

Impact of burn injuries on maternal and fetal outcomes during pregnancy: A prospective study at a tertiary care hospital



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ABSTRACT

Background: Burn injuries are a significant public health concern in India, consuming substantial healthcare resources, with a higher prevalence in rural areas. The management of burns during pregnancy is particularly challenging due to limited published data, making treatment difficult in peripheral hospitals. Given this context, we conducted a retrospective analytical study on burn injuries in pregnant women. **Aims and Objectives:** This study aims to analyze the clinical presentation of pregnant burn patients and evaluate the impact of burns on maternal and fetal outcomes. **Materials and Methods:** A total of 33 pregnant women with burn injuries were analyzed. The study assessed the causes of burns, maternal mortality, and fetal complications. **Results:** Among 187 female burn patients of reproductive age admitted during the study period, 33 (17.6%) were pregnant. Of these, 27 had burns covering <50% of the total body surface area (TBSA), while 6 had burns exceeding 50% TBSA. Maternal mortality was lowest in cases with TBSA below 25% and significantly increased when TBSA exceeded 50%. Fetal mortality followed a similar pattern. Burn severity, shock, and respiratory complications were the primary determinants of maternal and fetal outcomes. **Conclusion:** Burn injuries during pregnancy have severe consequences for both maternal and fetal health. While early and aggressive management can mitigate some adverse effects, prevention remains the most effective strategy to reduce morbidity and mortality.

Key words: Burn injury; Pregnancy; Gestational age; Abortion; Total body surface area

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INTRODUCTION

In developing countries such as India, burn injuries constitute a major cause of morbidity and mortality among the general population.¹ Four million women suffer severe burns from fire each year worldwide the same number as those diagnosed with human immunodeficiency virus/acquired immunodeficiency syndrome.^{2,3} The management becomes more difficult when burn injury occurs in pregnant females, as it affects maternal and fetal outcomes simultaneously. If the victim is pregnant, the type and severity of the injuries may pose some challenges depending on the mother's physical condition during pregnancy⁴ and possible

complications include precipitated labor and stillbirths. The factors contributing to this are hypovolemia, pulmonary injury, septicemia, and a catabolic state associated with the burn. Maternal and fetal survival rates have been related to the percentage of the total burn area, and when it exceeds 50%, fetal and maternal morbidity increases significantly.^{4,5} Burns in pregnancy is not a topic frequently mentioned in obstetrics texts or books on burn care.⁶⁻⁸ Because of rare occurrences in developed countries, there are limited studies present in the world literature describing different aspects of burn patients with pregnancy. A multidisciplinary approach consisting of surgeons, gynecologists, and intensive care specialists is needed to manage those critical patients properly.

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Aims and objectives

The study aims to analyze the clinical presentation of pregnant patients with burns and evaluate the effects of burns on fetal outcomes.

MATERIALS AND METHODS

This study is a prospective analytical study conducted in a rural-based tertiary care hospital in West Bengal, India, from April 2022 to January 2025.

Inclusion criteria

All pregnant females having burn injuries admitted from April 2022 to March 2024 were included.

Exclusion criteria

Pregnant patients with burn injuries managed on an outpatient basis, as well as burn injury patients with associated trauma (such as abdominal, head, or chest injuries), were excluded from our study.

After approval of the Institutional Ethics Committee (Memo No. IEC/DMGMCH/2022/07), this study was conducted in the burn ward of this hospital. Among a total of 256 female burn cases, a total of 33 cases that met the inclusion criteria were included in this study. Initial resuscitation of these burn patients was done in the surgery department, and then management was done by a combined team of surgeons and obstetricians. After admission, a thorough history was taken and documented with special emphasis on age, type of burn injury, total body surface area (TBSA) burned, status of pregnancy, and past medical and surgical history. Initial baseline investigations, including urine for a pregnancy test, routine blood for complete hemogram, renal function and liver function test, and ultrasound of the abdomen for fetoplacental profile were done in all cases. All patients were treated by a routine burn care protocol, including fluid resuscitation, topical antimicrobial agents, and regular moist occlusive dressing. All patients were given tetanus prophylaxis if not vaccinated or of unknown status. Systemic antibiotics were used only when clinically indicated. The choice of agent depends on the microbial culture and sensitivity of wound swab and safety of the agent on fetal outcome. Later on, if required, early escharotomy, debridement, and tangential excision were done, followed by skin grafting depending on the patient's general condition. All surgical procedures were done under general anesthesia.

Gynecologists were consulted for all patients to look after and monitor fetal condition along with pregnant mothers.

RESULTS

A total of 256 female patients with burn injuries were admitted to our hospital during the study period. Out of them, 187 were in the reproductive age group, of which only 33 were pregnant (17.6%). We presume that a few cases of a higher degree of burn with early pregnancy who died immediately after admission could have been missed. The percentage of TBSA varied 20–85%. Three patients died within 24 h of admission, having 85%, 72%, and 65% TBSA, respectively. The rest of the patients were resuscitated successfully. We found fire catching during cooking from a hand-made oven and open fires for warmth during winter were major causes of burn injury (42.4% and 36.3%, respectively). The gestational age of pregnant mothers at the time of injury varied from 8 weeks to 35 weeks, with 15 cases in the first trimester, 12 cases in the 2nd trimester, and 6 cases in the 3rd trimester. Seventeen mothers died due to severe burn injury, and 22 fetal deaths occurred out of 33 cases.

The data in Table 1 indicate that maternal mortality is significantly affected by burn severity (% TBSA) ($P=0.00063$), while fetal mortality shows a trend but is not statistically significant ($P=0.106$). Maternal mortality increases with TBSA involvement, with 100% mortality observed in cases where TBSA exceeded 50%. Similarly, fetal death rates were highest in these groups, highlighting the severe impact of extensive burns on pregnancy outcomes. Shock ($P=0.0243$) and respiratory complications ($P=0.00073$) were significantly associated with maternal death, whereas septicemia ($P=0.2602$) showed no significant association. Fetal death was strongly associated with respiratory complications ($P=0.00000904$) and Shock ($P=0.00069$). However, septicemia had no significant impact on fetal mortality ($P=1.0$), possibly because maternal death often occurred before sepsis set in. The correlation coefficient (0.904) indicates a strong positive relationship between maternal and fetal mortality. Although this correlation is strong, it is not statistically significant ($P=0.0956$).

Table 2 demonstrates that maternal mortality is high across all trimesters. Since $P>0.05$, the results are not statistically significant. This suggests that gestational age does not have a strong effect on maternal mortality in this study population.

Table 3 suggests that pregnancy may have a statistically significant impact on survival rates in burn patients ($P=0.0194$).

Table 1: Distribution of study population according to maternal and fetal deaths and maternal complications in relation to TBSA

TBSA (%)	No. of cases	Shock	Septicemia	Respiratory complications	Maternal deaths (%)	Fetal death (%)
0–25	9	0	0	0	0 (0)	4 (44.4)
26–50	16	1	4	1	9 (56.25)	10 (62.5)
51–75	7	2	6	1	7 (100)	7 (100)
>76	1	1	1	0	1 (100)	1 (100)
Total	33	4	11	2	17	22

TBSA: Total body surface area

Table 2: Distribution of study population according to maternal outcome in relation to gestational age

Trimester	Maternal deaths (%)	Survive (%)	Total
1 st	7 (46.66)	8 (53.33)	15
2 nd	7 (58.33)	5 (41.66)	12
3 rd	2 (33.33)	4 (66.66)	6
Total	17	16	33

Statistical inference: Chi-square statistic- 1.0373, P=0.595319

Table 3: Distribution of study population according to comparison of survival rate with non-pregnant women of the same age (18–35 years)

TBSA (%)	Pregnant		Non-pregnant		Pregnant deaths	Non-pregnant deaths
	(Survived/total)	Survival rate	(Survived/total)	Survival rate		
0–25	9/9	100	81/84	96.4	0	3
26–50	9/16	56.2	27/35	77.1	7	8

Statistical inference: Chi-square statistic- 5.47 P=0.0194

As shown in Table 4, gestational age has a significant impact on fetal outcome, with a clear trend of improving survival as pregnancy advances ($P=0.047955$). Pregnancies in the first trimester have the highest risk of abortion, while those in the third trimester have the best survival chances.

DISCUSSION

In developing countries like India, burn injury remains a significant medical and social burden. In peripheral regions, use of open lanterns and open coal ovens by country women mainly causes an increased number of burn injuries in developing countries. The incidence has been reported to range from 1.3% to 15% in various previous studies.^{9–16} In our study, 17.6% of women of the reproductive age group (12.9% among females) who were admitted with burn injury were pregnant. The incidence rate is higher than in previous studies because most of the study population is financially underprivileged, and they continue to depend on traditional wood or coal stoves (chulhas) and open fires for warmth during winter. Accidental fires (from cooking, open flames, kerosene lamps) and superstition-driven attacks (like witch-hunting) are more common. Poor housing, lack of fire safety awareness, and limited healthcare worsen the situation.

Table 4: Distribution of study population according to Fetal outcome in relation to gestational age

Trimester	Abortion (%)	Survival (%)	Total
1	13 (80)	2 (20)	15
2	7 (66.67)	5 (33.3)	12
3	2 (33.33)	4 (66.6)	6
Total	22	11	33

Statistical inference: Chi-square statistic- 6.075, P=0.047955

The overall maternal mortality rate in our study is 51.51%, while other studies reported a maternal mortality rate between 28.3% and 63%.^{17,18} Akhtar *et al.*, in a comparative analysis of 50 pregnant and non-pregnant women with burn injuries, also reported that TBSA is the only statistically important factor that affects the prognosis of the mother and fetus.¹⁴ In our study, maternal mortality is significantly influenced by burn severity (% TBSA). Shock and respiratory complications are strongly associated with maternal death, while septicemia is not, likely because many patients may succumb to burns before sepsis could develop. Fetal death is significantly linked to maternal respiratory complications and shock, likely due to hypoxia and reduced placental perfusion, whereas septicemia had no significant effect. Although statistically not significant, a strong positive correlation (0.904) exists between maternal

and fetal mortality, suggesting that worsening maternal health directly impacts fetal survival.

Pregnancy significantly impacts burn survival rates in this study ($P=0.0194$). This may be due to physiological changes affecting cardiovascular function, immune response, respiration, metabolism, and treatment challenges. Increased blood volume and hypercoagulability can complicate fluid resuscitation and thromboembolism risk, while immune suppression raises susceptibility to infections. Respiratory limitations and higher metabolic demands may worsen burn recovery, and treatment options are restricted due to fetal considerations. These factors highlight the need for specialized burn management protocols for pregnant patients to improve maternal and fetal outcomes. Amy *et al.*, and Akhtar *et al.*, recommended early treatment of burn injury (e.g., hemodynamic stabilization and skin grafting) as the most important interventional factor that affects the outcome in pregnancy.^{11,14}

The fetal mortality rate in our study is notably high at 66.67%, aligning with previous research that has reported even higher rates exceeding 70%.^{9,14,17,19} Our findings suggest that burn injuries significantly elevate fetal mortality, particularly in the first trimester (93.33%), a pattern corroborated by other studies. This underscores the profound impact of burns as a critical risk factor for miscarriage and preterm labor.^{19,20} In our study, fetal death is significantly linked to maternal respiratory complications and shock, likely due to hypoxia and reduced placental perfusion. Gestational age significantly influences fetal survival, with outcomes improving as pregnancy progresses. The first trimester carries the highest risk of miscarriage due to placental immaturity and fetal vulnerability, while survival chances are highest in the third trimester due to better organ development and medical intervention options. This study failed to find any significant effect of maternal septicemia on fetal mortality, possibly due to other dominant risk factors like burn severity and shock. Although statistically not significant, a strong positive correlation (0.904) exists between maternal and fetal mortality, suggesting that worsening maternal health directly impacts fetal survival.

Limitations of the study

This study is limited by its single-center, retrospective design and small sample size, affecting generalizability. Long-term maternal and fetal outcomes were not assessed, and confounding factors such as socioeconomic status and healthcare access were not fully analyzed. In addition, the study lacks an in-depth evaluation of treatment impact and psychosocial factors such as domestic violence. Future multi-center, longitudinal studies are needed for a more comprehensive understanding of burn injuries in pregnancy.

CONCLUSION

Burn injuries in pregnant women present a significant medical and social challenge, particularly in financially deprived regions where traditional cooking methods and poor living conditions increase risks. Our study highlights a high maternal mortality rate (51.51%) and fetal mortality rate (66.67%). Burn severity (% TBSA), shock, and respiratory complications are key determinants of outcomes. Pregnancy further complicates burn management due to physiological changes affecting cardiovascular, immune, and respiratory functions. The strong correlation between maternal and fetal mortality underscores the urgent need for specialized burn care protocols for pregnant women in peripheral hospitals, including early intervention, hemodynamic stabilization, and skin grafting, to improve survival outcomes.

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