

Analysis and discussion of high-risk factors in nine cases of uterine scar combined with complete uterine rupture

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Summary

Objective: This study aims to investigate the high-risk factors, clinical characteristics, and outcomes of complete uterine ruptures in patients with uterine scars. **Methods:** The data of nine patients with complete uterine ruptures, who were admitted to Huaian First People's Hospital from January 2015 to December 2017, were retrospectively analyzed. The general information of these patients and courses of treatment were summarized. **Results:** Among these nine patients with complete uterine ruptures, the induction of labor induced uterine rupture in four patients, placenta implantation induced uterine rupture in one patient, an unknown factor induced uterine rupture in one patient (with a history of artificial abortion), scar rupture occurred after laparoscopic cornual surgery in one patient, and the incision scar of a previous cesarean section ruptured after labor contractions in two patients. Rupture position: Rupture of the uterine body occurred in three patients, rupture of the uterine base occurred in one patient, rupture of the uterine horn occurred in one patient, and scar rupture at the previous incisions at the lower segment of the uterus occurred in four patients. The clinical manifestations were persistent abdominal pain in two patients, irregular lower abdominal pain in four patients, and no obvious abdominal pain in two patients. Six patients had complications with vaginal bleeding, while three patients had no vaginal bleeding. Seven patients underwent uterine rupture repair, while two patients underwent a subtotal hysterectomy. Among the five patients without induced labor, one patient had intrauterine fetal death, while the remaining four patients had good outcomes for newborns. **Conclusion:** Patients with a cesarean scar pregnancy, who underwent another pregnancy, suffer a high incidence of uterine rupture. The induction of labor with rivanol and misoprostol, placenta previa, multiple cesarean sections, multiple artificial abortions, and a history of gynecological uterine surgery are all high-risk factors for scar uterine pregnancy.

Key words: Complete uterine rupture; Uterine scar; High-risk factor.

Impact statement

Complete uterine rupture is a rare obstetric emergency, which seriously threatens maternal and infant life.

This study aims to investigate the high-risk factors, clinical characteristics, and outcomes of complete uterine rupture in patients with uterine scars.

Both a detailed understanding of the medical and surgical history and analysis of potential risk factors are needed, and physicians should be vigilant in monitoring scar ruptures at the original incision of the cesarean section. They must also be alert to the possibility of rupture in other parts of the uterus.

Introduction

Complete uterine rupture is a rare obstetric emergency, which seriously threatens maternal and infant life. The high-risk factors for uterine rupture include congenital uterine malformation and uterine operation histories, such as myomectomy and laparoscopic oviduct surgery, uterine perforation, head dystocia, multiple artificial abortions, improper use of prostaglandin or oxytocin, placental factors and external trauma [1]. The main cause of uterine rup-

tures for women in developing countries is head dystocia [2]. However, in China, with the increase in cesarean section rates and the popularity of gynecologic minimally invasive surgery (such as laparoscopy), a second pregnancy with a uterine scar in situ is the most common risk factor of uterine rupture. Although there are many studies on the risk of uterine rupture, there are few studies on risk factors for uterine rupture, or the prognosis of the mother and fetus on the basis of uterine scars [3]. In the present study, the data of nine scar uterus patients with complete uterine rupture during pregnancy and childbirth were summarized and analyzed, and the risk factors and clinical symptoms, including complex threatening uterine rupture symptoms in mothers and fetuses, were assessed to improve the diagnosis and treatment of complete uterine rupture.

Materials and Methods

The data of nine patients with complete uterine rupture, who were admitted to Huaian First People's Hospital from January 2015 to December 2017, were collected and retrospectively analyzed. (1) Induction indicators: general information on the patient's age, gestational age, gravidity and parity history, history of operations, how long since the

Table 1. — *The general information of nine patients with complete uterine rupture.*

No.	Age (Years)	Gestational age (Weeks)	Pregnancy history	History of operation	Time from the last operation (Years)	Complications	Regular prenatal	Outside hospital referral
1	32	19	G4P2	Twice cesarean section	5	None	None	Yes
2	22	21 + 5	G2P1	Once cesarean section	1	None	None	Yes
3	28	31 + 5	G4P2	Once cesarean section, twice artificial abortion	2	Partial placenta previa	None	Yes
4	26	28	G3P2	Twice cesarean section	4	Placenta implantation	None	Yes
5	30	23 + 4	G6P1	Once cesarean section, four times artificial abortion	2	None	None	Surgical referral in our hospital
6	25	33 + 6	G2P1	Once cesarean section	9	Placenta implantation/ Pregnancy with cardiac disease/ Cardiac function grade II	None	Yes
7	25	41 + 2	G6P1	Once cesarean section, four times artificial abortion	4	None	None	Yes
8	36	39 + 3	G4P2	Twice cesarean section, once artificial abortion	10	Severe preeclampsia	None	Yes
9	30	39 + 1	G2P0	Laparoscopic right fallopian tube resection and partial right uterine horn resection	1	None	None	Our hospital

last operation, presence of regular antenatal care, complications, and presence of transfer treatment (Table 1). (2) Pathogenetic process (Table 2): Chief complaint during the first visit, clinical manifestations and signs, auxiliary examination results, location of uterine rupture, bleeding volume, hysterectomy/uterine repair, and hemorrhagic shock. This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Nanjing Medical University (No. 190). Written informed consent was obtained from all participants.

Results

General situations

The average age of nine patients with complete uterine rupture was 28.22 years. The average education level was junior high school. Patients did not receive regular antenatal care during pregnancy. Six patients were transferred from other hospitals. All of these patients were multipara. The uterine rupture occurred at the gestational age of 19–41⁺² weeks.

High-risk factors for complete uterine rupture

All nine patients with complete uterine ruptures had a history of uterine surgery. Among these patients, one patient underwent a partial hysterectomy due to a cornual pregnancy (case 9), while the remaining patients had a history of transverse incisions of the lower uterine segment during cesarean sections. One patient had a uterine rupture after induced labor with mifepristone plus misoprostol at the 19th week of pregnancy (case 1). Three patients had a uterine rupture after intravaginal induced labor with rivanol (cases 2, 3, and 4). One patient had a rupture of the uterine

fundus without an obvious cause, and the rupture was not at the scar of the original cesarean section incision (case 5). One patient had critical placenta previa complicated with a complete rupture at the scar of the uterine incision for placenta implantation (case 6). Two patients had ruptures of the scar uterus after full-term labor contractions (cases 7 and 8).

Clinical manifestations, signs, and auxiliary examinations (Tables 1 and 2)

Among these nine patients with complete uterine ruptures, only two patients had no abdominal pain. Of these two patients, one had a history of laparoscopic surgery for uterine cornual pregnancy and developed complete uterine rupture only during surgery. The other patient presented only with painless vaginal bleeding, which was found during the cesarean section due to “complete placenta previa”. Of the remaining patients, four had hypogastric pain accompanied by vaginal bleeding after induced labor. This pain was initially irregular, but gradually developed into persistent hypogastric pain, and was accompanied by tenderness and rebound pain of the total abdomen. One patient had persistent pain around the umbilicus without obvious inducement. The pain was accompanied by nausea and vomiting. She had no vaginal bleeding and had tenderness in the epigastrium, but no tenderness in the lower segment of the uterus. A color Doppler ultrasound revealed seroperitoneum, and an exploratory laparotomy revealed a rupture at the base of the uterus. One patient presented with persistent hypogastric pain with vaginal bleeding, non-obvious tenderness of the lower uterine segment, and obvious tenderness in the uterine body and total abdomen.

Table 2. — *The pathogenetic process of nine patients with complete uterine rupture.*

No.	Initial complaint	Clinical signs and auxiliary examinations	Location of uterine rupture	Bleeding volume	Intraoperative diagnosis	Maternal and fetal outcomes
1	Mifepristone + misoprostol drug induces paroxysmal lower abdominal pain with massive vaginal bleeding after induction of labor	Abdominal tenderness / rebound tenderness / muscle tension	Longitudinal 8 cm rupture of the uterus extends to the cervical canal	2000 mL	Complete uterine rupture	Uterine repair Hemorrhagic shock
2	Persistent lower abdominal pain with minor vaginal bleeding following misoprostol induction after failure of intracavitary induction of labor with rivanol	Total abdominal tenderness rebound tenderness / mobile dullness	Uterine original incision scar 9 cm completely split	1500 mL	Complete uterine rupture	Hemorrhagic shock / uterine rupture repair
3	After the induction of labor, rivanol showed irregular lower abdominal pain with a small amount of vaginal bleeding	The tenderness of the uterine scar is obvious	The longitudinal rupture of the uterus extends upward from the original scar to the bottom of the palace	1500 mL	Complete uterine rupture	Hemorrhagic shock / uterine rupture repair
4	Irregular lower abdominal pain with multiple vaginal bleeding after rivanol induced abortion	Large uterine tension / tenderness in the lower uterus	The rupture of the uterine scar was 1 cm long, and active bleeding occurred	5000 mL	Placenta implantation, complete uterine rupture	Hemorrhagic shock / DIC / cardiopulmonary resuscitation / respiratory arrest / subtotal hysterectomy
5	Persistent pain around the umbilicus with nausea and vomiting	Mid-abdominal tenderness and rebound pain	The base of the uterus is about 4 × 3 cm	2500 mL	Complete uterine rupture	Hemorrhagic shock / uterine rupture repair
6	Painless vaginal bleeding for 1 hours	Abdominal no tenderness and rebound tenderness	Rupture of 5 × 5 cm area at the original scar of uterus	7000 mL	Placenta implantation, complete uterine rupture	Hemorrhagic shock / total hysterectomy
7	Menopause 41 + 4 weeks irregular lower abdominal pain 2 days, no vaginal bleeding	The tenderness of the lower uterus is obvious	The full-thickness rupture of the left margin of the uterus was long 2 cm without active bleeding	500 mL	Complete uterine rupture	Uterine repair
8	Menopause 39 + 3 weeks, persistent abdominal pain with vaginal bleeding	The upper part of the uterus and the whole abdomen are tender, and the lower part of the uterus is not tender	The left side of the uterus is split 10 m to the left lower cervix and the broad ligament is torn to the cervix	1500 mL	Complete uterine rupture	Uterine repair Hemorrhagic shock
9	Asymptomatic	No positive sign	Rupture of hematoma on the right side of the original scar at 1 cm × 3 cm	500 mL	Complete uterine rupture	Uterine repair

Note: DIC, disseminated intravascular coagulation.

Prognosis

Among these nine patients with complete uterine rupture, seven patients underwent uterine rupture repair. Among the three patients with placenta implantation, two patients suffered severe bleeding and underwent subtotal hysterectomy to save their lives, because the disease was discovered and treated early enough to allow this. One patient underwent uterine rupture repair. Seven patients had postpartum hemorrhages complicated with hemorrhagic shock. Among these patients, two developed disseminated intravascular coagulation (DIC) and were transferred to the intensive care unit (ICU) after the operation. Seven patients were treated with blood transfusions. Two patients developed intrauterine fetal death, and another patient gave birth to a healthy newborn. One patient gave birth to a premature baby, who was transferred to the Department of Newborns, and no abnormalities were found during the follow-up. The remaining four patients had induced labors. All patients were cured and discharged (Tables 1 and 2).

Discussion

With the opening of the second child policy and the high cesarean section rate in China, uterine ruptures have become a thorny problem for clinicians. In the present study, eight patients with complete uterine rupture (88%) had a history of cesarean section, while four patients (44%) had a history of twice having a cesarean section. These results further strengthen the indication that the uterine scar caused by a cesarean section is the main cause of uterine ruptures. Therefore, the adequate assessment of high-risk factors for uterine rupture is an important measure to prevent uterine rupture and protect maternal and infant safety.

In the present study, among these nine patients with complete uterine rupture, four patients (44%) developed a complete uterine rupture during induced labor in scar uterus pregnancy. Of these four, half were treated with misoprostol (cases 1 and 2) [4]. Misoprostol is a derivative of prostaglandin E1, which can induce gestational uterine contractions and initiate deliveries. A large sample study revealed that the risk of uterine rupture is less than 0.3% in patients with uterine scars, who were treated with misoprostol [5]. Berghella reported that the incidence of uterine rupture was 0.4% [6]. Due to the variables in the conditions of pregnant women, the different reactions of uterine muscles to misoprostol, and the different drug absorption rates depending on routes of administration, drug dosage precision is difficult to achieve, and irregular medication can easily cause excessive stimulation and rupture of the uterus. Studies have reported that the causes of uterine rupture are mostly correlated to the excessive use of misoprostol [7, 8]. In the present study, the excessive use of misoprostol was found in two patients. This reveals that the improper dosage of prostaglandins increases the risk of uterine rupture. The above studies also reveal that obstetricians are not allowed to indiscriminately change and add doses of drugs during the misoprostol induction of labor in uterine

scar pregnancies, and the lowest effective dose should be reasonably adopted according to different individual situations, in order to reduce the risk of uterine rupture.

In the present study, another important factor was that some patients developed spontaneous complete uterine rupture due to placenta implantation (cases 4 and 6). Spontaneous uterine rupture induced by placenta implantation is rare but can cause serious damage. It was reported in previous studies that the incidence was 1/4366 [9], but commonly occurs in patients with uterine scars. The cause of placenta implantation is the partial or complete absence of decidua, and the invasion of chorion to the myometrium, reaching the serosa [10]. The onset of uterine rupture induced by placenta implantation is mostly obscured. The uterine outline is clear, the amniotic membrane is intact, the fetus remains in the uterine cavity, active bleeding only occurs in the serosa penetrating part of the uterus even if hematoma occurs, and it is difficult to diagnose preoperatively. When bleeding causes a peritoneal irritation sign, it is easily misdiagnosed as a disease, which delays diagnosis and treatment, eventually leading to massive abdominal bleeding and threatening the life of the patient. This is also the main reason for two puerperants undergoing hysterectomy. Magnetic resonance imaging (MRI) and B-ultrasound are both auxiliary tools for predicting placenta implantation, but the effects are limited. It was reported in previous studies that the sensitivity of MRI and ultrasound was 38% and 33%, respectively [11]. Therefore, physicians should not excessively rely on medical examinations, but should also make full use of these tools. When necessary, re-examinations should be performed, as should dynamic observations.

Case 5 had a history of multiple artificial abortions. The cause of uterine rupture may be correlated to myometrial damage caused by multiple uterine operations. As the uterus gradually increases in the gestation period, intrauterine pressure increases and the uterine wall becomes thin. Relative to the lower uterine segment, the scar tissue at the bottom of the uterus or in the body of the uterus is more vulnerable to pressure and more likely to rupture. In this case, the gestational age was 23⁺⁵ weeks. The chief complaint at the first visit was persistent navel abdominal pain with nausea and vomiting, no vaginal bleeding was found, and tenderness was located in the middle and upper abdomen. Color Doppler ultrasounds revealed that the continuity of the scar at the original cesarean section site in the lower segment of the uterus was normal, and a small amount of fluid was found in the abdominal cavity. Uterine rupture was excluded in the primary diagnosis, and the problem was considered to be a surgical disease, such as liver or spleen rupture. The patient was transferred to the Department of Surgery for treatment. After 12 hours of observation, the fetal heart sounds disappeared, and uterine rupture was suspected. Exploration during the operation revealed that the uterine rupture was located at the bottom of the uterus. Since the patient's clinical signs were not typ-

ical and the scar of the incision in the lower segment of the uterus was intact, the clinician's judgment was misled, and it was classified as a difficult disease case. Hence, this lesson is worth learning. This case suggests that when a patient with a history of multiple uterine cavity operations develops persistent lower abdominal pain with nausea and vomiting during pregnancy, careful examination of abdominal signs, B-ultrasound, or MRI dynamic examination is needed to exclude the possibility of rupture in the rest of the uterus. This should be in addition to routine cesarean section history, especially when there are signs of internal and surgical disease, or the rupture of the scar at the original uterine incision. Treatment scheme: for pregnant women who are highly suspected of having had a uterine rupture, an urgent exploratory laparotomy is necessary. For patients with an even edge of the uterine cleft without an obvious infection, who have fertility requirements, uterine rupture repairs should be carried out, and an abdominal drainage tube should be placed during the operation. In the present study, except for the two patients with placenta implantation, the uterus could not be preserved due to the large implanting area, heavy bleeding, and unstable intraoperative vital signs. The seven patients underwent uterine rupture repair, and the prognoses of these patients were good.

In summary, at present, the clinical symptoms of uterine rupture are becoming increasingly diverse and complicated. In order to reduce the risk of uterine rupture, understandings of detailed medical history, surgical history, and analysis of potential risk factors are needed. Meanwhile, physicians should be vigilant toward scar ruptures at the original incision of the cesarean section and pay attention to the possibility of rupture in other parts of the uterus. An individualized treatment plan should be set up according to the specific conditions of patients, in the hope of early detection and early treatment, and to improve maternal and infant prognosis.

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Conflict of Interest

The authors declare no competing interests.

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References

- [1] Guiliano M., Closset E., Therby D., LeGoueff F., Deruelle P., Subtil D.: "Signs, symptoms and complications of complete and partial uterine ruptures during pregnancy and delivery". *Eur J Obstet Gynecol Reprod Biol.*, 2014, 179, 130-134.
- [2] Mukasa P.K., Kabakyenga J., Senkungu J.K., Ngonzi J., Kyalimpa M., Roosmalen V.J.: "Uterine rupture in a teaching hospital in Mbarara, western Uganda, unmatched case-control study". *Reprod Health*, 2013, 10, 29.
- [3] Zhang D., Lin L., Zhang L.J.: "Clinical analysis of a cases of complete uterine rupture during pregnancy". *Journal of Dalian Medical University*, 2017, 39, 370-373.
- [4] Abbas A.M., Sheha A.M., Hussein R.S., Talaat E., Ali M.N.: "First-trimester rupture of a scarred uterus after use of sublingual misoprostol, a case report". *Proceedings in Obstetrics and Gynecology*, 2016, 6, 5-10.
- [5] Alfrevic Z., Aflaifel N., Weeks A.: "Oral misoprostol for induction of labour". *Cochrane Database Syst Rev.*, 2014, 6, CD001338.
- [6] Gardeil F., Daly S., Turner M.J.: "Uterine rupture in pregnancy reviewed". *Eur J Obstet Gynecol Reprod Biol.*, 1994, 56, 107-110.
- [7] Kim J.O., Han J.Y., Choi J.S., Ahn H.K., Yang J.H., Kang I.S., Song M.J., NavaOcampo A.A.: "Oral misoprostol and uterine rupture in the first trimester of pregnancy, a case report". *Reprod Toxicol*, 2005, 20, 575-577.
- [8] Ngassa P.C., Mboudou E.T., Kouam L., Wamba M., Simeu C., Nkwabong E., Takang W., Mve V.K.: "Rupture of a previously scarred uterus during second trimester misoprostol-induced labour for a missed abortion: A case report". *Clinics in Mother & Child Health*, 2006, 3, 501-503.
- [9] Turner M.J.: "Uterine rupture". *Best Pract Res Clin Obstet Gynaecol*, 2002, 16, 69-79.
- [10] Blé R.K., Adjoussou S., Doukoure B., Gallot D., Olou N., Koff A., Fanny M., Koné M.: "Placenta percreta: A rare etiology of spontaneous uterine perforation in the second trimester of pregnancy". *Gynecol Obstet Fertil*, 2011, 39, e11-e14.
- [11] Lam G., Kuller J., McMahon M.: "Use of magnetic resonance imaging and ultrasound in the antenatal diagnosis of placenta accreta". *J Soc Gynecol Investig*, 2002, 9, 37-40.

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