# EFFECT OF BURNS ON MATERNAL AND FOETAL OUTCOME IN PREGNANCY

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**SUMMARY**. Burns sustained during pregnancy have been reported as having an adverse effect on maternal and foetal survival. More recently, results have improved. We report 16 cases with generally satisfactory results. We also provide the long-term follow up in ten of the children. The study was carried out by retrospective chart review over a 19-yr period. The 16 cases ranged in age from 13 to 34 yr (mean, 22 yr). Burn size ranged from 2 to 94% (mean, 25.3%). Gestational age at admission ranged from 3 to 38 weeks (mean, 17.5 weeks). Seven patients had inhalation injuries. No treatment-related complications were identified. Two patients (12%) died, one of whom was first delivered of a viable infant. Three surviving patients underwent spontaneous abortions, two in the hospital and one post-discharge. Twelve patients were discharged doing well with pregnancies undisturbed. After discharge, eight patients delivered viable infants: the outcome in three cases is unknown. Ten surviving children whose families could be contacted were functioning normally at one to 15 years of age. The mortality and morbidity of pregnant patients who required hospitalization for the treatment of acute burns were felt be satisfactory. No long-term abnormalities were noted in the ten surviving children available for follow-up.

### Introduction

Burns sustained during pregnancy have been reported as increasing the mortality and morbidity of both mother and infant. Series of such cases are rare, as is follow-up of surviving infants. We report maternal and foetal outcomes in 16 pregnant burn patients treated at a regional burns centre. Longterm follow-up of surviving children is available in ten cases. Such results have not been reported previously so far as we can discover.

#### Method

A retrospective chart review of pregnant patients admitted with acute burns to the Joseph M. Still Burn Center at Doctors Hospital in Augusta, Georgia, from 1 January 1981 to 31 December 1999 was performed. Total body surface area (TBSA) burned, age, status of pregnancy, and past medical history were recorded. Length of stay, medical and surgical care, complications, and maternal and foetal outcome were documented. All cases were followed in the burn unit by the medical and surgical services in consultation with the obstetrical service. Medications known to be a possible risk during pregnancy were reviewed. Outcome of the pregnancy after discharge was followed up, if possible. The status of the infants who survived was recorded by interview with the primary care giver, or the paediatrician if possible.

#### Results

A total of 16 patients admitted to the burn unit

while pregnant were identified during a 19-year report period. During this time period, 712 women ranging in age from 13 to 50 yr were admitted to the burn unit. Of these patients, 16 (2.22%) were pregnant. Maternal age at the time of admission varied from 13 to 34 yr, with a mean of 22 yr. Pregnancy was either known to the patient on admission or identified shortly after admission by the beta-HCG blood test. The TBSA burned varied from 2% to 94% (mean, 25.3%). The mechanism of injury was reported as cooking or grease fires in six cases, house fires in four, assault in two, and four other. Maternal complications noted at admission included inhalation injury in seven cases, depressed skull fracture in one, and active gonorrhoea in one. Wound management ranged from bedside debridement and application of a skin substitute such as Biobrane or porcine xenograft to debridement and split-thickness skin grafting in the operating room. Maternal complications developing during the hospitalization included ARDS in two cases, corneal perforation in one, deep venous thrombosis in one, gram-negative septicaemia in one, pyelonephritis in one, and abruptio placentae in one.

Therapies employed in the treatment of the mother that might theoretically have had an adverse effect on the foetus included the use of neuroparalytic agents, antibiotics, narcotics, sedatives, anaesthetic agents, and hyperbaric oxygen. No complications attributable to any of these modalities were identified.

There were two maternal deaths (12.5%) - one due to septicaemia and one to multi-organ failure. One of the patients who died was 13 years of age. She had sustained a 50% TBSA burn and severe in-

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halation injury. Gestational age was estimated at 36 weeks at the time of admission. The infant, a six pound three ounce (2.8 kg) male, was delivered by Caesarean section on post-burn day one. The patient ran a downhill course and died of septicaemia on post-burn day (PBD) 6. The infant did well.

The second patient who died was 19 years of age. She had sustained an 85% TBSA burn and severe inhalation injury. She was pregnant on admission with a viable foetus felt to be 18 to 20 weeks gestational age. She had a spontaneous abortion on PBD 1. She underwent two debridement and grafting procedures. She then became septic, had a sudden cardiac arrest, and died on PBD 16.

One patient, who miscarried in the hospital and survived, was admitted with a 65% TBSA burn and severe inhalation injury. Foetal heart tones were present, and a sonogram revealed a normal intrauterine pregnancy estimated at 12 to 13 weeks gestational age. She underwent tracheostomy and escharotomies on PBD 1. Subsequently seven additional operations for debridement and skin grafting were performed, with generally good results. On PBD 40, the patient developed nausea, vomiting, and diarrhoea, diagnosed as gastroenteritis. On PBD 41, she developed vaginal bleeding. On PBD 42, foetal heart tones were lost and a sonogram revealed foetal death. Spontaneous delivery of a stillborn infant occurred later that day. After two further operations, the patient was discharged doing well on PBD 55.

A 31-yr-old patient with a 22.5% burn and inhalation injury was estimated on admission as being pregnant with a viable infant of 36 weeks gestational age. She was delivered by spontaneous vaginal delivery of a viable infant on PBD 2. The mother underwent several debridement and grafting procedures and was discharged with her wounds completely healed on PBD 50.

The two viable infants delivered while the mothers were hospitalized for their burns showed initial respiratory depression with APGAR scores respectively of 2 and 4 at 1 minute and 8 and 7 at 5 minutes. Both babies were intubated but had a rapid recovery and were extubated within 24 h. They were discharged from hospital doing well.

Twelve of the patients were discharged with wounds healed and pregnancies undisturbed. Of these 12 patients discharged while pregnant, one sustained a miscarriage 2.5 weeks after discharge. Three cases were unavailable for follow-up after discharge. The other eight patients discharged while pregnant were later delivered of viable infants.

Of the ten children available for long-term follow-up (including the two live births in hospital), ages ranged from 1.5 to 15 yr (mean, 7.1 yr) at the time of follow-up. The family or paediatrician was contacted by telephone or letter. Of the six school age

Patient number	Age of patient (yr)	TBSA (%)	Total no. operations	Duration of pregnancy (wks)	Maternal mortality	LOS (days)	Complications post-burn injury
# 1	19	94	2	18-21	PBD 16	16	Inhalation injury
#2	26	55	3	12		39	N/A
#3	22	36	7	15		138	Inhalation injury, ARDS, corneal perforation, retardation of uterine growth, gram-negative sepsis, gram-positive sepsis, pyelonephritis, CNS dysfunction secondary to hypoxia
#4	20	65	9	12		23	Inhalation injury, pneumomediastinum, placentae abruptio, gastroenteritis
#5	25	4	2	20		23	N/A
#6	26	4	1	6		3	N/A
#7	28	8	1	28		2	N/A
#8	25	20	5	27		5	N/A
#9	16	5	1	10		5	N/A
#10	13	51	1	38	PBD 6	6	Inhalation injury, depressed skull fracture
#11	30	6	1	8		26	Inhalation injury, DVT, ARDS, UTI, sepsis
#12	21	4	1	20		3	N/A
#13	34	2	1	7		1	N/A
#14	23	11	1	3		5	N/A
#15	31	22	0	36		50	Inhalation injury
#16	30	15	3	20		16	Yeast infection, hypomagnesmia
PBD = post-burn day: LOS = length of stay (days): $N/A$ = not available.							

Table I - Overall statistics

children, all were in the grade appropriate to their age and performing satisfactorily. In the opinion of their families, the four younger children met developmental standards appropriate to their age. None have any reported mental or physical defects (*Table 1*).

# Discussion

Mother and foetus are placed at increased risk by trauma. In a study of foetal death after non-burn trauma, in a review of 80 patients reported by Demitrios et al.,<sup>1</sup> three patients died, 23 had the pregnancy acutely terminated, and 14% suffered foetal death. Crosby<sup>2</sup> reported car accidents to be commonest cause of death of women of reproductive age, with falls, burns, and firearm injuries next in descending order.

The reported outcome of burn injuries in pregnant patients varies from one burn centre to another. Mortality of mother and infant is reported to be high in some series. Rayburn et al.<sup>3</sup> reported 30 pregnant patients with burns ranging from 11% to 97%, eight of whom (26.7%) died. Each foetus was delivered spontaneously before maternal death, but seven of the eight were stillborn. Foetal death occurred in 12 (40%) of the 30 cases, mainly in patients with large burns. The largest burn survived by both mother and foetus was 58%. No foetus survived if the burn exceeded 60% TBSA.

Taylor<sup>4</sup> reported 19 pregnant women with burns ranging from 6% to 92% TBSA. He found that maternal survival was usually accompanied by foetal survival. If the patient had an eventually lethal injury, the pregnancy terminated spontaneously prior to death. Seven of the 19 patients (36.8%) with burns greater than 60% TBSA died.

Matthews<sup>5</sup> reviewed 50 patients. Of these, 23 (46%) were discharged doing well and still pregnant. In 27 cases (54%), the infant failed to survive. Fourteen (28%) of the mothers died. Amy et al.6 reported 30 patients, among whom 10 of the mothers (33.3%) failed to survive. In 12 instances, the infant failed to survive, and in all but one of these cases the mother also did not survive. Yingbei et al.<sup>7</sup> reported 24 cases of burns in pregnant women, of whom two (8.3%) died. The foetus failed to survive in five cases (20.8%). Deitch<sup>8</sup> reported 11 patients, all of whom survived and six of whom (54.5%) delivered surviving infants. Gang et al.9 reported 16 patients, with one maternal death (6.3%) and five foetal deaths. Haddadin et al.<sup>10</sup> reported a 30% maternal mortality and a 50% foetal mortality in the first trimester. In all series the mothers who failed to survive were usually those with the largest burns. These were the patients who were most likely to spontaneously abort their infants. Maternal mortality varied from zero to 33.3%.

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In our series there were two maternal deaths (12.5%), in one of which cases a viable infant was delivered pre-mortem. Both women who died had large burns and inhalation injuries.

As noted, foetal mortality varied extensively in various series. Napoli et al.11 reviewed 16 series reported since 1982. In eight series with more than 10 patients each, foetal mortality ranged from 27 to 72%. As would be expected, in all series both maternal and foetal mortality increased with the burn size and the presence of inhalation injuries. Some series report only those foetal deaths occurring during acute burn hospitalization. In our series there were three foetal deaths (18.8%), two during acute hospitalization and one post-discharge. This is a lower figure than that reported in most series. Deitch<sup>8</sup> noted five foetal deaths in a series with no maternal mortality. As noted, one of our patients, with a 65% TBSA burn, delivered a stillborn infant and survived after a complicated course.

We did not find any mention in the literature of major problems encountered in viable infants born in hospital during treatment of the mother's acute burn. Yingbei<sup>7</sup> specifically noted that his group did not encounter any foetal problems in hospital due to general anaesthesia.

We have been unable to find any reports of longterm follow-up of infants born to mothers acutely burned during pregnancy. In the ten children (two born during acute hospitalization for burn care and eight born after discharge) available to us for followup, physical and mental development appeared to be normal insofar as could be determined.

Care of patients was carried out in accordance with standard burn management programmes in use at the time. Since the patients were admitted over a 13-yr period, there were progressive changes in burn treatment regimens over time. Close co-operation with the obstetrical staff was felt to be essential.

# Conclusion

In spite of the potential problems of pregnancy in burned patients, results as regards maternal and foetal mortality and long-term results regarding the children's later development appear satisfactory. **RÉSUMÉ**. Selon les données de la littérature, les brûlures pendant la grossesse ont un effet négatif sur la survivance maternelle et fœtale. Plus récemment les résultats ont montré une amélioration. Les Auteurs présentent 16 cas avec des résultats généralement positifs. Ils fournissent en outre le suivi à long terme dans dix des enfants. L'étude a été effectuée moyennant une analyse rétrospective des résultats pendant une période de 19 ans. L'âge des patientes variait de 13 à 34 ans (moyen, 22 ans). L'extension des brûlures oscillait entre 2 et 94% (moyen, 25,3%). L'âge gestationnel au moment de l'hospitalisation variait de 3 à 38 semaines (moyen, 17,5 semaines). Sept patientes présentaient des lésions dues à l'inhalation. Les Auteurs n'ont pas observé aucune complication corrélée au traitement. Deux patientes (12%) sont décédées, dont une a premièrement accouché d'un enfant viable. Trois patientes ont subi un avortement spontané - deux à l'hôpital et une après la sortie. Douze patientes ont été renvoyées de l'hôpital en bonnes conditions et sans problèmes pour leur état de grossesse. Ensuite, huit patientes ont eu un enfant viable: en trois cas on ignore l'aboutissement. Dix enfants survivants dont les familles ont pu être contactées fonctionnaient normalement à l'âge d'un à 15 ans. La mortalité et la morbidité des patientes enceintes qui ont nécessité l'hospitalisation pour le traitement des brûlures aiguës ont été considérées satisfaisantes. Les Auteurs n'ont pas noté aucune anormalité à long terme en aucun des dix enfants survivants disponibles pour le suivi.

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