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Original Article

Rupture of the scarred and unscarred gravid uterus: Outcomes and risk factors analysis

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A B S T R A C T

Objective: To study the maternal and fetal outcomes and assess the risk factors in patients with rupture at the lower-segment or non-lower-segment scarred, or unscarred gravid uterus.
Materials and Methods: Gravid patients with uterine rupture were retrospectively collected in Chang-Gung Memorial Hospital from November 2004 to July 2017. The rupture timing and location in association with maternal and fetal outcomes were collected as well as the possible risk factors including surgical history and interval prior to conception were analyzed.
Results: Thirty patients were included [mean age ($\pm$SEM), 34.4 $\pm$ 0.7 years; mean body mass index, 25.0 $\pm$ 0.6 kg/m^2] with mean onset of rupture at 34.2 $\pm$ 0.9 weeks, in which, 12 occurred at term and 18 at preterm (range 20−34 weeks). Four fetal demises, 22 transferals to neonatal intensive care unit, and 17 maternal blood transfusions without maternal mortality were noted. Twenty-two patients presented with acute abdominal pain and/or abnormal fetal heart rate tracing were managed with emergent cesarean delivery. Four ruptures were found in postpartum of vaginal delivery, in which 3 were after trials of labor after cesarean delivery and 1 was unscarred uterus, and two of the four eventually underwent hysterectomy. Unscarred uterus (n = 6) without identifiable risk factor ruptured in significantly later gestation associated with higher fetal birthweights than those of the scarred uterus (n = 24) (both $p < 0.05$), both of which yielded morbidity. The rupture timing between patients of non-lower-segment scar (n = 14) and lower-segment scar (n = 10) were not significantly different.
Conclusion: Rupture of gravid uterus prevalently occurred after 30 weeks of gestation with remarkable morbidity. Unscarred uterus could rupture in later gestation than the scarred ones without identifiable risk factor. Alertness to the acute abdominal pain, atypical from uterine contraction or the suspicious fetal heart rate tracing is the key to the timely rescue and successful management.

Introduction

Rupture of the gravid uterus, defined as complete disruption of all uterine layers during pregnancy, is a rare incidence but can lead to catastrophic maternal and fetal consequences. Although previously reported at around 0.8 to 5.3 per 10,000 births in literature [1,2], the incidence gradually increased over the recent decades [3,4], which may be associated with the increasing trend of advanced maternal age, increasing numbers of transmyometrial surgeries prior to conception [5] as well as a higher rate of induction or augmentation with prostaglandin or oxytocin. The complications could be severe, including maternal hemorrhage, blood transfusion, hysterectomy, bladder injury, maternal death, as well as the fetal prematurity, lower Apgar scores, and death [6,7]. The poorer outcomes may result from the delayed identification and management because of the unexpectedness and rareness.

The risk factors of uterine rupture included advanced maternal age, overdue pregnancy, macrosomia, shorter interval of deliveries, single-layer uterine closure, multiple previous cesarean deliveries, and trial of labor after cesarean section (TOLAC), as well as laparoscopic or abdominal myomectomy [8,9] or adenomyomectomy [10]. However, there were reports of rupture in unscarred gravid uteri [2,11]. The risk factors may be associated with the weakness of the myometrium due to trauma, congenital anomaly, or multiple gestation and the use of uterotonic drugs. Nevertheless, none of

these risk factors of scarred or unscarred uterine rupture was clinically reliable to predict individual risk of antepartum or intrapartum uterine rupture.

Moreover, literature found an increasing trend of uterine rupture in the past 40 years in both scarred and unscarred uteri during pregnancy, ranged from 0.9/10,000 to 6.1/10,000 and sharply increased in scarred uteri from 14.2/10,000 to 66.8/10,000 [3]. Some studies comparing outcomes of scarred and unscarred uterine rupture in pregnancy and showed higher composite of maternal and neonatal morbidity in the unscarred uterus [2,11]. However, there was no further comparison between lower segment scar (low transverse cesarean scar) and non-lower segment scar (myomectomy in fundus or corpus) rupture in pregnancy. The lower uterine segment, composed by uterine isthmus and inner cervical os, was formed in the third trimester and contained less muscle fibers. During labor, the upper segment would actively undergo periodic retraction and progressively the lower segment would be passively stretched and become thinning. We presumed that the different physiological changes in upper and lower uterine segments with uterine contraction may lead to different characteristics and outcomes of uterine rupture in pregnancy. Thus, the aim of this study was to assess uterine rupture and compare the characteristics, risk factors, and maternal and perinatal outcomes among lower or non-lower segment scar and unscarred uterine ruptures in pregnancy.

Material and method

This study retrospectively included patients treated in Linkou Chang-Gung Memorial Hospital, a tertiary referral center, and hence was reviewed and granted approval by its Human Investigation Review Board (IRB No. 201601145B0).

Patients

Patients with rupture of the gravid uterus from November 2004 to July 2017 was identified using code of international Statistical Classification of Disease (ICD-9 code 66,500 and 66,511 from 2004 to 2015, as well as ICD-10 code O710 and O711 from 2016 to 2017) and verified in the operation records by a notable full-thickness defect with visible chorioamniotic membrane or fetal parts. The antepartum or intrapartum course as well as the surgical history were determined from hospital records. The lower segment uterine scar was defined as previous low transverse cesarean section, while the non-lower segment scars were those with classical cesarean section and other uterine surgeries either through laparoscopy or laparotomy. Excluded from the current study were surgical complication related uterine lacerations or birth trauma (Fig. 1).

Data collection

Detailed clinical information were obtained from chart review, including maternal demographics (age, parity, and body mass index [BMI]), obstetric history (type of previous cesarean section and the interpregnancy interval), the interval between prior surgeries and the estimated conception date, clinical course such as tocolysis for preterm labor or medication for induction or augmentation, if any, onset and manifestation at rupture, delivery method, maternal complication, and neonatal outcomes.

Known risk factors for the rupture of gravid uterus, including advanced maternal age, multiparity, inter-pregnancy interval <6 months, parturition induction or augmentation, overstretched uterus (including the overdue pregnancy, macrosomia [birthweight > 4000 gm], or multiple gestation), undergoing TOLAC, and history of prior uterine surgery, were especially highlighted during the chart review. Outcomes including post-partum hemorrhage (estimated blood loss >1000 mL), maternal blood transfusion or hysterectomy, neonatal transferal to intensive care unit (NICU), and maternal or neonatal death, if any, were all assessed.

Statistical analysis

Age and BMI were considered as continuous variables and parity as discrete variables. Normality testing of data distribution was performed with the Kolmogorov−Smirnov test. Data with normal distributions were presented as mean ± SEM, while data without normal distributions were presented as median value and inter-quartile [25th−75th percentile] range. Incidence was presented as percentage (%). Nonparametric test, such as Mann−Whitney U test and Kruskal Wallis test, was used to compare the variances in maternal characteristics, risk factors, and outcomes of the lower segment or non-lower segment scarred uterus, and the unscarred uterus. Statistical calculation was performed using SPSS for Windows (release 17.0.0/2008; IBM-SPSS, Inc, Chicago, Illinois). Significance was defined as $P < 0.05$.

Result

We found 37 uterine ruptures in the survey; however, 7 patients were excluded as thought of surgical complication or birth trauma, in which, 2 were cervical lacerations extending into lower corpuses after vaginal deliveries, four were tearing of the incision angles in cesarean sections, and one was an iatrogenic uterine perforation after instrumental removal of undiagnosed placenta percreta (Fig. 1). Among the 30 patients experienced uterine ruptures, 24 (80%) women had scarred uterus while the other 6 were unscarred uterus. For the scarred uterus, prior uterine surgeries included laparoscopic myomectomy (n = 5), laparoscopic adenomyomectomy (n = 4), laparoscopic resection of cornual pregnancy (n = 2), laparotomic myomectomy (n = 2), low transverse cesarean section (n = 10), and classical cesarean delivery (n = 1). Moreover, there were 51,462 deliveries during the study period; hence the rupture rate of gravid uterus was estimated around 5.8 per 10,000 deliveries.

The result of total thirty maternities revealed mean maternal age 34.4 ± 0.7 years, median parity 1, and mean BMI 25.0 ± 0.6 kg/m^2, respectively. The mean interval between pregnancy and prior surgery was 43.3 ± 9.0 months, in which 6 women had intervals <6 months. Table 1 demonstrates detailed maternal characteristics and Table 2 listed the clinical risk factors. The mean gestational age of uterine rupture was 34.2 ± 0.9 weeks in the current series. In addition to 12 uterine ruptures happened in term pregnancy, 18 patients encountered ruptures and led to preterm birth with 16 of them (88.9%) occurring at ≥ 30 weeks of gestation. The distribution of gestational age in women with uterine rupture is illustrated in Fig. 2. The extremely preterm births at 20 and 24 weeks both had abrupt courses while presenting at our emergent department. The one ruptured at 20 weeks, twin pregnancy with only history of cesarean section once presented with acute abdominal pain and significant intra-peritoneal fluid. Magnetic resonance image (MRI) was arranged owing to the inadequate ultrasound image and demonstrated pending cornual rupture. The emergent laparotomy verified the protruding of one of the fetal parts at left cornus. The other one, ruptured at 24 weeks at fundus manifested intra-peritoneal fluid and fetal bradycardia on the ultrasound scan at presentation. However, the history of laparotomy myomectomy 10 years ago could not be obtained.

Acute symptoms followed by subsequent emergent cesarean delivery were noted in 22 patients, in which the majority were in