

Uterine rupture in the third trimester of a pregnancy subsequent to a cesarean section by transverse uterine fundal incision: A case report and literature review

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September 12, 2022

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Title page

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Conflicts of Interest notification

The authors have no conflicts of Interest of financial support for this work.

Key words

Uterine rupture; cesarean section; uterine transverse incision; cardiac arrest; cardiopulmonary resuscitation; perimortem cesarean delivery.

Key Clinical Message:

Cesarean section by a transverse uterine fundal incision is applied for patients with placenta previa to reduce blood loss. We describe a case of uterine rupture in a pregnant women with previous cesarean section by its procedure who had recovered from cardiac arrest by multidisciplinary management.

Abbreviations

DIC: disseminated intravascular coagulation, CPR: cardiopulmonary resuscitation, PMCD: perimortem cesarean delivery, MRI: magnetic resonance imaging, PNC: prenatal care, GCS: Glasgow Coma Scale, ED: emergency department, IVR: interventional radiology, ICU: intensive care unit.

Abstract

Cesarean section by a transverse uterine fundal incision is applied for patients with placenta previa to reduce blood loss. We describe a case of uterine rupture in a pregnant women with previous cesarean section by its procedure who had recovered from cardiac arrest by multidisciplinary management.

Main document

Introduction

Uterine rupture in pregnancy is rare but has the potential to be critical for both the mother and fetus.¹ Uterine rupture could lead to intraabdominal bleeding, disseminated intravascular coagulation (DIC), shock and cardiac arrest, which could result in maternal death. Cardiac arrest in pregnancy is also rare, and it is essential to initiate cardiopulmonary resuscitation (CPR), identify the cause of cardiac arrest and treat its cause as soon as possible to achieve a favorable outcome.² Perimortem cesarean delivery (PMCD) is a rarely performed procedure for patients after experiencing cardiac arrest during CPR.

Cesarean section, which is usually performed by low transverse uterine incision, is well known as a risk factor for uterine rupture.³ A transverse uterine fundal incision is applied for patients with placenta previa to reduce blood loss.⁴ There are few reports of uterine rupture in pregnant women with previous cesarean section by transverse uterine fundal incision.^{5,6} In the present case report, we describe a case of uterine rupture in a pregnant women with previous cesarean section by transverse uterine fundal incision who had recovered from cardiac arrest by CPR and PMCD and survived by multidisciplinary management. We also reviewed cases of uterine rupture in pregnant women who underwent previous cesarean section by transverse uterine fundal incision.

Case presentation

The patient's first pregnancy occurred at the age of 33 years; cesarean section was performed at a previous hospital by a transverse uterine fundal incision with a double layer closure of the uterine muscle due to placenta previa, in which the placenta covered the anterior uterine wall. Sagittal T1-weighted magnetic resonance imaging (MRI) with contrast revealed a cesarean section scar defect at the uterine fundus at 12 months postpartum (Figure 1). The patient was not recommended to become pregnant in the future considering the risk of uterine rupture. The couple wished for a second baby, and the patient conceived by in vitro fertilization at 38 years old and embryo transfer was performed at another clinic.

The patient received prenatal care (PNC) at our hospital at 9 weeks of gestation. At the first visit, transvaginal ultrasonography revealed that a part of the muscle layer in the uterine fundus was very thin or interrupted (Figure 2). Thus, the patient was informed of the risk of maternal and fetal morbidity due to uterine rupture. However, the couple strongly wished to continue the pregnancy.

The patient received PNC every 2 weeks, and an ultrasound study was performed for early detection of possible fetal membranes bulging outside the uterus. The patient was also diagnosed with total placenta previa, which was located in the posterior uterine wall, at 28 weeks of gestation. At 30 weeks of gestation, the patient was recommended to undergo an MRI study to evaluate the thickness of the uterine muscle layer and to be hospitalized until delivery, considering the maternal and fetal risks due to uterine rupture. However, she refused. At 33 weeks of gestation, the patient called an ambulance at home because of sudden

severe abdominal pain. During transport, the patient developed cardiac arrest 10 minutes before arriving at our hospital, and CPR was initiated by paramedics.

Upon arrival, the patient was unconscious, with a Glasgow Coma Scale (GCS) score of E1V1M1, and exhibited asystole. Our emergency department (ED) doctor performed intubation immediately, and a central venous catheter was inserted. CPR was continued with the administration of epinephrine. The gravid uterus was displaced to the left side to relieve aortocaval compression to make resuscitation more effective. Arterial blood gas analysis showed the following results: a pH of 6.8, a pO₂ level 16.6 mmHg, a pCO₂ level of 90.0 mmHg, a hemoglobin level of 6.6 g/dl, a lactate level of 12.7 mmol/L, and a potassium level of 5.3 mEq/L. A point-of-care obstetrical ultrasound showed massive accumulation of free fluid in the abdominal cavity and fetal death. We suspected uterine rupture. The patient recovered from arrest by 6 cycles of CPR 19 minutes after arriving at our ED. The total duration time of CPR was 29 min. The decision was made to perform PMCD in the operating room.

She had exhibited asystole twice on the way to the operating room. PMCD was initiated 6 minutes after the decision. At laparotomy, there was a massive intraabdominal hemorrhage. PMCD was performed via a low transverse incision and a deceased male fetus weighing 1,984 g was delivered. An 8 cm-sized uterine rupture was detected exactly at the previous transverse uterine fundal incision site, and the amniotic membrane was intact. We repaired the ruptured site. The patient had also developed DIC due to the peripartum hemorrhage caused by uterine rupture and received blood transfusion with 14 units of packed red blood cells, 40 units of packed platelets, 10 units of packed fresh frozen plasma, 12 units of packed cryoprecipitate and 3 g of fibrinogen concentrate between arrival of the hospital and the end of the operation.

After PMCD, massive vaginal bleeding from the uterus was observed. Computerized tomographic angiography showed engorged bilateral uterine arteries supplying the whole uterus (Figure 3A). Interventional radiology (IVR) was required to control bleeding from the uterus. Embolization of the bilateral uterine arteries was performed by a radiologist, and her bleeding was controlled (Figure 3B). The patient was transferred to an intensive care unit (ICU) after IVR. Her vital signs gradually stabilized. Impairment of consciousness persisted (GCS: E4, Vt, M2). On the 119th postoperative day, the patient was discharged from our hospital and transferred to a rehabilitation facility.

Discussion

Uterine rupture is an obstetrical complication that is associated with maternal and fetal morbidity and mortality, with an incidence of approximately 0.05% of all deliveries.¹ The risk factors for uterine rupture include previous uterine surgery, such as cesarean section and myomectomy, induced labor and multiparity.³ The incidence of uterine rupture after cesarean section is 0.3%.⁷ In women who have had a cesarean section, uterine rupture can suddenly occur even in the absence of labor, although induced labor has been known to be a leading cause of uterine rupture.⁸ The typical signs of uterine rupture include abdominal pain, bleeding, shock and fetal distress.⁹ Thus, uterine rupture should be considered in the differential diagnosis of severe abdominal pain, especially for patients with risk factors for uterine rupture.

Cesarean section is commonly performed by a low transverse uterine incision. It has been reported that pregnant women with previous cesarean section by vertical uterine incision have an increased risk of uterine rupture and preterm birth compared to pregnant women with cesarean section by transverse uterine incision.¹⁰ In the current case, prior cesarean section was performed by transverse uterine fundal incision, which is one of the procedures for reducing blood loss during cesarean section in cases of placenta previa in which the placenta covers the anterior uterine wall.⁴

There are limited reports of uterine rupture due to prior transverse uterine fundal incision.^{5,6} The previous case reports and the current case are summarized in Table 1. Two patients, including the current patient, underwent MRI at 12 months postpartum, which revealed cesarean section scar thinness and a defect at the uterine fundus. The diagnoses of uterine rupture were made at 21, 30 and 33 weeks of gestation. Only one patient without symptoms was diagnosed with uterine rupture by MRI and delivered a live neonate. In this case, the diameter of the ruptured site was 5 to 7 mm. In the other two patients, the ruptured sites were

large enough to expel their fetuses outside the uterus, so they were considered to have complained of severe abdominal pain. It is more difficult to evaluate the thickness of the uterine wall at the fundus by ultrasonography as the gravid uterus is enlarged. MRI is an effective method of determining the thickness of the uterine wall during pregnancy.¹¹ However, it is uncertain when or how many times MRI should be performed during pregnancy and when admission should be recommended during pregnancy in pregnant patients with previous cesarean section by transverse fundal incision. Thus, it is considered that the safety and strategies of perinatal management have not been established for subsequent pregnancy following transverse uterine fundal incision.

PMCD is performed in patients with imminent cardiac arrest or active cardiac arrest, with the ultimate goal of successfully resuscitating the mother and improving fetal survivability. The American Heart Association recommends that PMCD should be initiated after four minutes of failure of resuscitative efforts with a goal of delivery within five minutes (the four- to five-minute rule).² Cardiac arrest in pregnancy is rare, with an incidence of 2.76 to 7.6 per 10,000 pregnancies.^{12,13} Thus, when performing PMCD, the decision, timing and place could be challenging. In the UK, a prospective, descriptive study of cardiac arrest in pregnant women revealed that maternal survival rates depended on the time from cardiac arrest to PMCD and that cardiac arrest occurred in the hospital, not outside of the hospital.¹² This study also showed that the time from cardiac arrest to PMCD in all survivors who received CPR was within 12 min. It is not necessarily easy to perform PMCD while achieving ‘the four- to five-minute rule’, especially for cases of cardiac arrest that occur outside of the hospital.

In the current case, cardiac arrest occurred outside of the hospital. Upon arrival, the patient had not recovered from arrest despite undergoing CPR for 10 minutes. It had been considered to be quite difficult for the current patient to survive, considering the asystole at arrival and the time for performing CPR after arrival at our hospital. The decision was made to perform PMCD based on the timing of her recovery from arrest by 6 cycles of CPR. It would have been possible to initiate PMCD earlier after the decision if our hospital had a well-established system for performing PMCD in the ED. The patient also developed peripartum hemorrhage caused by uterine rupture. DIC is a leading cause of maternal mortality.¹⁴ The patient survived by multidisciplinary management of CPR, PMCD, surgical repair of the ruptured site, blood product transfusion, IVR and intensive care; however, impairment of consciousness persisted.

In conclusion, it is known that the safety for future fertility, pregnancy and delivery in cases of previous cesarean section by uterine transverse incision has not been established, although the procedure is useful to reduce blood loss in cases of placenta previa. It is essential to be prepared to perform multidisciplinary management of cardiac arrest in pregnancy.

Author Contributions

Study conception: K Koshimizu, S Murata. Data collection: all authors. Analysis: all authors. Investigation: all authors. Writing: K Koshimizu, J Kakogawa. Critical review and revision: all authors. Final approval of the article: all authors. Accountability for all aspects of the work: all authors.

Acknowledgments

We would like to thank American Journal Experts (<https://www.aje.com>) for English language editing.

Funding Information

No funds, grants, or other support was received to assist with the preparation of this manuscript.

Conflict of Interest Statement

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Date Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Consent

Informed consent was obtained from the patient's family for publication of this case report and accompanying images in accordance with the journal's patient consent policy.

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Figure legends

Figure 1

Sagittal T1-weighted magnetic resonance imaging with contrast at 12 months postpartum showed a cesarean section scar defect at the uterine fundus (arrow).

Figure 2

Transvaginal ultrasonography at 9 weeks of gestation showed that a part of the muscle layer in the uterine fundus that was very thin or interrupted (arrow).

Figure 3

(A) Angiography prior to interventional radiology (IVR) showed engorged bilateral uterine arteries (arrow) supplying the whole uterus.

(B) Angiography after interventional radiology (IVR) showed obliteration of the bilateral uterine arteries (arrow).

Table legend

Summary of case reports of patients with uterine rupture who underwent previous cesarean section by transverse uterine fundal incision.

+:At cesarean section, there were two portions (looked like a well with diameter of 5 to 7 mm) of the uterine fundus in which there was no or only a very thin muscle layer.

CS: cesarean section, MRI: magnetic resonance imaging, PNC: prenatal care, CPR: cardiopulmonary resuscitation, PMCD: perimortem cesarean delivery.

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Authors [ref]	Year	CS by transverse uterine fundal incision Information of CS and pregnancy outcome	MRI findings after CS by transverse uterine fundal incision	Subsequent pregnancy after previous CS by transverse uterine fundal incision				
				Age of pregnancy	Pregnancy course before uterine rupture	Diagnosis of uterine rupture Gestational weeks Symptoms	Pregnancy outcome	
Nishida et al. [5]	2014	A 29-year-old primigravida CS due to placenta previa at 24 weeks of gestation (Pregnancy outcome) Mother: blood transfusion, discharge without sequelae Fetus: live birth weighting 406 g, neonatal death due to chronic lung disease at postnatal days 93	CS scar thickness or defect at the uterine fundus: at 12 months postpartum	31	Hospitalization from 18 weeks of gestation until delivery, ultrasonography twice a week and a total of 4 MRI studies for evaluation of uterine muscle layer	30	No symptoms (interruption of muscle layer in a part of uterine funds which had been pointed out by MRI study)	Mother: CS and surgical repair of the ruptured site (previous transverse uterine fundal incision scar) Fetus: live birth weighting 1,832 g, discharge with normal findings at postnatal days 68
Fujiwara et al. [6]	2017	Maternal age and parity: data not available CS due to placenta previa accreta and large myoma (Pregnancy outcome) Mother: data not available Fetus: data not available	Data not available	32	Transfer to a tertiary referral hospital due to severe abdominal pain and low back pain	21	Severe abdominal pain and low back pain	Mother: cesarean hysterectomy (ruptured site: previous transverse uterine fundal incision scar) Fetus: still birth (evacuation into the abdominal cavity through the ruptured cite)
Present case	2022	A 33-year-old primigravida CS due to placenta previa at 37 weeks of gestation (Pregnancy outcome) Mother: blood transfusion, discharge without sequelae Fetus: healthy neonate weighting 2,442 g, discharge with mother at postnatal days 6	CS scar defect at the uterine fundus: at 12 months postpartum	38	PNC and ultrasonography for evaluation of uterine muscle layer every 2 week, refusal for hospitalization and MRI study	33	Sudden severe abdominal pain	Mother: CPR, PMCD and surgical repair of the ruptured site (previous transverse uterine fundal incision scar), blood transfusion, IVR and intensive care, discharge with impairment of consciousness on the 119th postoperative day Fetus: still birth (evacuation into the abdominal cavity through the ruptured cite)