
Uterine Rupture in Third Trimester of Pregnancy in a Tertiary Centre: A Descriptive Observational Study

Doaa S. Belal¹ MD
Heba M. Marie¹ MD
Amr H. Wahba¹ * MD, MRCOG
¹Department of Obstetrics and
Gynecology, Cairo University,
Alsaraya street, Al Kasr Al Ainy,
Cairo Egypt, postcode: 11562.

Abstract

Background: Uterine rupture is a rare but serious obstetric complication that can have an adverse impact on the mother and the fetus.

Methods: This is a cross-sectional study conducted in a tertiary care centre over a one-year period, including all cases with uterine rupture occurring at or after 28 weeks of gestation. We collected demographic data, possible causes, diagnosis, management and feto-maternal outcome.

Results: We had 48 cases of uterine rupture in the study period; 42 cases with a scarred uterus, most commonly cesarean section (CS), and 6 cases with unscarred uterus most commonly due to labour-related causes. Adverse outcome included blood transfusion (n=25), hematoma formation (n=6) bladder injury (n=4) and one mortality. The perinatal death rate was 37.8%. Surgical repair of the uterus was possible in 79.2% of the cases. Those with unscarred uteri had significantly more bleeding and hematoma formation with more risk for blood transfusion than those with scarred uteri. No statistically significant differences in the rate of hysterectomy, bladder injury or perinatal death rate between both groups.

Conclusion: In our population, CS represents the most common cause of uterine rupture followed by labour-related causes. Uterine rupture in an unscarred uterus is associated with more bleeding, hematoma formation and more risk for blood transfusion than scarred uterus group. Surgical repair is possible in most cases. Reducing the rate of CS, optimizing care for women with previous CS and careful management of labour can help to reduce the incidence of uterine rupture.

Keywords: Uterine rupture, cesarean section, placenta percreta, obstructed labour, induction of labour, fundal pressure.

Introduction

Uterine rupture is the disruption of the uterus during pregnancy or delivery. It can either be a complete rupture if the tear is involving the 3 layers of the uterus; namely (endometrium, myometrium and serosa) or partial

Corresponding author:

Dr. Amr H Wahba, MD, MRCOG
E-mail: dr.amrwahba@yahoo.
com
Phone number: 002001002642285.
Address: Department of Obstetrics
and Gynecology, Cairo
University, Alsaraya street, Kasr
AlAiny, Cairo Egypt, postcode:
11562.

rupture if it doesn't involve all layers. The latter is referred to as uterine dehiscence and is usually an incidental finding in an asymptomatic patient (1).

Complete uterine rupture is a serious potentially life-threatening obstetric emergency with high maternal and fetal morbidity and mortality. The incidence of this complication and the fetomaternal outcome depends on the level of the maternal care women receive and thus has been reported to vary between nations with prevalence tending to be lower in countries classified by the United Nations as developed than the less or least developed countries (2). There is however, limited data on the magnitude of the problem, and more efforts are required to monitor its frequency, causes and management.

In this study, we aimed to evaluate the incidence of uterine rupture in a tertiary care referral centre, identify risk factors, diagnosis, management and fetomaternal outcome of this serious obstetric emergency.

Materials And Methods

This was a cross-sectional study in which we collected data of cases with complete uterine rupture occurring at or after 28 weeks of gestation (when chances of viability would be reasonable in a low resource setting) admitted to the Emergency Unit at the Department of Obstetrics and Gynecology at Cairo University Hospital in the period from 1st of August 2017 till 31st of July 2018. Our department is a tertiary centre providing care for high-risk pregnant women referred from other facilities. Only cases with complete uterine rupture at or after 28 weeks of gestation were included. We excluded cases with dehiscent scar (partial uterine rupture) and cases occurring before 28 weeks of gestation. We collected demographic data, gestational age, cause of uterine rupture, clinical presentation, surgical findings, management as well as fetomaternal

outcome. We also collected information on the total number of deliveries during the time period of the study. This study was approved by the Research Scientific and Ethical Committee of the Department of Obstetrics and Gynecology – Cairo University Hospital with ethical approval number (O-170014).

Statistical analysis

Data were statistically reported in terms of mean \pm standard deviation, or frequencies and percentages when appropriate. Comparison of numerical variables between 2 study groups was done using the student t-test. Welch's t-test was used if the study groups do not have equal sample size. Comparison of categorical data was performed using Chi square (χ^2) test. p values less than 0.05 was considered statistically significant. All statistical calculations were done using SPSS for IBM (IBM Corp., Armonk, NY, USA).

Results

We encountered 48 cases of complete uterine rupture occurring during the third trimester of pregnancy (at or after 28 weeks of pregnancy) who were admitted to the Emergency Unit at the Department of Obstetrics and Gynecology at Cairo University Hospital, in the period from 1st of August 2017 till the 31st of July 2018.

In this time period, we had 14,994 total deliveries with 8084 vaginal deliveries (53.9%) and 6910 cesarean deliveries (46.1%). Thus, the incidence of uterine rupture in our study is 0.3%. The mean age of the patients was 31.75 ± 4.1 years with a mean BMI of 31.9 ± 5.8 kg/m². All cases were parous apart from two cases were primigravidae and 60.4% of women in the study were para 3 or more. More than half of the women were obese (58.3%). The mean gestational age at which uterine rupture occurred was 35.9 ± 2.45 weeks, with rupture reported as late as 41 weeks. Most cases were term (66.7%) and

33.3 % of cases were preterm. There were 42 cases (87.5%) with scarred uterus while 6 cases only had unscarred uterus (12.5%). Co-morbidities were found in 25% of the cases, the most common of which was hypertensive disorders (12.5%). The baseline characteristics of women with uterine rupture in the third trimester are summarized in Table 1.

Table 1: The baseline characteristics of women with uterine rupture in the third trimester

Variable	Mean \pm SD (Range)	N	%
Age (years) :	31.75 \pm 4.1 (19- 40)	48	100
• 19-29		12	25
• 30-40		36	75
BMI (kg/m²)	31.9 \pm 5.8 (24.9 - 60.3)	48	100
• Normal weight (18.5-24.9)		2	4.2
• Overweight (25-29.9)		18	37.5
• Obese (>30)		28	58.3
Parity	2.875 \pm 1.36 (0 – 6)	48	100
• P0		2	4.2
• P1		5	10.4
• P2		12	25
• P3 or more		29	60.4
Gestational age (weeks)	35.9 \pm 2.45 (31-41)	48	100
• Singleton	36 \pm 2.6 (31-41)	42	87.5
• Twins	34.6 \pm 1.2 (33-36)	6	12.5
• 28-< 36 weeks		16	33.3
• 36 -<38 weeks		18	37.5
• 38-41 weeks		14	29.2
Associated co-morbidity:			
• No morbidity		36	75
• Co-morbidities (12)		12	25
• Hypertensive disorders		6	12.5
• Diabetes		4	8.3
• Cardiac condition		2	4.2
• Thyroid disorders		1	2.1
• Hepatic dysfunction		1	2.1
• Hepatitis C virus		2	4.2
• Severe anemia (HB<4)		1	
Placenta accreta		2	4.2
Inter-delivery interval (years) for parous women with previous CS	2.7 \pm 1.29 (1-8)	42	87.5
• Less than 9 months		0	0
• 9-18 months 6		36	14.3
• More than 18 months 36		36	85.7

Mode of previous deliveries:			
• No previous delivery (primigravida)		2	4.2
• NVD		4	8.3
• Cesarean section		42	87.5
Unscarred uterus		6	12.5
• Primigravida		2	4.2
• Multigravida		4	8.3
Scarred uterus		42	87.5
• Previous 1 CS		9	18.7
• Previous 2 CS		13	27.1
• Previous 3 or more CS		20	41.7

**BMI = Body mass index, NVD = normal vaginal delivery , CS= cesarean section*

Causes of uterine rupture in our study population are summarized in Table 2. These included most commonly previous CS followed by labour-related causes (improper use of prostaglandins, obstructed labour, fundal pressure and one case had no identifiable cause apart from grand multiparity and induction of labour), rarely by placenta percreta, previous perforated uterus and abdominal trauma. None of the cases in our study population had a previous history of myomectomy or uterine rupture.

In cases with an unscarred uterus, uterine rupture was most commonly related to labour and only one case occurred during pregnancy due to abdominal trauma, while, in scarred uterus, half of the cases occurred with spontaneous onset of labour and the other half occurred during pregnancy. See Figure 1. In unscarred group, all cases related to labour, had induction with prostaglandins except one case that had spontaneous onset of labour but ended with obstructed labour. All cases received oxytocin. Uterine rupture occurred in the first stage of labour in 2 cases, and in the second stage in 3 cases. Figure 2 demonstrates the timing of uterine rupture in relation to pregnancy and stage of labour.

Table 2: Causes of uterine rupture in the studied population

	Causes of Uterine rupture	N	%
Scarred uterus (87.5%)	Previous cesarean delivery	39	81.2
	Previous perforated uterus	1	2.08
	Placenta percreta	2	4.16
Unscarred uterus (12.5%)	Labour-related:	5	10.4
	• Improper use of Prostaglandins	2	4.16
	• Assisted fundal pressure	1	2.08
	• Obstructed labor	1	2.08
	• No identifiable cause apart from high parity and induction of labour (P5)	1	2.08
	Trauma	1	2.08

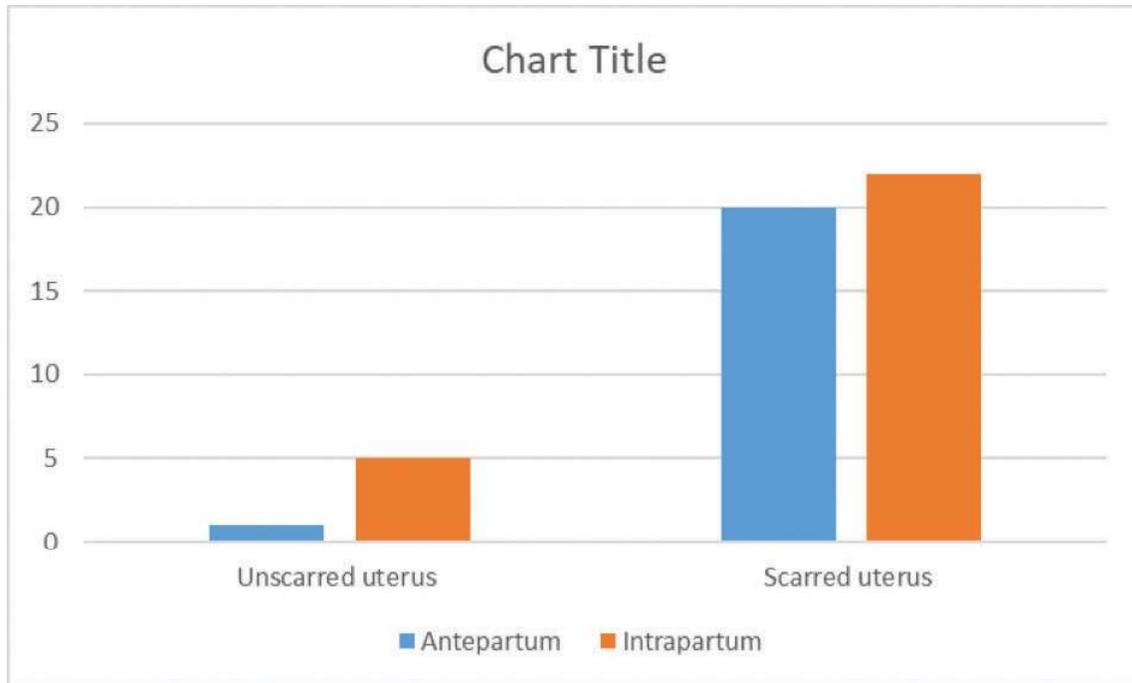


Figure 1: Onset of uterine rupture in relation to labour pains in scarred and unscarred uterus

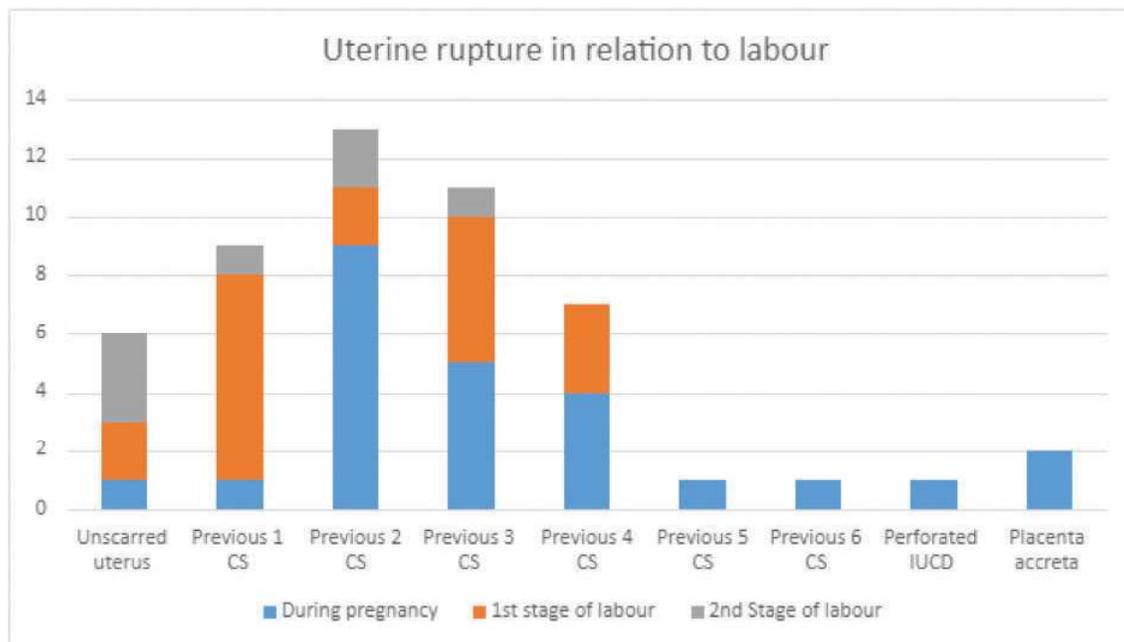


Figure 2: Timing of uterine rupture in relation to pregnancy and stage of labour

The most common presenting symptom was abdominal pain (68.75%) followed by vaginal bleeding (20.8%). However, 5 cases did not have significant symptoms. These cases had previous uterine scar (two cases had previous 3 CS presented at 38 weeks, one case had previous 4 CS and presented at 36 weeks, another case had previous 5 CS presented at 37 weeks for delivery and one case with previous 2 CS was diagnosed after vaginal delivery during

digital exploration of the uterus). Two cases in the unscarred uterus group were diagnosed after delivery during the management of traumatic postpartum hemorrhage. Table 3 shows clinical presentation of uterine rupture. Ultrasonography confirmed the diagnosis by visualization of the fetus outside the uterus. This was documented in 9 cases and in 2 cases the rupture was suspected by the ultrasound from the presence of hematoma.

Table 3: Clinical presentation of uterine rupture

Symptoms	N	Percentage
Abdominal pain	33	68.75
Vaginal Bleeding	10	20.8
Hypovolemic Shock	9	18.75
Asymptomatic	5	10.4
Vaginal bleeding	4	8.3
Abnormal CTG	4	8.3
Failure to progress	4	8.3
Loss of presenting part	2	4.2
Cessation of contractions	2	4.2

The diagnosis was confirmed in all cases intraoperatively. Pfannenstiell incision was used in 41 cases (85.4%) while midline incision was used in 7 cases (14.6%). In cases with a scarred uterus, the site of uterine rupture was at the site of previous CS scar except in 3 cases; one case had rupture in the posterior uterine wall and two other cases had rupture in the upper uterine segment; due to perforated intrauterine contraceptive device (IUCD) and the other due to previous hysterotomy. Figure 3 demonstrates uterine rupture at the site of previous CS scar in a woman with previous CS with intact amniotic membrane.

In cases with an unscarred uterus, uterine rupture involved the lower uterine segment in all cases. Surgical repair of the uterus was possible in 38 cases (79.2%); however, 10 cases had hysterectomy (20.8%). Figure 4: Total hysterectomy specimen in women

with unscarred uterus showing lateral tear extending from cervix upwards. The mean estimated blood loss (EBL) was 1442.7 ± 753.7 ml (300-3800 ml) and the mean hospital stay 4.3 ± 2.1 (2-11). Table 4 shows operative findings and surgical procedures.



Figure 3: Uterine rupture at the site of previous cesarean scar in a woman with previous CS with intact amniotic membrane



Figure 4: Total hysterectomy specimen in women with unscarred uterus showing lateral tear extending from cervix upwards

Table 4: Surgical findings and procedures:

Operative findings	Number	Percentage
Incision:		
• Midline incision	7	14.6
• Pfannenstiel incision	41	85.4
Site of the Uterine rupture		
• Upper uterine segment	2	4.1
• At site of CS scar (Extensions were seen in 7 cases)	39	81.3
• LUS	6	12.5
• Posterior uterine wall (scarred uterus)	1	2.1
Ruptured membranes	28	58.3
Intact membranes	17	35.4
Extrauterine fetus	15	31.2
Extrauterine placenta	11	22.9
Surgical management		
• Repair of rupture uterus	38	79.2
• Hysterectomy	10	20.8
• Additional procedures:		
o Internal iliac artery ligation	1	2.1
o Bilateral tubal ligation	1	2.1

The adverse maternal outcomes included blood transfusion in 25 cases (52.1%), bladder injury in 4 cases (8.3%), hematoma formation in 6 cases (12.5%). Nine cases were transferred to the ICU (18.75%). One mortality occurred due to shock with multisystem organ failure (2.5%). We evaluated the fetal outcome in singleton pregnancies after excluding twin pregnancies (n=6) and cases with intrauterine fetal death (IUFD) due to associated co-morbidities (n=6). The mean fetal weight was 2744.86 ± 710.54 (750–4000 gm). Out of 37 singleton pregnancies, 12 fetuses were born dead (32.4%) and 25 fetuses were born alive (67.6%). Apgar score in 1 min was less than 7 in 13 cases (52%). NICU admission was required in 5 of the liveborn fetuses (20%), 3 were discharged and 2 died. Thus, the perineatal death rate was 37.8%. Table 5 demonstrates the fetomaternal outcome.

Fetomaternal outcome for the scarred uterus group was compared to that of the unscarred uterus group. The unscarred uterus group was associated with significantly more blood loss, more risk for hematoma formation and more risk of blood transfusion (but the latter was not statistically significant). There were no cases of bladder injury in the unscarred uterus group compared to 4 cases in the scarred uterus group, but the difference was not statistically significant. No statistically significant difference in rate of hysterectomy, NICU admission and perinatal death rates between both groups. Both groups showed no statistically significant differences in baseline characteristics including age, gestational age and BMI. See Table 6 Fetomaternal outcome in scarred vs unscarred uterus group.

Table 5: Fetomaternal outcome (Fetal outcome –excluding cases of IUFD due to associated morbidities, and cases with multiple pregnancies)

Fetomaternal outcome	Mean \pm SD (Range)	Number	Percentage
Maternal outcome			
EBL (ml)	1442.7 \pm 753.7 ml (300-3800 ml)	48	100
Blood transfusion		25	52.1
Bladder injury		4	8.3
Hematoma		6	12.5
ICU admission		9	18.75
Hospital stay (days)	4.3 \pm 2.1 (2-11)		
Readmission		0	0
Mortality		1	2.1
Fetal outcome			
Fetal weight	2744.86 \pm 710.54 (750-4000 gm)	37	100
Live born		25/37	67.6
Dead		12/37	32.4
Perinatal death		14/37	37.8
NICU admission		5/25	20
Apgar in 1 min <7		13/25	52
Apgar in 5 min <7		2/25	8

Table 6: Feto-maternal outcome in unscarred vs scarred uterine rupture

	Unscarred uterus (n=6)	Scarred uterus (n=42)	p value
Age	31.5 ± 7.8	31.8 ± 3.45	0.93
Gestational age	37 ± 3.8	35.7 ± 2.31	0.45
BMI	31.2 ± 4.3	32.0 ± 6.026	0.713
EBL (ml)	1875 +/-534.5	1369.048 ± 747.27	0.045
Blood transfusion	6 (100 %)	19 (45.2%)	0.12
Bladder injury	0	4 (9.52%)	0.43
Hematoma	3 (50%)	3 (7.1%)	0.001
Hysterectomy	1 (16.7%)	9 (21.4 %)	0.78
NICU admission	0	5 (20%)	0.593
Perinatal death rate	1(out of 4 cases) (25%)	13/33 (39.39%)	0.575

Discussion

Uterine rupture is a potentially life-threatening complication that occurs between 1 and 280–12,000 births (3, 4). The incidence of uterine rupture in the current study was 0.3%. We expect this to be higher than the actual community-based incidence given that the data were collected from a tertiary care centre with referral of high-risk cases. The prevalence of uterine rupture was found in a WHO systematic review to be much lower in community-based (median 0.053, range 0.016-0.30%) than in facility-based research studies (0.31, 0.012-2.9%). The incidence of uterine rupture in our study is within the reported range for developed countries where the incidence was reported to be in the range from 1.9 to 38 cases per 10,000 births (0.019 - 0.38%) (3,4). The incidence reported in other parts of Africa is much higher (5,6,7).

In our study, 87.5 % of uterine rupture cases occurred in the scarred uterus while 12.5% occurred in an unscarred uterus. This is similar to the study conducted in USA by Finnsdottir et al. in which rupture occurred in 82.1% and 17.3% respectively (8). In developed countries, the uterine rupture was found to occur most commonly due to previous CS, while in developing countries,

it was found to occur most commonly in the unscarred uterus (2,9).

Most cases of uterine rupture in our study were attributed to previous uterine scar, most commonly CS. In scarred uterus group, two cases had uterine rupture due to placenta percreta which has been reported as a rare cause of uterine rupture in all trimesters (10,11, 12, 13, 14, 15). It represents 5 % of the placenta accreta spectrum (16). Previous uterine surgery has been identified as the most important risk factor for placenta accreta (11), although it has been reported in the unscarred uterus (17).

One case in the scarred uterus group had a history of previous intrauterine contraceptive device (IUCD) perforation. Since uterine rupture, in this case, occurred at the upper uterine segment (fundus) rather than at site of previous cesarean scar, the cause was attributed to the history of perforated uterus rather than to the CS. The uterine fundus has been reported as the commonest site of uterine perforation with several reports described uterine rupture after perforation in an unscarred uterus (18, 19;20, 21).

In women without uterine scar, the uterine rupture was mostly related to labour with causes including improper use of

prostaglandins (n=2), fundal pressure during the second stage of labour (n=1), obstructed labour (n=1) and no cause was identified in one case apart from high parity and induction of labour (n=1). Assisted fundal pressure has been reported as a cause of uterine rupture in previous studies (22,23). Obstructed labour due to cephalopelvic disproportion is a major factor in uterine rupture (24).

Uterine rupture in the unscarred uterus group mostly occurred intrapartum, with only one case occurred during pregnancy as a result of abdominal trauma. This is unlike scarred uterus group in which cases were almost equally divided between labour and antepartum period. This agrees with the findings of the study by Schrinky and Benson (25). Almost half of the uterine rupture in our study, occurred during or after the second stage of labour which is similar to the findings of the study by Miller et al who described a series of women with primary uterine rupture (26).

In our study, 75% of cases were above 30 years old. This agrees with the study by Ezechi et al in which the incidence was found highest in patients aged 30-34 years and lowest in those aged 25-29 years (27). Only 2 cases in our study were primigravidae and 60.4 % of cases were para 3 or more. Multiparity and particularly grand multiparity is considered a high risk for uterine rupture (23).

The most common clinical presentation in our study was acute abdominal pain. This agrees with the study by Savukyne et al., 2020 (28). Other presentations included vaginal bleeding, shock, CTG abnormalities, cessation of uterine contractions and loss of the presenting part. It has been reported that CTG changes (prolonged, persistent fetal bradycardia) are the most consistent early sign of uterine rupture according to Revicky et al., 2012. (29). However, we encountered 5 cases with no significant symptoms. Silent or asymptomatic uterine rupture has been described in the literature in a few case reports (30,31). Thus, clinicians must

remain watchful for signs and symptoms of uterine rupture and a high index of suspicion is necessary for diagnosis to ensure prompt management. Ultrasound was diagnostic by finding the fetus outside the uterus or by the presence of hematoma. Three cases were diagnosed after delivery of the placenta; one in scarred uterus with previous 2 CS in which uterine rupture was diagnosed with digital exploration of the uterine cavity after delivery of the placenta and two cases in unscarred uterus during management of primary postpartum haemorrhage following vaginal deliveries.

In most cases of the scarred uterus, the uterine rupture occurred at the site of the previous cesarean scar except in 2 cases occurred at the upper uterine segment (one due to previous history of uterine perforation and another one due to previous history of hysterotomy). Another case had a rupture in the posterior uterine wall with intact CS scar. This case was para 4, had previous 2 CS and was in second stage of labour. There are few case reports describing rupture of the posterior uterine wall, the exact mechanism of which is unknown but could be due to element of obstruction associated with strong inelastic scar (32,33,34).

Surgical repair of the uterine rupture was possible in most cases (79.2%) and hysterectomy was done in 20.8 %. The mean estimated blood loss was 1442.7 ± 753.7 ml (300-3800 ml). The adverse outcomes included blood transfusion which was required in 25 cases, hematoma (n=6) and bladder injury (n=4). The perinatal death rate related to uterine rupture was 37.83 % (excluding cases with IUFD due to associated co-morbidities, and multiple pregnancies). The mortality rate in our study was 2.1% which is similar to the study by Fitzpatrick et al., 2012 and Guise et al., 2004 (3,4), but the stillbirth rate was higher (32.4%) compared to that reported by Fitzpatrick et al.2012 (12%) (3).

Cases with an unscarred uterus were found to

have statistically significant more EBL and more hematoma formation. The rate of blood transfusion was higher in the unscarred uterus group (but was not statistically significant). This is similar to the results of studies by Gibbins et al. 2016 (35) and Finnsdottir et al. (8). The lower EBL in scarred uterus group can be explained by the relatively reduced vascularity at the scar site.

On the other hand, bladder injury was encountered only in 4 cases in the scarred uterus group with no cases in the unscarred uterus group. This is unlike the study by Finnsdottir in which they found a higher risk for bladder injury in unscarred uterus (8). The bladder adhesions in cases with previous CS explain the increased risk of bladder injury in scarred uterus group. There was no significant difference in the rate of hysterectomy between scarred and unscarred uterus group. This is unlike the results of the study by Gibbins et al., 2016, and Finnsdottir et al, in which risk for hysterectomy was higher in the unscarred uterus group (35,8). In the series of Miller et al, in which primary uterine rupture was studied, the rate of hysterectomy was only 10% rate (which is similar to the rate of hysterectomy in women without uterine scar in our study 16%) (26). The neonatal outcomes did not show statistically significant difference between scarred and unscarred uterus group in our study. This is in contrast to the study by Gibbins et al., in which the rupture of unscarred uterus was found to cause significantly more neonatal morbidity than the rupture of a scarred uterus (35).

Conclusion

In our population, CS represents the most common cause of uterine rupture followed by labour-related causes. Uterine rupture in the unscarred uterus is associated with more bleeding, hematoma formation and more risk for blood transfusion than the scarred uterus group. Surgical repair is possible in most

cases. Reducing the rate of CS, optimizing care for women with previous CS and careful management of labour can help to reduce the incidence of uterine rupture.

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;179:130-4.
2. Hofmeyr GJ, Say L, Gülmezoglu AM. WHO systematic review of maternal mortality and morbidity: the prevalence of uterine rupture. *BJOG.* 2005 ;112(9):1221-8.
3. Fitzpatrick, K.E.; Kurinczuk, J.J.; Alfirevic, Z.; Spark, P.; Brocklehurst, P.; Knight, M. Uterine Rupture by Intended Mode of Delivery in the UK: A National Case-Control Study. *PLoS Med.* 2012; 9:e1001184.
4. Guise, J.M.; McDonagh, M.S.; Osterweil, P.; Nygren, P.; Chan, B.K.S.; Helfand, M. Systematic review of the incidence and consequences of uterine rupture in women with previous caesarean section. *BMJ* 2004; 329; 19–25
5. Nyengidiki TK, Allagoa DO. Rupture of the gravid uterus in a tertiary health facility in the Niger delta region of Nigeria: A 5-year review. *Niger Med J.* 2011; 52(4):230-4.
6. Ezechi OO, Mabayoje P, Obissie LO. Rupture uterus in Southern Western Nigeria: A reappraisal. *Singapore Med J.* 2004;45:113–6
7. Gessssew A, Mengiste MM. Rupture uterus. A eight year retrospective analysis of causes and management outcome in Adigrat Hospital, Tigray Region, Ethiopia. *Ethiop J Health Dev.* 2002;16:241–5.

8. Finnsdottir SK, Maghsoudlou P, Pepin K, Gu X, Carusi DA, Einarsson JI, Rassier SLC. Uterine rupture and factors associated with adverse outcomes. *Arch Gynecol Obstet.* 2022; 22.
9. Berhe Y, Wall LL. Uterine rupture in resource-poor countries. *Obstet Gynecol Surv.* 2014;69(11):695-707.
10. Khandaker S. An undiagnosed case of placenta percreta presenting as a massive hemoperitoneum in obstetric emergency. *Proc. Obstet. Gynecol.* 2013;4:1-5.
11. Esmans A., Gerris J., Corthout E., Verdonk P., Declercq S. Placenta percreta causing rupture of an unscarred uterus at the end of the first trimester of pregnancy: case report. *Hum. Reprod.* 2004;19:2401-2403.
12. Norwitz E.R., Stern H.M., Grier H., Lee-Parritz A. Placenta percreta and uterine rupture associated with prior whole body radiation therapy. *Obstet. Gynecol.* 2001;98:929-931.
13. Bouab M, Kiram H, Jalal M, Lamrissi A, Bouhya S. Uterine rupture with massive hemoperitoneum due to placenta percreta in a second trimester: A case report. *Int J Surg Case Rep.* 2022;99:107652.
14. Boujida S, M'Hamdi O, Flissate F, Baidada A, Kharbach A. Placenta percreta as a cause of uterine rupture in the second trimester: Case report. *Int J Surg Case Rep.* 2022;94:107069.
15. Topuz S. Spontaneous uterine rupture at an unusual site due to placenta percreta in a 21 week twin pregnancy with previous cesarean section. *Clin Exp Obstet Gynecol* 2004;31:239 - 241.
16. Wu S., Kocherginsky M., Hibbard J.U. Abnormal placentation: twenty-year analysis. *Am. J. Obstet. Gynecol.* 2005;192:1458-1461.
17. Enebe JT, Ofor IJ, Okafor II. Placenta percreta causing spontaneous uterine rupture and intrauterine fetal death in an unscarred uterus: A case report. *Int J Surg Case Rep.* 2019;65:65-68.
18. Sentilhes, L.; Sergent, F.; Roman, H.; Verspyck, E.; Marpeau, L. Late complications of operative hysteroscopy: Predicting patients at risk of uterine rupture during subsequent pregnancy. *Eur. J. Obstet. Gynecol. Reprod. Biol.* 2005;120: 134-138.
19. Davis AA. A womb like a broken heart. *BMJ Case Rep.* 2018; 22.
20. Heemskerk, S.G.; Ten Eikelder, M.L.G.; Janssen, C.A.H. Uterine rupture in pregnancy after an intervention complicated by uterine perforation: Case report and systematic review of literature. *Sex. Reprod. Healthc.* 2019; 19: 9-14.
21. Schwarzman P, Baumfeld Y, Mastrolia SA, Yaniv-Salem S, Leron E, Silberstein T. Obstetric Outcomes after Perforation of Uterine Cavity. *J Clin Med.* 2022; 30;11(15):4439.
22. Wei SC, Chen CP. Uterine rupture due to traumatic assisted fundal pressure. *Taiwan J Obstet Gynecol.* 2006;45(2):170-2.
23. Hasegawa J, Sekizawa A, Ishiwata I, Ikeda T, Kinoshita K. Uterine rupture after the uterine fundal pressure maneuver. *J Perinat Med.* 2015; 43(6):785-8.
24. Neilson JP, Lavender T, Quenby S, Wray S. Obstructed labour. *BrMed Bull* 2003;67:191 - 204
25. Schrimsky DC, Benson RC. Rupture of the pregnant uterus: a review. *Obstet Gynecol Surv.* 1978; 33(4):217-32
26. Miller DA, Goodwin TM, Gherman RB, Paul RH. Intrapartum rupture of the unscarred uterus. *Obstet Gynecol.* 1997;89:671-3.
27. Ezechi OO, Mabayoje P, Obissie LO. Rupture uterus in Southern Western Nigeria: A reappraisal. *Singapore Med J.* 2004;45:113-6.

28. Savukyne, E.; Bykovaite-Stankeviciene, R.; Machtejeviene, E.; Nadisauskiene, R.; Maciuleviciene, R. Symptomatic Uterine Rupture: A Fifteen Year Review. *Medicina* 2020, 56, 574.
29. Revicky, V.; Muralidhar, A.; Mukhopadhyay, S.; Mahmood, T. A Case Series of Uterine Rupture: Lessons to be Learned for Future Clinical Practice. *J. Obstet. Gynaecol. India* 2012; 62: 665–673.
30. Woo JY, Tate L, Roth S, Eke AC. Silent Spontaneous Uterine Rupture at 36 Weeks of Gestation. *Case Rep Obstet Gynecol.* 2015;2015:596826.
31. Soyama H, Miyamoto M, Sasa H, Ishibashi H, Takano M, Furuya K. Pregnancy with asymptomatic uterine complete rupture after uterine artery embolization for postpartum hemorrhage. *Taiwan J Obstet Gynecol.* 2017; 56(4):538-540.
32. Figueroa R, Garry D, Mackenzie AP. Posterior uterine rupture in a woman with a previous Caesarean delivery. *J Matern Fetal Neonatal Med* 2003;14(2):130–131
33. Majumdar S, Warren R, Ifaturoti O. Fetal survival following posterior uterine wall rupture during labour with intact previous caesarean section scar. *Arch Gynecol Obstet.* 2007 ;276(5):537-40.
34. Singhal SR, Agarwal U, Sangwan K, Khosla A, Singhal S. Intrapartum posterior uterine wall rupture in lower segment cesarean section scarred uterus. *Acta Obstet Gynecol Scand.* 2005;84(2):196-7.
35. Gibbins KJ, Weber T, Holmgren CM, Porter TF, Varner MW, Manuck TA. Maternal and fetal morbidity associated with uterine rupture of the unscarred uterus. *Am J Obstet Gynecol.* 2015;213(3):382.e1-6