

## Original Article

# Maternal and fetal outcome of burn during pregnancy: 3<sup>rd</sup> report from Kermanshah, Iran

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**Abstract:** Objective: Burn injuries in the course of pregnancy can lead to significant complications and mortality for both mother and fetus. Mortality and morbidity depend on the severity of burn. The current article is the third report authored on burn during pregnancy from Kermanshah, Iran. Method: The present descriptive analytic study seeks to review the entire number of files belonging to the pregnant women with burn injury admitted in the Burn Ward of Imam Khomeini Hospital in Kermanshah during the period 2012-2020. Demographic data and fetal and maternal complications and outcome were extracted. Chi-square test was applied to analyze quantitative parameters statistically, and probit regression analysis was performed to calculate the *Lethal Area 50%* (LA50%) index. Results: Thirty-seven patients with mean age of  $32 \pm 6.07$  years and mean gestational age of  $19.5 \pm 10.47$  years were enrolled. Fifteen (40.5%) patients had undergone less than 25% total burn surface area (TBSA), 5 (13.5%) 25%-50%, and 17 (45.9%) more than 50%. Maternal mortality was 16 (43.2%). Fetal complications included premature labor in 4, abortion in 14, and intrauterine fetal death in 7 cases. LA50% was calculated as 54%. Conclusion: Burn during pregnancy has a high rate of maternal and fetal mortality. These complications are highly related to severity of burn and TBSA. Preventive measures can play an important role in decreasing complications.

**Keywords:** Burns, pregnancy, lethal area, outcome

## Introduction

Although burn injuries during pregnancy are not common, they can lead to significant mortality and morbidity of both mother and newborn (fetus) [1]. Probable complications include abortion, intrauterine fetal death (IUFD), preterm labor, still birth, and escalated maternal mortality and morbidity [2]. The factors contributing to these complications include hypervolemia, pulmonary injury, septicemia, and a catabolic state related to the burn [3]. However, the medical literature includes few reports [4] often including a small number of patients. Fetal and maternal mortality and morbidity significantly depend on total burn surface area (TBSA) [5]; accordingly, maternal survival is unlikely when TBSA exceeds 50%, although there are significant differences among different studies [6]. These differences may be related to different

settings and medical facilities in different centers. We previously reported maternal and fetal outcome of burn among pregnant women in two distinct time periods. The first report, covering the time period from 1991 to 2002, comprised 91 pregnant women with burn injury [7]. The second report, covering the time period from 2003 to 2008, included 39 cases [8]. Imam Khomeini Hospital is one of the most distinguished burn centers in western Iran and the only one in Kermanshah province. Thus, our reports encompass a significant number of patients from western Iran, including four provinces with similar culture and economy. The present article reports 37 cases of the burned pregnant women during the period 2012-2020 to compare the recent results with the ones from the previous reports related to our center and other centers in Iran and other countries. Given the dramatic improvement in treatment

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facilities during recent years in our center, the authors seek to answer the question of how effective these advances have been in reducing mortality and morbidity of burn in pregnant women.

### Methods & materials

#### *Study design*

This descriptive analytic study uses a simple sampling method. The authors reviewed the entire collection of files related to cases of burn in women admitted in the Burn Ward of Imam Khomeini Hospital, Kermanshah, Iran, from 2012 to 2020. Then the files related to the pregnant women were extracted. The required data, including patient age, education, residence, parity, gestational age, TBSA, cause of burn, and season, and fetal complications such as abortion, still birth, preterm labor and maternal mortality, were collected from the patients' files using a questionnaire. Fetal outcome and complications, and maternal mortality were determined according to the different trimesters. All cases of burned pregnant women within the reference period were included and no exclusion criteria were used. In the case of incomplete data, the authors called the patients' families and completed the missing data. The percentage of TBSA was estimated clinically using the method of "Rule of Nine". Diagnosis of pregnancy was made by history, physical examination, urine Human Chorionic Gonadotropin (hCG) measurement, and ultrasonography scanning. Trimester of pregnancy was calculated by last menstrual period or obstetric ultrasonography. Intravenous fluid therapy was initiated for all patients using the Parkland formula (percentage of TBSA  $\times$  4 ml per kg of body weight). Accuracy of fluid therapy was controlled by measuring urine output and repeated laboratory investigations. Topical antimicrobial agents and moist occlusive dressing were initially prescribed for all patients. Informed consent was signed by the patients or close relatives. However, systemic antibiotics were used if indicated. The Research Committee of Kermanshah University of Medical Sciences (980165) and the Ethical Committee approved (IR.KUMS.REC.1398.161) the current study.

#### *Inclusion and exclusion criteria*

Inclusion criteria for pregnant women with burns and hospitalization in the Burn Ward of

Imam Khomeini Hospital during the period 2012-2020 were determined, and in the case of deficiency of information in the patient's medical record, it was overcome in consultation with the patient over telephone. No exclusion criteria was used.

#### *Statistical analysis*

Descriptive statistical methods were used to determine the frequency and percentage of the demographic and clinical features of the patients and Chi-square test was used to find the association between TBSA and maternal and fetal complications and mortality. Lethal Area 50% (LA50%) was calculated using probic regression analysis. Statistical analysis was performed using the SPSS statistical software, version 16.0 (SPSS, Chicago, IL).  $P < 0.05$  was considered significant.

### Results

#### *Demographic status*

During the study period, 371 women in reproductive age were hospitalized in the Burn Ward of Imam Khomeini Hospital, of which 37 (9.97%) were pregnant. The mean age of the pregnant women was  $32 \pm 6.07$  years (range 21-46 years). The mean gestational age was  $19.5 \pm 10.47$  weeks (range 3-37 weeks). Eighteen patients (48.6%) resided in urban areas, while 19 (51.4%) in rural areas.

Mean gravity was  $1.75 \pm 0.95$  (range 1-4) and mean parity was  $1.02 \pm 0.07$  among patients under study. In terms of education level, 15 (40.5%) patients were illiterate, 7 (18.9%) were literate to the extent of reading and writing, 13 (35.1%) were educated in high school or had a high school diploma, and 2 (5.4%) patients were bachelor or higher.

Seasonal distribution revealed occurrence of burn in 10 (27%), 11 (29.7%), 7 (18.9%), and 9 (24.3%) patients during spring, summer, fall, and winter, respectively. In 15 patients (40.5%), TBSA was less than 25% (mild), 25%-50% (moderate) in 5 (13.5%) patients, and more than 50% (severe) in 17 (45.9%) patients. Burn was due to self-immolation in 16 (43.2%) cases and accidental in 21 (56.8%) cases. Burn agents in terms of frequency included kerosene and gasoline in 16, gas explosion in 9, boiled water and

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**Table 1.** Relationship between TBSA burned and fetal outcome in the first, second and third trimesters of pregnancy

Variables	Level	Level	TBSA burned outcome			Total	P-value*
			< 25%	25-50%	> 50%		
fetal outcome during first trimester of pregnancy	Abortion	Yes	1 (2.7%)	0 (0%)	3 (8.1%)	4 (10.8%)	0.42
		No	14 (37.84%)	5 (13.51%)	14 (37.84%)	33 (89.2%)	
fetal outcome during second trimester of pregnancy	Abortion	Yes	0 (0%)	4 (10.8%)	6 (16.2%)	10 (27%)	0.001
		No	15 (40.54%)	1 (2.71%)	11 (29.74%)	27 (73%)	
	IUFD	Yes	0 (0%)	0 (0%)	1 (2.7%)	1 (2.7%)	0.54
		No	15 (40.54%)	5 (13.51%)	16 (43.24%)	36 (97.3%)	
fetal outcome during third trimester of pregnancy	Premature labor	Yes	0 (0%)	2 (5.4%)	0 (0%)	2 (5.4%)	0.001
		No	15 (40.54%)	3 (8.11%)	17 (45.94%)	35 (94.6%)	
	IUFD	Yes	0 (0%)	0 (0%)	6 (16.2%)	6 (16.2%)	0.015
		No	15 (40.54%)	5 (13.51%)	11 (29.74%)	31 (83.8%)	
Total			15 (40.54%)	5 (13.51%)	17 (45.94%)	37 (100%)	

TBSA: total burn surface area, IUFD: intrauterine fetal death, \*chi-square test.

**Table 2.** Relationship between TBSA burned and Maternal outcome in the first, second and third trimesters of pregnancy

Variables	Level	Level	TBSA burned outcome			Total	P-value*
			< 25%	25-50%	> 50%		
Maternal outcome during first trimester of pregnancy	Maternal Death	Yes	0 (0%)	1 (2.71%)	5 (13.5%)	6 (16.2%)	0.07
		No	15 (40.54%)	4 (10.8%)	12 (32.44%)	31 (83.8%)	
Maternal outcome during second trimester of pregnancy	Maternal Death	Yes	0 (0%)	2 (5.4%)	6 (16.2%)	8 (21.6%)	0.03
		No	15 (40.54%)	3 (8.11%)	11 (29.74%)	29 (78.4%)	
Maternal outcome during third trimester of pregnancy	Maternal Death	Yes	0 (0%)	0 (0%)	2 (5.4%)	2 (5.4%)	0.28
		No	15 (40.54%)	5 (13.51%)	15 (40.54%)	35 (94.6%)	
Maternal mortality		Yes	0 (0%)	3 (8.1%)	13 (35.1%)	16 (43.24%)	< 0.0001**
		No	15 (40.54%)	2 (5.41%)	4 (10.84%)	21 (56.76%)	
Total			15 (40.54%)	5 (13.51%)	17 (45.94%)	37 (100%)	

TBSA: total burn surface area, IUFD: intrauterine fetal death, \*chi-square test. \*\*significant at the 0.01 error level.

steam in 7, car fire in 2, electricity in 1, hot oil in 1, and unknown in 1 patient.

### *Mortality and morbidity*

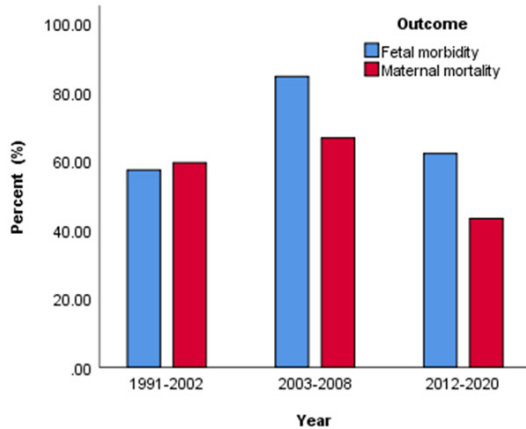
Maternal and fetal mortality and morbidity included maternal death in 16 (43.2%), premature labor in 2 (5.4%), abortion in 14 (37.83%), and IUFD in 7 (18.91%) cases. The relationship between TBSA burned and maternal and fetal outcome is summarized in **Tables 1** and **2**. As shown in the **Table 1**, there are a significant correlations between TBSA burned and fetal morbidity included abortion, IUFD and premature labor except abortion in first trimester and IUFD in second trimester that probably low sample size has limited proper conclusion (4 and 1 patients, respectively). On the other hand, results are shown in **Table 2**, strongly emphasize a significant correlation between TBSA burned and maternal mortality in first and

second trimesters and in total. More than 50% of the women with TBSA more than 54% died (LA50%). Taken together, these results show a correlation between TBSA burned and maternal mortality, also fetal morbidity, especially in patients with more than 50% TBSA burned.

### **Discussion**

This is our third report of maternal and fetal outcome of burn during pregnancy from Kermanshah, Iran. Our previous reports included 91 and 39 pregnant women burned between the periods 1991-2002 and 2003-2008, respectively [7, 8]. The current study includes 37 pregnant women burned during the period 2012-2020, which shows less average number of patients per year (4.6 patients per year versus 7.6 and 7.8). In this study, 16 out of the 37 patients died, indicating a mortality rate of 43.2%. The rate is less than that of our prior

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**Figure 1.** Fetal and maternal outcome percentage in three distinct report from Kermanshah, Iran.

reports, which revealed 59.5% and 66.7% mortality rates (**Figure 1**).

Decrease in number and mortality rate of patients in our third study sounds highly promising, and implies better prevention policy and medical care. Other reports from other centers in Iran show a similar mortality rate [9-11]. However, Rezaei reported a considerably lower mortality rate from Mashhad (29.1%) [12], while Vaghardoost et al. [13] and Karimi et al. [14] reported 47.3% and 52.8% mortality rates from Motahari Hospital in Tehran (capital of Iran), probably due to the referral nature of the center and more complicated cases. Higher mortality rate has been reported from other developing countries such as Nigeria [3] with 70% and India [15] with 52.6%. However, the sample sizes in such researchs were small (10 and 19 patients, respectively). Mean age of the patients was  $32 \pm 6.07$  years, which is higher than that of our last report ( $23.5 \pm 4.78$  years) [8]. Also, in comparison to other reports from Iran [1, 10, 11, 13, 14] and other countries [5, 16, 17], mean age of our patients was higher. This may be due to increased age of marriage and pregnancy in our society. The main burn agent was flame burn due to kerosene and gasoline. Although this finding is similar to the vast majority of published studies [2, 5, 13], it is quite different from our last report in which hot oil was the main agent. This finding may indicate a change in the behavior of pregnant women and their less inclination to cooking. Unfortunately, self-immolation rate was high (43.2%), as indicated in our previous reports

(47% and 43.6%) [7, 8]. Nevertheless, self-immolation rate is lower than that of other developing countries [5]. These results highlight the necessity of attaching greater significance to socio-economic and cultural problems. In our series, only 2 patients (5.4%) had university education, whereas 22 cases (59.4%) were illiterate or only literate up to the level of writing and reading. Similar findings have been reported previously [2, 14], to the extent that Mehdizadeh et al. reported a significant relationship between education level and the risk of burn during pregnancy [18].

In contrast to Karimi et al. [14], who showed maximum and minimum frequencies of burn cases during summer and spring, respectively, we failed to find any difference in seasonal distribution of burn in pregnant women. Similar results were published in our previous reports [7, 8] and by Mehdizadeh et al. [18]. However, seasonal distribution of burn is not mentioned in the majority of published studies.

Given that in many cases administration of systemic antibiotics is inevitable, possible side effects for the fetus is a major concern. In addition, silver sulfadiazine, a topical agent used in burn injury, could be absorbed from the wounds with some potential risks for the fetus [6]. However, like other studies [2-4, 6-20], we could not determine drug side effects on the fetus.

There was a significant correlation found between abortion and TBSA in the second trimester. However, this correlation was not statistically significant in the first trimester, probably due to a small sample size. There was also a correlation found between IUFD and TBSA during the second and third trimesters with *P* value equal to 0.54 and 0.015, respectively. Maternal death as the most important factor in such studies is significantly correlated with TBSA during the second trimester ( $P = 0.03$ ) but near significant in the third trimester ( $P = 0.07$ ) and non-significant in the third trimester ( $P = 0.28$ ) due to a low number of patients. However, when this correlation was analyzed in overall, a strong correlation was found ( $P = 0.0001$ ). Despite an annual decrease in number of pregnant women and decrease in maternal mortality rate in the present study in comparison to the two previous reports, and despite improvement in equip-

ment and facilities in our center, there is still a high maternal and fetal mortality and morbidity rate with higher TBSA in the recent study. On the other hand, LA50% shows no significant change (54% versus 60%). These findings shows that higher TBSA burned significantly correlated with higher risk of mortality and morbidity so that in TBSA burned more than 50%, this risk is very higher. Similar findings have been reported by Vaghardoost et al. [13]. They reported a lower maternal mortality rate in comparison to Tavassoli Afshars' study [19] in the same center but many years before Vaghardoosts' report (47.4% versus 66%). Although this finding indicated an improvement in the management of patients with burn, he eventually came to the conclusion that with TBSA > 50%, mother survival is unlikely. Such findings underscore benefits of preventive measures rather than medical and hospital facilities. Similar findings have been reported by other authors [1, 2, 15, 20]. The study performed by Ogbogu from Nigeria is the only research that fails to find an association between mother burn characteristics (including TBSA) and maternal and fetal outcome. More importantly, Ogbogu's report includes only 10 patients, which is too small a size to perform a perfect statistical analysis [3].

### Conclusion

Burn during pregnancy significantly increases maternal and fetal mortality and morbidity. Despite improvement in medical facilities in developed and developing countries, high mortality and morbidity rates in patients with more than 50% TBSA are still prevalent. Preventive socio-economic intervention may prove more effective.

### Disclosure of conflict of interest

None.

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