

Outcomes and Risk Factors Analysis of Rupture of the Scarred and Unscarred Gravid Uterus: A 30 Years Review in a Single Saudi Center

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Abstract

Background: Uterine rupture (UR) in pregnancy is a rare devastating obstetrical complication that can have catastrophic consequences. Perinatal morbidity and mortality is significant and maternal mortality due to extensive damage to the uterus and blood loss has been documented.

Objective: To review the incidence and maternal and perinatal outcome of uterine rupture in pregnancy, to compare risk factors, site of rupture, and outcome of uterine rupture among patients with a scarred versus an unscarred uterus, and Highlights the management approach taken to preserve the women's fertility potential with follow-up of subsequent pregnancies in these patients.

Results: Hospital records indicated that between January 1987 and December 2017, there were 91 documented cases of complete uterine rupture. Over the study period, 91 pregnancies out of 178,453 deliveries were complicated by complete uterine rupture. The overall incidence was calculated to be 0.05% (1 per 1961 deliveries). Out of the 91 patients, 70 had prior history of a scarred uterus and 21 had no scarred uterus. The average age of patients with an unscarred uterus was significantly older (34.0 ± 1.6 years) than that of patients with a scarred uterus (27.2 ± 0.8 years). In terms of parity, almost a third of the overall study population (30.7% n=28) was defined as grand multipara (≥ 5 previous deliveries) with a higher proportion amongst the unscarred uterus group (71.4%, n=15) compared to patients with a scarred uterus (25.7%, n=18). The gestational age at which the rupture occurred was significantly more advanced for the patients with an unscarred uterus ($39+6$ weeks ± 3 days) in comparison to patients with a scarred uterus ($37+6$ weeks ± 6 days).

Conclusion: Antenatal care is vital, not to prevent or predict uterine rupture but to highlight the high-risk cases that need more care. For all patients in labor there should be a low threshold of suspicious for ruptured uterus, in particularly high risk patients that develop abnormality in fetal heart pattern or any abnormal per vaginal bleeding. The most senior expert obstetrician should deal with the surgical management. Reservation of fertility should be a target especially in conservative communities without compromising maternal health.

Keywords: Pregnancy; Cesarean scar; Cesarean delivery; Scarred uterus; Unscarred uterus; Trial of Labor After Cesarean Section (TOLAC)

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Introduction

Uterine rupture (UR) in pregnancy is a rare devastating obstetrical complication that can have catastrophic consequences. Perinatal morbidity and mortality is significant and maternal mortality due to extensive damage to the uterus and blood loss has been documented. The incidence of UR in pregnancy varies worldwide, posing a great health burden especially in less and least developed countries. The overall international rate of ruptured gravid uterus in facility-based studies is 0.31% (0.012% to 2.9%) [1]. Previous cesarean section scar has been considered one of the most significant risk factors for UR. Other conditions associated with UR have been described in the literature include multiparity, induction and augmentation of labor, short interdelivery interval in previous cesarean section, malpresentation, prior invasive molar pregnancy, alkaloid cocaine abuse, and obstructed labor [2-5]. Labor is usually, but not always, required for UR. However, about one third of ruptures in patients with a previous classical uterine incision occur before the onset of labor [6]. Timely management of UR is challenging and depends on prompt detection, as delayed diagnosis may be associated with increased perinatal and maternal morbidity and mortality [7]. Many signs and symptoms classically were taught to be reliable in diagnosing UR such as sudden tearing abdominal pain, vaginal bleeding, cessation of uterine contraction, abnormal fetal heart tracing, and regression of the presenting part [8]. Recent experience has shown that abnormal fetal heart tracing is the most reliable presenting manifestation of UR [9].

The aim of management is to stabilize the maternal condition and achieve delivery of a live born healthy infant where possible [10] thereafter, closer inspection of the uterus and adjacent structures will determine the management modality whether to be repair with or without tubal sterilization or hysterectomy in cases where the damage is beyond repair. The diagnosis, treatment, and prognosis of rupture of gravid uterus has been changed dramatically in recent years, due to the use of continuous electronic fetal monitoring, improvements in anesthesia, surgical techniques, blood banking and maternal and neonatal intensive care units.

Materials and Methods

Patient population

Security Forces Hospital Program (SFHP) in Riyadh is one of the main portals among the group of providing health care services in the Kingdom. It is the only hospital that provides services to Ministry of Interior personnel and their families with total number of deliveries around 6000 annually.

Data collection

Ethical committee approval was obtained for this study. All the charts of uterine rupture cases after 20 weeks of gestation that occurred at SFHP over a period of 30 years from January 1987 to December 2017 were reviewed by an independent physician working in the hospital. A structured questionnaire was used for capturing relevant data from the charts. All charts were available for review. Only complete uterine rupture was included in this

study which was defined as separation of the entire uterine wall, including the peritoneal covering, with communication between the uterine and peritoneal cavities, with or without expulsion of the fetus or placenta. Cases of scar dehiscence (incomplete uterine rupture) were excluded.

Patients were divided into two groups, scarred and unscarred uteri at the time of uterine rupture. Scarred uterus was defined as uterus that underwent cesarean section, myomectomy, or complicated dilatation and curettage before the current pregnancy.

For each case, the following data was recorded:

- Demographic and clinical characteristics including maternal age, parity, gestational age, and fetal outcome.
 - Antepartum obstetrical risk factors for uterine rupture including number and type of previous cesarean sections, other uterine operations, complications of previous curettage, abdominal trauma, and history of any disorders affecting uterine integrity (gestational trophoblastic neoplasm and abnormal placentation) and factors that would lead to over-distention of the uterus (polyhydramnios, macrosomia and multiple gestation).
 - Labor characteristics including labor induction and augmentation, instrumental delivery and cesarean section.
 - Signs and symptoms of uterine rupture including non-reassuring fetal heart tracing, abdominal pain, intrapartum bleeding per vagina, shock and post-partum hemorrhage.
 - Intraoperative and postoperative management of uterine rupture including procedures performed, estimated blood loss, operative time, SICU admission, blood products required and operative complications.
- Fetal outcomes including Apgar scores, birth weight, perinatal mortality, admission to NICU and long-term sequelae.
- Data analysis
 - Data were collected and entered on Microsoft Excel. Data Analysis was carried out using Microsoft Excel 2017. Significance was defined as $p < 0.05$.

Results

Study population

Hospital records indicated that between January 1987 and December 2017, there were 91 documented cases of complete uterine rupture. All patients had received prenatal care and all charts were available for review. For the purposes of analysis, patients with a scarred uterus (76.9%, $n=70$) were considered separately from those with an unscarred uterus (23.1%, $n=21$) in order to investigate the distinguishing characteristics between these two groups of patients.

Incidence of uterine rupture

Over the study period, 91 pregnancies out of 178,453 deliveries were complicated by complete uterine rupture. The overall incidence was calculated to be 0.05% (1 per 1961 deliveries).

Demographics and Obstetrical History of Study Population (Table 1).

The average age of patients with an unscarred uterus was significantly older (34.0 ± 1.6 years) than that of patients with a scarred uterus (27.2 ± 0.8 years). In terms of parity, almost a third of the overall study population (30.7% n=28) was defined as grand multipara (≥ 5 previous deliveries) with a higher proportion amongst the unscarred uterus group (71.4%, n=15) compared to patients with a scarred uterus (25.7%, n=18). The gestational age at which the rupture occurred was significantly more advanced for the patients with an unscarred uterus (39+6 weeks \pm 3 days) in comparison to patients with a scarred uterus (37+6 weeks \pm 6 days). All the ninety-one cases of uterine rupture occurred between 21 and 45 weeks' gestation. In the scarred uterus group, (n=63) had at least one previous cesarean section with the majority (82.5%, n=52) had only one previous cesarean section. Of note, all previous cesarean sections in this study population had been documented to be transverse lower uterine segment incision. Eleven patients had two or more previous cesarean section; none of them underwent trial of labor. For the seven patients with a scarred uterus and no history of cesarean section, the mechanism for uterine scarring was complication at dilatation and curettage (D&C) in four patients and previous history of myomectomy in the other three patients.

Associated factors with uterine rupture for patients with a scarred uterus

In addition to the history of uterine scar, an important risk factor to document is trial of labor (TOL) and use of induction and augmentation. Of the 52 women with history of only one previous cesarean section, 82.8% encountered uterine rupture during a TOL: 6 (11.5%) patients with spontaneous labor, 14 patients (26.9%) with Oxytocin use, 17 patients (32.6%) with Oxytocin in addition to Prostaglandin (PGE2) induction, and 10 patients (19.2%) with PGE2 induction only. The remaining 5 women (9.6%) with one previous cesarean section encountered uterine rupture without TOL. Three patients presented to hospital at term in shock with fetal demise, one with tearing abdominal pain and vaginal bleeding, and one patient with severe abdominal pain at 21 weeks gestation, uterine rupture at the posterior wall was identified with fetal demise. In this last case, the patient had a recent history of gestational trophoblastic neoplasm being managed with Actinomycin D. For the four patients with the complicated D&C as cause for their uterine scar, three of them underwent TOL with Oxytocin and the other, encountered uterine rupture at 30 weeks' gestation without labor. For the three patients with history of myomectomy as a cause of their uterine rupture, 2 of them had TOL with PGE2 and Oxytocin and the other one was spontaneous labor.

Associated factors with uterine rupture for patients with unscarred uterus

Eighteen out of the twenty one cases of UR in patients with an unscarred uterus had other identifiable risk factors. The majority of these patients (n=15, 71.5%) were grand multiparous women. Additionally, the vast majority of these patients (n=20, 95.2%) had induction and/or augmentation of labor. Eight patients

(38.1%) underwent induction of labor with PGE2, 15 patients (71.5%) had been administered Oxytocin for augmentation of labor. Six patients (28.5%) underwent instrumental delivery and one had a breech delivery. Finally, six patients (25.5%) delivered a macrosomic infant. Only three patient with an unscarred uterus experienced uterine rupture without other identifiable risk factors (1 per 59,484 deliveries). Diagnosis of Uterine Rupture (Table 2).

The diagnostic features for uterine rupture varied slightly between the two groups (Table 2). Overall abnormal fetal heart tracing (n=47, 51.6%) (Prolonged, late, or variable decelerations and bradycardia) was the most common manifestation of UR. Whereas postpartum hemorrhage occurred significantly greater in the unscarred compared with the scarred group (79.1% vs 27.2%; P=0.002). Site of Uterine Rupture (Table 3).

The lower segment was more likely to be the site of rupture for patients with a scarred uterus (92.8%, n=65); compared to patients with an unscarred uterus (71.4%; n=15). Urinary bladder involvement at the site of rupture occurred exclusively in patients with a scarred uterus (5.5%; n=5). Meanwhile, cervical tears and broad ligament hematomas were more common for patients with an unscarred uterus than Scarred Uterus (19.5% and 48.2%, respectively).

Management of uterine rupture

Management strategies described included abdominal hysterectomy (39.7%; n=36) and repair of the site of uterine rupture (67.2%; n=61) with tubal sterilization (18.2%; n=17), and repair without tubal sterilization (53.1%; n=48). Management strategy was not significantly different between the groups. The vast majority of cases underwent repair of the site of uterine rupture without tubal sterilization (53.1%; n=48).

Maternal outcomes

Generally, maternal outcome was favorable in all patients except for one mortality for a woman with previous one cesarean section presented to the hospital at term with ruptured uterus in profound shock and fetal demise required immediate hysterectomy and ICU admission. However, after 41 days in ICU, patient expired with multi-organ failure.

Perinatal outcomes

Overall 17 cases of perinatal mortality (11 Still births, 6 Early Neonatal Deaths) encountered in the studied population with no significant difference between the two groups. Apgar scores at birth were similar between groups; overall 29.4% (n=27) had Apgars of ≤ 7 at 5 minutes. Birth asphyxia was diagnosed in 16 babies in the scarred group and 3 in the unscarred group. In terms of long-term squeal, 9 of these babies had neurodevelopmental delay (4 cerebral palsy and 1 with delayed speech).

Future fertility

From 48 women (49%) managed with repair of the UR without tubal sterilization, 27 (57.3%) successfully conceived at least once. A total of 33 infants were delivered for these women, all by elective cesarean section. Only one patient had recurrent

Table 1 Demographic, clinical characteristics of scarred and unscarred group.

Characteristics	Scarred Uterus (n=70) (76.9%)	Unscarred Uterus (n=21) (23.1%)	p-value
Age (years)	34.0 ± 1.6	27.2 ± 0.8	-
Parity			
0-1	18 (25.7)	0	0.019
2-4	34 (48.5)	6 (28.6)	
≥5	18 (25.7)	15 (71.4)	
Gestational age	37+6 weeks ± 6 days	39+6 weeks ± 3 days	0.027
Previous CD			
0	7 (10)	21 (100.0)	<0.001
1	48 (68.5)	0	
2	6 (8.6)	0	
3	8 (11.4)	0	
4	1 (1.4)	0	
VBAC			
Previous VBAC	20 (28.5)	0	<0.001
No Previous VBAC	43 (61.4)	0	
No previous CD	7 (5.6)	21 (100.0)	

VBAC: Vaginal Birth after Cesarean Delivery CD: Cesarean Delivery.

Table 2 Presenting manifestations of uterine rupture for patients with a scarred vs. and unscarred uterus.

Diagnostic Characteristics	Scarred Uterus (n=70) (76.9%)	Unscarred Uterus (n=21) (23.1%)	p-value
NRFHR	37 (53.1)	7 (33.3)	0.21
Intrapartum PVB	21 (30.0)	5 (23.8)	0.329
Abdominal Pain	18 (25.7)	5 (23.8)	0.312
Shock	11 (15.7)	4 (19.0)	0.292
Recession of Presenting Part	5 (7.1)	0 (0.0)	0.398
PPH	19 (27.2)	16 (79.1)	0.002

Table 3 Site of uterine rupture among patients with scarred and unscarred uteri.

Site of Rupture	Scarred Uterus (n=70) (76.9%)	Unscarred Uterus (n=21) (23.1%)
Uterine fundus	6 (8.5%)	4 (19.0%)
Lower segment	65 (92.8%)	9 (69.2%)
Involvement of Cervix and/or broad ligament hematoma	14 (39.5%)	10 (48.2%)
Involvement of bladder	5 (5.5%)	0

complete uterine rupture in two consecutive pregnancies remote from term, was refusing tubal ligation. Three women had silent scar dehiscence twice, and required repair at the time of her elective cesarean.

Discussion

Rupture of the gravid uterus is a serious obstetric emergency, with its accompanying maternal and perinatal morbidity and mortality on its occurrence, with a devastating effect on the patient, her family and attending staff. It has consequences not only for the current pregnancy but also, if the uterus can be conserved, for the future fertility and future pregnancy outcomes.

There has been wide variation in its etiology over the last two decades, where beside obstetrics related complications (malpresentation, obstructed labor etc), the increase in cesarean section rate has created a very common cause of ruptured uterus [10]. In fact, and cesarean section scar became one of the most leading causes of such a catastrophe. History of previous

cesarean section was the most common risk factor in our series with almost 70% of the UR cases, while grand-multiparty highest risk factor in the unscarred group.

The incidence of (1 per 1961 deliveries) of uterine rupture (0.05%) over a period of 30 years is a much lower than the international rate (0.31%) and is comparable to that of Fedorkow et al. in Canada (0.03%) [1,11]. Our low incidence of ruptured uterus is a reflection of the good standard of obstetric care in our institute, in which all patients were booked antenatally. This is in addition to the use of continuous electronic fetal monitoring for all patients intrapartum. Hence, abnormalities of fetal heart were readily picked up and quick action taken, especially in VBAC cases. The use of Partogram to monitor the progress of labor, with avoidance of hyperstimulation of the uterus also played a role. Quick access to emergency cesarean section theatre when expeditious delivery was aimed, added to a better outcome [11].

The challenge in UR cases diagnosis is the unpredictability [12] so obstetricians should be vigilant with careful fetal and maternal

monitoring whole through stages of labor. The diagnosis could be challenging with variable manifestations. Silent, quiet or occult UR has been reported; with delayed diagnosis and management. However, obvious signs and symptoms likely develop over a short period of time indicate that acute serious visceral accident has just occurred. Rupture of uterus might occur at the end of the second stage of labor after vaginal delivery of the fetus is completed. So obstetrician should always be on the lookout for its occurrence, quick diagnosis, rapid management by fluids and blood products replacement, and having the most senior experienced obstetrician to deal with the surgical management.

The lower uterine segment was almost always involved site of rupture in the scarred uterus group in our series (92.8%). This may be due to inherent weakness and overstretch of the old scar. Other studies have also reported high rates of involvement of the lower uterine segment [13,14] Characteristic cervical and broad ligament involvement has been more observed in the unscarred group than the scarred (39.5% and 48.2%). The significance involvement of such anatomical part of the uterus may be an indication of increased severity that necessitates in most cases the need for hysterectomy other than just repair in that group of patients. In our series, 19 cases of 23 in total (82.6%) of cervical tear in association with UR were managed by hysterectomy. Similar results were reported [13,14].

In our series the management of ruptured gravid uterus was mainly dealt with the most senior obstetrician available, hence the percentage of hysterectomy was not exaggerated but yet governed by the site, size and degree of damage to the uterus.

Clearly conservative management was almost always the trend by most obstetricians in our series, as there are social and cultural issues that need to be taken into consideration. Although early recourse to hysterectomy should be considered if there is any immediate threat to the life of the mother [10]. The aim of conservative repair without sterilization is due to fertility reasons primarily, and psychological effect of not having monthly period at a lesser extent. This view agrees with Soltan et al. [15].

Conclusion

Antenatal care is vital, not to prevent or predict uterine rupture but to highlight the high-risk cases that need more care. For all patients in labor there should be a low threshold of suspicious for ruptured uterus, in particularly high risk patients that develop abnormality in fetal heart pattern or any abnormal per vaginal bleeding. The most senior expert obstetrician should deal with the surgical management. Reservation of fertility should be a target especially in conservative communities without compromising maternal health.

Authors' Contributions

Alwadi drafted the manuscript. Farid and AlWadi contributed to study conception and study design. Chamsi and Alwadi contributed to literature review and data collection. Chamsi and Alwadi contributed to data analysis and data presentation in tables and figures. Farid and Alwadi reviewed manuscript for editorial and intellectual contents. All authors have read and approved the final draft of manuscript.

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