

Feto-maternal Outcomes in Pregnancies Complicated by Thermal Burns

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Abstract

Background Burns in pregnancy can be a potentially life-threatening condition for both mother and baby. Human physiology is altered during pregnancy and burns add further stress leading to diminished maternal reserves. Very few studies have been reported for management of such patients.

Materials and Methods This was a prospective based study carried out in Department of Burns and Plastic Surgery in collaboration with Department of Obstetrics and Gynaecology and Department of Pediatrics for a period of 20 months from December 2011 to July 2013. Pregnant women with thermal injuries more than 15% TBSA were included in the study. Patients with coexisting obstetrics complications and burns other than thermal were excluded.

Results Out of 3397 female patients of burns admitted, 1382 patients were in reproductive groups, 1116 were married and 67 were pregnant; these were enrolled. Maternal and fetal outcome is inversely linked with the TBSA of the mother ($p < 0.001$). In TBSA group 15–30%, there was no maternal and fetal mortality, but in TBSA >30–50% maternal mortality was 44%, and in 50–70% maternal mortality was 83% and no mother survived in >70%. In TBSA 30–50%, fetal mortality was 72%. Only one baby survived in 50–70% TBSA group and one in >70% TBSA group after intensive care in NICU for prematurity. Fetal survival was also dependent on gestational age, and there are better outcomes in late trimesters.

Conclusion Maternal and fetal outcome are directly related to TBSA of mother, and best care can be offered to such patients with a multidisciplinary team-based approach.

Keywords Burns · Pregnancy · TBSA · Maternal and fetal outcome

Introduction

Burns are one of the most severe injuries afflicting human beings. Women of reproductive age groups get exposed to various hazards unrelated to pregnancy and burns are one of them. Human physiology alters during pregnancy and burn adds further stress to systems [1]. Burns during pregnancy present a unique medical problem as both the mother and fetus are at a great risk of fluid loss, hypoxemia and sepsis. The highest incidence of burns during pregnancy has been reported from India. It ranges from 7 to 15% [2] by various studies. Most of the previous studies are retrospective based on the data collected from the past; the role of active management cannot be based on these studies. Furthermore, there is a paucity of local studies in Delhi and nearby regions regarding data on the specific problems of burnt pregnant women.

This study was carried out to determine the factors responsible for poor maternal and fetal outcome, and the morbidity and mortality for both mother and fetus in pregnancies are complicated by burns.

Materials and Methods

This prospective study was carried out in Department of Burns and Plastic Surgery in collaboration with Department of Obstetrics and Gynaecology and Department of Pediatrics for a period of 20 months from December 2011 to July 2013.

Pregnant women with thermal injuries more than 15% total body surface area (TBSA) were included in the study. Patients with coexisting obstetrics complications and burns other than flame and scald, i.e., electrical, chemical and radiation burns were excluded. Patients were received in burns casualty, and after initial resuscitation, detailed history was taken regarding the mode of injury and initial treatment received between the injury and reporting time to the hospital. Call was sent for obstetricians, and obstetric evaluation was also done side by side. The burned surface area (BSA) was estimated using the Lund and Browder’s chart (Fig. 1). Fluid loss was replaced with Ringer lactate (RL) solution using modified Brooke’s formula, i.e., first 24 h no colloids only RL solution 2 ml/kg/% burn is given and for next 24 h colloids at 0.3–0.5 ml/kg/% burn and no crystalloids are given. Glucose in water is added in the amounts required to maintain good urinary output [3]. The burned wounds were debrided, cleansed and covered with 1% silver sulfadiazine (SSD) or collagen dressings or with silver dressings. Plastic surgeons team was working in proper coordination with the team of obstetricians. Active and passive tetanus immunization was given to every patient. Antibiotic and analgesics which are safe during pregnancy were given. After initial resuscitation, patients were shifted to burns ICU. Ultrasonography (USG) was performed within 24–48 h after initial stabilization of patient. Obstetrical intervention was done according to the fetal viability and maternal condition depending upon TBSA.

In pregnancy below 24 weeks irrespective of degree of burns, no intervention was done in viable fetus, but

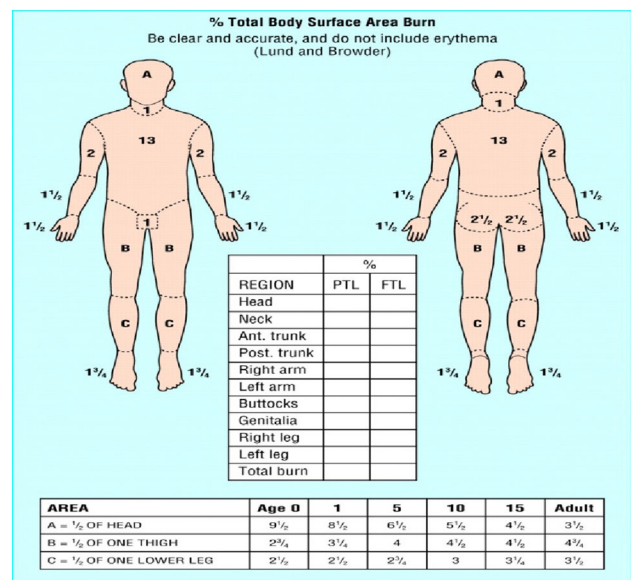


Fig. 1 Lund and Browder chart for estimating TBSA

Table 1 Obstetric management of patients beyond 20 weeks of gestation

Extent of burn (TBSA) (%)	Gestational age of fetus						
	Up to 28 weeks		28–36 weeks			>36 weeks	
	Viable fetus*	Non-viable fetus	Viable fetus ^a		Non-viable fetus	Viable fetus	Non-viable fetus
			In labor	Not in labor			
15–30	No active intervention Steroids only	Induction of labor	Steroids and tocolytics/delivery if imminent	Steroids + continued pregnancy	Induction of labor	Induction	Induction
31–50	No active intervention Steroids only	Induction	Steroids and tocolytics/delivery if imminent	Steroids + delivery within 24/48 h	Induction of labor	Induction/CS	Induction
51–70	No active intervention Steroids only	Induction	Steroids and tocolytics/delivery if imminent	Steroids + delivery within 24/48 h	Induction of labor	Induction/CS	Induction
>70	No active intervention Steroids only	No active intervention	Steroids + delivery	Cesarean section as an emergency procedure at the earliest	No active intervention	Cesarean section as an emergency procedure at the earliest	No active intervention

^a Steroid injection was given between 24 and 34 weeks of pregnancy

monitoring of ongoing pregnancy was done. For steroid coverage, two doses of betamethasone 24 h apart were given between 24 and 34 weeks of pregnancy. In cases of extensive burns, earliest termination of pregnancy was considered where fetus was beyond the period of viability (28 weeks.) as maternal prognosis is very poor once TBSA is more than 50%. Patients in labor were shifted to labor room and post-delivery after 4 h they were shifted back to burns ICU. The labor rooms in Safdarjung Hospital are well equipped for monitoring critically ill patients, and also there is a well-equipped HDU in Department of Obstetrics and Gynaecology. Patients requiring emergency LSCS were also admitted in emergency obstetrics O.T due to lack of neonatal resuscitation facility in burns O.T. Babies after delivery were managed in NICU. Patients aborting were managed in burns ICU. Patients discharged with live fetuses were followed up in antenatal OPD. Those who did not report were telephonically tracked (Table 1).

Results

During the period of 20 months from December 2011 to July 2013, total 3397 burnt female patients were admitted in our casualty of burns, plastic and maxillofacial surgery of Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi. Out of these 3397 females, 40.68% (1382) were in reproductive age group who got thermal burns. In these 1382 patients, 80.75% (1116) were married.

In these female married patients, 5.74% (64) patients were pregnant. These 64 pregnant patients with burn injuries were our study subjects.

Average age of patients was 24.6 years. According to percentage of total burn surface area of patients, they were divided in four groups in increasing order of severity of burn. According to gestational age of fetus, mothers were categorized trimesterwise with maximum patients in 2nd trimester. Maternal and fetal outcome in each trimester and TBSA group is summarized in Table 2.

In 6 patients, no obstetric intervention could be done because mother was having extensive burns and died during resuscitation.

There were 22 patients in 1st trimester out of which 13 patients expired, and 5 mothers discharged with viable fetus and follow-up done in OPD. In 4 cases, fetus expired and pregnancy was terminated.

There were 29 patients in second trimester out of which 19 mothers expired, and 10 were managed conservatively. Two mothers with severe inhalational injuries landed in premature labor. In both cases, gestational age was 24 weeks, and in another case, gestational age was 24 weeks. Delivered babies were extremely premature with 800 and 900 g birth weight. These babies were shifted to NICU but both expired within 24 h due to hyaline membrane disease. Three patients delivered after discharge, and four pregnancies continued with live babies after July 2013. Three patients had IUD.

Table 2 Outcomes of the present study (December 2011 to July 2013)

TBSA (%)	Total no. of cases	First trimester	Second trimester	Third trimester	Maternal survival			Fetal survival			
					1st	2nd	3rd	1st	2nd	3rd	
15–30	11	1	5	5	11				11		
					1	5	5	1	5	5	
31–50	25	9	11	5	14			7			
					1st	2nd	3rd	1st	2nd	3rd	
					7	5	2	3	2	2	
51–70	12	6	4	2	2			1			
					1st	2nd	3rd	1st	2nd	3rd	
					1	0	1	1	0	0	
>70	16	6	9	1	None			1			
					1st	2nd	3rd	1st	2nd	3rd	
					0	0	0	0	0	1	

Thirteen patients were in third trimester out of which only 8 mothers and 8 fetuses survived, and one patient with 40% TBSA came in active labor and delivered a live baby. In three patients with more than 36 weeks of pregnancy, induction was done: Two delivered live babies and one had stillbirth. One patient with 36 weeks of pregnancy and 35% TBSA had PROM within 10 h of admission, so labor was augmented and a live baby was delivered. One patient with 32-week primi pregnancy with >70% TBSA was referred from rural area of UP in a state of hypovolemic shock. Her general condition was very poor and she had cardiac arrest during her resuscitative face, and fetal cardiac activity was confirmed with immediate USG. As prognosis of patient with >70% burns is itself very poor, a joint decision for immediate termination of pregnancy was taken by senior consultants of obstetrics and burns and plastic with consent of attendants. Bishop's score was very poor, so perimortem LSCS was performed; a live preterm female baby of 1.4 kg was born which was immediately shifted to NICU. The mother did not survive, but with efficient care by our neonatologist baby survived. Three pregnancies less than 36 weeks were managed conservatively and continued with live fetus.

In 9 cases, mother with TBSA >70% and fetus were non-viable, so as per protocol conservative management was done; otherwise, in case of non-viable fetus pregnancy has been terminated in all other TBSA groups.

Maternal Outcome

Out of 64 mothers, 27 survived; in 37 who did not survive, the cause of death was sepsis in 29 cases and burn shock during resuscitation in 8 patients. In group A, all 11(100%) mothers survived, in group B 14(56%) survived out of 25, in group C only 2(17%) patients survived out of 12 and in group D none survived.

Fetal Outcome

Out of 64 fetuses, only 20 survived. According to gestational age, fetal survival in 1st trimester was 5 out of 22(22.73%), in 2nd trimester 7 out of 29(27.59%) and in 3rd trimester 8 out of 13(53.85%). Out of 20 survived fetuses, 5 delivered alive in same admission, 7 delivered after mother was discharged from hospital and in 8 cases pregnancy continued with live fetus whose EDD was after July 2013. Forty-four fetuses did not survive in which abortion was the cause in 29, stillbirth was in 4 cases and 11 mothers with non-viable fetus expired in antepartum period.

Neonatal Outcome

Out of 5 neonates, 2 were term babies and 3 were preterm babies. Both term babies survived and 1 out of 3 preterm babies survived. One term baby was discharged from nursery after 6 days, but another one was kept for a longer period of 12 days, whose mother was in active labor at the time of reporting to casualty. Baby was hypoxic and Apgar score was poor, but baby recovered completely in NICU. Single survived preterm baby was discharged after 7 days from nursery. Both extremely premature babies died within 24 h due to hyaline membrane disease.

On applying Chi-square test to see the correlation between TBSA and Feto-maternal outcome, it was seen that maternal outcome and fetal outcome are inversely linked with the TBSA of the mother (p value <0.001). In TBSA group 15–30%, there was no maternal and fetal mortality, but in TBSA >50% survival was dismal in both. Our study also supports that during last trimester once the fetus is viable with early intervention we can improve the fetal outcome in mother whose survivals are nearly difficult in TBSA >70%.

Postpartum Complications

Sepsis was the most common complication reported in postpartum period. Postpartum sepsis was suspected where sepsis occurred within 3–4 days of burn because sepsis in burn is uncommon in this early phase. Postpartum sepsis developed in 2(16.67%) mothers out of 12 who delivered live babies, but this complication was much higher in cases where abortion or stillbirth was the result, 11 out of 33(33.33%).

Risk Factors

Most of the causes of burn injuries in developing countries are indirectly related to social and economic problems, illiteracy and poverty [2]. In a developing country such as India, the incidence of burns in pregnancy is as such more than the similarly aged women of developed world. In the present study, cause of injury was accidental in most of the cases 95% (58), 3% (4) cases were homicidal and only 2% [2] cases were suicidal. Flame burn was mode of injury in 61 cases and scald in 3 cases. Kerosene oil use was involved as mode of burn injury in 42 out of 64 cases, 66%. In only 17(26%) cases, LPG was as mode of injury. Candle and flash burn was responsible for burn injuries in one case. This indicates that in India still there is lack of availability of proper cooking facilities and people are still using kerosene for cooking purposes in kitchen; also people need awareness and education about safe cooking practices.

Patients arriving to hospital after burn had an average delay of 10 h and 23 min. This shows that patients especially coming from outside of Delhi are spending their crucial first 8 h in journey, without adequate fluid management. Nineteen percentage patients presented to the casualty without maintaining any referral slip or IV access from remote referral centers. Three patients came after days to weeks of their burn injuries, after being treated at various centers even by minimally qualified healthcare personnel. Pregnancy is associated with a hyperdynamic cardiovascular state and an expanded total body plasma volume to supply the placental vascular bed. After a burn, there is increased capillary permeability and accelerated fluid loss which can cause the patient to become hypovolemic. That is why prompt early resuscitation is required to improve maternal and fetal outcome. Mokube et al. [4] study showed that like in other burnt patients early and adequate fluid resuscitation was the key factor in avoiding hypovolemic shock, which in turn may lead to decreased uterine blood flow, leading to fetal hypoxia and poor outcome. It is responsibility of referring authority that patient should be sent in a well-equipped ambulance and with trained personnel that can give this much amount of fluid while patient is on the way.

Discussion

This study was carried out to assess the maternal and fetal outcomes in pregnancies complicated by burns. Pregnancy is a state of hyperdynamic circulation with increased cardiac output of 43%, decreased systemic vascular resistance of 21%, increased intravascular volume by 50% and decreased colloid osmotic pressure; all these changes make the burnt pregnant women lose additional fluid beyond the amounts seen in non-pregnant females. Major degree of burns causes both increased capillary permeability and inhalational injury to the maternal airway; this leads to maternal hypotension and respiratory insufficiency, causing reduction in the uterine blood flow and decreased supply of oxygen, leading to fetal hypoxia and acidosis. The condition of hypotension and acute respiratory insufficiency is further accompanied by septicemia. Hypovolemia with hypoxia and the synthesis and release of prostaglandins from the skin in the burn area lead to spontaneous miscarriage and premature delivery.

The maternal and fetal outcome was inversely associated with the severity of TBSA of the patients in our study as it was seen in other studies also [5, 6]. Overall maternal mortality was 57.81% and fetal mortality was 68.75%. No fetal or maternal mortality was recorded in TBSA <30%, but as the TBSA increased the mortality also increased with no maternal survival in >70% group although we could save one fetus with immediate postmortem caesarian section in this group. Fetal survival was increased with increasing gestational age of the fetus in same TBSA group. Fetus in first trimester was at maximum risk of non-viability. In patients presenting with extensive burns (>50%) with viable fetus where maternal survival is difficult, timely intervention to terminate pregnancy can result in at least better fetal outcome, and with good NICU care, premature babies can also survive.

As our hospital is apex referral center for burns patients in Delhi NCR, we could enroll 64 patients in our study which amounts to a good number. Being the tertiary center equipped with latest facility for management of burns patients with emergency obstetrics care and NICU, we could offer these patients a multidisciplinary team-based approach which resulted in better outcomes in our study.

There is very limited literature available on thermal burns during pregnancy, there are few studies both retrospective and prospective, and in most of these studies the extensive percentage of TBSA was the only significant factor responsible for the adverse fetal and maternal outcome. Maternal survival was not affected by the pregnancy. Gaffar et al. [2] in their prospective study of 32 patients also showed that maternal mortality increased with burns >25% TBSA and was maximum with burns more

than 50% TBSA, and also burns precipitate abortions and premature labor on a very significant number of patients of burns.

Masoodi et al. [4] in their study also confirmed that fetal and maternal mortality is directly proportional to TBSA and multidisciplinary team-based approach with early intervention in patients with viable pregnancy can significantly improve the fetal outcome. Findings of these studies support our outcome.

Conclusion

Our study confirmed the grave effects of burn on the fetus and mother as the more is the TBSA, the higher is the maternal mortality. It also reflects that peripheral referral system needs strengthening in context to the primary treatment, resuscitation and transportation of such patients. Our study supports prevention as the first and foremost important tool to save both mother and fetus because most of the cases are accidental. Timely intervention and multidisciplinary team-based approach of burns and plastic surgeons, obstetricians and neonatologists can significantly change the positive outcome in such patients.

Compliance with Ethical Standards

Conflicts of interest The authors declare that they have no conflict of interests.

Informed Consent Informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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