ORIGINAL ARTICLE

Obstetric management of pregnant patients during an earthquake

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ABSTRACT

BACKGROUND: The Kahramanmaraş Earthquake, often referred to as the "disaster of the century," occurred on February 6, 2023. Following the 7.7 magnitude earthquake, extensive destruction and significant loss of life occurred across 10 provinces. This study aims to analyze the outcomes and share the surgical and radiologic algorithm applied to live, trauma-affected pregnant patients who were referred to the obstetrics and gynecology emergency department of our hospital following the earthquake.

METHODS: This is a retrospective observational study. The study included pregnant patients affected by the earthquake who were admitted to and/or referred to the obstetrics and gynecology emergency department of a tertiary hospital between February 6 and March 6, 2023. Demographic data, trauma-related findings, surgical details, and obstetric outcomes were recorded.

RESULTS: A total of 58 pregnant earthquake victims were evaluated. The mean gestational age was 22.24±10.59 weeks. The most common obstetric complaint was pelvic pain or contractions (36.3%). Eleven patients gave birth, two via vaginal delivery and nine via cesarean section. The mean gestational age at delivery was 32.81 weeks. Curettage was performed in three patients, and hysterotomy in one patient. There were six live births and five stillbirths. In patients undergoing cesarean section, a midline incision was made. After delivery, the uterus was sutured, and intra-abdominal organs were evaluated. In cases of pelvic or other fractures, intraoperative scope devices were used. When necessary, patients were consulted by general surgery and orthopedics departments and were transferred to either the ward or the intensive care unit, depending on their clinical condition.

CONCLUSION: Ultrasound has become the primary diagnostic tool for emergency evaluation in pregnant women. For earthquake victims who lack access to radiological assessment and require rapid clinical decisions, the recommended surgical approaches, particularly midline incisions, and intraoperative evaluations (such as the use of intraoperative scope after delivery) can be life-saving for both the baby and the mother.

Keywords: Earthquake; pregnancy; trauma; cesarean surgery in trauma.

INTRODUCTION

Our country has experienced numerous earthquake disasters throughout its history and is located in an active seismic zone. The recent Kahramanmaraş Earthquake, often described as the "disaster of the century," occurred on February 6, 2023. Following the 7.7 magnitude earthquake, widespread destruction and significant loss of life occurred in 10 provinces, with Kahramanmaraş being the most severely affected.[1,2] In addition to the many individuals who lost their lives or remained missing, countless others were left homeless. This disaster has once again highlighted the critical importance of first aid services, and difficulties of rescuing victims trapped under rubble, and the need for timely and appropriate access to healthcare services.[3] Healthcare workers in the region, many of whom were themselves victims of the earthquake, faced the difficult

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task of balancing their professional responsibilities with their personal hardships. During this period of emergency interventions, patients requiring continuous care and treatment, such as those with cancer, chronic diseases, and ongoing pregnancy follow-up, were affected by the crisis. In parallel with these observations, healthcare professionals bear substantial responsibility in terms of emergency response, standardization of care protocols, transportation, and the provision of essential services.[4]

Thanks to its solid and secure infrastructure, our hospital and clinic were able to remain operational and successfully treat many trauma patients in the region.[5] Based on our experiences as a gynecology and obstetrics team, we developed an algorithm to manage pregnant trauma patients with viable pregnancies, particularly during the first week following the earthquake.

Currently, there is no clear consensus or established clinical practice guidelines regarding the management of pregnant patients in trauma situations such as earthquakes. There were numerous patients awaiting imaging, and there was no clear or immediate prioritization system in place, particularly for pregnant patients with multiple traumas. Additionally, the limited use of radiological examinations due to pregnancy further complicated the diagnostic process. Other critical concerns included prioritizing the mother's life and managing the risk of premature birth.

The aim of this study is to analyze the outcomes and share the surgical and radiologic algorithm we implemented for pregnant trauma patients with viable pregnancies who were referred to our hospital's obstetrics and gynecology emergency department following the earthquake.

MATERIALS AND METHODS

This is a retrospective observational study. The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Adana City Trainning and Research Clinical Research Ethics Committee (Approval Number: 142, Date: 21.12.2023), along with institutional permission prior to the study's initiation. The study included pregnant patients affected by the earthquake who were admitted to and/or referred to the obstetrics and gynecology emergency services of a tertiary hospital located in the Southeastern Anatolia Region of Türkiye, between February 6 and March 6, 2023. Pregnant patients aged 18 years and older, with viable and/or intrauterine ex pregnancies, comprised the study group. Pregnant patients who were not earthquake victims (i.e., those whose emergency admissions were unrelated to the earthquake) were excluded from the study. Patient information was obtained from the hospital's computerized data system, and any records that were incomplete or inaccurate were excluded from analysis. Data collected included obstetric complaints at the time of admission, patient age, gestational age, type of injury, radiological examinations, and the anatomical region of the injury. Additionally, follow-up duration, surgical procedures (if performed), multidisciplinary consultations, and postnatal follow-up details were recorded.

Statistical analysis was performed using SPSS version 26.0 (IBM Corporation, Armonk, New York, United States). Descriptive statistics were presented as percentages (%) and numbers (n); continuous variables were expressed as mean ± standard deviation (SD) and median (minimum-maximum).

RESULTS

A total of 58 earthquake-affected pregnant patients were referred to or presented at the emergency department of our hospital during the one-month period following the disaster. The mean age of the patients was 29.25±7.95 years. The mean gestational age was 22.24±10.59 weeks. The most frequently reported obstetric complaint was pelvic pain or contractions, observed in 36.3% of patients. Other obstetric complaints included vaginal bleeding (10.3%), intrauterine ex fetus (10.3%), and rupture of membranes in one patient (1.7%). Among the 58 earthquake-affected pregnant patients, 24 (41.4%) presented without obstetric complaints but were still consulted and evaluated by the obstetrics department. Demographical data, obstetric findings, and fetal characteristics are presented in Table 1. Eleven patients gave birth during the study period, two via vaginal delivery and nine via cesarean section. The mean gestational age at delivery was 32.81±5.30 weeks. Curettage was performed in three patients, while hysterotomy was required in only one patient. There were six live births and five stillbirths. Among the live births, one newborn was diagnosed with intracranial hemorrhage.

The mean Glasgow Coma Scale score of the pregnant patients was 14.89±0.44. At least one extremity fracture, including facial bone or pelvic fracture, was reported in 17 patients (29.3%). Orthopedic interventions and surgical procedures are detailed in Table 2. Two patients (3.4%) required amputation (one arm and one leg). Fasciotomy was performed in 3 patients (5.2%), all of whom also developed crush syndrome. Among these three victims, two had head injuries including the neck region, while one had an arm injury. Detailed obstetric delivery characteristics, along with maternal and fetal outcomes, are summarized in Table 3.

We, as healthcare providers, were ourselves victims of the earthquake, experiencing multiple aftershocks, being separated from our homes and families, yet we continued to serve and support others in the hospital during this difficult time. We performed eight emergency cesarean sections in our clinic, particularly within the first two days following the earthquake. These patients, who had no available imaging records, were rapidly evaluated in the emergency room and immediately referred to our department. The most common indications for emergency cesarean section were vaginal bleeding and fetal distress. Uterine pain and contractions were also

Table 1. The demographical data, obstetrics and fetal characteristics

	n=58
Age (year)	29.25±7.95
Gravida	2.87±2.45
Parity	1 [0-15]
Abortion	0 [0-3]
Gestational age (week)	22.24 ±10.59
Obstetric complaint	
None	24 (41.4%)
Vaginal bleeding	6 (10.3%)
Contraction	12 (36.3%)
Rupture of membrane	1 (1.7%)
Intrauterine ex fetus	6 (10.3%)
Pregnancy termination	
None	43 (74.1%)
Vaginal delivery	2 (3.4%)
C/S	9 (15.5%)
Hysterectomy	1 (1.7%)
D/C	3 (5.2%)
Hospital stay	
None	29 (50.0%)
Service	26 (44.8%)
ICU	3 (5.2%)
Gestational age at delivery (week)	32.81±5.30
Baby status	
Live birth	6 (10.3%)
Stillbirth	5 (8.6%)
Apgar 1st minute	7 [0-8]
Apgar 5th minute	8 [0-10]

IUC: intensive care unit; C/S: cesarean section; D/C: dilatation curettage.

Table 2. The orthopedic intervention and surgery rates.

	n=58
Glasgow coma scale	14.89±0.44
Fracture	
(+)	17 (29.3%)
(-)	41 (70.7%)
Amputation	
(+)	2 (3.4%)
(-)	56 (96.6%)
Fasciotomy	
(+)	3 (5.2%)
(-)	55 (94.8%)
Orthopedic surgery	
(+)	20 (34.5%)
(-)	38 (65.5%)
Crush syndrome	
(+)	3 (5.2%)
(-)	55 (94.8%)

frequent indications, especially in cases involving either a live fetus or intrauterine fetal demise in patients with a history of previous cesarean sections. Our primary goal was to achieve delivery of a live fetus while minimizing maternal trauma. As earthquake victims ourselves, once we overcame the initial shock of the disaster, we quickly devised and implemented an emergency algorithm. First, a midline incision was performed for cesarean sections to facilitate potential exploration of intra-abdominal injuries. After the delivery of the baby and closure of the uterus, the abdominal organs were assessed and evaluated by general surgeons. Subsequently, both the lower and upper parts of the body were examined intraoperatively using a scope device. Orthopedic surgeons were consulted when fractures were suspected or identified. Once the patient was stabilized, postoperative follow-up was conducted according to her clinical condition, either in a general ward or in the intensive care unit as needed. The algorithm used in these emergency procedures is illustrated in Figure 1. As obstetricians and gynecologists, we adopted a multidisciplinary approach in managing emergency deliveries for pregnant earthquake victims. General anesthesia was administered in all surgical cases.

DISCUSSION

The Türkiye earthquake of February 2023 was a catastrophic event, ranking among the deadliest earthquakes in history. On March 1, 2023, AFAD (Ministry of Interior Disaster and Emergency Management Presidency) announced that more than 41,000 individuals had died (with 31,643 fatalities occurring within the first week), and over 115,000 individuals were injured as a result of the Kahramanmaraş-centered earthquakes.[1,2] A significant number of individuals were asleep in their homes during the initial earthquake, and many were unable to escape or find shelter from the disaster. Among the 131 deceased victims, a majority were women (52.7%), while 20.6% were children and 7.6% were elderly. Despite the large number of pregnant women affected, there was no clearly defined trauma management protocol specifically tailored for this group. To provide effective care for pregnant patients during the disaster, we, as obstetricians, recognized the urgent need to develop a practical management approach. Therefore, we designed this algorithm.

Trauma is one of the leading causes of non-obstetric mortality in pregnant women.[6] Fetal mortality in trauma cases can be as high as 65%, primarily due to complications such as pla-

Table 3. The detailed obstetrical delivery characteristics including maternal and fetal outcomes.

Patients	Age	Gravida	Parity	Delivery mode	Gestational age at delivery (week)	Obstetric complaint	Indication for operative delivery	Fetal status/ Apgar 1. -2. minunte	Diagnosis of maternal injury
1	27	1	0	C/S	22	Vaginal bleeding	Ex fetus*	Ex fetus 0 - 0	Closed pelvic fracture Bladder injury Retroperitoneal hemorrhage
2	22	2	1	C/S	39	Rupture of membranes	Fetal distress	Live 7 - 9	Closed pelvic fracture
3	28	3	2	C/S	30	Contraction	Repeated C/S, Fetal distress	Live 7 - 8	Head injury Ear injury
4	39	6	3	NVD	37	Cervical dilatation	Labor	Live 7 - 10	Soft tissue trauma
5	21	3	2	C/S	31	Vaginal bleeding	Repeated C/S	Ex fetus 0 - 0	Pelvic fracture
6	18	1	0	C/S	37	Vaginal bleeding	Intraperitoneal bleeding*	Live 8 - 10	Head injury, Blunt abdominal injury
7	26	2	1	C/S	35	Ex fetus	Ex fetus	Ex fetus 0 - 0	Extremity (Leg broken)
8	41	16	15	NVD	34	Cervical dilatation	Preterm labor	Live 6 - 8	Soft tissue trauma
9	26	4	3	C/S	26	Vaginal bleeding	Ex fetus	Ex fetus 0 - 0	Blunt abdominal trauma
10	38	4	2	C/S	38	Contraction	Fetal distress	Live 8 - 10	Blunt abdominal trauma
11	32	1	0	C/S	32	Vaginal bleeding	Fetal distress	Live 8 - 9	Blunt abdominal trauma

*: Obstetrics team involved in previously initiated surgery by general or orthopedic surgeons. C/S: Cesarean section; NVD: Normal vaginal delivery.

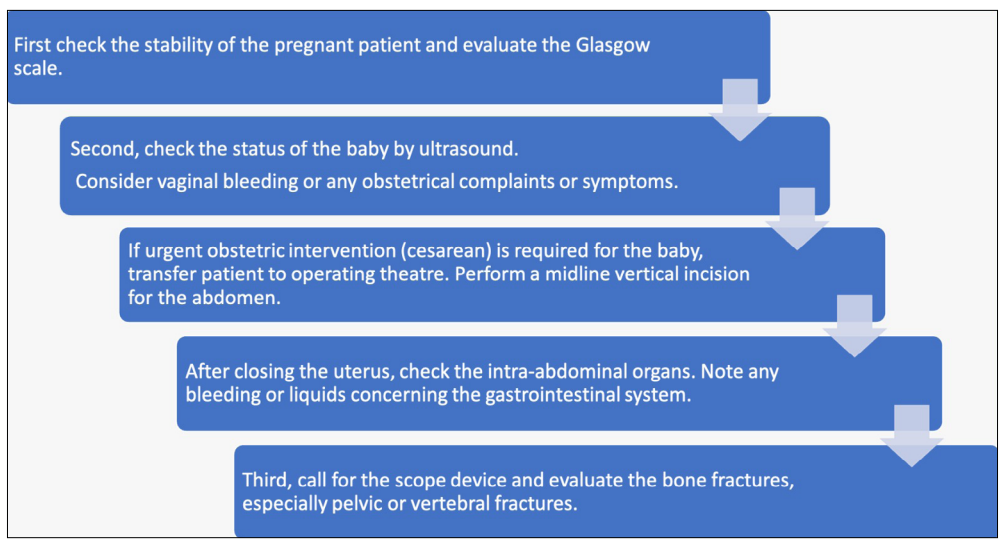

Figure 1. Surgical algorithm for the management of pregnant women with trauma during an earthquake.

cental abruption, direct fetal injury, and other associated factors.[6] Even relatively minor injuries can pose life-threatening risks to both mother and fetus; therefore, it is essential to assess the need for prompt and serious medical intervention. When trauma occurs in areas remote from the uterus, pregnancy prognosis is generally favorable.[7] We identified two primary considerations regarding fracture management in pregnant patients. The first is whether to manage the patient conservatively or through surgical intervention. The second consideration is the role and timing of cesarean section in the context of trauma. A multidisciplinary approach is essential, involving a gynecologist, an orthopedic surgeon, and a neonatologist. The indication of cesarean section may depend on gestational age. The literature includes reports of preterm cesarean deliveries performed prior to orthopedic surgery, particularly in cases involving hip and femoral fractures.[8-10]

It is well established that primary trauma care differs little between pregnant and nonpregnant patients—the mother remains the highest priority. However, in the early stages of pregnancy or in the presence of morbid obesity, pregnancy may not be immediately apparent on physical examination. Once pregnancy is identified, healthcare providers must consider both the mother and fetus, as well as the numerous anatomical and physiological changes associated with pregnancy, to ensure appropriate treatment for this specific patient population.[10]

The American College of Obstetricians and Gynecologists supports the performance of perimortem cesarean sections in critically ill or deteriorating pregnant patients.[11] This intervention is recommended for viable fetuses at a gestational age of at least 25 weeks, with a reasonable expectation of survival outside the uterus. This procedure should be performed within 5 to 10 minutes following maternal cardiac arrest to achieve optimal outcomes. These recommendations are primarily based on expert opinion and clinical experience, due to the limited availability of evidence on this topic.[11] In our study, no perimortem cesarean sections were performed, as all pregnant patients included in the study were transferred while still alive.

Although a small amount of pelvic free fluid is generally considered physiological during pregnancy and in women of reproductive age, the presence of free fluid in the context of trauma should be regarded as pathological and requires further evaluation, either by computed tomography (CT) imaging or surgical exploration, depending on the clinical scenario.[12] A negative FAST (Focused Assessment with Sonography for Trauma) ultrasound does not exclude the presence of intraperitoneal hemorrhage; rather, it should prompt evaluation for other causes of hypotension in unstable patients or further assessment through serial examinations or CT in stable patients.[12,13]

Ceylan et al.[14] discussed the importance of timely decision-making regarding amputations during the earthquake period in the Van region and shared their observations and recommendations based on their experience during such disasters. Although no specific data were provided regarding the condition of pregnant patients, the authors emphasized the need to establish pre- and post-earthquake working groups and to develop clinical algorithms in departments beyond orthopedics.

Kaya et al.[15] reported that the second most frequent admissions following the Kahramanmaraş earthquake in their hospital in Isparta were to the Gynecology and Obstetrics Department. They highlighted the ongoing need for pregnancy, childbirth, and postpartum care services for earthquake victims of reproductive age. Moreover, since pregnancy follow-up cannot be postponed and childbirth is inevitable, urgent maternal healthcare services are critically needed. In another study, it was reported that pregnancy complications, including bleeding and abnormal discharge, increased following the earthquake.[16]

Direct fetal injuries are rare in cases of blunt trauma, as the uterus and amniotic fluid help buffer and reduce the transmission of kinetic forces to the fetus.[17] However, in cases of penetrating trauma, the risk of fetal mortality increases significantly.[17,18] Earthquakes can cause both direct and blunt trauma. In our study, there were four cases of fetal demise, with gestational ages ranging from 22 to 35 weeks. All of the affected mothers sustained bone fractures and required cesarean section. In addition, one hysterotomy was performed on a pregnant woman at 16 weeks' gestation due to a crushed fetus. Initial assessment and resuscitation of the pregnant patient are essential to support fetal survival. When direct fetal injuries are identified, the decision to deliver the fetus must take into account both gestational age and the severity of the injury.[19]

According to the literature, when significant intra-abdominal bleeding is detected, an exploratory laparotomy with a midline incision is recommended.[17] Although no cases of uterine rupture or placental abruption were observed in our study, it is possible that minor, undetected placental abruptions may have occurred in patients presenting with fetal distress. Trauma is associated with a twofold increased risk of preterm delivery, regardless of the mechanism, even in cases of minor injuries.[20] Our findings were consistent with those reported in the literature.

The main limitation of this study is its single-center, retrospective design. As a retrospective study, it only includes victims who had access to medical care. Although it is difficult to establish a definitive algorithm based on this limited dataset, this study represents the first attempt to propose a structured management algorithm for pregnant patients with multiple trauma in the context of earthquakes.

We believe that these data will be valuable to clinicians, especially considering that our country is located in an active earthquake zone and similar events may occur again in the future. Although current technology does not allow for the

accurate prediction of earthquakes, having a comprehensive and up-to-date disaster preparedness plan, tailored to the specific geographical location and risk profile of each hospital, can help mitigate the adverse consequences in the aftermath of such disasters.

CONCLUSION

The management of pregnant trauma patients presents significant challenges. Accessible, pregnancy-specific guidelines would be highly beneficial, particularly for general surgeons. We believe that our proposed algorithms and recommendations will aid in the effective management of pregnant patients during earthquake-related emergencies. Ultrasound has become the primary and most rapidly accessible diagnostic tool for emergency assessment in pregnant women. For earthquake victims who lack access to radiological evaluation and require immediate decision-making, the recommended surgical approach, particularly midline incisions, and intraoperative evaluations (such as post-delivery scoping) can be lifesaving for both the baby and the mother.

Ethics Committee Approval: This study was approved by the Adana City Trainning and Research Clinical Research Ethics Committee (Date: 21.12.2023, Decision No: 142).

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Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Deprem sırasında gebe hastaların obstetrik bakımdan yönetimi

AMAÇ: Son dönemde yaşanan ve hatta "yüzyılın felaketi" olarak anılan Kahramanmaraş Depremi, 6 Şubat 2023'te meydana gelmiş, 7.7 büyüklüğündeki depremin ardından 10 ilde çok sayıda yıkım ve kayıp meydana gelmiştir. Amacımız deprem sonrası hastanemiz kadın hastalıkları ve doğum acil servisine başvuran canlı gebe hastalarda uyguladığımız cerrahi ve radyolojik algoritmayı sonuçları analiz ederek paylaşmaktır.

GEREÇ VE YÖNTEM: Bu retrospektif gözlemsel bir çalışmadır. Araştırmaya, 6 Şubat-6 Mart 2023 tarihleri arasında Adana ilinde bulunan üçüncü basamak eğitim ve araştırma hastanesinin kadın hastalıkları ve doğum acil servislerine başvuran ve/veya sevk edilen, depremden etkilenen (yatırılarak takip edilen) hamile hastalar alındı. Hastaların başvuru şikayetleri, travma bulguları, ameliyat detayları ve obstetrik sonuçlar kaydedildi.

BULGULAR: 58 depremzede hamile hasta vardı. Ortalama gebelik haftası yaşı 22.24±10.59 haftaydı. En sık saptanan obstetrik şikayet pelvik ağrı veya kasılma (%36.3) idi. Depremzedelerin 11'inin 2'si vajinal, 9'u sezaryenle doğum yaptı. Doğum sırasındaki ortalama gebelik yaşı 32.81 haftaydı. Üç hastaya küretaj yapılırken, sadece 1 hastaya histerotomi uygulandı. 6 canlı doğum, 5 ölü doğum gerçekleşti. İlk değerlendirme sonucu sezaryen kararı verilen gebelerde midline kesi uygulanmış, bebeğin doğumu ve uterusun kapatılmasının ardından batın içi organlar kontrol edilmiş olası pelvik ve diğer fraktürler için intraoperative skopi cihazı ile kontrol edilmiştir. Gerekli durum halinde genel cerrahi ve ortopedi bölümleri ile hasta konsülte edilmiştir ve durumuna göre servis yada yoğunbakıma gönderilmiştir.

SONUÇ: Ultrasonografi gebelerde acil durumlarda hızla kullanılan ana yöntem haline gelmiştir. Radyolojik değerlendirme imkanı olmayan ve hızlı karar vermek zorunda kalan depremzedeler için önerilen cerrahi adımlar özellikle midline kesi ve değerlendirmeler (doğum sonrası intraoperatif skopi cihazı ile değerlendirme) hem bebek hem de anne için hayat kurtarıcı olabilir.

Anahtar sözcükler: Deprem; gebelik; travma; travmada sezaryen.

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