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Review Article

Uterine Rupture: A Literature Review and Case Presentation Highlighting Diagnostic and Clinical Challenges Posed by this Rare and Potentially Catastrophic Obstetric Emergency

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Abstract

Uterine rupture is a rare but life-threatening condition, with incidence ranging from 1 in 5,700 to 1 in 20,000 pregnancies. It is an obstetrical emergency requiring rapid intervention to mitigate harm and allow the best possible chance of survival for mother and baby. While the most frequent antecedent is scar dehiscence associated with previous uterine surgeries such as caesarean section or, less commonly, myomectomy or curettage, other non-iatrogenic aetiologies must also be considered to allow a fully inclusive approach sufficient to spur acute clinical care. This review highlights these factors and the limitations of diagnostic imaging modalities in an acute management setting. It aims to accrue the importance of broad clinical suspicion and pre-emptive action in patients presenting with pain during pregnancy regardless of predisposing risk and the assurances of non-interventional scanning. We offer this review to share an experience of clinical care and improve knowledge and understanding to improve future patient care.

Introduction

Complications during pregnancy and labour present varying degrees of risk to both the mother and fetus. A rare but often catastrophic condition that may occur is a rupture or full-thickness tearing of the gravid uterine wall. This may be complete when the serosal layer is compromised. In this situation, pregnancy contents may be lost or expelled from the uterine cavity. The concept of uterine rupture has been documented in medical literature for centuries, but there are no exact details of the first recorded case. Ancient Mesopotamia, the cradle of civilization, developed a complex understanding of medicine. Clay tablets dating back to around 2000 BCE narrate the story of a woman presenting with severe abdominal pain during labour. The text cryptically mentions "the belly breaking open," suggesting a likely uterine rupture. The Ebers Papyrus, dating back to 1550 BC, contains some of the oldest known medical treatises. Among the many case descriptions is an account of a woman suffering from severe abdominal pain during childbirth, presumed by modern scholars to be a uterine rupture. It describes a woman in distress during the late stages of her delivery. The text mentions "a tearing sensation in her middle" and the realisation of "her life force fleeing." In the Hippocratic Corpus, a collection of ancient Greek medical texts written in the 5th and 4th centuries BCE, Hippocrates (circa BC 460- 370) made many observations of obstetrics and, tragically, the agonies of complicated childbirth, most notably those of prolonged or arduous labour which according to modern interpretations, may well have included uterine rupture [1]. Soranus of Ephesus circa (AD, year 98 – 138) described a case of a young woman assailed with unbearable pain during her delivery. Soranus felt the protrusion of a fetal limb through a tear in the uterine wall. His account says, "The limb appeared as if attempting to escape, signifying damage to the womb's enclosure" [2].

In the modern world, uterine rupture continues to complicate pregnancy and childbirth. It occurs most often as a complication of obstructed labour, particularly in remote or third-world settings where obstetric or midwifery care is limited or inaccessible, and women with abnormal progress of labour or dystocia may languish without care or intervention [3]. In developed countries, uterine rupture is often due to "scar rupture" in women with previous caesarean section deliveries or, less commonly, following other uterine surgeries such as myomectomy [4]. In the former, studies suggest that women with a single-layer closure are more likely to have thinner residual myometrium than those with a double-layer closure, suggesting greater susceptibility to future dehiscence and rupture [5,6].

Rupture has also been reported as a complication of inadvertent perforation during prior hysteroscopy or curettage [7]. Procedures that entail uterine manipulation, such as an antenatal external cephalic version for breech presentation or an internal podalic version during breech extraction for vaginal delivery of an after-coming second twin, may also be associated with rupture [8,9]. Not surprisingly, rupture is more likely to be seen with difficult deliveries such as those associated with abnormal

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presentation, foetal macrosomia or assisted instrumental deliveries [3]. It is also more likely to occur when there has been excessive uterine distension, such as with multiple pregnancies or polyhydramnios [8]. Maternal age and parity are also associated with increased risk. The uterine wall may become less pliable with subsequent pregnancies, which may predispose to rupture or tearing. Additionally, abdominal wall laxity, associated with high parity, may permit malpresentation of the presenting part with subsequent dystocia of labour and uterine rupture, particularly in oxytocic stimulation [10,11]. More rarely, uterine adenomyosis, where the inflammatory process may disrupt myometrial fibres, pelvic radiation, connective tissue disorders, and prolonged corticosteroid use, is also associated with increased risk [12,13].

In one case, a 27-year-old primigravida woman at 22 weeks with no known significant history presented to the emergency department with acute abdominal pain. Ultrasound demonstrated normal fetal biometrics and evidence of diffuse adenomyosis in the uterine wall. Soon after admission, her condition deteriorated, and she became pale with tachycardia and hypotension, suggesting hypovolemia. Repeat ultrasound showed the presence of a single still viable foetus in the abdomen associated with free fluid. Laparotomy revealed massive hemoperitoneum and uterine rupture with extravasation of the entire gestational sac. The baby was stillborn at delivery. In other reports, abnormalities of placentation, such as placenta percreta or accrete, have been associated with mid-trimester uterine rupture [12,13].

A recent systematic review of pre-labour uterine rupture between 14 and 34 weeks of gestation using PubMed Google Scholar from 1988 to 2020 showed that nearly half, 36 cases, were associated with previous caesarean deliveries. In a further 6, a classical uterine incision had been performed. Myomectomy was seen in 20 cases, uterine malformations in 13 and 35 cases identified placenta accreta. Paradoxically, studies also show that mothers with pregnancy complications, such as hypertensive and cardiac disorders, antepartum haemorrhage or premature membrane rupture, are less likely to develop uterine rupture. This may well reflect the increased obstetric surveillance in these patients and decreased tolerance for variances of labour that might otherwise conjure an increased risk or predisposition to uterine rupture [14].

Universally, case reports of uterine rupture in the first trimester are rare. They are slightly more common in the second trimester [15,16]. However, they are most often reported in the third trimester, particularly in the setting of labour and delivery, where, in addition to the risks previously noted, they are most commonly linked to uterotonic stimulation for induction or augmentation of poor progress [17]. Spontaneous rupture of the uterus in the early second trimester is a rare and unprecedented event that challenges preconceptions of emergency obstetric presentation and may elude conventional methods of diagnostic delineation. It demands urgent, definitive care to safeguard maternal well-being and to protect future reproductive potential [18]. It is universally associated with grievous maternal outcomes and inevitable pregnancy loss.

Case Presentation

We present the case of a 27-year-old female, 16+6 weeks pregnant, who presented to the Emergency Department with sudden onset of right-side abdomen pain. The pain was unprovoked, constant, and experienced initially as a score of 9/10. It was localised to the Right Iliac Fossae (RIF), epigastrium and right shoulder tip. Apart from nausea and vomiting, there were no other bowel symptoms. There were no urinary symptoms and no history of abnormal vaginal bleeding. She had no shortness of breath or chest pain. Her vital signs were stable on arrival. She was afebrile, her Heart Rate (HR) was 131 bpm, her Blood Pressure (BP) was 148/88 with no postural drop, and her oxygen saturation was 100% on room air. The ED, General Surgery, and Obstetric teams reviewed her. Her abdomen was soft, with localised tenderness in the RIF & RUQ associated with guarding and rebound tenderness. Investigations taken at admission revealed normal FBC with HB 110, WCC 8.3 and PLT 271. Her CRP was 40.9. She had normal Urea and electrolytes, Liver function tests and Lipase. Her serum HCG was 36463. An urgent Ultrasound scan of the abdomen and pelvis showed free fluid around the spleen and in Morrison's pouch and RIF. The appendix could not be visualised. Both ovaries were normal, and a live intrauterine pregnancy consistent with dates was confirmed – Figures 1, 2 and 3. The initial impression was of localised peritonitis with suppuration consistent with suspected acute appendicitis.

From her history, it was noted that she had two prior miscarriages, both of which were managed by curettage. She had two normal vaginal births; the most recent was in April 2021 and was complicated by post-partum infection associated with Retained Products of Conception (RPOC). She was managed

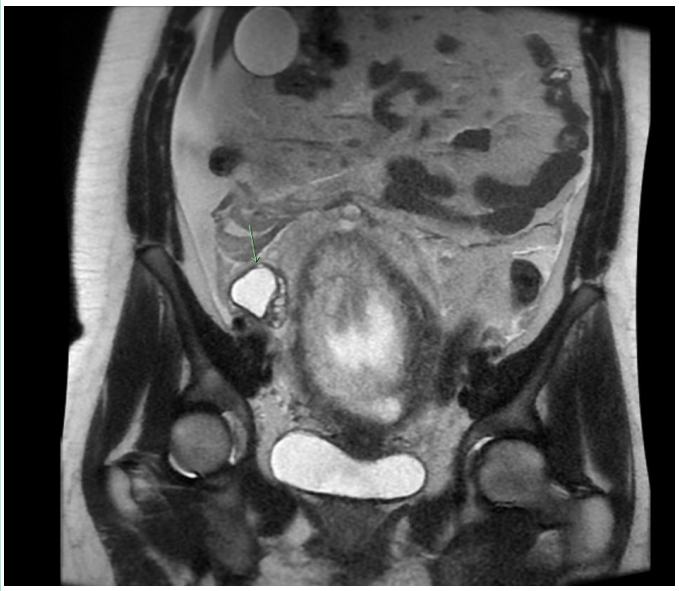

Figure 1: MRI demonstrating normal uterus and free fluid.

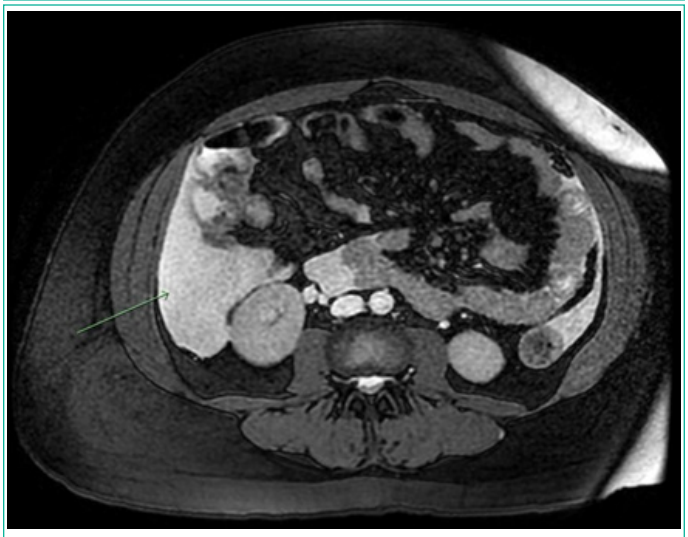

Figure 2: MRI demonstrating free fluid Morrison's pouch.

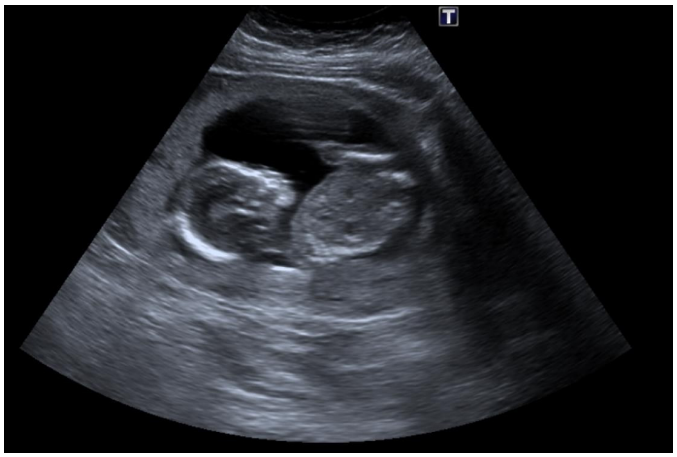

Figure 3: USS view of intact gestational sac and viable pregnancy.

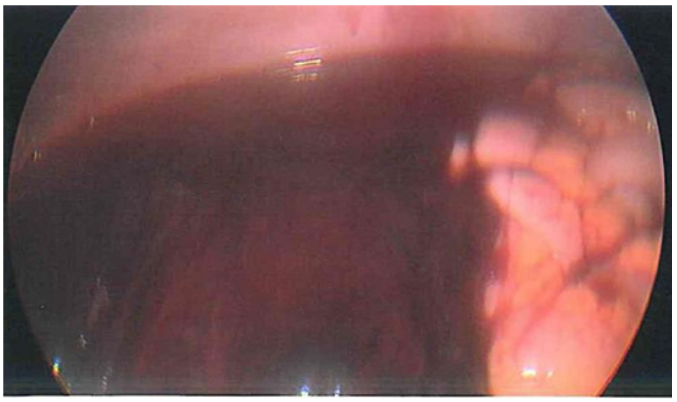

Figure 4: Heamoperitoneum with blood filling pelvis.

with antibiotics and Suction D & C. Her medical history was otherwise unremarkable other than a mood disorder for which she took Venlafaxine regularly. She lived with her husband and two sons. She was an ex-smoker and a non-drinker. Her current pregnancy had, until this time, been uncomplicated. She had routine antenatal care, which included dating and first-trimester screening ultrasound examinations.

She was admitted to the surgical team and was kept fasting; IV fluid and antibiotics were commenced, and an urgent MRI of the abdomen was organised to demonstrate the appendix. The results showed a normal Appendix. The uterus and adnexa were reported as normal, and free fluid was again demonstrated in the abdominal cavity but with no source identified. The patient's clinical findings did not improve, and the surgical team agreed to proceed to Diagnostic Laparoscopy. Entry to the abdominal cavity was uncomplicated and immediately confirmed significant hemoperitoneum - Figure 4. The upper abdomen was inspected and found to be normal. The O&G team examined the pelvis and discovered a ruptured uterus at the fundus with partial protrusion of the gestational sac through the defect – Figure 5. The procedure was converted to a laparotomy using a low transverse abdominal incision. By then, the foetus, sac and placenta had been wholly expelled into the abdominal cavity - Figures 6 and 7. Active bleeding at the rupture site was mitigated by a tourniquet using a latex IDC clamped at the level of the cervix. The cavity was cleaned, and the uterine fundus was over-sown, utilising a combination of interrupted and continuous 1/0 Vicryl sutures in two layers. The procedure lasted approximately 40 minutes. At completion, the tourniquet was released, and further bleeding was controlled using either diathermy ablation or figures of 8 with interrupted 2/0 Vicryl sutures.

A massive blood transfusion protocol was activated intra-operatively. The patient received five packed RBC units, four

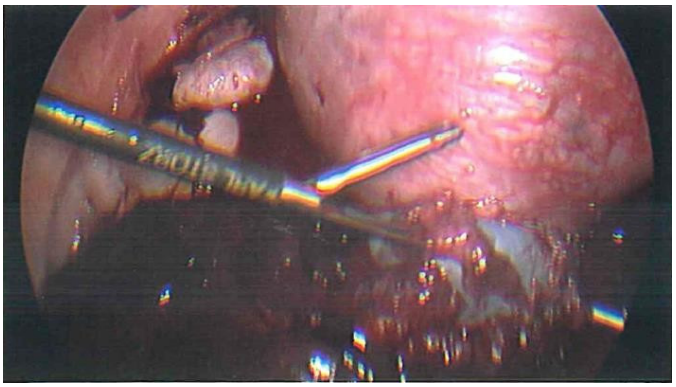

Figure 5: Partially extruded gestational sac through uterine rupture.

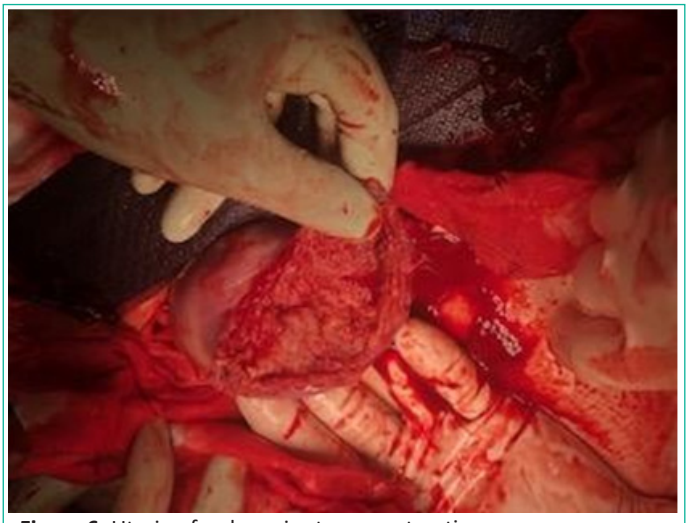

Figure 6: Uterine fundus prior to reconstruction.

units of Fresh Frozen Plasma, and one of platelets. The estimated blood loss was 3 litres. Post- operatively, the patient was admitted to the Intensive Care Unit for monitoring, where she remained stable and had an uncomplicated recovery. She and her family were provided support from social workers. They were debriefed on multiple occasions to ensure a complete and shared understanding of her care and the outcomes, which included, tragically, the loss of her early pregnancy and the implications that this might confer on future fertility and pregnancy safety. She was discharged on day five with an opportunity for review by the clinical team in the Outpatient clinic. The event was listed as significant and presented for external review.

Discussion

The case presentation describes a pregnant patient who presented with abdominal pain at approximately 16 weeks gestation She had no vaginal bleeding, and her vital signs were stable at presentation Ultrasound imaging demonstrated a normal, gravid uterus with viable pregnancy consistent with dates Foetal heart activity was present, body and limb movements were noted, and the AFI was normal The pelvic adnexa showed no abnormality There was, however, a significant volume of free fluid consistent with suspicion of intra-abdominal bleeding The O&G on-call team reviewed the patient They noted that the patient described a seemingly unremarkable antenatal and past obstetric history They felt the bleeding was likely secondary to a non-obstetric cause and asked for an emergency surgical review This occurred, and an urgent MRI was arranged, which confirmed the earlier findings The surgeons took the patient to theatre, at which point a full-thickness rupture of the uterine fundus was identified.

The case highlights a misapprehended limitation of imaging modalities. In this example, the findings suggested that the

uterus was intact, thus relegating an alternative diagnosis for the source of suspected intra-abdominal bleeding. The subsequent surgical findings were, however, otherwise, which suggests that the uterine dehiscence was either missed or had not, at the time of imagining, led to the expulsion of the gestational sac. A case similar to this describes a 35-year-old woman with a history of systemic lupus erythematosus requiring long-term use of steroid medications, who presented at 28 weeks pregnancy with sharp, localised abdominal pain Ultrasound revealed a live intrauterine fetus and significant free fluid in the abdomen. Immediate surgical exploration revealed a ruptured uterus. The baby was delivered live and survived after admission to the special care nursery [19]. In another case, a 29-year-old woman with a history of myomectomy presented at 32 weeks with mild abdominal discomfort initially attributed to Braxton Hicks contractions. Despite normal findings on Ultrasound, she went on to experience increased symptoms requiring laparotomy. Surgery revealed uterine rupture at the site of the prior myomectomy. A preterm but otherwise healthy infant was delivered via emergency caesarean section [20]. Reports such as this, including our own, are atypical. In both, rupture of the uterus occurred despite the reassurance of ultrasound imaging. In most other reports, where uterine rupture is suspected, Ultrasound examination reveals evidence of pregnancy loss or extravasation, making diagnosis incontrovertible. In one report, a 30-year-old multiparous woman with a previous caesarean section delivery presented acutely to the emergency department with severe abdominal pain in her 36th week of pregnancy. An urgent ultrasound failed to visualise the fetus in the uterus. Immediate surgical intervention confirmed uterine rupture at the site of the previous caesarean scar. A stillborn foetus was found in the peritoneal cavity. In another example, a 21-year-old primigravid woman presented to the emergency department at approximately 20 weeks gestation with sudden onset, severe abdominal pain associated with dizziness, and shoulder tip pain. There was no vaginal bleeding. Ultrasound examination revealed fluid filling the abdominal cavity with clots and a non-viable fetus in the abdominal cavity with fetal biometry of 20 weeks. The diagnosis was a ruptured uterus. After resuscitation, a decision for emergency laparotomy was made. Findings showed a bicornuate uterus with a ruptured left horn at the fundus with a massive intraperitoneal hemorrhage of approximately two litres of blood clots [21].

In all these examples, the imminently catastrophic nature of this condition is a forewarning for pre- cognisance of risk in any woman presenting with signs of an acute abdomen in pregnancy, even when imaging studies suggest a normal uterus status. Dr Charu Sundar Dawn, better known as C.S. Dawn, was an Indian physician who significantly contributed to the field of obstetrics in India in the 1920s [22]. He described the case of a 32-year-old woman who had had five previous pregnancies and presented to a small village clinic in extreme distress with signs of an acute abdomen. No ultrasound machines were available, and diagnostic options were minimal. Dr Dawn conducted an emergency laparotomy and found a complete uterine rupture along its lateral wall. Incredibly, the fetus was still alive. It was delivered safely, and the tear was sutured with preservation of the uterus, a feat rarely achieved in that era. As with this case, the best outcomes are associated with prompt and definitive surgical intervention with or without adjunctive diagnostic imaging. This is because they allow rapid interruption of maternal haemorrhage, minimisation of foetal harm consequent to disrupted placental circulation and uterine wall dehiscence, and an overall reduction of maternal cardiovascular insult and progressive uterine injury, thus promoting improved recovery and safeguarding reproductive potential by limiting harm to uterine anatomy. Such decisions, however, are not without trepidation. With uncertain aetiology, one may not anticipate the possibility of unsuspected operative findings, and the patient may be at risk of harm if the procedure is performed without the necessary preparation or proficiency. For this reason, a broad awareness of differential pathology coupled with timely and effective collaborative communication must always pre- empt operative intervention. As evidenced by these examples, however, these diagnostic decisions should not delay the urgency of action, which must be swift and definitive to minimise the impending harm of this fulminant condition.

A question that arises from our report is whether MRI confirmation was warranted and whether it delayed critical intervention that may have prevented ultimate rupture It is unlikely Free fluid suggests active bleeding, and we surmise that it was a sign of uterine wall dehiscence, meaning that eventual rupture was inevitable Would earlier surgery have prevented the loss of the pregnancy We believe it is unlikely In common with all case reports, the contents of the uterus cannot remain or be preserved in situ in the setting of wall disruption Management is to evacuate the uterus and repair the defect When this occurs at 16 weeks, the foetus cannot be saved Moreover, the MRI was requested in our case to help identify a source of bleeding that was thought to be non-uterine The patient was stable, and we believed the additional information would facilitate subsequent surgical exploration by forewarning the likely origin of the bleed, ensuring the right people were present, with the right experience and expertise to manage the expected findings most effectively.

A literature review tells us that rupture will likely occur later in pregnancy [23,24]. With this expectation, our case is again confounding, given that the rupture occurred at just 16 weeks. When we reviewed the patient's medical history, we discovered that she had had an emergency curettage performed on day 11 following her last delivery in the setting of prolonged postpartum bleeding and probable endometritis. She had been admitted for IV antibiotics, and suction evacuation was performed the next day. The procedure was complicated by a haemorrhage of 1.1 litres of blood for which uterotonics were administered. Operative notes did not concede a suspicion of uterine perforation. She recovered well and was discharged the following day with oral iron supplements. Histopathological examination confirmed retained products of conception and showed, in addition, fragments of myometrium, which it stated may have been consistent with a benign leiomyoma. We viewed the original ultrasound films and found no evidence of mural disease. We suggest that the findings may have been evidence of an unsuspected uterine wall injury or perforation during the surgery. Regrettably, this may explain why rupture occurred in the patient's subsequent pregnancy. As noted previously, any form of uterine injury or abnormality may predispose to rupture.

On reflection, we acknowledge the relevance of her prior traumatic surgical curettage as a risk that may have led to increased uterine wall susceptibility to rupture. Had this been highlighted, it may have led to a more immediate decision for acute surgical intervention. The literature describes a case study of a woman who had a previous myomectomy and presented at 38 weeks in labour with uterine rupture. She had undergone a myomectomy two years prior and was not informed

of the heightened risk for uterine rupture due to this surgery. She presented with abdominal pain but no classic signs of rupture. Initial monitoring showed stable maternal and fetal vitals. Due to the non-specific presentation, the decision was initially made to monitor the patient. However, a sudden deceleration in fetal heart rate led to an immediate decision for an emergency C-section.

The surgical team discovered a rupture at the old myomectomy site, but fortunately, both the mother and baby survived with prompt intervention. Our ability to mitigate risk depends on a broad differential diagnosis encompassing the possibility of all conditions likely to cause harm. To do so require a thorough history and examination but equally depends on a comprehensive documentation of prior events, including nuances of care or aberration that may have longstanding import. This is a contemporaneous responsibility. It underlies and makes possible the safety and effectiveness of all subsequent episodes of care. Critical to this is the necessity for transparent patient education, especially in the setting of prior uterine surgeries commonly associated with rupture. The patient must know her findings to remain empowered to support and direct future decision-making.

In terms of future care, studies have demonstrated successful term pregnancy in women following previous uterine rupture [25]. They advocate elective caesarean section delivery between 36 and 37 weeks of gestation [25]. Nonetheless, the risk of subsequent uterine rupture remains pre-imminent. A recent systematic review examined the maternal outcomes of prelabour uterine rupture between 14 and 34 weeks of gestation using PubMed and Google Scholar from 1988 to 2020 showed that of 80 pregnancies where uterine rupture had occurred, approximately 10 % were in patients with previous uterine rupture [26].

Conclusion

The case discussion highlights the clinical urgencies of uterine rupture. It demonstrates the possibility of significant morbidity when patients present with pain in pregnancy and the challenge posed by the contradictions of diagnostic imaging, especially when fallibility is unsuspected. Ultrasound and MRI findings of a normal intrauterine pregnancy may not exclude imminent uterine rupture. Unprovoked, antenatal uterine rupture is rare but should be included in any differential diagnosis when patients present with pain in pregnancy, especially when presenting symptoms are associated with free fluid in the pelvis. While most patients will not have a uterine rupture, the case highlights the significance of this contingency. Swift, definitive intervention is imperative to ensure the best possible outcome but must be conceived by collaborative, multidisciplinary assessment to allow safe, effective preparation for all eventualities. We acknowledge that this case reflects the life and actual pregnancy outcome for a patient and her family. We reflect on her suffering and hope that by presenting this report, we can learn and share our experience to improve the immediacy and efficacy of future care for others.

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