

# Assessment of Maternal and Fetal Outcomes of Burn in Pregnancy

Sunita Mishra<sup>1</sup>, Shilpa Sapre<sup>2</sup>, Nootan Chandwaskar<sup>3</sup>, Roshni Sahu<sup>4</sup>

## ABSTRACT

**Background:** Burn injuries in pregnancy are often associated with a high rate of maternal and fetal mortality. They are considered relatively rare, but they affect the fate of the mother and the developing fetus.

### Aims and objectives:

- To study the maternal and fetal outcomes in pregnant women with burns.
- To evaluate the predictors of maternal and fetal mortality due to burns.

**Materials and methods:** A retrospective study was conducted in the Department of Obstetrics and Gynaecology at Sri Aurobindo Institute of Medical Sciences and Postgraduate Institute, Indore (MP). The duration of this study was 2 years (March 2015 to February 2017). A total of 15 pregnant women with thermal injuries were included in this study. Data were obtained from the Medical Records Department of all the cases of burns during pregnancy, who were admitted into the hospital. The obtained data were analyzed regarding the age, duration of hospital stay, percentage of total body surface area (TBSA) burned, gestational age, and the maternal and fetal outcomes.

**Result:** The mean age was  $24.6 \pm 5.26$ , median hospital stay 12.5 days, median gestational age 22.5 weeks, and burn size 59%. Eleven (73.4%) patients of accidental and four (26.6%) of suicidal cases were found. There were five (33.3%) cases in the 20–39% TBSA group, two (13.4%) cases in 40–59% TBSA, five (33.3%) cases in 60–79% TBSA, and three (20%) cases in >80% TBSA, respectively. There was a significant difference between fetal death and aliveness according to the first five (100%) and zero (0%), second five (83.4%) and one (16.6%), and third trimester one (25%) and three (75%),  $p = 0.001$ . The first trimester was associated with the highest incidence of fetal death. We found that TBSA (positive predictive value [PPV] = 0.607;  $p = 0.001$ ) and trimester (PPV = 0.638;  $p = 0.001$ ) were positive predictors for abortion/fetal deaths.

**Conclusion:** The rate of fetal mortality was highest in the first and second trimesters. Maternal and fetal morbidity and mortality were directly proportional to TBSA.

**Keywords:** Burns in pregnancy, Fetal outcomes, Gestational age (trimester), Maternal outcomes, Total body surface area (TBSA).

*Journal of South Asian Federation of Obstetrics and Gynaecology* (2021); 10.5005/jp-journals-10006-1932

## INTRODUCTION

Burn injury in pregnant patients is more common in developing countries because most of the case reports have come from low-income countries.<sup>1–4</sup> Usually accidental kerosene ignition is the most common type of burns. About 295,000 women died during and following pregnancy and childbirth in 2017.<sup>5</sup> The vast majority of these deaths (94%) occurred in low-resource settings, and most could have been prevented.<sup>6</sup> Total body surface area (TBSA) strongly correlates with maternal–fetal morbidity and mortality. Various factors can affect the rate of mortality and morbidity in burned patients during pregnancy, including the depth and size of burn injury, age at pregnancy, maternal health, and simultaneous existence of inhalation and burn injuries.<sup>7</sup> Human physiology alters during pregnancy and adds further stress to systems that are highly modified. Close cooperation between the surgical and the obstetric teams and individualization of management are always necessary.<sup>8</sup> Thermal injury increases the risk of spontaneous abortion and premature labor. Prostaglandins released into the circulation of the mother due to the thermal insult to the tissues stimulate the myometrium, leading to fatal obstetric complications. Fetal survival depends on its maturity and fluid volume electrolyte changes have the most dramatic consequences. Infection is the most severe complication of burn injuries. Educating pregnant women regarding clothing along with secondary preventive measures like prompt first-aid methods may reduce the incidence.

<sup>1,3,4</sup>Department of Obstetrics and Gynaecology, Sri Aurobindo Medical College and PG Institute, Indore, Madhya Pradesh, India

<sup>2</sup>Department of Obstetrics and Gynaecology, Pramukhswami Medical College, Karamsad, Gujarat, India

**Corresponding Author:** Sunita Mishra, Department of Obstetrics and Gynaecology, Sri Aurobindo Medical College and PG Institute, Indore, Madhya Pradesh, India, Phone: +91 9893361434, e-mail: dr\_sunitamishra\_16@yahoo.co.in

**How to cite this article:** Mishra S, Sapre S, Chandwaskar N, *et al.* Assessment of Maternal and Fetal Outcomes of Burn in Pregnancy. *J South Asian Feder Obst Gynae* 2021;13(4):226–229.

**Source of support:** Nil

**Conflict of interest:** None

Women in less-developed countries have, on average, many more pregnancies than women in developed countries, and their lifetime risk of death due to pregnancy is higher.<sup>9</sup> In pregnancy, during and after childbirth, all women need access to high-quality care. Maternal health and fetal health are closely linked. There are only a few reports, which have studied dissimilar aspects of this problem. Therefore, in this study, we aim to evaluate the predictors of maternal and fetal mortality due to burns and the maternal and fetal outcomes in pregnant women with TBSA and gestational age.

**MATERIALS AND METHODS**

A retrospective study was conducted in the Department of Obstetrics and Gynaecology at Sri Aurobindo Institute of Medical Sciences and Postgraduate Institute, Indore (M.P). This study research protocol was approved by the ethical committee. The duration of this study was 2 years (March 2015 to February 2017). A total of 17 pregnant women with thermal injuries were included; two patients left against medical advice, hence were not included in the study. Data were obtained from the Medical Records Department of all cases of burns during pregnancy, who were admitted into the hospital. The obtained data were analyzed regarding age, duration of hospital stay, percentage of TBSA burned, gestational age, and maternal and fetal outcomes.

**Statistical Analysis**

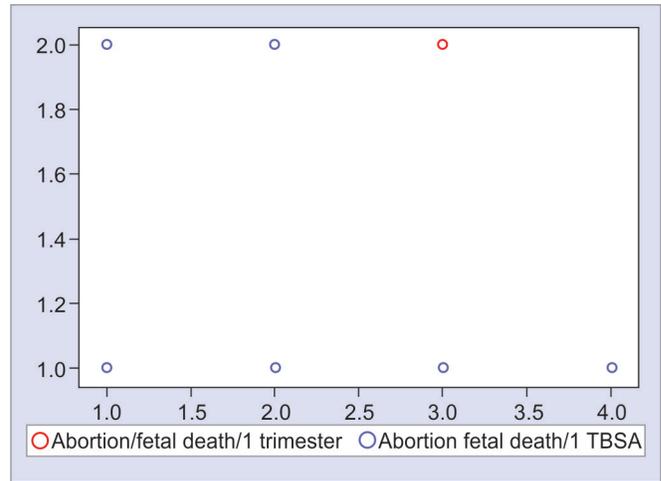
Statistical results were obtained by the regression analysis ( $R^2$ ), the Chi-square test, using Statistical Package for the Social Sciences, SPSS 12.0. A  $p$  value of  $<0.05$  was considered significant. These statistical analyses were used to assess the relative predictive power of TBSA, age, trimester of pregnancy, and duration of hospital stay as predictors of maternal and fetal mortality.

**RESULTS**

A total of 15 cases of burns during pregnancy were included in this study. On admission, patients' mean age was  $24.6 \pm 5.26$ , median hospital stay 12.5 days, median gestational age 22.5 weeks, and burn size 59%. Eleven (73.4%) patients of accidental and 4 (26.6%) of suicidal cases were found. There were five (33.3%) cases in the 20–39% TBSA group, two (13.4%) cases in 40–59% TBSA, five (33.3%) cases in 60–79% TBSA, and three (20%) cases in  $>80\%$  TBSA, respectively (Table 1).

Maternal and fetal outcomes according to the range of TBSA, two (40%) abortion/fetal deaths, were found and no maternal deaths were seen in 20–39% of the TBSA group. One (50%) had maternal death, one (50%) abortion/fetal death in 40–59% TBSA, three (60%) maternal deaths, and five (100%) abortion/fetal deaths in 60–79% TBSA. In more than 80% of cases, both died within 24 hours of admission (Table 2 and Fig. 1).

The maternal and fetal outcomes, based on the gestational trimester, were as follows: Two (40%) mothers died in first, four



**Fig. 1:** Abortion/fetal death predation association with trimester and TBSA

(66.7%) in second, and one (25%) in third trimester. There was a significant difference between fetal death and aliveness according to the first five (100%) and zero (0%), second five (83.4%) and one (16.6%), and third trimester one (25%) and three (75%),  $p = 0.001$ . The survival rate in mothers was eight (53.4%) out of 15 cases. Maternal or fetal death was significantly higher according to TBSA. The maternal and fetal mortality rate increased with increasing TBSA. Most of the fetal deaths were found when the mother was still alive within the first burn week (Table 3).

We performed a positive predictor analysis in abortion/fetal deaths. We found a significant difference between TBSA and trimester. The predictor value was positive predictive value (PPV) = 0.607;  $p = 0.001$  in TBSA. And the predictor value was PPV = 0.638;  $p = 0.04$  in trimester (Table 4).

**DISCUSSION**

Burn injury in the developing countries is a social issue. Pregnant women constitute one of the most significant high-risk groups with burn injuries because of the typically large burn sizes involved

**Table 1:** Demographical characteristics

Baseline	Total no. of patients 15
Mean age of patient	24.6 years (24.6 $\pm$ 5.26)
Median hospital stay	12.5 days
Median gestational age	22.5 weeks
Burn size	59%
Survivors (maternal)	8 (53.4%)
Nonsurvivors (maternal)	7 (46.6%)

**Table 2:** Maternal and fetal outcome according to TBSA

Percent of cases	No. of cases (%)	Maternal deaths (%)	Abortion/fetal deaths (%)
20–39	5 (33.3)	0 (0)	2 (40)
40–59	2 (13.4)	1 (50)	1 (50)
60–79	5 (33.3)	3 (60)	5 (100)
$>80$	3 (20)	3 (100)	3 (100)

**Table 3:** Maternal and fetal outcome based on gestational age

Trimester	No. of cases	Accidental (%)	Suicidal (%)	Maternal deaths	Alive	Abortion/fetal deaths (%)	Alive
1	5	4 (80)	1 (20)	2 (40)	3 (60)	5 (100)	0 (0)
2	6	4 (66.6)	2 (33.4)	4 (66.7)	2 (33.3)	5 (83.4)	1 (16.6)
3	4	3 (75)	1 (25)	1 (25)	3 (75)	1 (25)	3 (75)
Total	15	11 (73.4)	4 (26.6)	7 (46.6)	8 (53.4)	11 (73.4)	4 (26.6)

**Table 4:** Predictor analysis based on abortion/fetal deaths

	Predictor	F	p value
Age	0.369	2.043	0.842
TBSA	0.607	7.57	0.001*
Trimester	0.638	8.931	0.047*
Duration of hospital stay	0.104	0.141	0.154
Maternal and fetal outcome	0.201	0.957	0.33

and the often-severe medical consequences to the woman and the fetus. Hence, it is directly related to the extent of the maternal thermal injury. Burn injury in developing countries is a social issue because it is closely associated with the use of lamps during cooking, especially at night; it is also a public health issue because its incidence is increasing and has a devastating effect on the patient, the fetus, family, as well as the community as a whole.<sup>10</sup> In this study, the mean age was  $24.6 \pm 5.26$ , median hospital stay 12.5 days, median gestational age 22.5 weeks, and mean burn size 59%. The percentage of accidental and suicidal 11 (73.4%) and 4 (26.6%) was seen. The total maternal mortality rate in our study was 46.6% while other studies reported a maternal mortality rate between 28.3 and 63%.<sup>11,12</sup> In the first trimester, fetal loss largely depended on maternal survival; three women survived and no fetuses were alive. The percentage of abortion/fetal deaths was high in the first and second trimesters. Gronert and Theye,<sup>13</sup> Yingbei et al.,<sup>14</sup> and McCauley et al.<sup>15</sup> reported that second and third trimester burns may be lethal to the fetus with maternal burns more than 50% of the TBSA. In the present study, TBSA was the most significant indicator of maternal mortality. There were no maternal deaths with TBSA of 20–39% and TBSA 40–59% was associated with 50% maternal deaths and 60% with 60 to 79% TBSA. The rate of fetal mortality (73.4%) remained high in our study. Akhtar et al.<sup>16</sup> showed a fetal mortality rate of 72% , as was also reported from Tehran, Tehran Province, and Iran by Mehdizadeh et al.,<sup>11</sup> who found 72.8% of fetal mortality. In our study, there was a direct relationship between TBSA and fetal viability. Fetal mortality is about 50% when the TBSA is 40–59% and 60% when the TBSA is 60–79% and TBSA 100% was associated with >80%. Maternal or fetal death was significantly higher according to TBSA. Maternal mortality and fetal mortality rate increased with increasing TBSA. The rate of fetal mortality was the highest in the first and second trimesters and in the third trimester the rate of fetal mortality reduced at the end of gestational period. Two (40%) mothers died in first, four (66.7%) in second, and one (25%) occurred in third trimester. There was a significant difference between fetal death and aliveness according to the first five (100%) and zero (0%), second five (83.4%) and one (16.6%), and third trimester one (25%) and three (75%),  $p = 0.001$ . In this study, maternal survival in the first and second trimesters was more than the third one additionally; fetal and maternal mortality had a significant relationship with TBSA. We performed predictor analysis in abortion/fetal deaths; we found a significant difference between TBSA and trimester. The predictor value was  $PPV = 0.607$ ;  $p = 0.001$  in TBSA. And predictor value was  $PPV = 0.638$ ;  $p = 0.04$  in trimester. We can deduce that burns increase fetal mortality in the first trimester. This is evidenced with the occurrence of all fetal losses in the first trimester and in the first postburn week. Similar findings have been documented by Chandra et al. and Ying-Bei et al.<sup>17,18</sup> In the termination of pregnancy before 24 weeks, fetuses generally will not survive while those delivered after 32 weeks will

do well with modern neonatal intensive care, which are required to salvage a near-term fetus.<sup>19</sup> It also underscores that emergent resuscitation and timely operative procedures might be able to salvage a living fetus, particularly in patients with burns covering more than 60% of TBSA.<sup>20</sup>

## CONCLUSION

Thermal injury increases the risk of maternal and fetal survival. The fetal outcome is closely linked to the maternal outcome, while maternal outcome can be affected by the presence of a fetus, and maternal survival depends on TBSA. Maternal mortality and fetal mortality rate increased with increasing TBSA. The rate of fetal mortality was the highest in the first and second trimesters and in the third trimester the rate of fetal mortality reduced at the end of gestational period. Burn increases fetal mortality in the first trimester. The percentage of fetus aliveness increased with increasing gestational age. Prevention of burns in pregnant women is essential to reducing the mortality and morbidity associated with these injuries.

## ACKNOWLEDGMENT

The authors would like to thank Dr Susmit Kosta, Senior Scientist and Head, Department of Central Research Lab, Sri Aurobindo Medical College and PG Institute, Indore, (MP) for acknowledging the help and guiding in the preparation of this article.

## REFERENCES

- Mabogunje OA. Burns injuries during pregnancy: an African series. *J Natl Med Assoc* 1990;82(9):641–644. PMID: 2213912; PMCID: PMC2626994.
- Rezavand N, Seyedzadeh A. Maternal and foetal outcome of burns during pregnancy in Kermanshah, Iran. *Ann Burns Fire Disasters* 2006;19(4):174–176. PMID: 21991046; PMCID: PMC3188112.
- Karimi H, Momeni M, Momeni M, et al. Burn injuries during pregnancy in Iran. *Int J Gynaecol Obstet* 2009;104(2):132–134. DOI: 10.1016/j.ijgo.2008.10.003.
- Mokube JA, Verla VS, Mbome VN, et al. Burns in pregnancy: a case report from Buea Regional Hospital, Cameroon. *Pan Afr Med J* 2009;3:21. PMID: 21532730; PMCID: PMC2984292.
- Available from: <https://www.paho.org/en/topics/maternal-health>.
- Trends in maternal mortality: 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: World Health Organization; 2019.
- Kennedy BB, Baird SM, Troiano NH. Burn injuries and pregnancy. *J Perinat Neonatal Nurs* 2008;22(1):21–30. DOI: 10.1097/01.JPN.0000311871.46075.3d.
- El-Gallal ARS, Yousef SM. Burns in pregnancy: a ten-year review of admitted patients. *Ann Burns Fire Disasters* 2002; 15:113–115.
- Available from: <https://www.who.int/news-room/fact-sheets/detail/maternal-mortality>.
- Mehdi P, Ali AM, Abdolreza R, et al. Epidemiology of burns during pregnancy in southern Iran: effect on maternal and fetal outcomes *World Appl Sci J* 2013;28(2):153–158. DOI: 10.5829/idosi.wasj.2013.28.02.81217.
- Mehdizadeh A, Akbarian A, Samareh Pahlavan P, et al. Epidemiology of burn injuries during pregnancy in Tehran, Iran. *Ann Burns Fire Disasters* 2002;15(4):163–170.
- Khadzhiiski S. Burns during pregnancy. *Khirurgiia (Sofia)* 1991; 44(3): 26–29. PMID: 1895705.
- Gronert GA, Theye RA. Pathophysiology of hyperkalemia induced by succinylcholine. *Anesthesiology* 1975;43(1):89–99. DOI: 10.1097/0000542-197507000-00018.

14. Ying-bei Z, Ying-jie Z, Xuwei W. Burns during pregnancy: an analysis of 24 cases. *Burns Incl Therm Inj* 1981;8(4):286–289. DOI: 10.1016/0305-4179(82)90011-0.
15. McCauley RL, Stenberg BA, Phillips LG, et al. Long-term assessment of the effects of circumferential truncal burns in pediatric patients on subsequent pregnancies. *J Burn Care Rehabil* 1991;12(1):51–53. DOI: 10.1097/00004630-199101000-00013.
16. Akhtar MA, Mulawkar PM, Kulkarni HR. Burns in pregnancy: effect on maternal and foetal outcomes. *Burns* 1994;20(4):351–355. DOI: 10.1016/0305-4179(94)90066-3.
17. Chandra G, Gaurav K, Kumar S, et al. Burns during pregnancy: a retrospective analysis of 19 cases. *Arch Int Surg* 2016;6(1):28–31. DOI: 10.4103/2278-9596.187198.
18. Zhang YB, Zhang YJ, Wang XW. Burns during pregnancy: an analysis of 24 cases *Burns* 1981;8(4):286–289. DOI: 10.1016/0305-4179(82)90011-0.
19. Banerjee T, Karmakar A, Adhikari S. Foetal salvage by caesarean section in a case of maternal burn injury. *Singapore Med J* 2012; 53(11):e247–e248.
20. Rölfing JH, Jensen PE, Lindblad BE. Second-degree burn in a pregnant woman. *Ugeskr Laeger* 2010;172(40):2770–2771. PMID: 20926050.