TREATMENT CHALLENGES IN A PREGNANT PATIENT WITH SEVERE BURN INJURY AND WOUND CARE USING AMNIOTIC MEMBRANE: A CASE REPORT

BRÛLURE GRAVE CHEZ UNE FEMME ENCEINTE, TRAITÉE LOCALEMENT PAR MEMBRANE AMNIOTIQUE : À PROPOS D’UN CAS

Rosadi Seswandhana M.,¹ Prawoto A.N.,¹ Rachman I.T.,² Wahdini S.I.,¹ Vityadewi N.,¹ Ramli R.N.,¹ Dachlan I.¹

¹ Plastic Reconstructive and Aesthetic Surgery Division, Department of Surgery, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada / Dr. Sardjito General Hospital, Yogyakarta, Indonesia
² Department of Obstetrics and Gynecology, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada / Dr. Sardjito General Hospital, Yogyakarta, Indonesia

SUMMARY. We report a case of severe burn injury in a 42-year-old pregnant patient referred to our hospital’s burn unit after experiencing a scald burn injury that burned her neck, chest, trunk, abdomen and limbs. The patient had burn wounds distributed on her neck, all four extremities, the chest and abdomen, with a total burn area of 46.5%. The burn wounds were treated with surgical debridement and then covered with silver sulfadiazine and damp gauze. The patient’s wounds were treated every three days. The patient delivered a healthy baby full-term through a spontaneous, vaginal delivery. After delivery, the amniotic membrane from the patient was used as an amniotic membrane graft and was planted on the patient’s chest, right arm and right thigh. The amniotic membrane in this patient helped to accelerate the preparation of the wound bed for skin grafting. Split-thickness skin grafts were then used on the wounds and the patient was discharged from the hospital one week later. Patients that present with burn injuries during pregnancy require intense monitoring and careful management from a multidisciplinary team. A collaborative effort needs to be made in order to plan the best outcome for the mother and fetus. Precise and early resuscitation is the first step to treating such cases. The administration of fluids should be titered based on the patient’s hemodynamic condition and urine output. Wound management can also be optimized using the amniotic membrane as a temporary dressing before skin grafting.

Keywords: severe burns, pregnancy, amniotic membrane

RÉSUMÉ. Nous rapportons le cas d’une femme de 42 ans, enceinte, hospitalisée dans le service après un ébouillantement touchant le cou, le thorax, l’abdomen et les membres, représentant 46,5% SCT. Les pansements étaient réalisés tous les 3 jours avec de la sulfadiazine argentique recouverte de gaze humide. La patient a accouché naturellement, à terme. Sa membrane amniotique a été utilisée pour recouvrir le thorax et les membres droits en attente de greffes, la patiente étant sortie 1 semaine après leur réalisation. Les patientes se brûlant durant leur grossesse doivent bénéficier d’un suivi multidisciplinaire attentif s’intéressant à la maman et au fœtus. Le remplissage initial doit être adapté à l’hémodynamique et à la diurèse. Le traitement local peut être optimisé, avant greffe, par l’utilisation de la membrane amniotique.

Mots-clés : brûlure grave, grossesse, membrane amniotique

¹ Corresponding author: M. Rosadi Seswandhana M.D., Plastic Reconstructive and Aesthetic Surgery Division, Department of Surgery, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada/Dr. Sardjito General Hospital, Yogyakarta, 55281, Indonesia. Tel.: +62 87838770099; email: rosadi_seswandhana@ugm.ac.id
Manuscript: submitted 07/06/2022, accepted 03/07/2022
**Introduction**

Burn injuries in pregnant women are a rare but disastrous occurrence that provides another layer of complexity for the care provider. Most of these cases are reported from developing countries.\(^1\) Cases of burns in pregnancy happened the most during the second trimester but showed the highest rates of morbidity in the third trimester. Although burns in pregnancy are rare, these cases have been shown to have a high mortality and morbidity rate for both the mother and the fetus. One study even showed a maternal mortality rate of around 45% and a fetal mortality rate of 46%.\(^4\)

Pregnancy causes the mother’s body to undergo changes both anatomically and physiologically. The occurrence of trauma such as burn places additional stress on the mother and the fetus. A better understanding of these changes in pregnancy helps us recognize the direct effect on maternal response to burn injuries as well as how to manage these cases. Burn injuries in pregnancy also require a multidisciplinary team to coordinate the care of and optimize the outcomes of these patients.\(^5\)

Biological dressings for burn wound coverage have been used for centuries. Reports on the usage of amniotic membranes have been published since the early 1900s with various levels of success in cases of burn injury wound coverage.\(^6\) Human amniotic membrane as a biologic dressing has been known for the reduction of pain, as an effective vapor barrier, bacteriostatic and a promoter of wound healing.\(^8\) There are very few cases published on the use of auto-transplantation of amniotic membrane for burn coverage.\(^9\) Auto-transplantation of amniotic membrane was used in our burn patient postpartum to help accelerate wound bed preparation.

In this paper we present a case of severe burn injuries in a pregnant woman in the third trimester who delivered spontaneously during her care in the burn unit. We discuss the complexities that health care providers will see in such cases, and review the current literature regarding the management of burn injuries in a pregnant patient.

**Case report**

We report the case of a 42-year-old pregnant woman at 29 weeks of gestation who was referred to our hospital’s Burn Unit seven days after experiencing a scald burn injury that burned her neck, chest, trunk, abdomen and limbs. The patient experienced a cooking accident causing her to fall and be burned by cooking oil. The patient was immediately brought to a nearby local hospital where she underwent a surgical debridement the day after the accident and was discharged from the local hospital within 5 days. Two days after going home, the patient went back to the emergency room of the local hospital because of severe pain and was referred to our hospital later that day. The referral from the local hospital to our hospital took approximately 4 hours. The patient was given 1 gram of ceftriaxone and infused with 2000 cc of Ringer’s lactate solution within 4 hours. One gram of ceftriaxone was then continued every twelve hours in this patient. The patient’s urine output was 2.4 cc/kg/hour.

Upon physical examination, the patient was cooperative and showed no signs of breathing difficulty. The patient presented with burn wounds on the neck and chin but they did not interfere with breathing. Physical examination revealed as follows: body weight, 67kg; blood pressure, 125/89 mmHg; heart rate, 107 bpm; body temperature, 37℃ and a respiratory rate of 20 bpm. The patient had burn wounds distributed on her neck, all four extremities, the chest and abdomen with a total burn surface area (TBSA) of 46.5%. The burn wounds consisted of a deep dermal burn injury with a 43.5% TBSA and a mid-dermal burn injury with a 3% TBSA, both due to scalding. Culture and sensitivity examinations were performed from blood and wound sample revealing *Enterobacter cloacae* bacteria from both sites. The patient was then given meropenem with good response, and no signs of sepsis were found during follow up.

The patient arrived in our hospital 7 days after her burn injury and was given fluids for maintenance. The maintenance fluid of this burn patient was calculated using the Shriner’s Cincinnati and Galveston’s formula:
Maintenance Fluid: \([1500 \text{ mL} \times \text{BSA (Body Surface Area in m}^2\text{)}] \text{ IWL:}\)

\([(35+\%\text{TBSA burned}) \times \text{BSA (in M²)}]\)

In our patient, BSA was calculated to be 1.75 m\(^2\) using the Mosteller formula with the patient’s height of 1.65 m and weight of 67 kg. The patient’s maintenance fluid was 2625 mL/24 hours (IWL: 135.02 ml/24 hours). The patient’s urine output was measured at 2.87 cc/kg/hour. The burn wounds were then treated with surgical debridement and then covered with silver sulfadiazine and damp gauze. The patient’s wounds were treated every 3 days for approximately 2 months. The patient also received transfused albumin to correct the low levels.

A healthy baby girl was delivered by a spontaneous vaginal delivery at 39 weeks with a body weight of 2,454 grams. Because of the extensive burn injuries to the patient’s breasts, breastfeeding was not an option for this case. After delivery the amniotic membrane from the patient was used as an amniotic membrane graft and was planted on the patient’s chest, right arm and right thigh. The amniotic membrane in this patient helped to accelerate the preparation of the wound bed for skin grafting. Split-thickness skin grafts were then used on the wounds and the patient was discharged from the hospital one week later. The patient was discharged from the hospital with a mid-dermal burn injury of 3% reduced to 0% and deep dermal burn injury of 43.5% reduced to 11% on the thighs and abdomen.

**Discussion**

Fluid resuscitation is of utmost priority and the most important factor in the management of patients with burns. After a burn, there is increased capillary permeability and accelerated fluid loss, which can cause the patient to become hypovolemic. Pregnancy increases the risk of hypovolemic shock due to the increase of total body plasma volume in order to supply the placental vascular bed.\(^{10}\) These conditions could cause placental insufficiency and lead to acute ischemic changes in the placenta and in fetal hypoxia.\(^{11}\) In cases where the patient is sent to the hospital within 24 hours after the injury, fluid resuscitation should be initiated using the modified Parkland formula at 3 mL/kg per TBSA burned and titrated accordingly. Fluid resuscitation should be monitored hourly (patient’s urine output, blood pressure, hematocrit and heart rate) to make sure of adequate organ perfusion.\(^{12}\) In one study, fluid resuscitation was increased in all pregnant patients of up to 150% from the Parkland formula to obtain urine output of 1 mL/kg/hour.\(^{13}\)

Because this patient came to our hospital 7 days after the initial injury, maintenance fluid was given based on the Shriner’s Cincinnati and Galveston’s formula. There is currently no standardized formula for fluid resuscitation in pregnant burn patients so each burn unit will have its own methods in such cases. Blood pressure should be maintained in order to provide a stable blood supply to the placental vascular bed. Physicians should also check for the presence of inhalation trauma which could lead to placental insufficiency. In addition, smoke inhalation causes an overall reduction in partial pressure of oxygen, possible production of cyanide and carbon monoxide.\(^{14}\)

Burns during pregnancy could lead to severe outcomes for both the mother and the fetus, such as abortion, intrauterine fetal death (IUFD), preterm labor, still birth, and escalated maternal mortality and morbidity.\(^{15}\) Because of the complexities of these cases, pregnant burn patients require the expertise of a multidisciplinary team. In this case, in addition to plastic surgeons, we also had a team consisting of an obstetrics and gynecologist, anesthesiologist and internal medicine specialist. To ensure the survival of the infant and to simplify management of the patient, late pregnancy patients should terminate their pregnancy as early as possible.\(^{16}\) High rates of IUFD occurring in severe burns may be caused by insufficient fetal-uterine circulation. Prostaglandin release in pregnant burn patients is responsible for spontaneous uterine contractions that could cause abortion or premature delivery of a fetus. Extensive release of prostaglandin occurs because of the burn injury itself and is also worsened by dehydration.\(^{17}\) Multiple studies have shown that fetal
outcomes are determined by the total body surface area (TBSA) of burns with the highest mortality and morbidity occurring in women with more than 50% TBSA.16-19 Because of the high TBSA burned in this patient, fetal monitoring was done daily to assess the fetal heart rate and fetal movement.

Managing obstetrical complications in a pregnant burn patient adds another layer of complexity for the burn team. Early recognition of the pregnancy will help to minimize teratogenic medications and ionizing radiological studies. Studies show that fetal mortality in burn patients is highest in the first trimester.20 Whereas in the third trimester, fetal survival is more determined from gestational age.21 This is why it is important to assess fetal viability from both gestational age and also fetal weight.22 Our team decided that it was best to carry on through the pregnancy until the pregnancy reached full term.

Obstetric considerations affect the choice of route and the timing of the delivery; spontaneous vaginal delivery is generally preferred even in presence of perineal burns. When there are obstetric indications for a caesarian section, this can be performed safely even when the lower abdominal wall is burnt. The patient complained of abdominal cramps at 34 weeks pregnant and was given allylestrenol 10mg every 12 hours up until the patient reached 37 weeks. This could happen because thermally injured tissue produces prostaglandins and increases the synthesis of free arachidonic acid, which increases uterine contractility thus initiating premature labor. Allylestrenol is a synthetic progesterone used to prevent threatened preterm labor. This treatment along with bed rest is effective in the management of threatened preterm labor with powerful pregnancy-maintaining and fetal weight-promoting actions.23 The patient managed to carry the pregnancy full term and spontaneously deliver a healthy baby.

Management of the burn wound is important to minimize fluid, continuous contamination, heat and nutrient loss. Silver sulfadiazine, a common topical agent used in the treatment of burn wounds, should be avoided in pregnant patients approaching or at term due to the increasing possibility of kernicterus.12 In our patient, silver sulfadiazine was applied on the deep dermal burn injuries from the beginning until the end of treatment due to the extent and severity of the burn wounds. The usage of amniotic membrane as a biological dressing for burn wounds has been shown to promote wound healing, relieve pain, and reduce the incidence of burn wound infections. In addition to these benefits, it can also be used as a temporary dressing to protect a wound before skin grafting.24-26

In this patient, we successfully utilized the patient’s amniotic membrane to promote wound healing and help wound preparation before skin grafting. Temporary skin substitutes have many advantages such as preventing water and electrolyte losses as well as promoting a moist wound environment. The patient’s amniotic membrane was obtained fresh after the birth. The amniotic membrane was prepared under sterile conditions, and was separated from the placenta, washed using saline water and then again with saline solution containing antibiotics. The amniotic membranes were then placed on the wounds on the breast, arm and thigh. Split-thickness skin grafts were then used as a permanent closure of the burn wounds and the patient was released from the hospital 1 week afterwards with a reduced burn injury of 11% deep dermal burn injury on the thighs and abdomen.

Conclusions

Patients that present with burn injuries during pregnancy require intense monitoring and careful management from a multidisciplinary team. A collaborative effort needs to be made in order to plan the best outcome for the mother and fetus. Precise and early resuscitation is the first step to treating such cases. The administration of fluids should be titrated based on the patient’s hemodynamic condition and urine output. Wound management can also be optimized using the amniotic membrane as a temporary dressing before skin grafting.
BIBLIOGRAPHY


Consent to publication. The patient gave written informed consent to publish this case report and the accompanying images. A copy of written informed consent is available for review by the Editor-in-Chief of this journal on request.

Acknowledgements. We thank all the hospital staff involved in the patient’s care.