



## Original Article

# Uterine rupture in Ekiti State University Teaching Hospital, Ado-Ekiti: a review of presentation and outcome of management

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## Abstract

**Background:** Uterine rupture is a potential life-threatening obstetric emergency associated with massive hemorrhage and is a major cause of maternal and perinatal morbidity and mortality. This study reviewed cases of uterine rupture to determine prevalence, management and outcome.

**Methods:** This study was a retrospective analysis of cases of women managed for uterine rupture in Ekiti State University Teaching Hospital, Ado-Ekiti between 1st July, 2008 and 30th June, 2018. Relevant data on sociodemographic characteristics, presentation, management and maternal and perinatal outcomes were obtained using a structured questionnaire and analyzed with SPSS software.

**Results:** There were 16,495 deliveries and 64 cases of uterine rupture with a prevalence of 0.39% or 1 in 258 deliveries. The mean age of the women was  $27.30 \pm 4.53$  years and the median parity was 3 while the majority (71.69%, 38/53) of them were unbooked. About 66.03% (35/53) of the patients with uterine rupture had previous uterine scar while the other 33.96% (18/53) occurred in the unscarred uterus. The booking status, pre-operative packed cell volume, blood loss, units of blood received and admission into special care baby unit differed significantly among women with scarred and unscarred uterus,  $p=0.046$ ;  $0.010$ ;  $0.041$ ,  $0.001$  and  $0.027$ , respectively. The mean age, parity, gestational age at rupture and duration of hospital stay were not significantly different between them,  $p=0.546$ ;  $0.069$ ;  $0.634$  and  $0.075$ , respectively. Acute renal failure was the commonest complication among women with uterine rupture. The case fatality rate among the women was 18.87% (10/53) while the perinatal mortality rate was 849.05/1000 births (45/53).

**Conclusions:** Uterine rupture remains an obstetric catastrophe with grave consequences on both the mother and the fetus. Good referral system, antenatal education and supervised deliveries in well-equipped health facilities will reduce its occurrence.

**Keywords:** maternal mortality, Nigeria, perinatal mortality, uterine rupture

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## Introduction

Obstetric hemorrhage remains the most frequent cause of maternal morbidity and mortality globally [1] and uterine rupture contributes significantly to obstetric hemorrhage [2]. Uterine rupture (UR) is a life-threatening obstetric emergency associated with grave maternal and perinatal consequences [3]. It is the disruption of the wall of the uterus and involves a spectrum of conditions ranging from an asymptomatic tear to a complete rupture. The complete rupture may be associated with massive bleeding and extrusion of the fetus from the uterus into the peritoneal cavity [4].

The incidence of UR varies widely ranging from 1 in 250 deliveries in developing countries to 1 in 5000 deliveries in developed countries [5]. Studies conducted in Nigeria have reported incidences ranging from 1 in 273 deliveries [6-8] with a case fatality rate of 17-33% [6,9] and perinatal mortality rate of 74-95% [7,8]. While UR is rare in developed countries; it remains a public health concern in developing countries including Nigeria.

Uterine rupture results from a cascade of events; poor obstetric services, non-utilization of the available services, ignorance, illiteracy, traditional practices, cultural belief and aversion for cesarean delivery are among the identified contributors to the higher rates in developing countries [6-8]. Risk factors for UR that have been documented in previous studies include cephalopelvic disproportion, use of oxytocic agents for induction and augmentation, prolonged and obstructed labor, fetal macrosomia, uterine anomalies and uterine scars from previous cesarean section or myomectomy [3,6]. However, uterine scars from previous cesarean sections or the use of uterotonic agents for induction and augmentation of labor are the two most important factors demonstrated [6].

The outcome of patients presenting with UR depends largely on the timing of the presentation and promptness of intervention. Management modalities include repair of the ruptured uterus with or without tubal ligation and subtotal or total hysterectomy, depending on the extent of the rupture and hemodynamic status of the parturients. The immediate consequences of UR seen in the woman include hypovolemic shock, infection and death while in the fetus, hypoxia, anemia and death may ensue [8,10]. Post-surgical morbidities such as anemia, wound and genital sepsis and burst abdomen may occur while in addition, others may lose their uterus and compromise their future fertility [11,12].

In Nigeria, poor access to resources including quality health care has been a factor for the relatively high incidence of uterine rupture [8,10]. Due to widespread illiteracy and poverty, more women seek care at primary health centers, traditional birth attendants, mission (faith) centers and home deliveries and this has continually contributed to adverse fetomaternal outcomes [10]. In this study, we set out to review the prevalence, management and materno-fetal outcomes of uterine rupture. To date, there has been no study carried out to evaluate uterine rupture in Ekiti State University Teaching Hospital (EKSUTH), Ado-Ekiti. Findings from this study may serve to provide the basis for evidence-based recommendations and policies that may stem the tide of this obstetric catastrophe.

## Methods

The study was carried out in the labor ward and theatre of the Department of Obstetrics and Gynecology, EKSUTH, Ado-Ekiti. EKSUTH is one of the tertiary health institutions in Ekiti State and it serves as a referral center for primary, secondary and private health facilities within the state. It also receives referrals from the surrounding states of Kogi, Kwara, Osun and Ondo. About 3000 women register annually for antenatal care with an annual delivery rate of 2400. This study was approved by the Ethics and Research Committee of the hospital and was conducted in accordance with the Declaration of Helsinki on human experimentation.

Uterine rupture in EKSUTH is managed by immediate resuscitation of the patient with intravenous fluids, broad-spectrum antibiotics, blood transfusion and laparotomy. The definitive surgery at laparotomy being either a hysterectomy (total or subtotal) or uterine repair with or without bilateral tubal ligation depends on the patient's clinical status, parity, the extent of damage and her consent.

This retrospective study analyzed all cases of UR managed at the hospital between 1st July, 2008 and 30th June, 2018. The names and hospital numbers of women who were managed for UR during the study period were obtained from the registers in the labor ward and labor ward theatre. The case files were then retrieved from the Maternity Unit Records Department and relevant demographic and clinical information were extracted from them by trained research assistants.

Demographic data extracted were the maternal age, parity, education and occupation of woman and spouse, booking status, gestational age at presentation while clinical data obtained were previous uterine surgery like cesarean section or myomectomy, use of uterotonic agents, time and type of rupture, estimated blood loss, type of surgery performed, amount of blood transfused, perinatal outcomes such as birth weight, perinatal mortality, special care baby unit (SCBU) admission, indications and its outcome and maternal complications such as hypovolemic shock, acute renal failure, intensive care unit (ICU) admission and its outcome and maternal mortality.

Data collected were analyzed using the Statistical Package for Social Sciences (SPSS Chicago III, USA) version 20. Categorical data were presented as frequency and percentages while continuous data were analyzed using mean and standard deviation. Categorical

variables were compared between groups using the chi-square test while continuous variables were compared using student independent t-test. The level of statistical significance was set at p-value < 0.05.

## Results

During the study period, there were 16,495 deliveries and 64 cases of uterine rupture (UR) with a prevalence of 0.39% (3.9 cases per 1,000 live births) or 1 in 258 deliveries. Fifty-three (82.8%) of the 64 case notes retrieved containing well-documented information were analyzed. About 66.0% (35/53) of the patients with UR had previous uterine scar while the other 34.0% (18/53) of the UR occurred in the unscarred uterus.

The average age of the women with UR was  $27.30 \pm 4.53$  years. The majority (90.5%, 48/53) were in the age range of 20-39 years. The median parity was 3 with an interquartile range of 2. More than two-thirds (71.7%, 38/53) of the women with UR were unbooked for antenatal care in our hospital. Other sociodemographic characteristics of the women are as shown in Table 1.

**Table 1.** Sociodemographic characteristics of women with uterine rupture

Variables	Frequency (n=53)	Percentages (%)
<b>Age (years)</b>		
≤ 19	0	0
20-29	18	33.9
30-39	30	56.6
≥ 40	5	9.5
<b>Parity</b>		
0	7	13.2
1	4	7.5
2-4	35	66.1
≥ 5	7	13.2
<b>Education</b>		
None	21	39.6
Primary	16	30.2
Secondary	9	17.0
Tertiary	7	13.2
<b>Occupation</b>		
Unemployed	17	32.1
Self-employed	20	37.7
Paid employment	16	30.2
<b>Booking status</b>		
Unbooked	38	71.7
Booked	15	28.3

Table 2 shows that about two-thirds of the women (66.0%, 35/53) with UR had had previous uterine surgery (at least one previous cesarean section), experienced partial uterine rupture involving the lower uterine segment (64.2%, 34/53) and with history of use of uterotonic agents like oxytocin or misoprostol on them (69.8%, 37/53). The majority (81.1%, 45/53) of the women had UR in labor with 67.9% (36/53) occurring after the gestational age of 36 weeks while abdominal pain was the commonest (88.7%, 47/53) presenting symptom in them.

Hemoperitoneum was found at surgery in 79.2% (42/53) of the women with UR while most (64.2%, 34/53) of them had partial rupture involving the lower segment (73.6%, 39/53) and anterior part (45.3%, 24/53) of the uterus. Uterine repair alone was the most common (43.4%, 23/53) form of surgery performed while hysterectomy was done in 34.0% (18/53) of the cases. The commonest complication experienced by the women was an acute renal failure (30.2%, 16/53) while 3/53 (5.7%) women had puerperal psychosis. Other findings are contained in Table 3.

**Table 2.** Clinical data of participants with uterine rupture at presentation

Variables	Frequency	Percentages (%)
<b>Previous uterine surgery</b>		
Yes	35	66.0
No	18	34.0
<b>Uterotonic agents</b>		
Yes	37	69.8
No	16	30.2
<b>Gestational age at rupture</b>		
< 36 weeks	17	32.1
≥ 36 weeks	36	67.9
<b>Time of rupture</b>		
Active labor	43	81.1
No labor	10	18.9
<b><sup>a</sup>Symptoms at presentation</b>		
Abdominal pains	47	88.7
Vaginal bleeding	22	41.5
Fainting spells	4	7.5
Hypovolemic shock	17	32.1
<b><sup>b</sup>Pre-operative packed cell volume (%)</b>	26.02 ± 2.89	

<sup>a</sup>Some women had more than one symptom at presentation.

<sup>b</sup>Mean ± standard deviation.

**Table 3.** The surgical findings in women with uterine rupture

Variables	Frequency	Percentages (%)
<b>Presence of hemoperitoneum</b>		
Yes	42	79.2
No	11	20.8
<b>Type of rupture</b>		
Complete	19	35.8
Partial	34	64.2
<b>Site of rupture</b>		
Upper segment	14	26.4
Lower segment	39	73.6
Anterior	24	45.2
Posterior	18	34.0
Lateral	11	20.8
<b>Type of surgery</b>		
Repair alone	23	43.4
Repair and BTL	12	22.6
Subtotal hysterectomy	16	30.2
Total hysterectomy	2	3.8
<b>Estimated blood loss at surgery</b>		
< 1000 mL	28	52.8
≥ 1000 mL	25	47.2
<b>Amount of blood transfused</b>		
< 4 units	18	33.9
≥ 4 units	35	66.1

<b>Surgical complications</b>		
No complication	27	50.9
Acute renal failure	16	30.2
Wound infection	7	13.2
Puerperal psychosis	3	5.7

BTL: Bilateral tubal ligation.

About 32.1% (17/53) of the neonates were admitted into the special care baby unit (SCBU) while birth asphyxia was the commonest (64.7%, 11/17) indication for these admissions. Only 35.8% (19/53) of the women were admitted into the intensive care unit (ICU). There were 10/53 (18.9%) maternal and 45/53 (84.9%) perinatal deaths. The perinatal deaths comprised 36 stillbirths and 9 early neonatal deaths [Table 4].

**Table 4.** Maternal and fetal outcome in women with uterine rupture

<b>Variables</b>	<b>Frequency</b>	<b>Percentages (%)</b>
<b>Perinatal outcome (n=53)</b>		
Stillbirth	36	67.9
Early neonatal death	9	17.0
Alive	8	15.1
<b>Special care baby unit admission (n=53)</b>		
Yes	17	32.1
No	36	67.9
<b>Indication for SCBU admission (n=17)</b>		
Birth asphyxia	11	64.7
Prematurity	6	35.3
<b>SCBU admission outcome (n=17)</b>		
Discharged	8	47.1
Dead	9	52.9
<b>ICU admission (n=53)</b>		
Yes	19	35.8
No	34	64.2
<b>ICU admission outcome (n=19)</b>		
Discharged	14	73.7
Dead	5	26.3
<b>Maternal mortality (n=53)</b>		
Yes	10	18.9
No	43	81.1

SCBU: Special care baby unit, ICU: Intensive care unit.

Table 5 shows that there was no statistical difference in the mean age, parity, gestational age at rupture and duration of hospital stay among the group of women with previous uterine surgery and those without previous uterine surgery,  $p=0.546$ ;  $0.069$ ;  $0.634$  and  $0.075$ , respectively. However, women with an unscarred uterus received more units of blood than women with a scarred uterus and this was statistically significant ( $6.39 \pm 1.19$  vs  $4.51 \pm 1.04$ ;  $p=0.001$ ). The booking status, pre-operative packed cell volume, blood loss and admission into SCBU were also statistically different between the two groups of women,  $p=0.046$ ;  $0.01$ ;  $0.041$  and  $0.027$ , respectively while the other sociodemographic characteristics did not show any statistical difference ( $p>0.05$ ) as shown in the table.

**Table 5.** Sociodemographic comparison between women with unscarred and scarred uterine rupture

Variables	Unscarred uterus	Scarred uterus	p-value
Age of women (mean ± SD, years)	27.03 ± 4.37	27.83 ± 4.91	0.546
Parity of women (mean ± SD)	2.06 ± 1.62	2.86 ± 1.41	0.069
Gestational age at rupture (weeks)	39.22 ± 1.42	37.52 ± 1.23	0.634
Preoperative packed cell volume (%)	24.61 ± 2.70	26.74 ± 2.74	0.010*
Units of blood transfused	6.39 ± 1.19	4.51 ± 1.04	0.001*
Duration of hospital stay (days)	8.34 ± 2.45	9.04 ± 2.16	0.075
Duration of labor (hours)	15.23 ± 3.25	14.45 ± 3.56	0.325
Birth weight (Kg)	3.25 ± 0.45	3.05 ± 0.23	0.245
<b>Booking status</b>			
Unbooked	16 (88.9%)	22 (62.9%)	0.046*
Booked	2 (11.1%)	13 (37.1%)	
<b>Gestational age at rupture</b>			
< 36 weeks	4 (22.2%)	13 (37.1%)	0.270
≥ 36 weeks	14 (77.8%)	22 (62.9%)	
<b>Time of rupture</b>			
Not in labor	3 (16.7%)	9 (25.7%)	0.456
Active labor	15 (83.3%)	26 (74.3%)	
<b>Type of rupture</b>			
Complete	7 (38.9%)	12 (34.3%)	0.741
Partial	11 (61.1%)	23 (65.7%)	
<b>Types of surgery</b>			
Repair of the uterus only	11 (61.1%)	13 (37.1%)	0.091
Repair of the uterus and bilateral tubal ligation	5 (27.8%)	6 (17.1%)	
Subtotal abdominal hysterectomy	2 (11.1%)	14 (40.0%)	
Total abdominal hysterectomy	0 (0%)	2 (5.7%)	
<b>Amount of blood loss during surgery</b>			
< 1000 mL	5 (27.2%)	20 (57.1%)	0.043*
≥ 1000 mL	13 (72.8%)	15 (42.9%)	
<b>Special care baby unit admission</b>			
Yes	4 (22.2%)	13 (37.1%)	0.027*
No	14 (77.8%)	22 (62.9%)	
<b>Intensive care unit admission</b>			
Yes	5 (27.8%)	14 (40.0%)	0.380
No	13 (72.2%)	21 (60.0%)	
<b>Perinatal mortality</b>			
Yes	15 (83.3%)	30 (85.7%)	0.819
No	3 (16.7%)	5 (14.3%)	
<b>Maternal mortality</b>			
Yes	2 (11.1%)	8 (22.9%)	0.301
No	16 (88.9%)	30 (77.1%)	

\*Statistically significant.

## Discussion

The rupture of the uterus remains an obstetric catastrophe plaguing the developing countries. The prevalence of UR in this study was 1 in 258 deliveries. Previous uterine surgery, lack of quality antenatal care (unbooked status), administration of oxytocics and education were significantly associated with UR. Patients with previous uterine surgical scar were more likely to have UR at an earlier gestation and

suffered more morbidities associated with UR while hemodynamic instability requiring multiple transfusions of blood and blood product was more common in those with unscarred uteri. Most cases of UR occurred intrapartum and uterine wall repair without tubal sterilization was the most common mode of management. The case fatality rate of 18.9% and the perinatal mortality rate of 849.05/1000 births were reported from this study.

The prevalence of UR from our study is relatively high. It is however comparable to the prevalence of UR from similar studies by Abbas et al [13] and Nguefack et al [14] in other sub-African countries and this is within the reported prevalence of UR for facility-based study in a systematic review carried out by Justus Hofmeyr et al [15]. As expected, this reported prevalence is higher than figures reported by Colmorn et al [16] and Markou et al [17] from studies done in the developed countries but lower than figures reported from similar studies done in other parts of Nigeria [18,19]. Previous studies have shown global differences in the prevalence of UR with higher figures emanating from the less developed countries [5,13]. This gulf in the prevalence of UR between developed and developing countries can be attributed to the quality of obstetric services available in the various settings as well as the patients' awareness and education [13,20]. Previous studies opined that differences in the level of obstetric practices, availability and utilization of essential care services would account for the persistent high rate of UR in our environment and its rare occurrence in the developed countries.

Several studies in developed and developing countries have highlighted the association between UR and previous uterine surgery especially cesarean section [16,18,20,21]. The findings from our study are consistent with this association of UR and previous uterine surgery. Previously due to aversion to cesarean section, earlier reports from studies in low resource countries showed that UR occurred more frequently in unscarred uterus from obstructed labor and use of uterotonic agents [6,7,20], but the current trend may be due to increasing rate of cesarean section in this setting without a concomitant improvement in the level of obstetric care, particularly at the lower and more frequently accessed level of healthcare [2,20]. Women with previous CS in this environment also showed aversion towards CS including repeat CS [22], thus they are more likely to attempt a trial of labor after CS and possibly in centers with no facilities for adequate monitoring or prompt intervention [6].

This study revealed that UR occurred mostly in women between 20 and 39 years, an age range which represents the reproductive age and the age of maximum fertility potential. While the uterine repair was the most commonly done procedure, over half of these women were sterilized either by tubal ligation or hysterectomy as a form of management meaning they had lost the opportunity to bear more children irrespective of their desired number of children. This may have psychological consequences in these women [12]. High parity has also been reported as a predisposing factor to UR [7,20]. It is therefore noteworthy that while less than a fifth of the women in this study were grand multiparous, the majority of the women managed for UR in this study had lower parity. This is consistent with findings by Abbas et al, who reported that more UR in women of low parity. This, however, contradicts previous findings from settings like ours [7,20].

Education has always had a role to play in access to and utilization of available quality health care services. It was noted from our study that the level of education significantly contributed to uterine rupture as most women had little or no formal education. Also, education appears to be a major determinant of employment and socioeconomic status. Women with low education and not in paid employment had greater occurrences of UR in this study. Previous studies have reported that ignorance and low socioeconomic status are major factors associated with UR [13,18]. Motomura et al [23] opined that women with low educational status may experience social and health inequalities and likely be subjected to multiple barriers to accessing and utilizing care described in the Thaddeus' three delay model of maternal mortality.

The management of uterine rupture involves immediate resuscitation and prompt surgery. The surgical management of UR depends on the women's general condition at presentation, parity, desire for future fertility, the extent of rupture and skill of the surgeon. Uterine repair only was commonly done here for women with an unscarred uterus and of low parity. This would preserve their fertility for future reproduction. However, among women with a scarred uterus, subtotal hysterectomy was the commonest surgery performed on them. This was due to the fact that the rupture was extensive and repair would be difficult and prolonged with continued blood loss and worsened outcome. The recourse to uterine preserving surgery is a trend that is concordant with the report from other studies [24].

Hemodynamic instability and hypovolemic shock are common presentations of uterine rupture. While uterine rupture occurred more frequently in women with previous uterine surgery, the amount of blood loss and units of blood transfused in women with an unscarred uterus in this study was significantly higher, compared with women with a scarred uterus. This was similarly reported by Abbas et al [13] and Eguzo et al [20] in their study on uterine rupture comparing scarred and unscarred uterus. They opined that this could be a result of the fact that fibrous tissues that are present in the scarred uterus are poorly vascularized tissues and therefore scarred uterus would bleed less compared to the unscarred one [13,20].

Uterine rupture is associated with adverse maternal and perinatal outcomes. The case fatality rate of uterine rupture in this study is 18.9% and this is comparable to findings from other studies by Eguzo et al [6] and Abbas et al [13] but higher than those of Osemwenkha et al

[18] and Adegbola et al [19]. This is because our facility is a referral center and most of these cases presented in moribund condition due to delayed diagnosis and referral. However, the high perinatal mortality recorded here is consistent with findings from previous studies [10,18,19]. The adverse maternal and perinatal outcomes were found more to be associated with UR that occurred in women with a scarred uterus. This finding contradicts reports from other previous studies where UR had worse outcomes in women with the unscarred uterus [13,17,20]. This difference could be a result of the fact majority of these women with scarred uterine rupture did not register for antenatal care in our facility and had unsupervised labor because of the aversion for a repeat cesarean section. Also, these women with complicated labor got late to our facility - a referral center- in bad conditions due to delays at the referring centers [6,22].

The role of quality obstetric care, including antepartum and intrapartum care, as a determinant of obstetric and perinatal outcomes, cannot be overemphasized. It is therefore not surprising that the majority of the women who experienced UR in this study did not receive antenatal care and many were referred following unsupervised labor. Many of these women not only had unsupervised labor, they also had injudicious use of uterotonic agents (oxytocin and misoprostol) administered to them.

The retrospective nature of this study is a limitation due to poor documentation, however, we made a significant attempt to correctly collate all the relevant information reported in this study. Also, this study is hospital-based and might have under-estimated the magnitude of this condition in the general population since the majority of cases of uterine rupture occurred in the community and poor health facilities, therefore many of them may not have been managed in our facility.

In conclusion, this study has demonstrated that uterine rupture which is an obstetric catastrophe with adverse maternal and perinatal mortality is still prevalent in resource-constrained settings. While it is more common in women with a scarred uterus from previous cesarean delivery, it may also occur in the unscarred uterus, therefore, every obstetrician should be vast in the diagnosis and prompt management of UR [6,20]. Our study further emphasizes the role of poor/lack of antenatal care, unsupervised labor and delivery due to non-availability of skilled birth attendants and the use of uterotonic agents especially misoprostol in the occurrence of uterine rupture [18,20]. Uterine rupture is largely a preventable condition with improved utilization of antenatal care, regular counseling and antenatal education on hospital and supervised delivery especially for women with previous CS and presence of skilled birth attendants at referring centers [13,17,19]. We strongly recommend that there must be increased vigilance in women with a previous uterine scar who are between 30-39 years, multiparous and at 36 weeks gestation being at risk of UR and policies that strengthen the referral system to ensure prompt diagnosis and early presentation at well-equipped hospitals with blood transfusion services and trained personnel for proper management. This would help to optimize both maternal and fetal conditions and improve their outcomes.

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### Conflict of interest

All authors declare that they have no conflict of interest.

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### References

1. Shabadala E, Sebitloane HM. An increase in rates of obstetric haemorrhage in a setting of high HIV seroprevalence. *S Afr Med J* 2017;107:602-7.
2. Kidanto HL, Mwampagatwa I, Van Roosmalen J. Uterine rupture: a retrospective analysis of causes, complications and management outcomes at Muhimbili National Hospital in Dar es Salaam, Tanzania. *Tanzan J Health Res* 2012;14:220-5.
3. Turgut A, Ozler A, Siddik EM, Soydinc HE, Goruk NY, Karacor T, et al. Uterine rupture revisited: Predisposing factors, clinical features, management and outcomes from a tertiary centre in Turkey. *Pak J Med Sci* 2013;29:753-7.
4. Mahbuba Alam IP. Uterine rupture - experience of 30 cases at Faridpur Medical college Hospital. *Faridpur Med Coll J* 2012;7:79-81.
5. Ahmed DM, Mengista TS, Endalamaw AG. Incidence and factors associated with outcomes of uterine rupture among women delivered at Felegehiwot referral hospital, Bahir Dar, Ethiopia: cross sectional study. *BMC Pregnancy Childbirth* 2018;18:447.
6. Eguzo KN, Umezurike CC. Rupture of unscarred uterus: a multi-year cross-sectional study from Nigerian Christian Hospital, Nigeria. *Int J Reprod Contracept Obstet Gynecol* 2013;2:657-60.
7. Eze J, Ibekwe P. Uterine rupture at a secondary hospital in Afikpo, Southeast Nigeria. *Singapore Med J* 2010;51:506-11.
8. Esike CO, Umeora OU, Eze JN, Igberase GO. Ruptured uterus: The unabating obstetric catastrophe in South Eastern Nigeria. *Arch Gynecol Obstet* 2011;283:993-7.
9. Aduloju OP, Aduloju T, Ipinimo OM. Profile of maternal near miss and determinant factors in a teaching hospital, Southwestern Nigeria. *Int J Reprod Contracept Obstet Gynecol* 2018;7:3450-8.

10. Mbamara SU, Obiechina N, Eleje GU. An analysis of uterine rupture at the Nnamdi Azikiwe University Teaching Hospital Nnewi, Southeast Nigeria. *Niger J Clin Pract* 2012;15:448-52.
11. Igwegbe AO, Eleje GU, Udegbumam OI. Risk factors and perinatal outcome of uterine rupture in a low-resource setting. *Niger Med J* 2013;54:415-9.
12. de la Cruz CZ, Coulter ML, O'Rourke K, Amina Alio P, Daley EM, Mahan CS. Women's experiences, emotional responses and perceptions of care after emergency peripartum hysterectomy: a qualitative survey of women from 6 months to 3 years postpartum. *Birth* 2013;40:256-63.
13. Abbas MM, Shehata MA, Fathalla MM. Maternal and perinatal outcomes of uterine rupture in a tertiary care hospital: a cross-sectional study. *J Matern Fet Neonat Med* 2019;32:3352-6.
14. Nguéfack CT, Ekane GH, Ngupeyou EA, Njamen TN, Kamgaing JT, Obinchemti TE, et al. Uterine rupture in the Douala General Hospital, Cameroon: prevalence, risk factors, management and prognosis. *Health Sci Dis* 2016;17:1-6.
15. Hofmeyr GJ, Say L, Gulmezoglu AM. WHO systematic review of maternal mortality and morbidity: the prevalence of uterine rupture. *BJOG* 2005;112:1221-8.
16. Colmorn LB, Petersen KB, Jakobsson M, Lindqvist, PG, Klungsoyr K, Kallen K, et al. The Nordic Obstetric Surveillance Study: a study of complete uterine rupture, abnormally invasive placenta, peripartum hysterectomy, and severe blood loss at delivery. *Acta Obstet Gynecol Scand* 2015;94:734-44.
17. Markou GA, Murray JM, Poncelet C. Risk factors and symptoms associated with maternal and neonatal complications in women with uterine rupture. A 16 years multicentric experience. *Eur J Obstet Gynecol Reprod Biol* 2017;217:126-30.
18. Osemwenkha PA, Osaikhuwomwan JA. A 10-year review of uterine rupture and its outcome in the University of Benin Teaching Hospital, Benin City. *Niger J Surg Sci* 2016;26:1-4.
19. Adegbola O, Odeseye AK. Uterine rupture at Lagos University Teaching Hospital. *J Clin Sci* 2017;14:13-17.
20. Eguzo KN, Lawal AK, Ali F, Umezurike CC. Patterns of uterine rupture in Nigeria: a comparative study of scarred and unscarred uterus. *Int J Reprod Contracept Obstet Gynecol* 2015;4:1094-9.
21. Zwart JJ, Richters JM, Ory F, de Vries JI, Bloemenkamp KW, van Roosmalen J. Uterine rupture in the Netherlands: a nationwide population-based cohort study. *BJOG* 2009;116:1069-80.
22. Olofinbiyi BA, Olofinbiyi RO, Aduloju OP, Atiba BP, Olaogun OD, Ogundare OR. Maternal views and experiences regarding repeat Caesarean section. *Niger J Clin Pract* 2015;18:489-92.
23. Motomura K, Ganchimeg T, Nagata C, Ota E, Vogel JP, Betran AP, et al. Incidence and outcomes of uterine rupture among women with prior caesarean section: WHO Multicountry Survey on Maternal and Newborn Health. *Sci Rep* 2017;7:44093.
24. Sayed Ahmed WA, Habash YH, Hamdy MA, Ghoneim HM. Rupture of the pregnant uterus - a 20-year review. *J Matern Fetal Neonatal Med* 2017;30:1488-93.