

# Maternal Sepsis in Intensive Care Unit at Omdurman New Hospital-Tertiary Obstetric Facility, Khartoum-Sudan

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## Abstract

**Introduction:** Severe sepsis and septic shock contributes to maternal morbidity and mortality. The etiology of severe sepsis and septic shock during pregnancy and postpartum result from obstetric related or non-obstetric related conditions. **Objectives:** It aimed to determine rate, characters, morbidity and mortality of septic obstetric cases at Omdurman New Hospital. **Methods:** It was a descriptive, prospective, analytic, cross-sectional hospital based total coverage study; conducted at Omdurman New Hospital (ONH), Khartoum-Sudan. **Results:** Severe sepsis and septic shock rate 1.16 (13/1124 = 1.16%) of hospital pregnancy complication admission. Hyperthermia, Tachycardia and hypotension are the main presenting clinical findings and uterine infection is the main focus of sepsis. The mean average Intensive Care Unit (ICU) stay is 6.3-day. Organs dysfunctions are the main morbidity and mortality is reported in five cases. **Conclusion:** Severe sepsis and septic shock contributes in maternal morbidity and mortality. Safe obstetric care prevents maternal sepsis and improves the outcome. Management of severe sepsis and septic shock remains a challenge in obstetric medicine.

## Keywords

Sever Sepsis, Septic Shock, Maternal Morbidity and Maternal Mortality

## 1. Background

The *systemic inflammatory response syndrome* (SIRS) describes a generalized inflammatory response of the host to a variety of insults. During a consensus conference conducted by the Society of Critical Care Medicine in 1992, the systemic inflammatory response syndrome (SIRS) was defined as a disseminated organic inflammatory response to various types of insult characterized by the presence of at least two of the following criteria: fever or hypothermia (body temperature  $>38^{\circ}\text{C}$  or  $<36^{\circ}\text{C}$ ), tachycardia (heart rate  $>90$  bpm), tachypnea (respiratory rate  $>20$  breaths per minute or arterial carbon dioxide tension— $\text{PaCO}_2 < 32$  mmHg), and leukocytosis or leukopenia (white blood cell count  $>12,000/\text{mm}^3$  or  $<4000/\text{mm}^3$  or  $>10\%$  of immature forms). In turn, sepsis was defined as SIRS associated with the presence of an infection source. However, those definitions were established based on non-pregnant individuals [1].

These criteria are based on vital signs; white blood count and organs dysfunctions. They guide admission to Intensive Care Unit (ICU) and treatment as well to predict mortality and serious morbidity.

**SEPSIS:** is systemic inflammatory response syndrome (SIRS) plus culture documented infection

**SEVERE SEPSIS:** is Sepsis plus organs dysfunctions, hypotension or hypoperfusion (including but not limited to lactic acidosis, oligouria, or acute mental status changes

**SEPTIC SHOCK:** is hypotension (despite fluid resuscitation) plus hypoperfusion

The term *multiple organs dysfunctions syndrome* (MODS) is introduced to define presence of altered organs functions in an acutely ill patient such that homeostasis cannot be maintained without intervention.

Obstetric patient with sepsis related disorders tend to be young, healthy women with less morbid course and decrease mortality once have timed intervention and proper care.

The etiology of sever sepsis and septic shock during pregnancy and puerperium caused by obstetric related or non-obstetric related conditions. Potential causes during pregnancy and puerperium are: serious wound infection and cesarean section, obstructed labor, retained products of conception (septic abortion-conservative management of placenta accreta or percreta), chorioamnionitis or endomyometritis, pelvic abscess, Pneumonia and necrotizing fasciitis. Intraperitoneal non-obstetric etiologies are bowel infarction, acute cholecystitis, pancreatitis and acute pyelonephritis [2].

## 2. Diagnosis

Alteration in physiology surrounding pregnancy is characterized by substantial changes in maternal hemodynamic as well as respiratory and renal functions. They are further influenced by conditions associated with intrapartum and postpartum blood loss, infections such as chorioamnionitis, endometritis, pneumonia, pyelonephritis, fluids usage, medications, delivery mode, and anesthesia. These factors influence vital signs and laboratory evaluations and make accurate diagnosis of severe sepsis and septic shock more difficult in obstetric patient, particularly during labor because heart and respira-

tory rates increase [3].

Symptoms and signs in sever sepsis during pregnancy differ from the non-pregnant state and based on etiology as well duration of infection. The most common presenting symptom is fever [greater than 38°C (>100.4°F)]. However septic case develops hypothermia [less than 36°C or <96°F] with tachycardia (heart rate greater than 110 beats/min) and tachypnea (respiratory rate greater than 24/min. **Table 1** & **Table 2**.

In most cases pain or tenderness site helps in determining the etiology of underlying infection.

### 3. Management

Early diagnosis and timed intervention with *early goal directed therapy* improves outcome of severe sepsis and septic shock, decreases hospital stay length and hospital cost [4] [5]. This requires multidisciplinary approach; includes physicians, nursing, clinical pharmacist, intensivist and hospital administration.

**Table 1.** Clinical findings of sever sepsis and septic shock.

Fever
Temperature instability (higher than 38.0°C or lower than 36.0°C)
Tachycardia (heart rate more than 110 beats/min)
Tachypnea (respiratory rate more than 24 cycles/min)
Diaphoresis
Nausea or vomiting
Clammy or mottled skin
Hypotension or shock
Pain (location based on site of infection)
Altered mental state (confusion, decreased alertness)
Oliguria or anuria

**Table 2.** Laboratory findings of sever sepsis and septic shock.

Leukocytosis or leucopenia
Positive culture from infection site or blood or infection site and blood
Hypoxemia
Thrombocytopenia
Metabolic acidosis (increased serum lactate, low arterial PH, increased base deficit)
Elevated serum creatinine
Elevated liver enzymes
Hyperglycemia in the absence of diabetes
Disseminated intravascular coagulation.

***Early goal directed therapy involves:***

- 1) Blood cultures obtained (goal within one hour).
- 2) Empiric antibiotics initiated (goal within one hour).
- 3) Central line placed (goal within 4 hours).
- 4) Central venous pressure 8 mmHg or higher (goal within 6 hours).
- 5) Norepinephrine infusion if indicated (mean arterial pressure lower than 65 mmHg after resuscitation).
- 6) Transfusion of packed red cells if indicated by Hemoglobin (Hb) less than 7 g/dl.

In severe sepsis associated with hypotension, fluid resuscitation to optimize cardiac preload, afterload, and contractility. Subsequent intravenous infusion is guided by maternal vital signs, pulse oximetry, central hemodynamic monitoring and urine output to avoid the development of pulmonary edema. Central venous access for central venous pressure measurement and oxygen saturation is recommended to guide fluids therapy and monitoring.

***Prognostic indicators of poor outcome in septic shock:***

- 1) Delay in initial diagnosis.
- 2) Pre-existing debilitating disease process.
- 3) Poor response to massive intravenous fluid resuscitation.
- 4) Depressed cardiac output.
- 5) Reduced oxygen extraction.
- 6) High serum lactate (greater than 4 mmol/L).
- 7) Multiple organs dysfunction syndrome.

## **4. Objectives**

The aim of this study is to determine rate, characters, morbidity and mortality of septic obstetric cases at Omdurman New Hospital during the study period.

## **5. Methods**

This is a descriptive, prospective, cross-sectional hospital based total coverage analytic study; which was conducted from November-2013 to May 2014 at Omdurman New Hospital (ONH) for Obstetrics & Gynecology, Khartoum Sudan. Data were collected using specific data collecting sheet designed for this purpose. This sheet includes the demographic details, clinical findings, gestational age, delivery mode, site of delivery or pregnancy termination focus of infections, medical history, laboratory findings, ICU stay, sustained morbidity and mortality.

The data was entered, analyzed using Statistical Package for Social Sciences (SPSS) data analysis tool, Version 17 facilities.

Ethical approval was obtained from the Ethical Committee of Sudan Medical Specialization Board and signed letter by Hospital's medical director. Informed consent was obtained from case or the guardian. The confidentiality was granted through and after the study.

Hospital guideline in sepsis management was applied for all cases, with following main points:

- Intra-venous fluids (I.V fluids)
- 3<sup>rd</sup> generation cephalosporin; waiting for culture result.
- Antipyretic.
- Proton pumps Inhibitor.
- Thromboprophylaxis.
- Blood and products transfusion.
- Serial organs functions tests.
- Complete septic work up (Base line investigations and body fluids culture and sensitivity infections indicators differential white blood cells, C-reactive protein and procalcitonin).
- Infection nidus management.
- Intropics and mechanical ventilation (when needed).
- Physiotherapy & Rehabilitation.
- Documentation & records keeping.

This care is applied by multidisciplinary team (obstetrician, intensivist, microbiologist, clinical pharmacist, physician, ICU nursing staff, psychologist and physiotherapist)

## 6. Results

During study period the hospital admission was 1124 cases from pregnancy complications; 142 cases were admitted at Intensive care unit (ICU) 13 cases were of severe sepsis and septic shock, made the rate 1.16 ( $13/1124 = 1.16\%$ ).

Most of the cases were at age group of 20 - 24 years.

Half of the cases were from hospital catchment area and others were referred from others facilities.

The mean average ICU stay is 6.3 days the rest of the care was given in the general words.

With respect to time of diagnosis in pregnancy; 7 cases diagnosed at first trimester with abortion or spontaneous miscarriage; the rest seen during puerperium. The bulk of the cases have uterine infection (9 cases).

The vital signs changes are seen at the time of diagnosis and admission. Obviously appeared in form of Tachypnea 10 Cases = ( $10/13 = 77\%$ ). Two third of the cases were hypertensive at diagnosis 8 cases ( $8/13 = 62\%$ ). 4 cases were normotensive cases ( $4/13 = 31\%$ ) and one case had low blood pressure case ( $1/13 = 7.7\%$ ). The pulse rate at diagnosis was reported as Tachycardia in 7 Cases ( $7/13 = 54\%$ ) and the bradycardia is seen in 6 cases ( $6/13 = 46\%$ ).

Hyperthermia 10 Cases ( $10/13 = 77\%$ ) and three cases of hypothermia ( $3/13 = 23\%$ ).

Renal function tests were normal in 6 cases ( $6/13 = 46\%$ ) and impaired in 7 cases ( $7/13 = 54\%$ ); typical result was obtained in the Liver function tests.

The Coagulation Profiles were reported as normal 7 cases ( $7/13 = 54\%$ ) and the impaired result was seen in 6 cases ( $6/13 = 46\%$ ).

Five cases were registered as maternal deaths ( $5/13 = 38.5\%$ ). All deaths reported at ONH were 26, sepsis represented almost one fifth of hospital deaths during the study

period (5/26 = 20%).

Small sample size limits application certain test of significant, although *one and paired sample test* was performed and showed a significant positive correlation.

The categorization of risk factors for diagnosis of sepsis in the one-sample t-test all of vital signs and laboratory investigations were highly significant associated with sepsis ( $p < 0.00$ ) (**Table 3**).

The identified risk factors for sepsis in the t-test analysis were gestational age [ $p < 0.00$ ], 95% confidence interval (CI) 1.32 - 2.84], age [( $p < 0.00$ ), 95% CI 1.86 - 3.52] and Focus of Infection [ $p < 0.01$ ], 95% confidence interval (CI) 0.86 - 2.52)] (**Table 4**).

The analysis of risk factors for acquiring sepsis in the one-sample t-test delivery site [ $p < 0.00$ ], 95% confidence interval (CI) 1.15 - 1.78] and [( $p < 0.00$ ), 95% CI 1.08 - 1.69].

The association of risk factors of experiencing sepsis in the one-sample t-test obtained that miscarriage site [ $p < 0.01$ ], 95% confidence interval (CI) 0.93 - 2.07] and delivery site [( $p < 0.00$ ), 95% CI 1.2 - 1.8].

The contribution of miscarriage site, delivery location association with sepsis [ $p < 0.01$ ], 95% confidence interval (CI) 0.93 - 2.07] and delivery location [( $p < 0.00$ ), 95% CI 1.1 - 1.7] and [ $p < 0.00$ ], 95% confidence interval (CI) 1.15 - 1.78] respectively (**Table 5** and **Figure 1**).

**Table 3.** Categorization of risk factors at sepsis diagnosis in the one-sample t-test (vital signs and laboratory investigations).

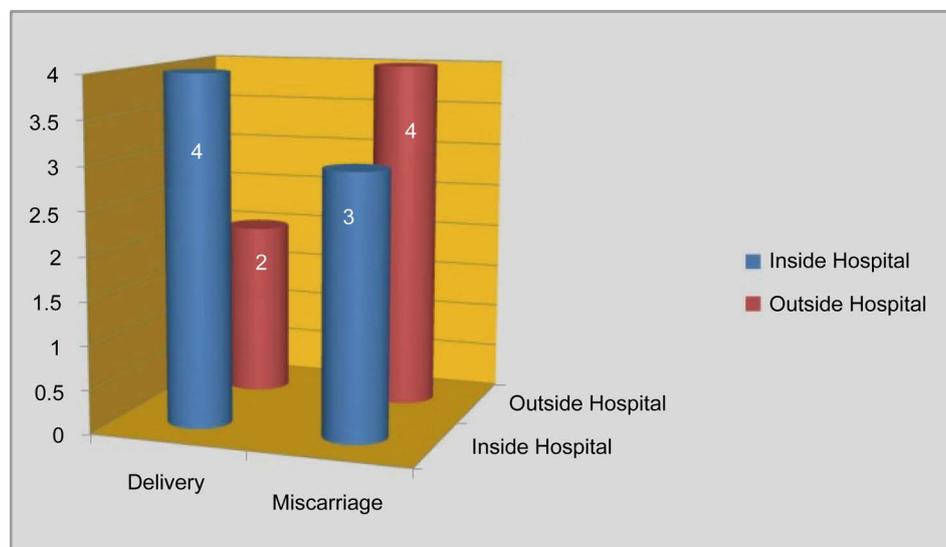
	Test Value = 0					
	t	df	Sig (2-tailed)	Mean Difference	95% Confidence Interval of the difference	
					Lower	Upper
<b>Pulse rate</b>	10.156	12	0	1.462	1.15	1.78
<b>Respiratory rate</b>	6.501	12	0	1.385	0.92	1.85
<b>Temperature</b>	10.119	12	0	1.231	0.97	1.5
<b>Blood pressure</b>	13.863	12	0	2.538	2.14	2.94
<b>Renal functions tests</b>	10.69	12	0	1.538	1.22	1.85
<b>Liver functions tests</b>	10.69	12	0	1.538	1.22	1.85
<b>Coagulation profile</b>	10.156	12	0	1.462	1.15	1.78

**Table 4.** Risk factors for sepsis in the t-test analysis (Gestational age, maternal age and focus of infection).

	Test Value = 0					
	t	df	Sig (2-tailed)	Mean Difference	95% Confidence Interval of the difference	
					Lower	Upper
<b>Gestational age</b>	5.963	12	0	2.077	1.32	2.84
<b>Maternal age</b>	7.047	12	0	2.692	1.86	3.52
<b>Focus of infection</b>	4.43	12	0	1.692	0.86	2.52

**Table 5.** Analysis of risk factors for acquiring sepsis in the one-sample t-test delivery site.

	Test Value = 0					
	t	df	Sig (2-tailed)	Mean Difference	95% Confidence Interval of the difference	
					Lower	Upper
<b>Delivery site</b>	10.156	12	0	1.462	1.15	1.78
<b>Delivery location</b>	9.859	12	0	1.385	1.08	1.69

**Figure 1.** The site of pregnancy termination.

One documented observation all referral cases had seek advice from tradition healers which delayed their arrival in time.

## 7. Discussion

Rate of sepsis and septic shock related to pregnancy and pregnancy complications is quite high and contribute as major cause for maternal morbidity and mortality. UNFPA and WHO reports proved 15% of maternal deaths are due to sepsis and sepsis is second direct cause of maternal mortality; this keeps sepsis one of the leading causes of maternal mortality Sudan. Although in some countries of the developing world in name; India they report declining in maternal mortality due to sepsis to 10% from 35% (Rural Medical institute 2005).

More or less maternal sepsis remains at front among causes in all reports of authorities at Ministry of Health, Khartoum State-Maternal Mortality committee report-2013- it accounts for 24% [6] and from Sudan national Reproductive health program-maternal deaths review report 2012 it is 10.7% [7].

Site and type of intervention for pregnancy termination are risk factors for maternal sepsis along with lack of medical access.

Almost all the cases were young and at age of medical fitness in spite of that morbidity and/or mortality are seen.

Lack of safe setup for obstetric services and delivery care contribute directly in maternal sepsis.

In view of health economics sepsis burdens the health system in case management and long ICU stay.

## 8. Conclusions

Sepsis is declined in developed world while in developing countries especially Sub-Saharan areas still remains along with obstetric hemorrhage and eclampsia at the most common causes of maternal morbidity and mortality.

Sepsis-related maternal morbidity and mortality is a significant and persistent problem in critical care obstetric unit. The management of sepsis during pregnancy is challenging.

## 9. Recommendations

1) Establishment of agreeable, applicable and clear well designed national protocols for obstetric sepsis for all health facilities where obstetrics & gynecology services are provided

2) Improvement of the ICU setup to cope with critical ill cases needs with involvement of the others functioning disciplines

3) High level of commitment and support for ICU run services with staff training and equipments supply and consumables.

4) Standard referral system following the protocols for early fluids and antibiotics intervention at golden time is articulate challenge in the management.

5) Increase the health awareness to contact the health facilities early and such cases should be away from any non-professional care providers.

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## Study Constrains

Short period of the study is the main constrain in addition to the lack of local and regional published studies.

## Disclosure

All authors have no conflict of interest and nothing to be disclosed.

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