

Relative Rate of Maternal Deaths in Pakistani Population due to sepsis

FAKHARUNNISSA¹, QAMARUNISSA MUHABBAT², ZAHEER³, SAJIDA MUNEEB⁴, WAQAR UN NISSA AHMED⁵, FAHMEEDA PARVEEN⁶

¹Assoc: Prof: Gynae/Obs, Indus Medical College, Tando Muhammad Khan

²Senior Instructor, Gynae/Obs, Agha Khan University

³Assoc: Prof: Medicine, Indus Medical College, Tando Muhammad Khan

⁴Senior Registrar, Gynae/Obs, Indus Medical College, Tando Muhammad Khan

⁵Senior Registrar, Gynae/Obs, Shaheed Muhtarma Benazir Bhutto Medical University, Larkana

⁶Asst: Prof: Gynae/Obs, Liaquat University of Health Sciences, Jamshoro

Correspondence to Dr. Fakhra un Nisa, Email: haniahira10@gmail.com, Cell: 03002666888

ABSTRACT

Aim: To investigate the relative rate of maternal deaths in Pakistani population due to sepsis including the most common causative agent.

Methods: The proposed study was a retrospective study model which was mainly conducted at a tertiary care hospital of Lodhran district-Punjab, Pakistan from 2019-2021 in association with the cases of maternal deaths due to sepsis reported and observed at the Gynecology & Obstetrics department of different tertiary care hospitals. Total 1200 number of participants had been examined in this study and the convenient sampling technique was used. Whereas, it discusses the maternal mortalities due to different types of sepsis during, between, and after the delivery of a baby, with diagnosed 50% cases reported for the maternal deaths due to sepsis. Data was analyzed using SPSS VR 20.0 with level of significance being kept at P-value <0.001.

Results: As per the observation, out of 1200 samples, 640 samples were culture-positive, including mixed culture growth. Highest percent positivity was showed up by *Streptococcus pyogenes* 640(53.33%), followed by *Chlamydia psittaci* 80(6.66%), *Mycobacterium tuberculosis* 120(10%), *Escherichia coli* 80(6.66%), *Neisseria meningitidis* 40(3.33%), and Epstein-Bar virus 40(3.33%). Different approaches of delivery, gender, and respiratory infections, and the time of admission to the hospital along with the qSOFA (Quick Sequential Organ Failure Assessment) Criteria were significantly associated with sepsis.

Conclusion: Group A *Streptococcus* (i.e. *Streptococcus pyogenes* strains) were the most active causative agents 640(53.33%) in inducing maternal sepsis leading to deaths. Therefore, proper preventive measures should be taken before, during and after the delivery (antepartum, post-partum) to reduce the dependent and independent risk factors and subsequently to decrease the burden of maternal deaths due to sepsis.

Keywords: Maternal, Sepsis, death, culture, *Streptococcus pyogenes*, GAS.

INTRODUCTION

In developing countries of South Asia like Pakistan, the rate of maternal mortalities is reportedly high. The estimated ratio of deaths of mothers is 186/1,00,000 live births in a country like Pakistan whose total population is 220.9 million (2020). These rates are apparently higher in rural areas rather than developed urban areas¹. The problem in finding the actual root cause and intensities of maternal mortalities is difficult to rationalize because the data has been generated from hospital statistics and these estimates could vary significantly in those areas where basic medical framework has not reached till date. More than 65% deliveries of babies take place at home as reported by a well-known tertiary care hospital of the country while only approximately 35% of the deliveries were observed under the supervision of experts and trained staff or personnel were available². Many a times, the mortalities may not be registered specially in the cases where a woman develops any obstetric complication. The data base is extracted from the number of entries in a government organizations or hospital. Majority of the cases who reach private hospitals for their pre-natal care rather than governmental set-up are still in the process of rightful reporting of maternal mortalities³. During the child-bearing duration, supposedly other than obstetrical issues, infectious diseases are also one of the contributing factors of maternal mortalities.

Worldwide, although the process of pregnancy is same but the real-life experiences may vary accordingly. This is mainly due to medical care and facilities the pregnant women receive. **Sepsis** is the extreme responsive behaviour of a body towards a dangerous infection. It could lead to life-threatening medical emergencies⁴. A chain of infections with your body can activate or trigger a septic event. In sepsis, generally organs like lungs, Urinary tract, Skin or GIT i.e., Gastrointestinal Tract can be severely infected. The statistics of Global Maternal Sepsis Study (GLOSS), which is a global initiative by World Health Organisation

(WHO) or Human Resource Planning (HRP) suggested that sepsis have a relatively higher impact and subsidise more in mortality or morbidity burden of mothers⁵. Around the world, both communicable and non-communicable ailments result in deaths. **Maternal Sepsis** refers to the condition in which a serious infection during, between or after the delivery which many times lead to fatality⁶. The risk factors stated by the Global sepsis alliance are poor healthcare facilities, socio-economic imbalances, women with poor resources of sanitation/hygiene or in fact those who delivers through caesareans⁷.

Maternal infections followed by bacteraemia and sepsis by *Streptococcus pyogenes* or Group A *Streptococcus* have been greatly associated with high risk of maternal mortalities⁸. The most commonly occurring diseases includes skin infections, throat irritation and respiratory distress while serious cases are less common but could be fatal at times⁹.

MATERIALS AND METHODOLOGY

The proposed study was a retrospective study model which was mainly conducted at a tertiary care hospital of Lodhran district-Punjab, Pakistan from 2019-2021 in association with the cases of maternal deaths due to sepsis reported and observed at the Gynecology and Obstetrics department of different tertiary care hospitals, after taking the ethical approval from the Ethical Review Board (ERB) of the organization. Total 1200 number of participants had been examined in this study and the convenient sampling technique was used.

The present research discusses all the maternal mortalities due to different types of sepsis during, between, and after the delivery of a baby, with diagnosed 50% cases reported for the maternal deaths due to sepsis. Data was analyzed using SPSS Version 20.0 with level of significance being kept at P-value <0.001.

The demographic data of the study population included Age of mothers (ranging from <24 years - >35 years), gender, phase of delivery/pregnancy, Signs and risk factors at the time of admission i.e., fever, abdominal pain, reoccurrence of the disease at the time

Received on 24-09-2021

Accepted on 13-03-2022

of hospitalization, Septic Shock, Unregulated Consciousness, respiratory tract infections, intrauterine fetal deaths (IUFD) etc. of the participants. In all the cases, the investigations were conducted to find out the pathogenic organism (causative bacteria) especially Group A Streptococcus (GAS).

Observation:

Table 1: Data analysis of study population (n=1200)

Variables	Characteristics	Observed/Total No. of participants	%age
Age of mothers			
<24 yrs	50/1200	4.17	4.17
25-35 yrs	700/1200	58.33	58.33
>35 yrs	450/1200	37.50	37.50
Pregnant status			
Antepartum	900/1200	75.00	75.00
Hospitalization (delivery)	0/1200	0	0
Postpartum	300/1200	25.00	25.00
Signs and risk factors (for admission)			
Fever	350/1200	29.17	29.17
Abdominal pain (at lower side)	250/1200	20.83	20.83
Onset (of hospitalization)	300/1200	25.00	25.00
Septic Shock	50/1200	4.17	4.17
Unregulated Consciousness	150/1200	12.50	12.50
Distress of respiratory tract	50/1200	4.17	4.17
qSOFA (Quick Sequential Organ Failure Assessment) Criteria			
Mental status	Altered	200/1200	16.67
Rate of respiration	>22 breaths/min	550/1200	45.83
Blood Pressure (100 mmHg)	Systolic	350/1200	29.17
On Admission (Body Temperature)	Normal	300/1200	25.00
	>38°C	900/1200	75.00
	<36°C	0/1200	0
Fetal death (intrauterine)	On admission	550/1200	45.83
Maternal Deaths	Sepsis	600/1200	50.00
	Asphyxia	100/1200	8.33

RESULTS

Characteristics of Infections leading to maternal mortality:

Approximately 7.3 million births had been reported in some of the major tertiary care hospitals of Pakistan from 2019-2021, with reportedly 186 maternal mortalities at a rate of 1,00,000 maternities. Where, sepsis was the route cause in most of the cases which is equivalent to 16.12 % prevalence ratio (10).

Table 2: Prevalence of certain Causative organisms in inducing Sepsis leading to maternal mortalities

Causative organism	n= (reported)	%
Streptococcus pyogenes	640	53.33
Chlamydia psittaci	80	6.66
Mycobacterium tuberculosis	120	10.00
Escherichia coli	80	6.66
Neisseria meningitidis	40	3.333
Epstein-Bar virus	40	3.333
Unknown source	200	16.6667

The organism that is found most infectious and the leading cause of sepsis were the bacterial species of Group A Streptococcus (GAS) or Streptococcus pyogenes in general i.e., in 53.4% (n=640) patients.

Period of onset	n	Mode of delivery	%age
Antepartum	492	VD, IUFD, CS, DC**	76.875
Postpartum	148	VD, CS**	23.125

**VD= Vaginal Delivery, IUFD= Intra-Uterine Fetal Death, CS= Caesarean section, DC= Dilation and curettage

^Chi-square Test was applied.

Demographically, the mean average age of the participants lies between the age range of 25-35 years i.e., 58.3% (n=700/1200 cases). Subsequently, the major reasons for hospitalizations were accountable for fever and lower abdominal pain. While, one-fourth of the patients i.e., 45.8% of the cases will be due to Intrauterine

Fetal death (IUFD). A total of 100 patients were reported to expire because of tuberculosis and bloodstream invasion (asphyxia) i.e., n= 8.40%

Characteristics of patient's maternal mortalities because of antepartum Group A Streptococcus (GAS): Table 2. suggested the Characteristics of patient's maternal mortalities because of antepartum Group A Streptococcus (GAS). The median age of mothers (ranging from 27-40 years) was testified to be 33.5 years. 100 cases were delivered through vagina (VD; n=8.33%). Or else through no delivery (ND) mode or by Intra-uterine route. The onset of antepartum and post-partum timings was 77% and 23% respectively as indicated in the Table.3. The age of gestational age varies from 50% to 40% depending on the number of cases in second and third trimester, respectively. 350 deaths (53.8%) were observed within 24 hours after the admission in hospital. While the GAS induced deaths have more significant occurrence than non-GAS cases which makes (n=1/2) i.e., 9.0%. Few patients were also observed to die during antepartum duration. Almost equivalent to nine cases in GAS-induced maternal mortality rather non-GAS group. Whereas, the in Group A Streptococcus antepartum case, most of the patients (n= 550/1200, 45.8%) were suffering from Intrauterine Fetal deaths (IUFD). While, in non-GAS scenario the prevalence is as low as 20.0%.

DISCUSSIONS

This study highlights various reasons of maternal deaths due to different types of sepsis. The major findings of the present study underlie the sepsis induced commonest cause of maternal mortalities and the most active organism in doing so which in this case is Group A Streptococcus (GAS). Secondly, this study also discusses the deaths of patients within 24 hours of hospitalization. Simultaneously, the rate of maternal deaths is significantly higher in GAS induced deaths in mothers rather non-GAS group during antepartum duration. This again is a huge achievement of the proposed study.

According to a recent investigation conducted at one of the renowned tertiary care hospitals of Pakistan, over the period of eleven years the trends of GAS induced sepsis are relatively higher in people >50 years of age while the rate of fatality was reported to be 34.1% in the fourteen observed cases out of the total 41. While despite of treating the patients with antibiotics the GAS induces septic shocks continues to produce the damaging effects and hence the in the continuous increment of mortality rate.

Although the rate of GAS induced sepsis is relatively higher in developing countries like Pakistan, but the comparative data suggested that in the last three decades the situation in United States is steady. While, the commonest causative organisms in non-pregnant ladies are E. coli, Staph. Aureus, Pneumococcal spp. or Pseudomonas species¹¹. Whereas, the most common causative organism of fatal sepsis in pregnant women is Group A streptococcus spp. The GAS septic shock is the result of activation of Interleukin (IL) 4, interleukin 5, IL-10, and IL-14 which are produced by the complementation of T-cells (CD4+) which are generally higher in pregnant women. The septic shock by Streptococcus spp. incorporates the activation of MHC-Class II complement system and it simultaneously activates the cytokines¹².

In many of the observed cases from the study population, Intrauterine fetal deaths (IUFD) were observed as high as 45.83% (n=550/1200) specially in the antepartum duration of the GAS-group. Maternal circulation demands the appropriate circulation between foetus and the placenta of the mother. The breakdown of the maternal cells will ultimately influence the fetoplacental circulation and causes Intrauterine fetal deaths (IUFD). The uterine contractions are the result of massive storm of cytokine activation, usually induced by neutrophils or macrophages (in GAS group). Therefore, patients suffering from GAS infections complains about the lower abdominal pain and aches.

CONCLUSION

As most of the maternal deaths were estimated within 24 hours of hospitalization, therefore, the preventive measures against GAS-induced sepsis must be taken at the right time to avoid the unforeseen situation and to decrease the overall burden of sepsis-induced maternal fatality rate. This is the reason why the rationale of the proposed retrospective study is limited and ascertain. Thus, it has been advised to investigate the ratio of sepsis in GAS vs. non-GAS classes for the maximum outcome.

Conflict of interest: Nil

REFERENCES

1. Sundin CS, Rigg K, Ellis KK. Maternal sepsis: presentation, course, treatment, and outcomes. *MCN: The American Journal of Maternal/Child Nursing*. 2021 May 1;46(3):155-60.
2. Bauer ME, Bateman BT, Bauer ST, Shanks AM, Mhyre JM. Maternal sepsismortality and morbidity during hospitalization for delivery: temporal trendsand independent associations for severe sepsis. *AnesthAnalg* 2013;117:944e50.
3. Bauer ME, Lorenz RP, Bauer ST, Rao K, Anderson FW. Maternal deaths due tosepsis in the state of Michigan, 1999e2006. *ObstetGynecol* 2015;126:747e52
4. O'Brien Jr JM, Ali NA, Aberegg SK, Abraham E. Sepsis. *The American journal of medicine*. 2007 Dec 1;120(12):1012-22.
5. Bauer ME, Bateman BT, Bauer ST, Shanks AM, Mhyre JM. Maternal sepsis mortality and morbidity during hospitalization for delivery: temporal trends and independent associations for severe sepsis. *Anesthesia& Analgesia*. 2013 Oct 1;117(4):944-50.
6. Morgan J, Roberts S. Maternal sepsis. *Obstetrics and Gynecology Clinics*. 2013 Mar 1;40(1):69-87.
7. Fahim F, Nabeel N, Utman N. Trends in maternal mortality in tertiary care hospital in Peshawar-Pakistan. *JPMI: Journal of Postgraduate Medical Institute*. 2012 Oct 1;26(4).
8. Shakoor S, Khan E, Mir F, Malik F, Jamil B. Secular trends of Streptococcus pyogenes sepsis in Pakistan and analysis of clinical features in ahospitalized cohort. *Trop. Biomed*. 2017 Sep 1;34:648-56.
9. Tanaka H, Katsuragi S, Hasegawa J, Tanaka K, Osato K, Nakata M, Murakoshi T, Sekizawa A, Kanayama N, Ishiwata I, Ikeda T. The most common causative bacteria in maternal sepsis-related deaths in Japan were group A Streptococcus: A nationwide survey. *Journal of Infection and Chemotherapy*. 2019 Jan 1;25(1):41-4.
10. Chadha A, Jamal W, Aziz AR, Rotimi VO. Overwhelming Streptococcus pyogenes sepsis in an elderly patient with septic arthritis. *Journal of Infection and Public Health*. 2018 May 1;11(3):434-5.
11. Efstratiou, A. &Lamagni, T. (2016). Epidemiology of Streptococcus pyogenes. In: Streptococcus pyogenes: Basic Biology to Clinical Manifestations [Internet], Ferretti J.J., Stevens D.L., Fischetti V.A., (editors). Oklahoma City (OK): University of Oklahoma Health Sciences Center. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK343616/>
12. Athey, T.B., Teatero, S., Sieswerda, L.E., Gubbay, J.B., Marchand-Austin, A., Li, A., Wasserscheid, J., Dewar, K., McGeer, A., Williams, D. &Fittipaldi, N. (2016). High incidence of invasive Group A Streptococcus disease caused by strains of uncommon emm types in Thunder Bay, Ontario, Canada. *Journal of Clinical Microbiology*, 54(1): 83-92.