

ORIGINAL PAPERS

Multidisciplinary Healthcare Strategies in Pre-labor Uterine Rupture after Minimal Invasive Procedures

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Abstract

Uterine rupture is a significant maternal and fetal morbidity and mortality factor. It is defined as the complete cleaving of the three uterine layers. The pregnancy distention leads to alteration of the uterine wall fibers, especially in the low resistance points like surgical scars. World Health Organization realized an extensive systematic review to determine the prevalence of uterine rupture. A lower prevalence was seen in developed countries and higher rates for least developed countries. The incidence of uterine rupture in women with caesarean section is estimated to be 1% and without caesarean section is as low as 0.006%. Although the uterine scar is the main feature of uterine rupture, other contributing influences on untoward outcomes must be promptly recognized. The aim of this paper was to assess the frequency of uterine ruptures in a tertiary referral center, to identify risk factors and symptoms for complete and partial uterine rupture before labor, common symptoms of uterine rupture, multidisciplinary approach, and emergency surgical management.

Keywords: uterine rupture, pregnancy complications, risk factor, emergency surgery.

Rezumat

Ruptura uterină reprezintă o cauză importantă de morbiditate și mortalitate maternă și fetală. Aceasta este definită ca scindarea completă a celor trei straturi uterine. Distensia sarcinii duce la alterarea fibrelor peretelui uterin, în special în punctele de rezistență scăzută precum cicatricile chirurgicale. Organizația Mondială a Sănătății a realizat o analiză sistematică extinsă pentru a determina prevalența rupturii uterine. O incidență mai scăzută a fost observată în țările dezvoltate și rate mai mari în țările mai puțin dezvoltate. Incidența rupturii uterine la femeile cu operație cezariană este estimată la 1%, iar fără operație cezariană este de până la 0,006%. Deși cicatricea uterină este principala caracteristică a rupturii uterine, alți factori care contribuie la rezultatele nefavorabile trebuie recunoscuți prompt. Scopul acestei lucrări a fost de a evalua frecvența rupturilor uterine într-un centru de gradul 3 de referință, de a identifica factorii de risc și simptomele pentru ruptura uterină completă și parțială înainte de travaliu, simptomele comune ale rupturii uterine, abordarea multidisciplinară și managementul chirurgical de urgență.

Cuvinte cheie: ruptură uterină, complicații ale sarcinii, factor de risc, intervenție chirurgicală de urgență

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INTRODUCTION

The disruption of the uterus in pregnancy or during childbirth is defined as uterine rupture. The uterine layers are represented by the inner epithelial layer – endometrium, the second smooth muscle layer – myometrium, and the third outer serosae surface – the perimetrium¹. Uterine rupture is a major surgery emergency with high fetal and maternal mortality and morbidity². Depending on the rupture degree, the approach can be conservative or radical with necessity hysterectomy³. The term uterine dehiscence is characterized by the incomplete separation of the uterine layers, producing a uterine thinning of the wall that allows the surgeon to see through the myometrium¹. Usually, this diagnosis is put during caesarean section for other indications since the women is asymptomatic⁴. If the diagnosis is made in the preterm period there is possible to follow a successful expectant management, while discovering it at term can often lead to caesarean delivery⁵. Complete and partial uterine rupture can be life-threatening for moth fetus and mother, being considered one of the most important hemorrhage causes in pregnant women⁶. The incidence is different depending on the healthcare system of the countries. In developed countries, uterine rupture has an incidence of 1 in 4800 births and 1 in 10.000-15000 in case of unscarred uterus⁶. In the last decades there was seen an increasing rate of uterine rupture⁷.

RISK FACTORS

The most common uterine rupture is on scarred uterus during labor. Although it is a rare complication, the outcomes for the infant and mother depend on many factors. Based on a prospective study, the GerOSS (German Obstetric Surveillance System) concluded that de prevalence of uterine rupture is 0.4 from 10000 deliveries in patients without caesarean section, reaching to 3.2 from 10000 deliveries in patients with previous caesarean section⁸. Most uterine ruptures happen during the onset of labor. Even if it is seen especially during the trial of labor after a caesarean section (TOLAC), the labor can lead also to rupture on the unscarred uterus⁹⁻¹¹. The reason for which the incidence of uterine rupture tends to be lower in developing countries is that there are lower rates of caesarean section¹².

It can be said that the increasing incidence of caesarean section is a lead factor in increasing the risk for

uterine rupture. In addition, factors like time between pregnancies, birthweight and gestational age, mother body mass index and maternal age, parity and labor characteristics (augmentation, oxytocin, prostaglandins) have an important role in labor outcome^{13,14}. American College of Obstetricians and Gynecologists encourage TOLAC (trial of labor after caesarean section) for low-risk candidates taking into consideration that the chance of successes is lowered by induction and maternal obesity^{15,16}. The risk of uterine rupture during TOLAC is increased with 2.7 per 1000 cases when compared with elective repeated caesarean delivery¹⁷. Even if there are many studies, there still are controversies regarding the optimal surgical technique for uterine wall closure during caesarean section in order to improve the healing of the scar. Systematics reviews on large groups of patients tried to establish the better closure- single or double layer. Their results concluded that there are no statistically significant differences¹⁸. There were similar rates of post-caesarean scar defects, similar rates of subsequent uterine rupture and uterine dehiscence. Uterine rupture during TOLAC had a higher incidence in cases in which methods of labor augmentation were used^{19,20}.

In the first and second trimester of pregnancy, uterine rupture is considered a very rare emergency²¹. If uterine rupture in labor is usually associated with previous caesarean section, uterine rupture before labor is associated with previous surgical interventions on the uterus like myomectomy or hysteroscopic interventions. Hysteroscopic resection of the uterus is a common cause of uterine rupture before term²²⁻²⁴. Factors like time from surgery to pregnancy and persistent use of diathermy resection can increase the risk for uterine rupture. In the literature, uterine ruptures were reported as early as 10 weeks, going up to 38 weeks and discovering the uterine tear during the elective caesarean section or even up to 41 weeks and discovering the uterine rupture during caesarean section performed for fetal distress^{25,26}. It is important when deciding to undergo hysteroscopic septal resection that the women in informed correct about the possible outcomes of future pregnancies. The literature consists mostly of case series, and it must be considered that the incidence of septate uterus is estimated to be 0.2 – 2.3% in the reproductive age females regarding the classification utilized²⁷.

Pregnancy risks after laparoscopic myomectomy for patients desiring fertility spearing management were

one of the main concerns of the procedure when it started to be used more frequently²⁸⁻³⁰. Even though leiomyomas are known to be associated with pregnancy loss, malpresentations, abnormal placentation, preterm labor, and peri-partum hemorrhage³¹, there is still a debate about the influence of uterine fibroids on infertility of the patients without specific causes. Minimally invasive uterine fibroid resection has been shown to statistically improve the pregnancies only in cases with cavity-distorting nodules³². In this context, the American Society for Reproductive Medicine (ASRM) recommended that myomectomy should not be performed in asymptomatic patients without fibroid distorted cavities³³. The incidence of uterine rupture after myomectomy is reported to be 0.2- 3.7%³⁴.

The uterine wall repair technique is important to avoid complications like abnormal placentation or uterine rupture³⁵. Different types of sutures had similar outcomes regarding complications, but the most important factor was represented by the multiple-layer suturing³⁶. It is important to mention that degree of myometrial penetration did not correlate with the incidence of uterine rupture in subsequent pregnancies³⁷. The incidence of uterine rupture appears to be higher in the first year after surgery compared to longer time interval^{38,39}.

When comparing uterine ruptures after caesarean section with uterine ruptures after other interventions, the studies have shown that the time interval between uterine surgery and pregnancy was shorter in the cases with uterine scar after other interventions, the uterine rupture occurred earlier in pregnancies with interventions other than caesarean section leading to preterm infants and severe blood loss requiring transfusions was more frequent in patients with surgeries other than caesarean section⁴⁰.

The optimal method of preventing uterine rupture on scarred uterus is by carefully selecting the cases that undergo caesarean section or minimally invasive techniques.

EMERGENCY MANAGEMENT AND MULTIDISCIPLINARY APPROACH

Uterine rupture is associated with high rates of mortality and morbidity for the mother and for the fetus. Uterine rupture can lead to vesico-vaginal fistulas, recto-vaginal, and bladder ruptures⁴¹. The main concern for the mother is represented by the severe blood loss.

Peri-partum hemorrhage is a leading cause of maternal death and immediate treatment is needed⁴². Abdominal hysterectomy can be the only option in managing the emergency. Maternal death following uterine rupture can be related to septic shock, hypovolemic shock, pulmonary edema or acuter renal failure⁴¹. The rate of stillbirths among pregnancy that end in uterine rupture is very high reaching up to 93-98%^{43,44}. If the baby survives after uterine rupture, the main concern is prematurity and related complications.

Detection of uterine wall dehiscence can be made with the help of imaging techniques during screening. When abnormal heart rate with acute setting is identified, an early uterine rupture diagnosis can be made⁴⁵. Other associated features are represented by abdominal pain, hemorrhagic shock, vaginal bleeding, or inability to lie down⁴⁶. This represents a major obstetrical emergency. The first surgical step is represented by exploratory laparotomy, The surgical treatment can include total hysterectomy, subtotal hysterectomy, or uterine repair with or without tubal ligation. The decision is made by the surgeon depending on the location of the rupture, the extension of it and the patient's status⁴⁷.

PREGNANCY OUTCOMES FOR PATIENTS WITH PREVIOUS UTERINE RUPTURE

There are few studies that include outcomes for pregnancies in patients with previous uterine rupture. There was reported a risk of sub-fertility and increased time between pregnancies in this category of patients^{48,49}. When pregnancy is obtained, the women with previous uterine rupture had higher incidence of miscarriage in the first trimester⁵⁰.

Recurrent uterine rupture has been reported to have an incidence of 8.6%. with most cases taken place before the labor onset⁵⁰. Favorable outcomes have been associated with close monitoring, patients' addressability and planned caesarean section⁵¹⁻⁵⁵. Fetal lung maturity must be assessed before the elective caesarean section⁵³. The recurrence of complete uterine rupture was considered to be low with a low rate of hemorrhage, abnormal placentation or neonatal and maternal death⁵⁴.

All studies agree that the caesarean section must be performed before the onset of labor and the thickness of the uterine wall must be evaluated with ultrasonography. Delivery must be scheduled between 32 and 37 weeks⁵⁴, or at 36-37 weeks according to other authors^{52,55}. Delivering at 35 weeks appears to be

beneficial for most of the women by pondering preterm birth related complication and maternal-fetal morbidity related to second uterine rupture [50].

Overall, the outcomes of patients with previous uterine rupture are similar with outcomes of patients with uterine scar, including maternal and fetal survival rates, uterine rupture complications and peripartum hysterectomies⁵⁰⁻⁵⁵.

MATERIAL AND METHOD

The analyze presented in this article represents a national, single-center, investigational, retrospective clinical research study, entitled “Uterine rupture before term” (study number 74824/07.12.2021) carried out in the clinic of Obstetrics-Gynecology, of the Bucharest Emergency University Hospital. There were included cases of uterine rupture that underwent surgery in our clinic between 2017 and 2022. The aim of the project was to thoroughly analyze the cases and to improve the effectiveness of rapid surgical therapeutic conduct. The main objectives are to promote fertility preservation techniques when the patient’s condition permits and rigorous patient monitoring.

RESULTS

Between January 2017 and December 2022 in our clinic were 7 cases of complete uterine rupture after minimally invasive procedures – laparoscopy, hysteroscopy, or D&C. The median age of the patients was 35 years (minimum 28, maximum 37). They were all from urban area. Three patients had previous life births and two patients had the current pregnancy obtained with assisted reproductive techniques. The current pregnancy gestational age at uterine rupture varied between 11 weeks of gestation and 29 weeks of gestation. In two cases fetal heart rate was present at admission and in the other 5 cases fetal demise was observed.

Table 1. Characteristics of the studied group

Patient	Age (years)	Previous life birth	Assisted reproductive techniques	Current pregnancy gestational age (weeks)	Fetal status at presentation (FHR)
Case 1	37	Yes	No	11	Present
Case 2	35	No	Yes	20	Absent
Case 3	29	No	No	29	Absent
Case 4	35	No	No	27	Present
Case 5	37	Yes	No	29	Absent
Case 6	35	No	Yes	20	Absent
Case 7	28	Yes	No	16	Absent

In this series of patients with uterine rupture before onset of labor, 4 women had previous hysteroscopy, 3 had previous laparoscopy and 2 had previous dilation and curettage (D&C). The hysteroscopies were performed for uterine septum resection (1), polyp resection (2) and exploratory with curettage (1). Laparoscopic myomectomies were performed in 2 cases and in 1 case the electrical resection of an endometriotic area. In 2 cases, dilatation and curettage were performed. Two of the patients experienced uterine rupture in previous pregnancies, one at 16 weeks and the other one at 37 weeks.

Table 2. Previous minimal-invasive interventions in the studied group

Patient	Previous hysteroscopy	Previous laparoscopy	Previous D&C	Previous uterine rupture
Case 1	-	-	Yes	-
Case 2	Yes	-	-	-
Case 3	Yes	Yes	-	-
Case 4	-	Yes	-	Yes
Case 5	-	Yes	-	Yes
Case 6	Yes	-	-	-
Case 7	Yes	-	Yes	-

The symptomatology at presentation varied between patients. Two patients were alert and conscious, stable hemodynamic and offered an accurate medical history. The clinical evaluation and modified blood tests were the main reasons for the surgical intervention. In the other cases, signs of hemorrhagic shock installing were present: skin pallor, hypotension, tachycardia, abdominal pain. In laparotomy massive hemoperitoneum were found in 6 patients with the medium volume of 2000 ml. The hemoglobin value varied from 3.2 g/dl to 9.4g/dl and a medium hematocrit of 23%. Transfusion was needed in 6 cases to regain hemodynamic stability and replace the massive blood loss.

During the surgery, the first step was represented by extracting the fetus and the placenta. For bleeding control, it is necessary an empty uterus. In all cases, preservation of the uterus was tempted. In five case uterine repair was possible (in two cases both the repair of the uterine rupture and the uterine incision). Two cases ended with total hysterectomies (in the cases with 16 weeks pregnancy and 27 weeks pregnancy). The decision to proceed to hysterectomy was made due to maternal deterioration, uterine macroscopic aspect, and signs of disseminated intravascular coagulation. In this series, no maternal death was registered. All patients had favorable evolution after surgery and were discharged after a median of 4 days.

One of the cases presents 37 years-old patients (gravida 2, para 2) that was brought to the emergency room for abdominal pain and altered general state. The pregnancy is 29 weeks, and the previous delivery was trough caesarean section. Shortly after arrival the patient was unconscious, the blood pressure was 40/20 mmHg and did not lose blood vaginally. Ultrasound showed sever fetal bradycardia. Emergency laparotomy was performed, revealing massive hemoperitoneum of 3500 ml. A dead female fetus of 1000 grams was extracted. The uterine rupture was found at the level of the postero-lateral wall and no rupture or dehiscence of the previous caesarean section scar. Initially it was tempted the conservative approach with uterine reconstruction. Due to the severely modified blood panel (fibrinogen 103 mg/dl, incoagulable PT, uncoagulable INR) it was decided to perform total hysterectomy with annexal conservation. During surgery blood products were administered.

The patient's post-surgery evolution was favorable. After three days in the intensive care unit, the women returned to the gynecological ward afebrile, conscious, cooperative, abdomen mobile with breathing, slightly sensitive to palpation. The complete patient history was conducted when she regained consciousness.

Subsequent history of the patient included one artificial insemination and one in vitro fertilization (2 embryo transfers) before the first pregnancy. These procedures were performed after an exploratory laparoscopy and hysteroscopy. During the laparoscopy the macroscopically normal uterus and ovaries were observed and was performed an electro-resection of an endometriosis focus on the uterus at the level of insertion of the uterosacral ligament. The exploratory hysteroscopy included a biopsy.

At 4 years after these procedures, the first child is born at 37 weeks via caesarean section. The first pregnancy was associated with bleeding outside labor and constant pain in the right quadrant. After the first caesarean section, the patient was verbally informed that the posterior wall was "reinforced" with couple of stiches during the intervention.

This case presents a patient with uterine interventions before pregnancy, with one birth at 37 weeks via caesarean-section in which uterine rupture was observed. The second pregnancy ended in fetal demise and total hysterectomy due to the posterior wall scar. The lesion of the posterior wall is corelated with the minimal invasive procedures, the electric resection and the cavity curettage that led to uterine scarring before pregnancy.

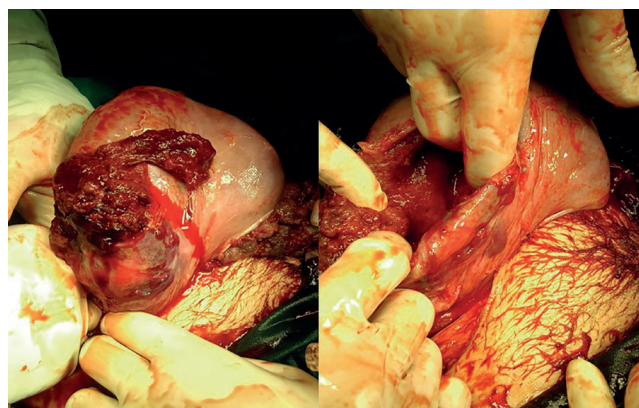


Figure 1. The aspect of the posterior uterine wall with complete rupture during emergency laparotomy

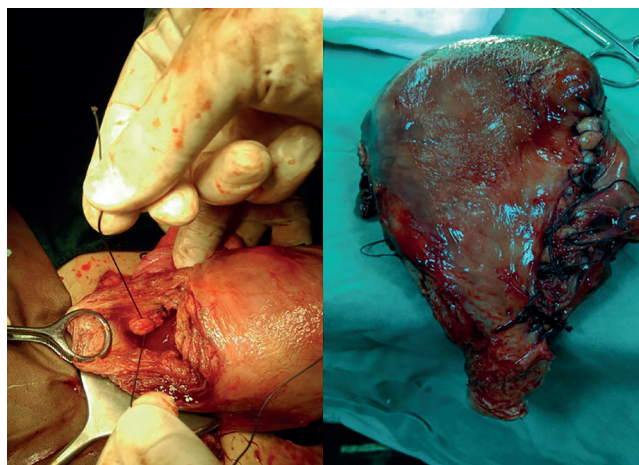


Figure 2. Image of the lower segment during suturing and the uterus after resection where the extended rupture can be observed after attempted repair.

DISCUSSION

Uterine rupture during pregnancy is a major emergency at any gestational age and the rapid deterioration of the patient's status requires prompt management^{56,57}. One important aspect in obtaining a favorable outcome is accurate history of the patient, rigorous monitoring in pregnancy, and rapid diagnosis when the early signs of uterine rupture appear. Our study reflects the reality encountered in an emergency hospital in which the patient comes during the acute period and there is few information available.

The multidisciplinary team formed of gynecologist, imagist, neonatologist and anesthesiologist, is important in managing hemorrhagic shock, performing surgery and neonatal care when needed. In our series the clinical presentation of patients and the surgical outcomes are similar to those available in the literature⁵⁰⁻⁵³. The short time between the arrival of the patient and surgery is the main factor in maternal survival. In our study were 4 pregnancies under viability, and 3 pregnancies with gestational age above 24 weeks that ended with one fetal demise and two life births.

Total hysterectomy was performed in 2 cases and in other 5, uterine repair was possible. Uterine sparing procedures can be done but it is important to properly instruct the patients about the risks in future pregnancies. Pregnancy outcomes in women with previous uterine rupture are similar to those in women with uterine scar⁵⁰⁻⁵⁵.

CONCLUSION

Minimally invasive procedures are responsible for most of the uterine rupture before the labor onset. Patients with uterine scar post hysteroscopy or laparoscopic myomectomy should be monitored in a high-grade emergency hospital that has the mean to address any potential complication. Time is crucial in this type of emergencies. The short time between presentation and diagnosis is an advantage for maternal and fetal favorable outcome. Although it is still a rare emergency, we must take caution to not increase the risk factors for uterine rupture in general population and to correctly inform the patients both on immediate results and long-term impact.

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