

Foetomaternal Outcome in Pregnancy with Burn Injury: A Prospective Cohort Study

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ABSTRACT

Introduction: Pregnancy is a state of an altered physiological process, and a burn injury during pregnancy, serves as an additive factor to this stressful state, such that it can directly or indirectly affect the feto-maternal outcome.

Aim: To find out the effects of burn injury in pregnant females, in terms of maternal and foetal outcomes.

Materials and Methods: This was a prospective cohort study, done in collaboration with the Department of Surgery at Rajashri Dashrath Autonomous State Medical College, Ayodhya, Uttar Pradesh, India, from September 2019 to November 2021, on 22 pregnant patients. All 22 confirmed cases of pregnancy with burn injury were included. Cases were evaluated in terms of age-wise distribution, parity, gestational age/ trimester of pregnancy, cause of burn injury, Total Body Surface Area (TBSA) distribution, the relation of TBSA distribution with foetal and

maternal mortality, and events associated with the burn injury. Data was analysed using trial version of Statistical Package for Social Sciences (SPSS) version 22.0.

Results: Mean age of pregnant patients with burns was 25.22±2.3 years. Thirteen (59.09%) patients with burn injuries were married for one to three years, incidence was more in primigravidae 14 (63.63%). Domestic violence and suicide attempts accounted for 12 (54.54%) cases. Kerosene and gas explosions were a major cause of burn injury, that is 16 (72.72%) and 5 (22.72%) respectively. Sixteen (72.72%) patients had burns with TBSA between 31-50%. Foetal mortality was 15 (68.18%) and maternal mortality was 14 (63.63%).

Conclusion: Feto-maternal outcome was directly related to TBSA involved in burns. Illiteracy, and cultural practices like the use of earthen lamps, wood, and charcoal used for cooking, were some of the important causes of burn injury.

Keywords: Domestic violence, Maternal and foetal affection, Total body surface area

INTRODUCTION

It is well known that burn injury is a major reason for both morbidity and mortality worldwide, and infliction of burn injury in a low resource country further increases the overall fatality rate [1,2]. Sub Saharan Africa and Southern Asia accounted for approximately 254000 (86%) of the estimated global maternal deaths in 2017; due to burn injury [3].

Pregnancy is a stressful condition, with a change in the haemodynamic state. Along with the pre-existing environmental and maternal factors, burn injury especially; severe burns (large body surface involvement) can lead to a hypermetabolic response, due to which there is an increase in the energy consumption from stored proteins and fat, leading to an overall catabolic response of the body [4]. As a result of this, there is a greater risk of fluid loss, hypoxemia, and increased chances of infection [5]. Thus, the greater the body surface area involved in burns, the higher the chances of adverse maternal and foetal outcomes. The prostaglandins released into the circulation of the mother due to thermal insult to the tissue stimulate myometrium, which can lead to spontaneous abortions and the onset of preterm labour [6].

Despite, being an important cause of adverse maternal and foetal outcome worldwide, there is a paucity of data, especially from India and other developing countries. Hence, the present study was conducted with an aim to determine the factors responsible for adverse feto-maternal outcome, associated with burn injury.

MATERIALS AND METHODS

A prospective cohort study was conducted in Rajashri Dashrath Autonomous State Medical College, Ayodhya, Uttar Pradesh, India, from September 2019 to November 2021. Ethical clearance was taken by the Ethical Committee, IEC number RDASMC/IEC/2019/02. Informed consent was obtained.

A total of 22 pregnant women with burn injuries reported during the study duration and formed the sample population.

Inclusion criteria: All pregnant patients with burn injury; irrespective of gestational age, parity, and severity of burn were included.

Exclusion criteria: All non-pregnant women with burn injuries were excluded from the study.

Study Procedure

The study took into consideration the age of the patient, parity, gestational age/ trimester of pregnancy, span of married life, underlying cause, TBSA, foetal outcome in relation with TBSA and foetal and maternal mortality in relation with TBSA.

Patients were admitted in the burn unit for better and secluded environment, with a provision for a separate burn ward for the pregnant females. Burned surface area was estimated using Lund and Browder's chart. Lund and Browder's chart (LB chart) is a tool, used for estimating the TBSA affected. It consists of two outlines- anterior and posterior [7,8].

Major division of body were demarcated by the lines and standard percentages of each part were indicated. The assessor drew an outline of the burn wound on the anterior and posterior body diagrams, calculated the burn area in each region, and then summed up the areas to obtain the body percentage of the burn wound.

After estimating the severity of burn, patients were followed up to obtain the feto- maternal outcome.

STATISTICAL ANALYSIS

Data was analysed using Trial version of SPSS version 22.0. (SPSS Inc; Chicago, IL) in terms of mean and standard deviation, frequency and percentage.

RESULTS

The majority of the patients 14 (63.63%) were between 18-25 years of age with mean age being 25.22±2.3 years [Table/Fig-1].

Age (years)	No. of patients	Percentage
18-25	14	63.63
26-35	07	31.81
36-45	01	4.54

[Table/Fig-1]: Age-wise distribution of patients with burns (N=22).

Out of 22 pregnant women with burn injury, majority of the women 13 (59.09%) were married for ≤3 years [Table/Fig-2].

Married life (years)	No. of patients	Percentage
≤3	13	59.09
4-7	07	31.81
>7	02	9.09

[Table/Fig-2]: Duration of married life (N=22).

Fourteen out of the 22 (63.63 %) pregnant women with burn injury were primigravidae.

In our study all primigravidae patients had conceived spontaneously within three years of marriage [Table/Fig-3].

Gravidity	No. of patients	Percentage
Primigravida	14	63.63
Multigravida	08	36.36

[Table/Fig-3]: Gravidity and its relationship with burn injury (N=22).

Domestic violence or suicidal cases accounted for the maximum, that is, 12 out of 22 (54.54%)

Accidental causes associated with use of earthen lamps, wood or charcoal use for cooking, gas stove or Liquid Petroleum Gas (LPG) cylinder explosions resulted in 6 out of 22 (27.27%) cases.

Uncertain causes, as a result of severe burn (where the patient was unable to narrate proper history, or attendant of patient gave a vague history raising doubts to its authenticity) accounted for 4 (18.18%) cases [Table/Fig-4].

Event	No. of patients	Percentage
Domestic violence/suicide/homicide	12	54.54
Accidental	06	27.27
Uncertain	04	18.18

[Table/Fig-4]: Events associated with burn injury (N=22).

Kerosene use was most frequently associated with burn injury which accounted for 16 out of 22 cases [Table/Fig-5].

Causes	No. of patients	Percentage
Gas explosion	05	22.72
Scalds	01	4.54
Kerosene explosion	16	72.72

[Table/Fig-5]: Causes of burn injury.

Maximum number of cases with burn injury were in their first trimester, that is, a total of 15 out of 22 (68.18%) cases [Table/Fig-6].

Trimester	No. of patients (Total - 22)	Percentage (%)
First	15	68.18
Second	06	27.27
Third	01	4.54

[Table/Fig-6]: Trimester of pregnancy at the time of burn injury.

A total of 16 (72.72%) out of the 22 women had 31-50% of TBSA involved in burn injury [Table/Fig-7].

TBSA	No. of patients	Percentage
≤30%	01	4.54
31-50%	16	72.72
51-70%	04	18.18
>70%	01	4.54

[Table/Fig-7]: TBSA of burn.

In the 1st trimester 12 (80%) out of 15 women, in the 2nd trimester three (50%) out of six women and in the 3rd trimester only 1 (100%) patient had a TBSA between 31-50% [Table/Fig-8].

TBSA (%)	1 st trimester (n=15, n (%))	2 nd trimester (n=6, n (%))	3 rd trimester (n=1, n (%))
≤30%	0	01 (16.66%)	0
31-50%	12 (80%)	03 (50%)	01 (100%)
51-70%	02 (13.33%)	02 (33.33%)	0
>70%	01 (6.66%)	0	0

[Table/Fig-8]: TBSA of burn in various trimesters.

Foetal outcome was the worst with TBSA between 51-70% (that is 2 out of the 4 were 1st trimester abortion and the rest 2 which were in 2nd trimester had IUD). Between 31-50% out of the 16 patients 09 (56.25%) were 1st trimester abortions, 1 (6.25%) 2nd trimester IUD, three foetus in their 1st trimester and one foetus in the 2nd trimester were delivered preterm vaginally later (data obtained on follow up), one foetus in 2nd trimester delivered vaginally at term at another hospital and one foetus in 3rd trimester delivered by caesarean section in our hospital due to foetal distress. Patient with ≤30% burn in her 2nd trimester delivered vaginally at term in another hospital [Table/Fig-9].

TBSA	Total Patients (n)	Abortion	IUD	Preterm VD	Term VD	CS
≤30%	01	0	0	0	01 (100%)	0
31-50%	16	09 (56.25%)	01 (6.25%)	04 (25%)	01 (6.25%)	01 (6.25%)
51-70%	04	02 (50%)	02 (50%)	0	0	0
>70%	01	0	01 (100%)	0	0	0

[Table/Fig-9]: Foetal outcome in relation with TBSA of burn in patient.

*N: Total number of pregnant women in each category of TBSA of burn; *Preterm VD: Preterm vaginal delivery; *NVD: Natural vaginal delivery; *CS: Caesarean section; *IUD: Intrauterine death

Maternal and foetal mortality was the highest in women with 51-70% and >70% burn, that is 100% in both groups, in both 1st and 2nd trimester. Overall maternal mortality was high in patients with 31-50% burn in all trimesters. One pregnant woman in her third trimester with 30-50% burn underwent a caesarean section due to foetal distress and baby was born live. Overall out of 22 pregnant women 14 (63.63%) died due to burn injury and foetal mortality was 15(68.18%).

Foetal outcome was the worst with TBSA between 51-70% (that is two out of the four were 1st trimester abortion and the rest two which were in 2nd trimester had IUD) and >70% (one 1st trimester abortion) [Table/Fig-10].

TBSA	Maternal outcome mortality			Foetal outcome abortion/mortality		
	1 st Tri-mester (N)	2 nd Tri-mester (N)	3 rd Tri-mester (N)	1 st Tri-mester (N)	2 nd Tri-mester (N)	3 rd Tri-mester (N)
≤30%	-	0/1	-	-	0/1	-
31-50%	7/12	1/3	1/1	9/12	1/3	0/1
51-70%	2/2	2/2	-	2/2	2/2	-
>70%	1/1	-	-	1/1	-	-

[Table/Fig-10]: Trimester-wise maternal mortality and foetal outcome in relation with TBSA of burn.

DISCUSSION

Low socio-economic status, illiteracy, and cultural practices are associated with the increased rate of burn injury. High incidence of 67.19% was reported in a study done by Dhoble SV et al., [9]. However, no association of the above was found in study conducted by Chinenye JO et al., [10]. The incidence reported in various studies was 7.9% by Srivastav S and Garg AK, [11], 13.3% by Jain M and Gark A, [12], 15% by Prassana M and Singh K, [13] and 7.4% by Subrahmanyam M, [14]. Literacy alone as a contributor to the raised number of burn cases in pregnancy was significantly seen in a study done by Dhoble SV et al., [9] with an incidence of 31.6% for high school educated whereas a study was done by Gupta R et al., (2012) [15] which showed an incidence of 49.2 % for those educated up to primary school level. In the present study, patient's mean age was 25.2 years \pm 2.3 which was comparable to studies performed by Maghsoud H et al., [16] with mean age of 24.2 years and 30 years as reported by Mago V et al., [17]. Women in their initial years of marriage were more susceptible to burn injury as depicted in the present study where 59.09% of the women were married for \leq 3 years. Similar incidence of 59.38% was observed in a study done by Dhoble SV et al., [9] and a much higher incidence of 77% was noted in a study done by Kumar V et al., [18]. Both of the above studies were done in India. Thus, depicting, that adjustment problems in the initial years of marriage or social customs like the dowry, could be a major cause behind this high incidence in India.

Suicidal, Homicidal, and domestic violence resulting in burns, in this study was 54.54%, the high incidence was also seen in other studies, 31% in a study done by Kumar V et al., [18], 70.31% were suicidal burn and unknown causes in the study done by Dhoble SV et al., [9], 25% suicidal incidence in Subrahmanyam M, [14] study. Thus, raising the probability that cultural practices like dowry to be an important cause of suicidal, homicidal deaths in a developing country like India.

The incidence of accidental burns due to kerosene gas stove explosion, charcoal, wood used for cooking, LPG cylinder explosions, and oil lamp use accounted for up to 27.27% of cases. In a study conducted by Subrahmanyam M, [14] the incidence was 7.5%. In our study the incidence of burn injury in primigravidae patients was higher which was 63.63%. This high incidence could again be linked to cultural practices in India, like dowry practice, whereas a study done by Chinenye JO et al., [10] in Nigeria, shows that only 30 % of primigravidae patients suffered a burn injury, as compared to 70% incidence in multigravida.

Kerosene-related burn injury with an incidence of 16 (72.72%) was the most common cause of burn in our study, similar incidence was reported in other studies as well 66.7% due to flame, 17.9% due to gas explosion in a study done by Mehdi P et al., [19]. Kerosene burn injury in 68.6% of patients were reported by Maghsoudi H et al., [16], 96.4% flame burns were reported by Karimi H et al., [20] and Haddadin KJ and Haddad KJ, [21].

In a study done by Masoodi Z et al., [22] there was a direct correlation between maternal and foetal mortality with the degree of burn, with 100% foetal and maternal death with TBSA $>$ 50%. However, a comparison between trimester of pregnancy and TBSA was not done in the study done by Masoodi Z et al., [22]. In a study done by Mittal P et al., [5] 83.34% maternal and foetal mortality was reported in first trimester and 50% maternal and 100% foetal mortality in second and third trimester with 51-70% TBSA burn, whereas with TBSA $>$ 70% there was 100% maternal and foetal mortality in first and second trimester and one foetus survived due to prompt caesarean section. Thus, concluding that the greater the body surface area of the burn, the more the chances of increased incidence of maternal and foetal mortality irrespective of the gestational age.

Foetal outcome in relation to TBSA of burn of the patient was inversely related. Patients with $>$ 50% burn were susceptible to an over all adverse foetal outcome, whether it was abortion,

preterm delivery, or IUD, and is also seen in a study conducted by Masoodi Z et al., [22] and Ying Bei Z et al., [23] which reported 100% abortions, dead foetuses and still births in first post-burn week. The over all foetal mortality in terms of abortions, and IUD, was as high as 68.18% in this study. Similar results were also seen in a study conducted by Akhtar MA et al., about 72% [24]. Mehdizadeh A et al., [25] ie 78.8% and Chandra G et al., [26] 100% and foetal mortality with TBSA of burn $>$ 50%. Mittal P et al., [5] reported 91.66% foetal mortality between 51-70% of TBSA, and 93.75% with TBSA $>$ 70%.

Over all maternal mortality in our study turned out to be 63.63% which was quite high and was in accordance with a study done by Chandra G et al., [26] with 53% incidence and 62.1% as reported by Mehdizadeh A et al., [25]. In present study with TBSA of burn between 31-50%, there was 56.25% maternal mortality, between 51-70%, and $>$ 70 % TBSA of burn there was 100% mortality. Data from other studies revealed a 44% maternal mortality in a study done by Mittal P et al., [5], 21.05% with a TBSA between 31- 50%, TBSA between 51-70% there was 83.33% maternal mortality in study by Mittal P et al., [5], and lastly with TBSA $>$ 70% there was 42.11% mortality in study by Masoodi Z et al., [22] and 100% mortality in study by Mittal P et al., [5].

The main strength of this study was a proper follow-up of all the admitted pregnant patients in the burn unit of the hospital. Since this study provides recent data, it is a reflection of the prevailing drift in the recent past regarding burns in pregnancy and their effect on foetal and maternal outcomes.

Burn injury in pregnancy is still a major cause of adverse maternal and foetal outcomes, the degree of burn and gestational age at the time of burn injury are some of the major considerations that should be taken into account.

Limitation(s)

The sample size was inadequate. Also, the time-lapse, since infliction of burn injury to admission in the hospital was not recorded in most of the cases, which could have been an important factor in determining foetomaternal prognosis, apart from TBSA. The fact that study sample size was limited, its generalizability could be questionable and hence, larger prospective studies will be needed for the same.

CONCLUSION(S)

This study is indicative that TBSA related to burns, was one of the most important prognostic indicators with respect to foetomaternal outcomes. Foetuses of pregnant women at or near-term gestation with a greater degree of burn can still have a relatively better prognosis if timely intervention is performed, though the mother would still be at a higher risk as far as outcome is concerned.

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PLAGIARISM CHECKING METHODS: [\[Jain H et al.\]](#)

- Plagiarism X-checker: May 14, 2022
- Manual Googling: Sep 05, 2022
- iThenticate Software: Sep 07, 2022 (5%)

ETYMOLOGY: Author Origin**AUTHOR DECLARATION:**

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **May 11, 2022**Date of Peer Review: **Jun 14, 2022**Date of Acceptance: **Sep 08, 2022**Date of Publishing: **Dec 01, 2022**