OPINION REVIEW

Minimizing the risk of community spread of COVID-19 via institutional quarantine of high-risk travelers with serial viral RNA testing: A successful experience from Macao SAR, China

Lio CF, Cheong HH, Lei CI, Lo IL, Lam C, Leong IH

REVIEW

Balloon pulmonary angioplasty for chronic thromboembolic pulmonary hypertension: State of the art

Jin Q, Zhao ZH, Luo Q, Zhao Q, Yan L, Zhang Y, Li X, Yang T, Zeng QX, Xiong CM, Liu ZH

Advances in para-aortic nodal dissection in gastric cancer surgery: A review of research progress over the last decade

Dong YP, Deng JY

Relevance on the diagnosis of malignant lymphoma of the salivary gland

Zhang XY, Wang ZM

ORIGINAL ARTICLE

Clinical and Translational Research

Role of peripheral eosinophilia in acute exacerbation of chronic obstructive pulmonary disease

Wu CW, Lan CC, Hsieh PC, Tseng IS, Wu YK

Case Control Study

Effects of prostaglandin E combined with continuous renal replacement therapy on septic acute kidney injury

Lei L, Wang MJ, Zhang S, Hu DJ

Retrospective Study

Modified technique of advanced core decompression for treatment of femoral head osteonecrosis


Initial experience with stereotactic body radiotherapy for intrahepatic hepatocellular carcinoma recurrence after liver transplantation

Au KP, Chiang CL, Chan ACY, Cheung TT, Lo CM, Chok KSH

Correlation between age of onset and gastrointestinal stenosis in hospitalized patients with Crohn’s disease

Yang SB, Du SW, Wang JH

Adjuvant nab-paclitaxel plus gemcitabine vs gemcitabine alone for resected pancreatic ductal adenocarcinoma: A single center experience in China

### Contents

**Observational Study**  
2787  
Case studies in psychotherapy training using Austria as an example  
*Neidhart E, Löffler-Stastka H*

**Prospective Study**  
2802  
Correlation between crowdedness in emergency departments and anxiety in Chinese patients  

**SCIENTOMETRICS**  
2817  
Bibliometric analysis of subject trends and knowledge structures of gut microbiota  

**CASE REPORT**  
2833  
Acute myelomonocytic leukemia during pembrolizumab treatment for non-small cell lung cancer: A case report  
*Kim HB, Park SG, Hong R, Kang SH, Na YS*

2841  
Metallic ureteral stent in restoring kidney function: Nine case reports  
*Gao W, Ou TW, Cui X, Wu JT, Cui B*

2849  
Pheochromocytoma with delayed tumor thrombus detection in renal vein: A case report  
*Jia Z, Wang BJ, Li X, Zhang X*

2855  
Laparoscopic repair of uterine rupture following successful second vaginal birth after caesarean delivery: A case report  
*Cui YQ, Liu W, Zhang H, He XQ, Zhang J*

2862  
Missed diagnosis of femoral deep artery rupture after femoral shaft fracture: A case report  
*Ge J, Kong KY, Cheng XQ, Li P, Hu XX, Yang HL, Shen MJ*

2870  
Posterior reversible encephalopathy syndrome and heart failure tacrolimus-induced after liver transplantation: A case report  
*Liu JF, Shen T, Zhang YT*

2876  
Significant benefits of pembrolizumab in treating refractory advanced pulmonary sarcomatoid carcinoma: A case report  
*Chen P, Yu M, Zhang JL, Chen WY, Zhu L, Song Y, Jiang CY, Zhang S*

2885  
Two sequential surgeries in infant with multiple floor of the mouth dermoid cysts: A case report  
*Liu NN, Zhang XY, Tang YY, Wang ZM*
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Laparoscopic repair of uterine rupture following successful second vaginal birth after caesarean delivery: A case report

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Abstract

BACKGROUND
With the increasing trend of vaginal birth after caesarean delivery (VBAC), evaluation of the feasibility and safety of a second VBAC with grand multiparity is worth considering. Intrapartum uterine rupture is diagnosed in approximately one-fifth of all VBAC cases following successful vaginal delivery. To our knowledge, no report is available on the application of laparoscopy to repair postpartum uterine rupture after a successful second VBAC in China.

CASE SUMMARY
A 31-year-old woman (gravida 5, para 2) at 39 wk and 5 d of gestation was admitted to the hospital in labour. After a successful VBAC and observation for approximately 13 h, the patient complained of progressive abdominal pain. Given the symptoms, signs, and auxiliary examination results, intraperitoneal bleeding was considered. Because the patient was stable and ultrasound imaging was the only method available to assess the possibility of rupture, we recommended laparoscopy to clarify the diagnosis and for prompt laparoscopic uterine repair or exploratory laparotomy if necessary. Operative findings included transverse uterine scar rupture at the lower uterine segment of approximately 5.0 cm in length and 800 mL of intraoperative pelvic haemoperitoneum. Finally, she successfully underwent laparoscopic repair of uterine rupture and recovered very well according to three-dimensional magnetic resonance imaging at 42 d postpartum.
CONCLUSION
Routine postpartum intrauterine exploration is not beneficial to the mother and may even increase the risk of rupture. This case highlights a laparoscopic approach for repairing uterine rupture in the immediate postpartum period.

Key words: Uterine rupture; Laparoscopic repair; Vaginal birth after caesarean section; Postpartum period; Grand multiparity; Case report

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INTRODUCTION
Uterine rupture is a serious complication of pregnancy and directly threatens the lives and safety of pregnant women and their foetuses\[^{1-4}\]. The primary causes of scar rupture include caesarean section, myomectomy, and hysterectomy\[^{5}\]. According to prospective studies by Singh et al\[^{6}\], the incidence of uterine rupture among women with a history of caesarean section is 1.69%, which is 11 times higher than that among women without a history of caesarean section. Because of the effects of China’s family planning and two-child policies, the rate of vaginal birth after caesarean delivery (VBAC) in China increased by 14% between 2012 and 2016\[^{7}\]. However, with the increasing trend of VBAC, evaluation of the feasibility and safety of a second VBAC with grand multiparity is worth considering but also challenging in terms of clinical treatment.

At present, many reports are available on risk factors and assessment methods for uterine rupture and the outcomes of the mother and child\[^{8-10}\]. Many studies have explored the risk of intrauterine rupture as predicted by ultrasound measurements of scar thickness from previous intrauterine dissection, including the remaining myometrium thickness of the uterine scar, the continuity of the myometrium, the serosal surface, and even the changes in the myometrium during pregnancy\[^{11,12}\]. However, scar thickness measurements in the lower uterine segment are affected by a variety of factors, including the measurement location, gestational age, and bladder filling degree. Therefore, no ideal scar thickness as a predictor of uterine rupture exists. Notably, women with caesarean scar diverticulum (CSD) have a weaker myometrium and a higher risk of uterine rupture in the third trimester than women without CSD, which has been widely accepted by researchers\[^{13}\]. Uterine scar in CSD women pursuing another pregnancy should be assessed and managed. In a random population of women with a history of caesarean section, the prevalence of CSD ranged from 56% to 84% and 24% to 70% when assessed by transvaginal ultrasound (TVU) with and without contrast enhancement, respectively\[^{14}\]. Thus, saline infusion sonohysterography and hysteroscopy are superior to conventional TVU for the assessment of uterine scar before pregnancy. If obvious menstrual abnormalities exist, the uterine diverticulum should be promptly repaired. Donnez et al\[^{15}\] reported that if imaging examination indicates that the anterior wall muscle layer of the lower uterine segment is less than 3 mm, laparoscopic repair of the diverticulum should be performed to increase the thickness of the lower uterine segment.
Intrapartum uterine rupture is diagnosed in approximately one-fifth of all VBAC cases following successful vaginal delivery\[^{14}\]. For the diagnosis and repair of uterine rupture, primary repair methods are performed by exploratory laparotomy, which undoubtedly increases maternal complications due to secondary trauma. Minimally invasive surgical methods are widely reported to be used to repair caesarean scar defects in women with abnormal menstrual manifestations. To our knowledge, no reports are available on the application of laparoscopy to repair postpartum uterine rupture after a successful second VBAC in China.

### CASE PRESENTATION

**Chief complaints**
The patient experienced irregular uterine contractions for half a day.

**History of present illness**
A 31-year-old woman (gravida 5, para 2) at 39 wk and 5 d of gestation presented to the labour and delivery unit with spontaneous rupture of membranes. From 34 wk of pregnancy to regular prenatal examination in our hospital, the pregnancy was smooth. Measured in the third trimester, the thickness of the lower uterine muscle layer was 2.1 mm. Because the pregnant woman and her family insisted on vaginal delivery, we closely consulted vaginal delivery trials after informing the patient of her risk. Her labour was natural with epidural analgesia and without induction with Pitocin. The first and second stages of labour lasted 404 and 9 min, respectively, and the weight of the foetus was 3290 grams at birth. No classic signs of uterine rupture were noted at the time of delivery. The placenta was delivered spontaneously and intact. The level of postpartum haemorrhage totalled 140 mL, and no concern for uterine rupture or a retained placenta arose after routine postpartum intrauterine exploration. After observation for approximately 13 h, the patient complained of progressive abdominal pain.

**History of past illness**
The patient had a history of term caesarean delivery 6 years ago (2013) and successful VBAC 2 years ago (2017). The pregnancy was conceived naturally. No change in postpartum menstruation between the first and second deliveries was reported.

**Physical examination**
Physical examination showed total abdominal tenderness, positive rebound pain, migration dullness, and notably, tenderness in the lower segment of the uterus. The height of the uterus was one finger breadth under the navel, with a clear outline. All the other vital signs such as heart rate, blood pressure, respiratory rate, and temperature were stable.

**Laboratory examinations**
Routine blood tests showed a 3-g/L decrease in haemoglobin (120 g/L) compared to that before delivery.

**Imaging examinations**
Detailed ultrasound imaging showed that the size of the uterus was 125 cm × 95 cm × 90 mm. A mixed-echoic region of 31 cm × 44 cm × 36 mm in size with an unclear boundary and no blood flow signals inside was observed in the lower uterine segment. However, the pelvic and abdominal cavities showed a large among of effusion, the hepatorenal fossae were 37 mm in length, and the left upper quadrant was 53 mm in length.

**FINAL DIAGNOSIS**
The final diagnosis of the case was “G5P3, 39 wk and 5 d of gestation, previous caesarean delivery, VBAC, and uterine rupture.”
TREATMENT

Given the symptoms, signs, and auxiliary examination results, intraperitoneal bleeding was considered. Because the patient was stable and ultrasound imaging was the only method available to assess the possibility of rupture, we recommended laparoscopy to clarify the diagnosis and for prompt laparoscopic uterine repair or exploratory laparotomy if necessary. The surgery was performed approximately 15 h after delivery.

Operative findings included transverse uterine scar rupture in the lower uterine segment of approximately 5.0 cm in length and 800 mL of intraoperative pelvic haemoperitoneum. The ruptured tissue was fresh, and the incised edge was neatly aligned with the boundary of the bladder. The uterine defect was closed using a two-layer technique. The myometrium was completely closed with intermittent 1-0 intestinal sutures. The myometrium and serosal layers were closed with 2-0 Vicryl in a running fashion using an intracorporeal knot-tying technique. Finally, 1-0 Vicryl was used in a running fashion to close the serosal layers again and to interrupt the defect of the bladder peritoneum (Figure 1). The surgery was completed in 2 h, one indwelling abdominal drainage tube was in place postoperatively, and the estimated total blood loss was 1100 mL.

OUTCOME AND FOLLOW-UP

The patient’s postoperative body temperature was stable, the abdominal wound healed well, and she was cured and discharged on the sixth day after the operation.

Postpartum follow-up showed that the lochia volume of the patient had decreased, and that postpartum bleeding lasted 25 d. Her routine examination at 42 d postpartum was normal. To understand the recovery of the lower uterine segment, we performed three-dimensional magnetic resonance imaging at 42 d postpartum. In the images, the signal of the muscle layer of the anterior wall of the uterus was uneven, and the high signal shadow penetrated into the muscle layer of the anterior wall of the uterus. The height, length, width, and remaining myometrial thickness of the diverticulum were 3 mm, 12.4 mm, 5.8 mm, and 4 mm, respectively (Figure 2).

DISCUSSION

Two of the most important factors influencing the success of VBAC are a previous vaginal delivery history and natural labour. According to the report by Guo et al.\textsuperscript{[15]}, the success rate of VBAC was higher among women with no vaginal delivery history. However, multiple studies have also shown that among the risk factors for uterine rupture, grand multiparity is notably related to an increased risk of uterine rupture after VBAC\textsuperscript{[16]}. Marie Bereka et al.\textsuperscript{[17]} demonstrated that uterine rupture was associated with obstructed labour, prolonged labour, malpresentation, and grand multiparity. The research by Ronel et al.\textsuperscript{[18]} showed that grand multiparity is an independent risk factor for uterine rupture (odds ratio [OR] = 1.2, 95% confidence interval [CI]: 1.1-1.3). In addition, Al-Zirqi et al.\textsuperscript{[19]} noted that compared to a parity of 1-2, parity ≥ 3 (adjusted OR = 2.8, 95% CI: 1.2-6.7) increased the risk of peripartum hysterectomy; that is, higher parity corresponds to lower muscle layer thickness in the lower uterine segment and a higher risk of rupture. Based on 5 years of VBAC case data collected at our hospital, we found that the percentage of successful VBAC cases with grand multiparity pregnancies (parity ≥ 3) was 6%, and 7/16 cases were second VBAC cases. The incidence rates of uterine rupture associated with the first VBAC and the second VBAC were 5.8% and 28.5%, respectively. Therefore, we speculate that the risk of uterine rupture with a second VBAC is definitively higher than that with the first VBAC. The reason may be weakness of the muscle layer of the inferior segment of the uterus after caesarean section and retraction of the myometrium with tissue oedema during vaginal birth for a second pregnancy. The feasibility and safety of a second VBAC require additional large-sample and multicentre studies for validation. Additionally, the patient should be fully informed of the increased risk of rupture during pregnancy and labour. Close monitoring and timely detection of uterine rupture are needed during the intrapartum and postpartum periods.

The diagnosis of uterine rupture is mainly based on clinical manifestations, foetal heart abnormalities, or imaging examinations. Some factors have been identified as independent risk factors for a delayed diagnosis, such as an unscarred uterus (OR =
Figure 1 Images of laparoscopic surgery. A: Image of laparoscopic exploration; B: Uterine defect observed laparoscopically; C: Repair of the myometrium and serosal layers using PDS; D: Repair of the bladder peritoneum.

Figure 2 Three-dimensional model based on magnetic resonance images of a caesarean scar defect at 42 d postpartum. A: Axial plane; B: Three-dimensional model; C: Sagittal plane; D: Coronal plane.

27.0, 95%CI: 6.58-111.1), epidural analgesia during labour (OR = 7.9, 95%CI: 2.32-27.05), and grand multiparity (OR = 4.6, 95%CI: 1.40-14.99)\cite{14}. The patient in our case report likely received epidural analgesia in her history of grand multiparity, which delayed the detection and diagnosis of uterine rupture. A previous study also showed that a delayed diagnosis was independently associated with hysterectomy and
significantly higher rates of blood transfusions and puerperal fever. Clinically, manual exploration of the uterine cavity is commonly carried out after delivery to assess whether a laceration is present in the scar of the lower uterine segment and to observe urine volume and vaginal bleeding. However, the French College of Gynecologists and Obstetricians guidelines recommend that a simple uterine scar is not an indication for routine postpartum uterine cavity exploration, and that only symptomatic rupture requires surgical repair due to the low accuracy of postpartum exploration for diagnosing uterine rupture[20]. In contrast, no surgical treatment is required even if symptoms of suspected uterine rupture are noted on exploration. Additionally, according to Silberstein’s report, the detection rate of scar defects or scars detected by palpation after delivery is only 0.23%, and trauma can easily increase during the intrauterine exploration process[21]. Moreover, some case reports have described uterine rupture caused by postpartum uterine massage[22]. Therefore, routine postpartum intrauterine exploration after delivery, and no obvious signs of rupture were detected. However, the typical symptom of abdominal pain in the patient appeared 13 h after delivery; therefore, the possibility of rupture caused by missed intrauterine exploration or improper postpartum massage cannot be excluded.

The treatment of uterine rupture mainly depends on the location of the rupture, the degree of involvement of the parauterine tissue, the desire for a subsequent pregnancy, and the willingness of patients and their families to make decisions. The treatment methods include uterine repair and hysterectomy. Exploratory laparotomy is the most commonly used method to confirm uterine rupture in clinical practice; however, laparoscopic uterine repair is rarely reported abroad. A case of postpartum uterine rupture and laparoscopic repair was reported by Rottenstreich et al[23]. Additionally, a special case of uterine and bladder rupture after VBAC and laparoscopic repair was reported by Lua et al[24]. With the continuous development of laparoscopic technology in recent years, its application has become increasingly extensive. The present case report shows that successful repair of uterine rupture can be achieved with a minimally invasive technique in the stable postpartum period. Since the patient had successfully delivered vaginally, no fresh scar was present on the abdomen, and her vital signs were stable. To determine the diagnosis, laparoscopy can be performed first, and then laparoscopic uterine repair can be carried out once the diagnosis is clear. The advantages of this approach include a small surgical wound and quick recovery, a clear diagnosis, fewer misdiagnoses of maternal injury, and the use of well-developed laparoscopic surgical technology. Thus, this approach should be applied more often in clinical practice.

**CONCLUSION**

The feasibility and safety of a second VBAC with grand multiparity require detailed clinical evaluations and additional study. Routine postpartum intrauterine exploration is not beneficial to the mother and may even increase the risk of rupture. This case highlights a laparoscopic approach for repairing uterine rupture in the immediate postpartum period.

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