proportion of the participants experienced various symptoms, including but not limited to abdominal pain, abnormal vaginal discharge, dyspnoea, abdominal distension, wound gap, and MODS. Specifically, 89 (19.8%), 75 (16.7%), 59 (13.1%), 49 (10.9%), 37 (8.2%), and 24 (5.3%) individuals reported experiencing these symptoms, respectively.

**Table 4.** Distribution of patients according to maternal and foetal outcome

Particular	Sub-particular	Sepsis in obstetric score				Tot al	%	Chi square value	p-Value
		<6		>6					
		N	%	N	%				
Normal Vaginal Delivery	Preterm	6	4.9 %	49	24.3%	55	16.9 %	20.422	.000*
	Full Term	117	95.1 %	153	75.7 %	270	83.1%		
LSCS	Preterm	4	8.2 %	18	23.7 %	22	17.6%	4.949	.026*
	Full term	45	91.8 %	58	76.3 %	103	82.4%		
Maternal outcome	Discharged	168	97.70%	254	91.4%	422	93.7%	7.263	0.02*
	Mortality	1	0.60%	5	1.8%	6	1.33%		
	Transferred out	3	1.70%	19	6.80%	22	4.89%		
Foetal outcome	Live birth	146	84.90%	21		LB	146	84.90%	21
	Still birth	8	4.70%	21	7.60	SB	8	4.70%	21
	IUFD	0	0.00%	9	3.20	IUFD	0	0.00%	9

Table 2. Distribution of patients according to risk factors

Particular	Sub-particular	Sepsis in Obstetric Score				Chi square value	p Value
		<6		>6			
		N (172)	% (38.2%)	N (278)	% (61.8 %)		
Cases	ANC	79	45.9%	138	49.6%		
	Puerperal Cases	93	54.1%	140	50.4%		
Sepsis in obstetric score	Mean±SD	8.7±3.9					
Age Group in years	18 - 25	81	47.1%	112	40.3%	3.790	.285
	26 - 30	43	25.0%	73	26.3%		
	31- 35	23	13.4%	55	19.8%		
	>35 years	25	14.5%	38	13.7%		
Bookin g Status	Registered	102	59.3%	170	61.2%	16.712	.000*
	Booked	67	39.0%	77	27.7%		
	Unbooked	3	1.7%	31	11.2%		
Socio Econo mic Status	Upper Class	7	4.1%	17	6.1%	2.718	.606
	Upper Middle Class	18	10.5%	39	14.0%		
	Lower Middle Class	38	22.1%	64	23.0%		
	Upper Lower Class	87	50.6%	127	45.7%		
	Lower Class	22	12.8%	31	11.2%		
Ante-partum Period							
Gestatio nal Age	Preterm	10	13.00%	67	87.00%	25.053	.000*
	Term	162	43.40%	211	56.60%		
Parity	One	63	52.90%	56	47.10%	47.412	.000*
	Two	77	48.70%	81	51.30%		
	Three	32	18.90%	137	81.10%		
	geq four	0	0.00%	4	100.00%		
Antenat al Care Visits	No Visits	24	27.00%	65	73.00%	19.466	.000*
	1 –4Visits	28	26.40%	78	73.60%		
	>4 Visits	120	47.10%	135	52.90%		
Intra-partum Period							
Number of PV examination	>3	30	16.60%	151	83.40%	60.091	.000*
	1-3	142	52.80%	127	47.20%		
PROM	Yes	20	23.50%	65	76.50%	9.581	.002*
	No	152	41.60%	213	58.40%		
ROM	<24 hour	170	39.40%	261	60.60%	6.444	.011*
	>24 hour	2	10.50%	17	89.50%		
Prolonged labour	>12 hour	15	21.10%	56	78.90%	10.434	.001*
	<12 hour	157	41.4%	222	58.60%		
Chorioamnionitis	Yes	10	27.0%	27	73.00%	2.14	0.144
	No	162	39.2%	251	60.80%		
Complicating pregnancy							
HDP	Yes	4	10.30%	35	89.70%	14.43	.000*
	No	168	40.90%	243	59.10%		
GDM	Yes	6	10.90%	49	89.10 %	19.796	.000*
	No	166	42.00%	229	58.00 %		
Respiratory infections	Yes	6	14.30%	36	85.70 %	11.24	.001*
	No	166	40.70%	242	59.30 %		
UTI	Yes	5	13.90%	31	86.10%	9.812	.002*
	No	167	40.30%	247	59.70%		
Anaemia	Yes	35	31.50%	76	68.50%	2.793	0.09
	No	137	40.40%	202	59.60%		
Place of delivery	Hospital	157	39.2%	243	60.8%	1.610	0.204
	Home	15	30.0%	35	70.0%		
Prolonged hospital stay	<10 days	116	44.30%	146	55.70%	9.729	.002*
	>10 days	56	29.80%	132	70.20%		
Genital infections	ANC	4	14.3%	24	85.7%	1.116	.291
	Puerperal Cases	6	26.1%	17	73.9%		
Mastitis	Yes	3	25.00	9	75.00%	0.931	0.334
	No	169	38.60	269	61.40%		
Breast abscess	Yes	4	40.00	6	60.00%	0.014	0.917
	No	168	38.20	272	61.80%		
Oro-dental Hygiene	Good	156	38.2%	252	61.8%	0.000	0.986
	Poor	16	38.1%	26	61.9%		

Table 4 illustrates the distribution of patients based on maternal outcomes. The study revealed a significant correlation between the sepsis score and preterm normal vaginal deliveries as well as preterm lower segment caesarean sections among patients. The study revealed that there was a significant correlation between the sepsis score and maternal outcome, specifically mortality and transfer out. 6. Categorization of patients based on fetal outcome. A significant correlation was observed between intrauterine fetal demise (IUID) and a sepsis score greater than 6.

**Table 5.** Distribution of patients with severe maternal morbidity

Severe Maternal Morbidity	Frequency	<6		>6	
		N	%	N	%
Hypertensive Disorder of Pregnancy					
1. Severe Pre Eclampsia	38	1	3%	37	97%
2. Eclampsia	12	2	17%	10	83%
3. HELLP syndrome	20	3	15%	17	85%
Acute Renal Failure	5	0	0%	5	100%
Puerperal Sepsis	153	29	19%	124	81%
Respiratory Infections					
1. ARDS	11	1	9%	10	91%
2. Pneumonia	15	4	27%	11	73%
3. Pulmonary oedema	16	1	6%	15	94%
ICU admission	80	7	9%	73	91%
Surgical complication prolonged ileus >= 4 days	18	12	67%	6	33%
Not severe maternal morbidity					
Chronic hypertension/gestation hypertension	39	4	10%	35	90%
Fever >38.5oF with elevate lactate level alone without hypotension	24	6	25%	18	75%
Fever >38.5oF with Chorioamnionitis with tachycardia with normal lactate level	7		29%	5	71%
ICU admission for observation after general Anaesthesia	62	22	35%	40	65%
Surgical Complication prolonged ileus <3 days	31	21	68%	10	32%

Table 5 provides an overview of the distribution of patients who have experienced severe maternal morbidity. The study revealed that 38 patients were diagnosed with severe pre-eclampsia, 12 with eclampsia, 20 with HELLP syndrome, 5 with acute renal failure, 153 with puerperal sepsis, 11 with acute respiratory distress syndrome, 15 with pneumonia, 16 with pulmonary edema, 80 were admitted to the intensive care unit, and 18 experienced prolonged ileus.

It also shows the distribution of patients who have experienced maternal morbidity that is not classified as severe. The study revealed that 39 patients exhibited Chronic Hypertension. Additionally, 24 patients presented with Fever exceeding 38.5°F and elevated lactate levels without hypotension, while 7 patients showed Fever exceeding 38.5°F with Chorioamnionitis accompanied by tachycardia and normal lactate levels. Moreover, 62 patients were admitted to the ICU for observation following general anesthesia, and 31 patients experienced Surgical Complication Prolonged Ileus lasting less than 3 days.

## 5. Discussion

The present study is an observational study titled "Prediction of Morbidity in Antenatal and Postnatal Women Using the 'Sepsis in Obstetrics Score'," conducted in the Department of Obstetrics and Gynecology, Gandhi Medical College, Bhopal. The study includes all antenatal and postnatal women who have met the inclusion criteria. Keeping in mind the aims and objectives, statistical analysis was carried out.

Sepsis is a major health issue with a high mortality rate. However, due to the lack of information on incidence, epidemiology, and outcomes in the obstetric population, particularly in low-resource countries, it is difficult to compare and estimate the burden.

The current study included 35,439 individuals, 450 of whom were diagnosed with sepsis, resulting in a burden of sepsis 1.04%. 1.19% of 18,085 antenatal care (ANC) cases had sepsis. Sepsis occurred in 233 of 17,354 puerperal cases, a burden of 1.34%. Illness scoring systems may help assess risk and prognosis. Clinically validated sickness grading systems like APACHE, SAPS, and SOFA are available. However, their main use is predicting ICU mortality, and they are not updated as per physiological changes in pregnancy. Due to high obstetric sepsis rates and limited critical care, low-resource nations face unique challenges. Thus, it's crucial to wisely use health resources. Emergency clinicians face a major challenge in triaging pregnant patients



with sepsis for critical care unit admission. The Sepsis in Obstetrics Score assesses sepsis during pregnancy. The update followed pregnancy's physiological changes. The scoring system gave greater weight to extreme values, whether high or low, while 0 was considered normal. Among 217 antenatal cases, 138 had SOS scores greater than 6, and 79 had scores less than 6. 140 puerperal cases had SOS scores greater than 6, while 93 had scores less than 6. Participants' mean age was  $27.8 \pm 6.6$  years.

Agrawal et al. [7] found that 9% of 100 women with pregnancy-associated sepsis had abortions, 24% were antepartum, and 67% were postpartum. 52 cases had an SOS below 6, while 48 had an SOS above 6. 83.3% (40/58) of severe sepsis patients had SOS scores of 6.

Drezo et al. [12] found that 732 of 767 antenatal care (ANC) cases scored less than 6 on the Systemic Inflammatory Response Syndrome (SOS) scale, while 35 scored more than 6. 70 of the 83 post-partum cases had SOS scores below 6, while 13 had scores above 6. The majority of study participants with an SOS score greater than 6 were aged 18–25 (40.3%), followed by 26–30 (26.3%), 31–35 (19.8%), and 35+ (13.7%). Agrawal et al. [7] found that most female participants were between 20 and 29 years old, with a mean age of  $26.0 \pm 4.6$  years. Drezo et al. [12] found that 802 of 859 sepsis cases had an SOS score of less than 6, while 48 had a score of 6 or higher. The study found a significant correlation. Balki et al. [13] found that parturient women 35 years of age and older were more likely to develop severe sepsis than non-severe sepsis. Unscheduled appointments and unmonitored deliveries cause maternal sepsis. 31 of 34 unbooked cases had SOS scores above 6, while 3 had SOS scores below 3. Booking status was statistically correlated with SOS scores.

Bakhtawar et al. [14] found that 79 of 100 sepsis cases were booked, and 21 were unbooked. Socioeconomic status is a known risk factor for sepsis. The study found that 23% of participants were lower middle class, and 48% were upper middle class. 191 cases from lower socioeconomic backgrounds had an SOS score greater than 6, but there was no statistically significant correlation. The current study does not support the idea that socioeconomic status is a risk factor for sepsis. Lower-socioeconomic obstetric patients may be unable to access adequate healthcare due to financial constraints. Poor nutrition and immunity may also make them vulnerable. A tertiary public hospital that treats low- and middle-income women conducted this study.

Bakhtawar et al. [14] found that 40% of obstetric sepsis patients were middle-class. Risk factors increase the probability of an outcome or event. These factors can be biological, behavioral, environmental, or social. Risk factors are crucial to developing effective prevention and intervention strategies. The current study found a statistically significant relationship between SOS scores and gestational age, parity, and antenatal visits. 17% ( $n = 77$ ) of patients delivered prematurely in this study. The study found that 158 patients had parity two, 169 had parity three, and 10 had parity four or more. 67 had SOS scores of 6 or higher, while 10 had scores of less than 6. Compared to lower parity cases, more cases with more pregnancies had sonographic ovarian scores (SOS) over 6.

In a study by Balki et al. [13], women who were hospitalized for their first delivery (OR-2) and their fifth delivery or more (OR-1.6) were more likely to develop sepsis than women with a parity of two or three. Frequent antenatal appointments promote home hygiene, health-seeking, early pregnancy complications, and risk factor detection. Visits also educate expectant mothers. Women who have one to four antenatal visits are more likely to deliver in a hospital and less likely to develop sepsis. 89 people did not receive antenatal care, and 106 received fewer than four visits. 65 of the 89 women who did not attend antenatal care had a systemic organ dysfunction (SOD) score greater than 6, while 24 had a score less than 6. Among 106 cases with fewer than four antenatal care (ANC) visits, 78 had a Systemic Obstetric Scoring (SOS) value greater than six, and 28 had a score less than six. This study shows that women without antenatal care are more likely to develop sepsis. Bakhtawar et al. [14] found that women with sepsis were 75% less likely to have 1-4 antenatal visits than those without sepsis (OR 0.25).

Intrapartum risk factors include repetitive vaginal examinations, which can lead to infectious morbidities from prolonged labor. The current study found a statistically significant association between the severity of illness scores and the number of vaginal examinations, premature rupture of membranes, and prolonged labor. These factors may increase the risk of puerperal sepsis. 151 of 181 cases with more than three vaginal examinations had an SOS score greater than 6. Based on the results, more than four vaginal examinations may increase the risk of sepsis due to the prolonged dilated cervix, which hinders mechanical infection defense. Bakhtawar et al. [14] found that women who have more vaginal exams are twice as likely to develop sepsis.

The current study included 85 cases of premature rupture of membranes (PROM), 19 of which lasted more than 24 hours. The incidence of premature rupture of membranes (PROM) and subsequent rupture lasting

longer than 24 hours is high. During the observation period of 24 hours, 65 and 17 cases had SOS scores exceeding 6. This is due to the prolonged exposure of internal components due to the removal of natural protective barriers like the membrane and the prolonged dilation of the cervix, which facilitates the ascension of internal components.

In their study, Balki et al. [13] found that women with chorioamnionitis had a seven-fold increased risk of sepsis. Of the 37 cases, 27 had an SOS score greater than 6, and 10 had a score less than 6. Demisse et al. [15] found that mothers with ruptured membranes for more than 24 hours had a 3.7-fold higher risk of puerperal sepsis than those with amniotic fluid leakage 24 hours or less before delivery.

Medical and obstetric conditions that can cause pregnancy complications: hypertensive disorders of pregnancy (HDP), gestational diabetes mellitus (GDM), respiratory infections, urinary tract infections (UTI), and anaemia were significantly associated with SOS assessment tool scores. 39 cases had hypertensive disorders of pregnancy (HDP), 55 cases had gestational diabetes mellitus (GDM), 42 cases had respiratory infections, 36 cases had urinary tract infections (UTI), and 111 cases had anaemia. A significant number of cases with maternal disorders had a systemic inflammatory response syndrome (SIRS) score greater than 6. After adjusting for confounding factors, diabetic women had a 47% higher risk of developing severe sepsis [16]. Numerous studies have shown a significant correlation between the inflammatory process of sepsis and pre-eclampsia [16]. Chronic hypertension was also found to be a risk factor for sepsis.

The current study examined 400 hospital deliveries and 50 home deliveries. Unsanitary home deliveries have been linked to postpartum sepsis. 35 of the 50 home-delivered cases had a Systemic Organ Failure Score (SOS) greater than 6, while 15 had an SOS less than 6. 188 study participants had extended hospital stays. 132 had SOS scores above 6, while 56 had scores below 6. According to Bakhtawar et al. [14], home deliveries had a nine-fold higher risk of sepsis than hospital deliveries due to untrained birth attendants' lack of aseptic measures like hand hygiene, antiseptic use, and perinatal hygiene.

Fikree et al. [17] found that women who gave birth at home had a 2.7-fold (95% CI: 1.1-6.2) higher risk of puerperal infection than those who gave birth in hospitals.

Sexually transmitted infections (STIs) can affect the reproductive organs, including the penis, vagina, cervix, uterus, fallopian tubes, and ovaries. The current study found genital infections in 28 antenatal and 23 postpartum cases. 24 of the 28 antenatal patients with genital infections had systemic inflammatory response syndrome (SIRS) scores greater than 6. 17 of the 23 postpartum genital infections had SIRS scores greater than 6, while 6 had SIRS scores less than 6. Genital infections include bacterial infections, trichomoniasis, and candidiasis. Bacterial vaginitis in pregnant women increases the risk of adverse outcomes such as preterm labor and delivery, premature rupture of membranes, chorioamnionitis, and post-caesarean endometritis.

Postpartum breast conditions: 12 women had mastitis, and 10 had breast abscesses. The study found a significant correlation between poor breast health and a sepsis score over six.

The current study found 42 cases of poor oral hygiene, including dental caries, swollen gums, cracked, broken, or stained teeth, and bad breath. These conditions are risk factors for sepsis.

The current study found that fever was the most common clinical manifestation, accounting for 53.6% (n = 241) of cases, while wound infection was the second most common. Abdominal pain, abnormal vaginal discharge, dyspnea, abdominal distension, wound gap (lower segment cesarean section and episiotomy), and multiple organ dysfunction syndrome (MODS) were common symptoms in the study. Specifically, 89 (19.8%) participants reported abdominal pain, 75 (16.7%) reported abnormal vaginal discharge, 59 (13.1%) reported dyspnea, 49 (10.9%) reported abdominal.

According to Roopa et al. [18], antenatal sepsis was associated with a twofold increase in caesarean deliveries. The systemic oxygen saturation (SOS) test scores correlated with delivery method. The risk of caesarean delivery increases with antepartum sepsis (2.6-fold) and postpartum sepsis (3.2-fold). Balki et al. [13] found that Caesarean (OR, 2.8) and instrumental vaginal deliveries (OR, 1.9) were more likely to cause severe sepsis than assisted vaginal deliveries.

Demisse et al. [15] found that caesarean-delivery mothers are 3.9 times more likely to develop puerperal sepsis than spontaneous vaginal-delivery mothers. The study found a significant correlation between maternal outcomes and SOS scores. 22 cases were transferred to other departments for medical treatment, and six mothers died in this study. Five deceased mothers had SOS scores above 6. Balki et al. [13] found a 0.5% mortality rate in women with obstetric sepsis. The current study analyses maternal morbidity, specifically severe and non-severe morbidity as defined by the World Health Organisation (WHO) [15]. The study found



38 patients with severe pre-eclampsia, 12 with eclampsia, 20 with HELLP syndrome, 5 with acute renal failure, 153 with puerperal sepsis, and 11 with acute respiratory distress. Most of these cases had SOS scores over 6.

39 severely morbid patients had chronic hypertension. 24 patients had elevated lactate levels and a fever over 38.5 oF without hypotension, while 7 had chorioamnionitis with tachycardia and normal lactate. 62 patients needed ICU observation after general anaesthesia, and several had surgical complications like prolonged ileus lasting less than 3 days (14). These complications were most common in SOS scores over 6. Agrawal et al.[7] found that 35% of pregnant women with severe sepsis had pulmonary involvement, followed by hepatobiliary, renal, cardiovascular, and nervous system involvement. 23 cases had single organ failure, 12 had two, and 23 had three. 40 of 60 women with organ failure had Sinusoidal Obstruction Syndrome (SOS) scores greater than 6, while 18 had scores less than 6. Organ failure and SOS scores correlated statistically. Drezo et al. [12] found that patients with an S.O.S. of 6 presented with pyelonephritis (25%), ILI (25%), and endometritis (10.4%). Conversely, those with S.O.S. scores below 6 had a higher rate of influenza-like illness (62.6%) and non-respiratory viral syndrome. Postpartum haemorrhage, preeclampsia, and chorioamnionitis increased the risk of severe sepsis, according to Balki et al. The research shows that valvular heart disease, respiratory disease, chronic renal disease, gastrointestinal disease, and anaemia increase the risk of severe sepsis. The investigation found 361 live births, 29 stillbirths, and 9 intrauterine foetal deaths. 21 stillbirths had Systemic Oxygenation Scores (SOS) greater than 6, while 8 had SOS scores less than 6. IUFD was associated with SOS scores greater than 6 in all cases. Balki et al. [13] found that stillbirths had a higher odds of severe sepsis (OR, 6.6) than non-severe cases.

## 6. Conclusion

Sepsis is emerging as a prominent and avoidable contributor to maternal mortality on a global scale. The prioritization of developing and validating tools that enable timely identification and uniform screening protocols for maternal sepsis and septic shock is crucial. Therefore, the SOS score represents a scoring mechanism utilised for the timely identification of high-risk obstetric patients who may be susceptible to sepsis. Currently, there is a limited number of scoring systems available for the purpose of triaging patients with pregnancy-associated sepsis, along with its associated complications, in emergency departments. The current investigation has reinforced the assertion that the SOS score possesses robust diagnostic capabilities in discriminating between pregnancy-related sepsis of severe and non-severe nature. Considering the severe impact of sepsis-related maternal morbidity and mortality in low-resource countries, it could prove advantageous to allocate and distribute critical care beds in a prioritized manner. Nevertheless, it is highly advisable to conduct further validation and demonstration of the effectiveness of SOS in cases of obstetric sepsis.

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