

Role of Dynamic MRI in Surgical Decision-making for a Postpartum Woman With a Prolapsed Degenerating Uterine Leiomyoma

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Abstract

Background: Surgical decision-making in the case of postpartum complications affecting fibroids can be difficult. We present a case that illustrates the potential role of MRI in assisting these decisions.

Case: A 28-year-old woman with a known uterine leiomyoma presented on postpartum day 10 with abdominal pain, fever, and foul-smelling vaginal discharge. Her condition improved after antibiotic therapy, but she subsequently returned to hospital with a liquefied fibroid filling the vagina and a solid mass palpable above the dilated cervix. Pelvic ultrasound did not conclusively identify the vascular supply or myometrial involvement of the mass. MRI identified one fundal vascular pedicle and a very thin posterior uterine wall. At abdominal myomectomy, the myometrium was found to be only minimally involved, and the fundal vascular pedicle was easily cross-clamped.

Conclusion: When available, MRI can be used to clarify the location of vascular pedicles and the extent of myometrial involvement of uterine fibroids, and it can assist in fibroid-related surgical decision-making.

Résumé

Contexte : La prise de décisions chirurgicales en présence de complications postpartum affectant des fibromes peut s'avérer complexe. Nous présentons un cas qui illustre le rôle potentiel de l'IRM pour ce qui est d'éclairer ces décisions.

Cas : Une femme de 28 ans chez laquelle la présence d'un léiomyome utérin était connue présentait, dix jours à la suite de l'accouchement, des douleurs abdominales, de la fièvre, et des écoulements vaginaux malodorants. Son état s'est amélioré à la suite d'une antibiothérapie, mais elle en est tout de même venue à retourner à l'hôpital en raison d'un fibrome liquéfié remplissant le vagin et d'une masse solide pouvant être palpée au-dessus du col utérin dilaté. L'échographie pelvienne n'a pas permis d'identifier de façon incontestable l'apport vasculaire ou l'envahissement myométrial de la masse. L'IRM a permis d'identifier un pédicule vasculaire fundique et une paroi utérine postérieure très mince. Au moment de la myomectomie abdominale, nous avons constaté que le myomètre n'était que minimalement mis en cause; le

pédicule vasculaire fundique a donc pu facilement faire l'objet d'un clampage croisé.

Conclusion : Dans la mesure où elle est disponible, l'IRM peut être utilisée pour clarifier l'emplacement des pédicules vasculaires et l'ampleur de l'envahissement myométrial des fibromes utérins; elle peut également contribuer à la prise de décisions chirurgicales en ce qui concerne les fibromes.

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INTRODUCTION

Leiomyomas are the most common uterine tumour, and their incidence increases to 25% in women over 35 years old.¹ Studies suggest that the overall incidence of leiomyomas in pregnancy is approximately 1% to 2%² but will inevitably increase as women delay child-bearing.³ Ten percent of these pregnancies will have fibroid-related complications, including abdominal pain, fibroid degeneration, miscarriage, placental abruption, preterm pre-labour rupture of membranes, preterm labour, fetal malpresentation, postpartum hemorrhage and endometritis, and increased rates of both Caesarean section and Caesarean hysterectomy.⁴ Pregnancy complications are more common with large, submucous, and retroplacental fibroids. Reports describing leiomyomas in pregnancy focus largely on early and late pregnancy complications, decision-making regarding mode of delivery, and decision-making about the necessity for and optimal timing of myomectomy.^{1,2} Unless it is absolutely necessary, myomectomy is generally discouraged in pregnancy because of the increased risk of miscarriage, hemorrhage, and preterm labour. Even if delivery is by Caesarean section, the risk of significant bleeding⁵ precludes concurrent myomectomy unless the leiomyoma is subserosal and pedunculated on a stalk less than 5 cm wide.⁶

Degenerating fibroids in the postpartum period can present a unique challenge since they can mimic endometritis or intra-abdominal abscess,⁷ can degenerate into pyomyomas,^{8,9}

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and can ultimately cause systemic sepsis.^{9,10} When myomectomy is considered, accurate characterization of the fibroid is imperative to minimize surgical risk. Pelvic ultrasound can usually distinguish between muscular and degenerating fibroids, and Doppler flow studies often delineate blood flow and vascular pedicles. However, MRI has proven more useful in localizing fibroids as submucous, intramural, or subserosal, and it can clarify vascular supply. Specifically, dynamic MRI can be used to assess tumour viability and vascularity. This information can be crucial in optimizing surgical management in this higher risk postpartum population.

THE CASE

The patient, a 28-year-old gravida 1, para 1, had an uncomplicated spontaneous vaginal delivery after induction of labour for pregnancy-induced hypertension at 39 weeks' gestation. She had a known intramural posterior wall uterine leiomyoma that was monitored throughout the pregnancy and that measured $10.6 \times 9.5 \times 11.6$ cm at 38 weeks. After an uncomplicated early postpartum course, she presented to the emergency department on postpartum day 10 with increasing abdominal pain, fever (38.2°C), tachycardia, and foul-smelling serosanguinous vaginal discharge. She had diffuse lower abdominal tenderness, and speculum examination showed a closed cervix and foul-smelling discharge. The uterus was tender but firm on bimanual examination.

The patient was admitted to hospital and treated with broad-spectrum intravenous antibiotics. At this stage, the differential diagnosis included degenerating fibroid, endometritis, and retained products of conception. Ultrasound assessment ruled out retained products of conception, but it also identified an inhomogeneous intrauterine mass measuring $12.6 \times 7.5 \times 8.2$ cm, with characteristics consistent with a degenerating fibroid. The patient's condition improved with treatment, and she was discharged on oral antibiotic therapy.

She returned to hospital on postpartum day 18, complaining of a mass at the introitus. She was hemodynamically stable and afebrile, and she had no abdominal tenderness. A degenerating, partially liquefied fibroid was visible at the introitus and filled the vagina. The cervix was 8 cm dilated, and a solid fibroid was palpable in the lower uterine segment above the cervix. Because of the potential for generalized sepsis, the patient was readmitted, and broad-spectrum IV antibiotic therapy was resumed. In preparation for myomectomy, imaging studies were undertaken to clarify the fibroid's location and vascular supply, and the extent of myometrial involvement.

Figure 1. Ultrasound images demonstrating features of viable and degenerating fibroids.

Figure 1A. Para-sagittal ultrasound images in the peri-partum period demonstrate homogeneous solid echotexture of an uncomplicated fibroid in the uterine body.

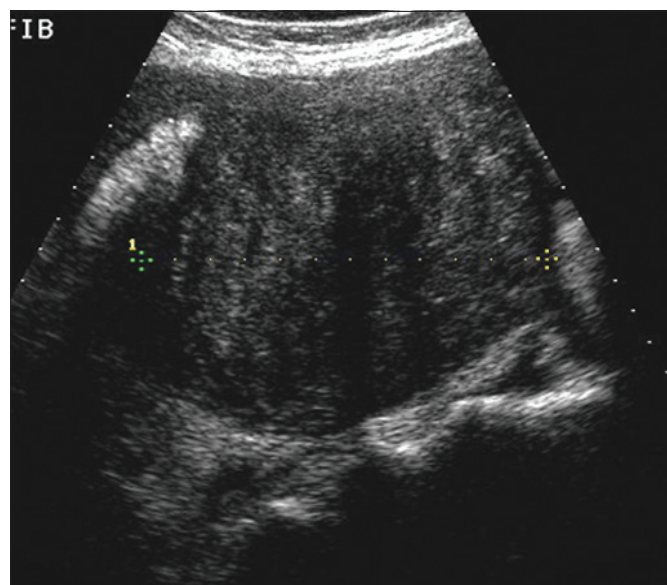


Figure 1B. Postpartum transverse ultrasound image at the level of the vagina shows the fibroid prolapsing into the vaginal canal with liquefaction (dashed arrow) and gas densities with dirty shadowing (solid white arrow).

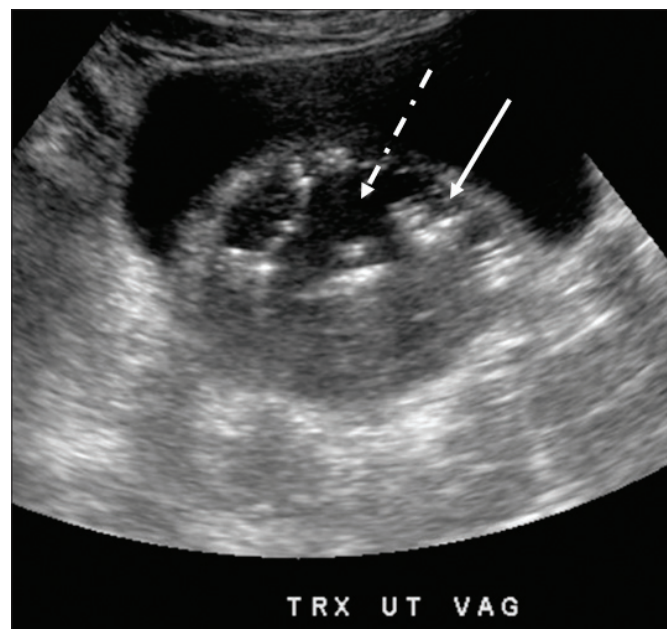


Figure 2. T₂-weighted MRI images of the pelvis demonstrate the prolapsing degenerating fibroid. **Figure 2A.** The sagittal plane illustrates the cranio-caudal extent of the fibroid that has prolapsed through the cervix into the vagina to the level of the introitus (arrows).

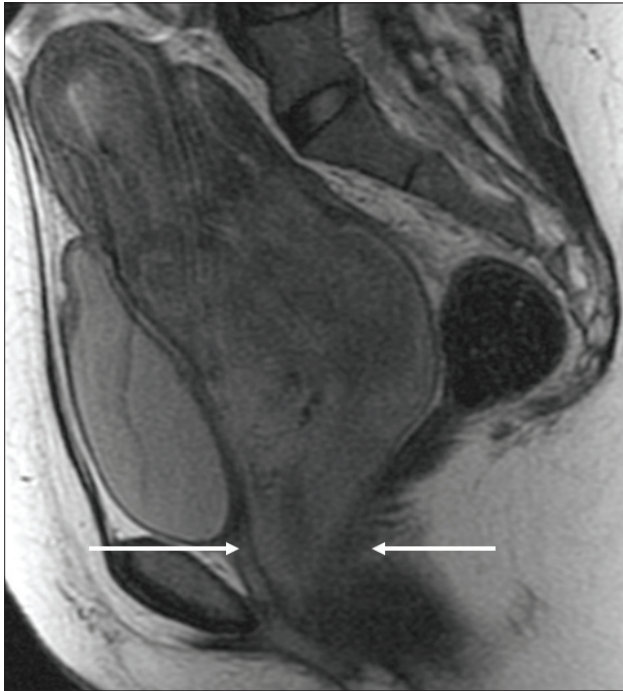
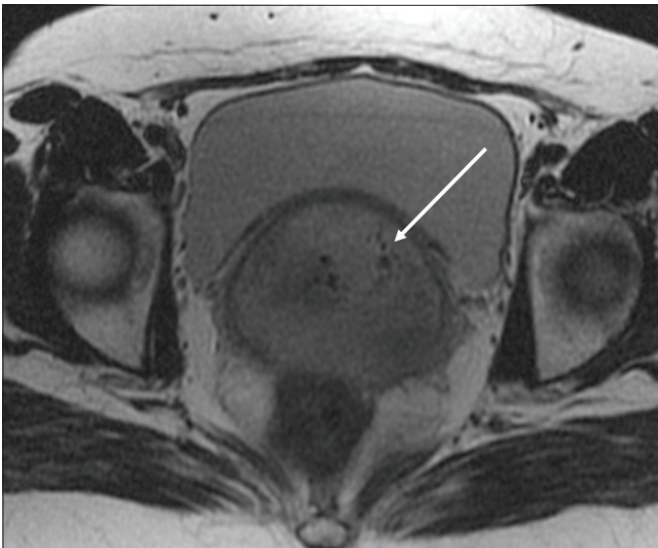


Figure 2B. The transverse image at the expected level of the cervix shows heterogeneity in the internal architecture of the fibroid that is generally quite hyperintense and has punctate areas of signal void (arrow) in keeping with gas within the fibroid.



Antepartum ultrasound examination had revealed a homogeneous solid hypoechoic circular mass in the uterine body, consistent with a predominantly intramural leiomyoma (Figure 1A) with a 25% submucous component. In contrast, postpartum images identified anechoic areas that were consistent with leiomyoma degeneration (Figure 1B). Transverse ultrasound images at the level of the vagina showed liquefaction and gas densities with dirty shadowing as the degenerating fibroid prolapsed into the vaginal canal. Overall, pelvic ultrasound examination confirmed a large posterior wall fibroid with minimal blood flow on Doppler studies. However, the vascular supply and extent of myometrial involvement were not fully defined, and we therefore performed MRI with gadolinium enhancement for clarification.

On T₂-weighted MR images, the fibroid could be seen prolapsed through the cervix into the vagina to the level of the introitus (Figure 2A). Transverse imaging at the expected level of the cervix showed heterogeneity in the internal architecture of the fibroid, including punctate areas of signal void in keeping with gas within the fibroid (Figure 2B). These MR images show a prolapsing degenerating fibroid measuring 16 × 8 × 8 cm. This intramural fibroid had sloughed into an almost complete submucous location, and the pedicle was the only remaining myometrial attachment. Dynamically enhanced sagittal T₁-weighted images demonstrated a lack of enhancement of the prolapsing fibroid (Figure 3A-D). T₁ hyperintensity was noted near the fundal attachment, in keeping with hemorrhage (Figure 3A), while the lack of enhancement within the remainder of the fibroid confirmed that it was completely necrotic (Figure 3B-D). Other features included a large prolapsing submucous component extending to the introitus (Figure 3B), and the 2.5 cm myometrial attachment enhancing superiorly (Figure 3D), which marks the only portion of viable tumour. At the time of the MRI, there was also severe thinning of the myometrium in the lower uterine segment due to stretching from the prolapsing fibroid. This raised the concern that myomectomy could leave a significant posterior uterine wall defect.

Treatment options including expectant management, uterine artery embolization, hysteroscopic resection under laparoscopic guidance, and abdominal or vaginal myomectomy were considered and discussed with the patient. Since the fibroid was already degenerating, embolization was considered redundant, but there was a significant ongoing risk of infection. Given that the patient was well, with no evidence of generalized sepsis, she was initially managed expectantly in the hope that the fibroid would continue to liquefy and extrude spontaneously without operative intervention. One of the primary factors

Figure 3A–3D. Dynamically enhanced sagittal T₁-weighted images of the prolapsing fibroid. The FAME (Fast Acquisition with Multiphase Efgre3D) sequence (GE Healthcare) is a fat-saturated quick and easy-to-perform sequence, which can be performed as a mask image before contrast (Figure 3A) and then repeated at 30 seconds (Figure 3B), 60 seconds (Figure 3C), and 90 seconds (Figure 3D). Figure 3A demonstrates hyperintensity in keeping with hemorrhage (arrow) within the fibroid. Figures 3B, 3C, and 3D demonstrate no enhancement within the completely necrotic fibroid. There is a large prolapsing submucosal component extending to the introitus (arrow in Figure 3B). There is a broad-based enhancing pedicle (arrow in Figure 3D) superiorly, which marks the only area of viable tumour. Note the severe thinning of the myometrium in the lower uterine segment, cervical canal and vagina.

Figure 3A



Figure 3B

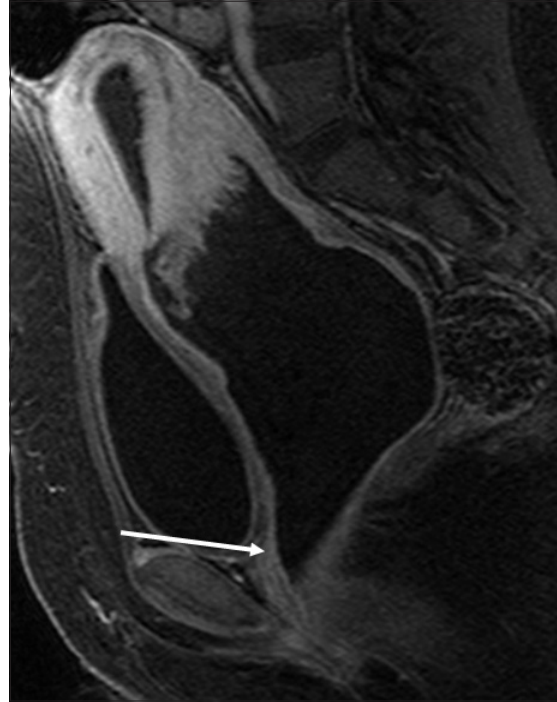


Figure 3C

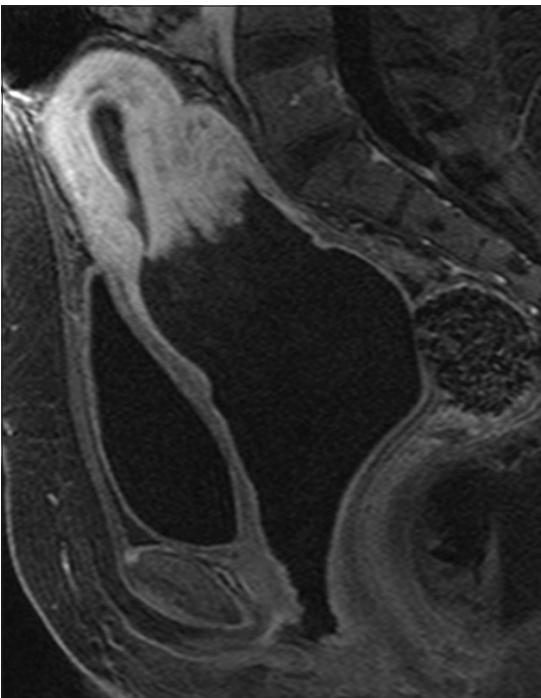
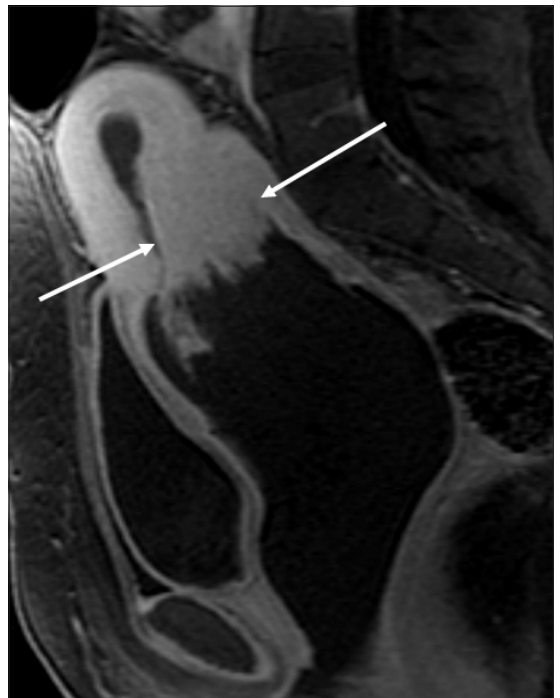


Figure 3D



considered was preservation of fertility. On postpartum day 21, with the mass prolapsed through the introitus and no resolution in sight, the patient elected to proceed with definitive surgical management. Bimanual and speculum examination under general anaesthesia confirmed that a vaginal approach would not be feasible. Laparotomy and vertical anterior uterine wall hysterotomy were performed. The pedunculated submucous fibroid filled the uterine cavity and was prolapsing through the fully dilated cervix. It was attached superiorly and posteriorly to the myometrium by a 2 cm wide stalk. At the time of the MRI, the posterior uterine wall appeared to be extremely thin. In the intervening days between the MRI and surgery, more of the fibroid had prolapsed through the cervix, thus reducing uterine distension. As a result, the posterior uterine wall seen at surgery was thicker than anticipated. The fibroid stalk was identified, cross-clamped and cut. Multiple horizontal mattress sutures were used at the base of the pedicle to achieve hemostasis. The anterior hysterotomy was closed in two layers, and the remainder of the surgery was uneventful.

The patient's postoperative course was uncomplicated. The pathology report confirmed an 11.0 × 6.0 × 6.0 cm degenerating leiomyoma with no atypical features.

DISCUSSION

As women delay child-bearing, the risk of pregnancy complications related to uterine leiomyomas will also increase. Many of these complications are related to fibroid size and location. Ultrasound studies report increased, unaltered, or decreased fibroid size in pregnancy.^{1,11} Fibroid growth has been reported in 32% of pregnancies, with the greatest increase in volume usually occurring before the tenth week of gestation.¹¹ Large leiomyomas may be less likely to grow during pregnancy. In the postpartum period, most leiomyomas either stop growing or decrease in size. One prospective study of 32 patients showed that fibroid size was similar during pregnancy and at six weeks postpartum.¹² Despite this common finding, fibroids may increase significantly in size in the first few weeks postpartum; one case report described a four-fold increase in uterine size during the first 10 weeks postpartum.¹³ Laparotomy in this case revealed a 36-week sized uterus, and pathology confirmed a hemorrhagic cellular leiomyoma with evidence of coagulative necrosis, calcification, and infarction.¹³

In addition to changes in leiomyoma size, postpartum changes in fibroid location have also been described. In one case, a 10 cm intramural fundal fibroid was found at the time of Caesarean section.² At definitive myomectomy six months later, this intramural fibroid remained 10 cm in diameter, but it was then pedunculated on a 4 cm wide stalk.² Submucous fibroids are quite uncommon in term

pregnancy,¹⁴ and they may also progress and become pedunculated postpartum. These pedunculated fibroids may be extruded from or prolapse through the cervical os. Postpartum complications reported include per vaginal extrusion of fibroids in the early postpartum period, either incidentally or in association with postpartum hemorrhage,^{14–17} and uterine rupture secondary to hematometra.¹⁸

Degenerating fibroids in the postpartum period can present a unique challenge for diagnosis and management. The presentation may suggest endometritis or intra-abdominal abscess⁷; degenerating fibroids can progress to become pyomyomas,^{8,9} and they can ultimately cause systemic sepsis.^{9,10} In 1949, Gainey described a case in which a patient presented several weeks postpartum with increased abdominal cramping, vaginal bleeding, and a vaginal mass.¹⁴ Examination under anaesthesia revealed a 10 cm soft, foul-smelling mass extending from the cervical canal. Most of the mass was removed under general anaesthesia, using a vaginal approach; however, a portion was left in situ when bleeding was encountered. Pathology confirmed a degenerating, infected leiomyoma, presumably submucous in origin. In a second case, a patient presented with fever that persisted despite IV antibiotic therapy and a non-tender uterus that failed to involute normally by 20 days post delivery.¹⁴ Examination under anaesthesia showed an effaced cervix and a large submucous fibroid with extensive pedicle attachments along the left lateral and anterior uterine walls. Ultimately, surgical intervention was required because of significant vaginal bleeding. Subtotal hysterectomy was performed, and pathological assessment confirmed a large degenerating intramural fibroid and mild endometritis.

In our case, radiological imaging was used to plan surgical intervention. Antepartum ultrasound assessment demonstrated a muscular leiomyoma characterized by a hypoechoic, solid circular mass, with sharp discrete borders between the mass and the normal uterine smooth muscle. Postpartum ultrasound assessments revealed anechoic areas that were consistent with a degenerating leiomyoma. Although Doppler studies suggested relative hypovascularity, the true extent of necrosis and the location and thickness of the vascular pedicle could not be determined.

MR imaging of fibroids has proven useful in identifying their location, blood supply, and general characteristics. Specifically, MRI can very accurately identify fibroids as submucous, intramural, or subserosal. In our patient, the large field-of-view capability of MRI showed the full extent of the prolapsing submucous component and demonstrated the vascularized pedicle superiorly. MRI can also differentiate fibroids from similar conditions such as adenomyosis, as most fibroids have homogenous

well-circumscribed low T₁ and T₂ signal lesions when compared to the normal myometrium.^{19,20} Higher T₂ signal will be seen in leiomyomas that are cellular,²⁰ degenerating, or that contain little collagen. Yamashita et al. found that degenerating leiomyomas generally had mixed and higher signal intensity than cellular leiomyomas.²⁰ Necrotic leiomyomas that have not yet liquefied usually have variable T₁ signal intensity and low T₂ signal intensity,²¹ while degenerating fibroids may have peripheral or diffuse high T₁ signal and variable T₂ signal.²¹ In our case, heterogeneity on T₁- and T₂-weighted images likely represented a combination of hemorrhage, gas bubbles from necrosis, and stromal edema related to infarction.

Dynamically enhanced MRI with gadolinium injection provides detail about the relative vascularity and viability of fibroids and other pelvic masses. In gynaecologic radiology, dynamic MRI is most often used in the local staging of endometrial and cervical cancers.²² Dynamic-enhancement patterns of leiomyomas have also been described.²⁰ Specifically, cellular leiomyomas demonstrate intense homogeneous enhancement in an early dynamic phase between 30 and 90 seconds,²⁰ while degenerating leiomyomas typically display minimal peripheral enhancement.²⁰ In our case, lack of enhancement suggested near-complete necrosis of this large prolapsing submucous fibroid. Only the pedicle at the superior and posterior margin of the fibroid enhanced, suggesting that this was the only remaining viable tumour.

After viewing these MR images, it seemed unlikely at the time that a vaginal approach would allow sufficient access to the vascular pedicle. Nevertheless, when the patient opted to proceed with definitive surgical management, the decision to make an abdominal or a vaginal approach to myomectomy was only made after further examination under anaesthesia. At that time it was evident that the fundal vascular pedicle could not be safely secured using a vaginal approach, and therefore abdominal myomectomy was performed.

CONCLUSION

Although most uterine leiomyomas remain asymptomatic during pregnancy, they can also present with diverse complications. Due to the higher complication rate, myomectomy is traditionally avoided during pregnancy and in the early postpartum period. When surgical intervention is necessary, accurate characterization of the fibroid's vascular supply and myometrial involvement are essential to minimize surgical risk. Ultrasound with Doppler studies is usually, but not universally, useful in identifying these features. If questions remain after ultrasound assessment, MRI, where available, can provide very precise and useful information about fibroid viability, vascular supply and myometrial involvement. This case illustrates the potential

role of MRI, including dynamic sequences, in surgical decision-making with respect to pregnancy-related fibroid complications.

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The woman whose story is told in this case report has provided signed permission for its publication.

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