

The role of clinical radiology in the management of uterine fibroids

Uterine fibroids, also known as leiomyomas, are common benign tumours in women with an estimated incidence of up to 90% in all women (Boosz et al, 2014). They may become clinically significant in 20–40% in women of reproductive age (Khan et al, 2014). Fibroids are thought to arise from the myometrium following neoplastic transformation of a single smooth muscle cell, with subsequent development of a connective tissue component and a pseudocapsule (Silberzweig et al, 2016). Their pathogenesis is yet to be fully delineated but there is strong evidence of hormonal drives as they rarely develop before menarche and often regress after menopause. With advances in imaging technology over the past few decades, radiology has evolved to play a key role in their diagnosis and management.

Presentation of uterine fibroids

Uterine fibroids are one of the most common conditions presenting to gynaecology outpatients or emergency departments in the UK (Khan et al, 2014). Their symptomatic presentation has traditionally been divided into three groups:

1. Menorrhagia or abnormal uterine bleeding
2. Pelvic pain
3. Urinary symptoms including frequency, urgency, incontinence and/or retention.

The most common primary symptomatic presentation is menorrhagia (65%),

bulk symptoms (23.3%) and pelvic pain (10.5%) (Myers et al, 2005).

The location of uterine fibroids can be divided into three categories: subserosal, submucosal and intramural. The submucosal fibroids may also become pedunculated to form an intracavity fibroid. Pedunculated subserosal fibroids may become exophytic (Silberzweig et al, 2016). The location of the fibroids has an impact on the primary clinical symptoms of the patient. The less common submucosal intra-cavity fibroids are more likely to impact on the function of the endometrium, resulting in menorrhagia and hypermenorrhoea (Boosz et al, 2014). The more common intramural fibroid of a similar size may be considerably less symptomatic. The presenting symptoms play an important role in deciding the appropriate form of treatment for affected women. In some patients, fibroids are associated with reproductive issues such as infertility and miscarriages.

Imaging uterine fibroids

The first line of imaging suspected uterine fibroids is ultrasound. This may be done as a transabdominal or transvaginal scan. It is easily accessible, with a low cost and carries no radiation burden (*Figure 1*). However, there are limitations on reproducibility and considerable operator dependence. Transvaginal scans are more sensitive for the detection of small fibroids but use is limited in patients who are virgo intacta, and transabdominal views can be limited in patients with increased body habitus.

The gold standard of imaging uterine fibroids is magnetic resonance imaging. It is more time consuming and costly than ultrasound but it is the most sensitive imaging modality, particularly in the detection of small fibroids. It has a sensitivity of up to 99% and specificity of 86% for uterine fibroids (Dueholm et al, 2002). Magnetic resonance imaging is also able to differentiate between small fibroids and focal adenomyosis, which is also a common cause of menorrhagia and pelvic pain (*Figure 2*) and which was traditionally difficult to

differentiate on ultrasound. With the use of gadolinium intravascular contrast, the degree of enhancement of the fibroids also provides a prediction of response to treatment by uterine artery embolisation.

Managing uterine fibroids

Up to 80% of fibroids are asymptomatic and therefore require no treatment (Murase et al, 1999). Other potential causes of abnormal uterine bleeding and pelvic pressure or pain need to be excluded before starting treatment. In women with smaller fibroids, milder symptoms or who are reaching menopause, conservative treatment with symptom control should be the first line of management. These include using haematinics and tranexamic acid for control of menorrhagia and anaemia.

Medical management

The medical management of symptomatic fibroids can be predominantly divided into two drug classes: gonadotropin-releasing hormone analogues and selective progesterone receptor modulators.

Gonadotropin-releasing hormone analogues

The use of gonadotropin-releasing hormone analogues was associated with reduced fibroid volume, reduced bulk symptoms and improvement in haematocrit (Lethaby et al, 2002). However, gonadotropin-releasing hormone analogues are also associated with menopausal symptoms and, with prolonged therapy, the loss of bone mineral density. As such, their use is usually limited to 3–6 months, usually pre-surgery. Following cessation of gonadotropin-releasing hormone treatment, fibroids are likely to return to pretreatment size (Olive et al, 2004).

Selective progesterone receptor modulators

Mifepristone, a selective progesterone receptor modulator, has been used since 2002 to treat symptomatic fibroids and demonstrated efficacy in reducing the size of fibroids by up to 49% (Eisinger et al, 2003).

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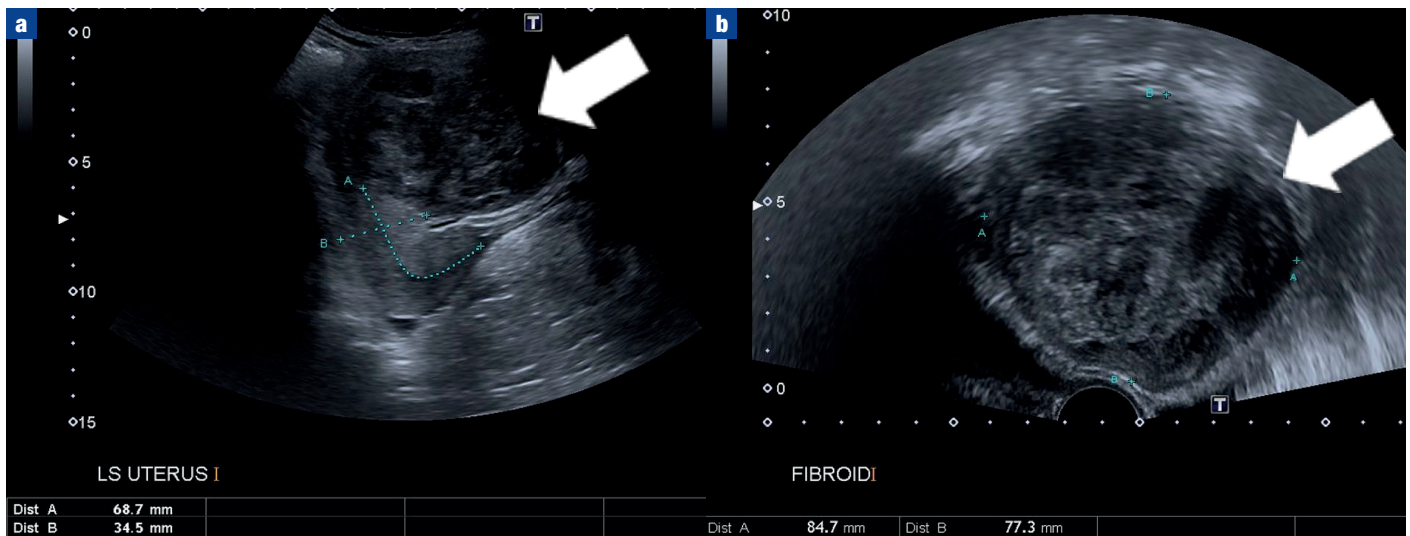


Figure 1. Transabdominal and transvaginal images of a fibroid. **a.** Longitudinal view of the uterus with a large fibroid (white arrow) on the anterior aspect of the uterus. **b.** The same fibroid (white arrow) from a transvaginal view.

Surgical management

Hysterectomy is the definitive treatment for any symptomatic fibroids, but is not the treatment of choice for many women. Myomectomy by abdominal laparotomy is associated with longer surgical time and more blood loss than hysterectomy and associated with a 15% recurrence rate. Persistent symptoms mean that about 10% of patients treated this way will still need a hysterectomy within 5–10 years (Lefebvre et al, 2003).

Minimally invasive uterine-sparing surgical techniques to enucleate fibroids

have been developed. Depending on the location of the fibroids, these may be done hysteroscopically or laparoscopically, even for fibroids up to 12 cm in size (Boosz et al, 2014). The use of uterine-sparing minimally invasive surgery also allows for future pregnancies.

Radiological management

Uterine artery embolisation has been extensively used to treat a variety of gynaecological haemorrhages for over 30 years. The method was subsequently

modified to treat uterine fibroids and a case series of 16 patients was reported in 1995 (Ravina et al, 1995). Uterine artery embolisation is now widely accepted as a minimally invasive option for the treatment of symptomatic fibroids. The aim of uterine artery embolisation is to cause fibroid tissue infarction with subsequent shrinkage of the fibroid, thus reducing fibroid volume and bulk symptoms (Figure 3).

In the UK, a joint working party between the Royal College of Radiologists and the Royal College of Obstetricians

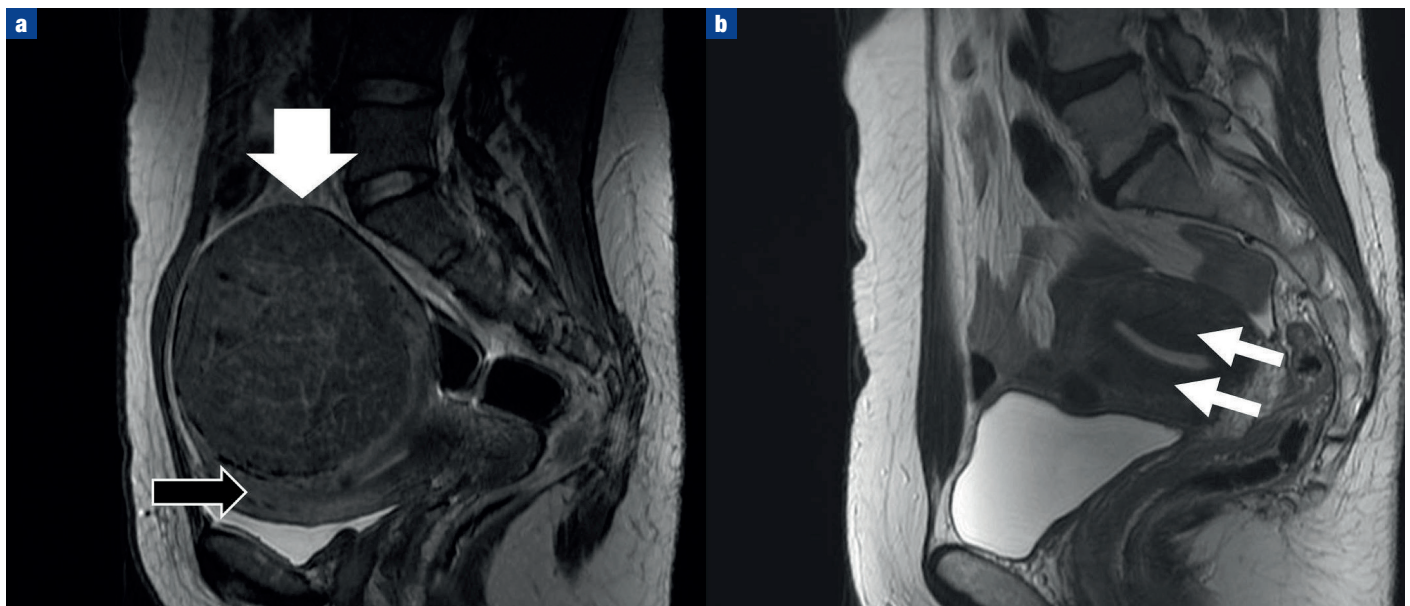


Figure 2. Magnetic resonance imaging appearances of fibroid and adenomyosis. **a.** T2 weighted magnetic resonance imaging demonstrating a large fibroid (white arrow) arising from the posterior aspect of the uterus (black arrow), causing ante-flexion of the uterus with resultant compression of the urinary bladder. **b.** T2 weighted magnetic resonance imaging demonstrates diffuse thickening of the junctional zone (white arrows) of the uterus, typical of diffuse adenomyosis.

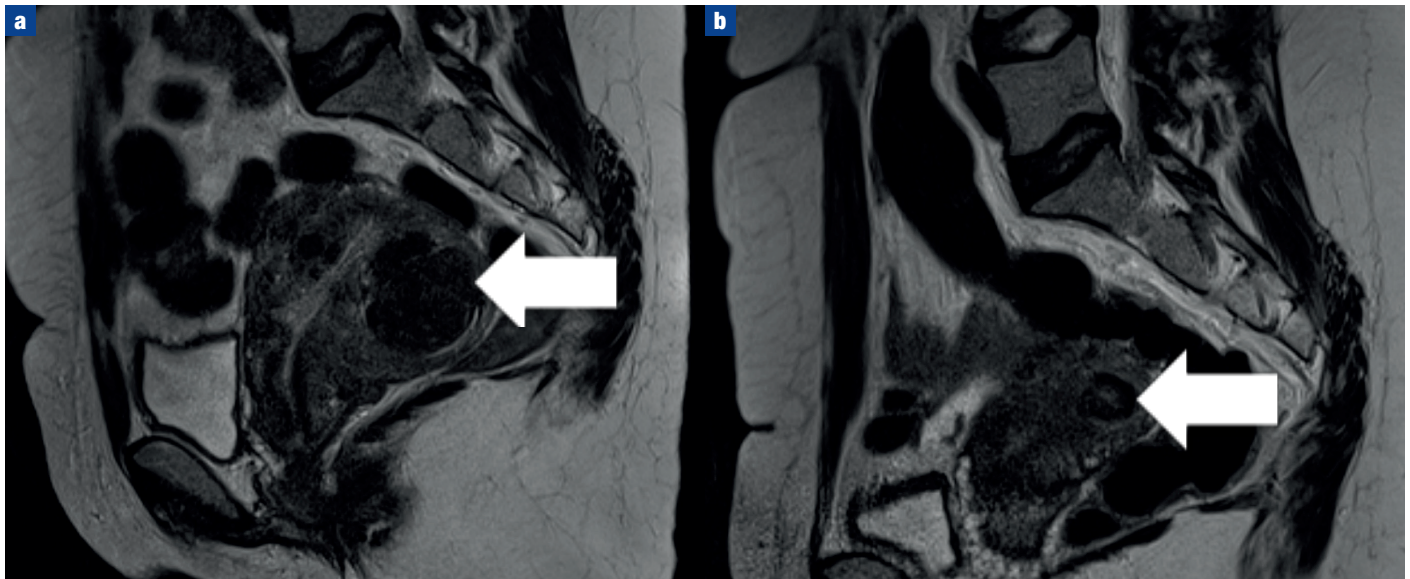


Figure 3. Pre- and post-uterine artery embolisation of an intramural fibroid. **a.** T2 weighted magnetic resonance imaging demonstrates a large intramural fibroid arising on the posterior aspect of the uterus. **b.** T2 weighted magnetic resonance imaging demonstrates the same fibroid after successful uterine artery embolisation with significant size reduction of the fibroid.

and Gynaecologists had been established since 2000 to provide guidance on uterine artery embolisation. The procedure is well established as safe with good short- and medium-term success. Uterine artery embolisation is recognized by the National Institute for Health and Care Excellence (2010) in its guidelines for heavy menstrual bleeding.

To date, there have been five reported clinical trials, one large American registry (Goodwin et al, 2008) and a large UK

retrospective study (Dutton et al, 2007) demonstrating the safety and efficacy of uterine artery embolisation compared to myomectomy or hysterectomy. A further UK trial measuring the quality of life of 250 women following myomectomy or uterine artery embolisation has finished recruitment and the publication of its results is eagerly awaited.

In uterine artery embolisation, the procedure is performed by an interventional radiologist and an interventional radiology

team, including a specialist radiographer, a scrub nurse and at least one other nurse present to monitor and administer appropriate medications as required. One or both femoral arteries will be accessed percutaneously under local anaesthetic and a catheter guided into the uterine arteries via the internal iliac arteries under fluoroscopic guidance. An embolic agent is then carefully injected into the uterine arteries to occlude the uterine vessels (Figure 3). Once the process is completed,

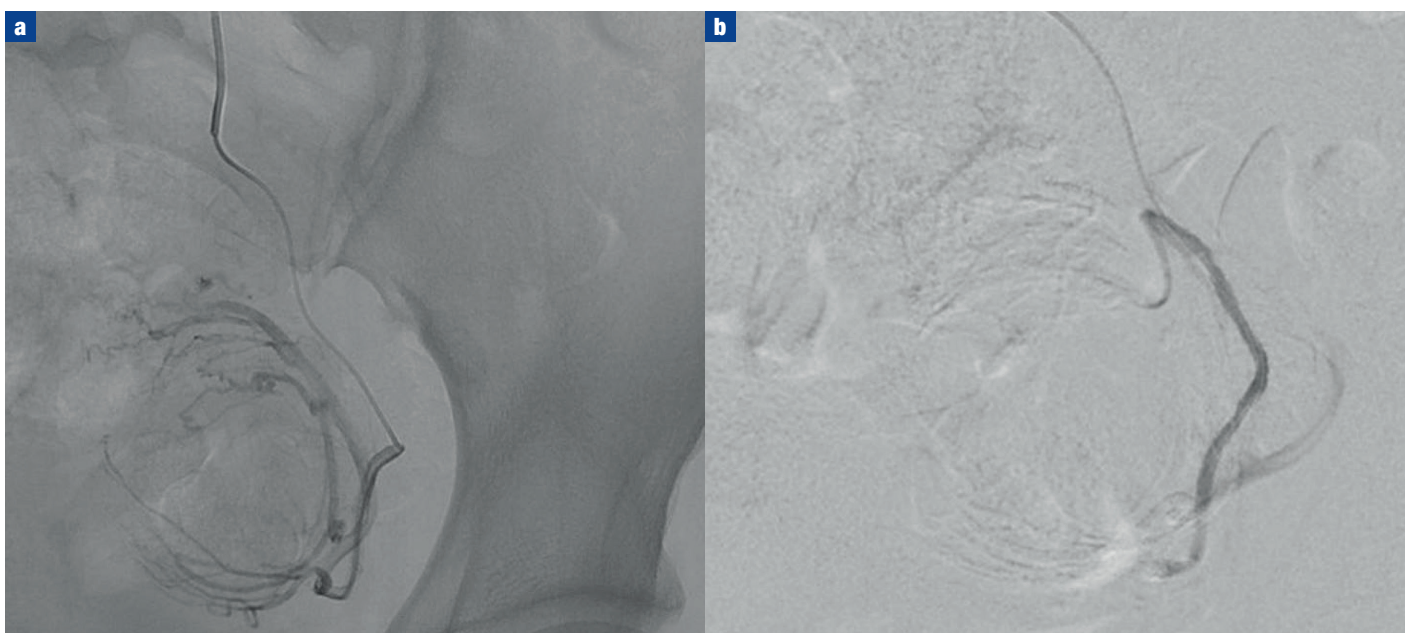


Figure 4. Embolisation of fibroid via the left uterine artery. **a.** This demonstrates hypervascularity of the fibroid on digital subtraction angiogram. **b.** This shows complete embolisation of the fibroid with no residual arterial flow to the fibroid from the uterine arteries post-embolisation.

KEY POINTS

- Fibroids are common and seen in up to 80% of women in childbearing age but are rarely symptomatic.
- Ultrasound is the first-line radiological investigation of choice in clinically symptomatic fibroids. Magnetic resonance imaging remains the gold standard for imaging fibroids if there are any doubts.
- Conservative and medical management of fibroids should be considered in the first instance.
- Uterine artery embolisation is a safe and effective minimally invasive method of treating symptomatic fibroids and should be considered alongside surgical treatments in patients who have failed to respond to conservative and medical management.
- Any patient undergoing uterine artery embolisation should have multidisciplinary team input, including the primary care physician, the gynaecology team and the interventional radiology team, with clear established responsibility for care.

the catheter is removed. The whole process usually takes between 30 and 90 minutes.

Following the procedure, most patients experience a degree of pelvic pain as the fibroids become ischaemic. Strong analgesics are often prescribed, usually via a patient-controlled analgesia device, and the patient needs an overnight stay in hospital. There remains a degree of controversy regarding the efficacy of perioperative antibiotics given that the time of greatest risk of infection is well after the procedure, usually only when tissue infarction has occurred.

In comparison to surgical treatment, uterine artery embolisation is associated with shorter stays in hospital with a similar complication rate. However, patients who undergo uterine artery embolisation are more likely than myomectomy patients to develop recurrent symptoms and the re-intervention rate tends to be higher at 7% in uterine artery embolisation patients compared to 4.2% for myomectomy at 1 year, and 24% for uterine artery embolisation and 19% for myomectomy after 5 years (Davis et al, 2018). Amenorrhoea is also seen in up to 7% of patients who undergo uterine artery embolisation (Spies et al, 2005).

For patients seeking fibroid treatment for infertility, uterine artery embolisation does not preclude subsequent successful pregnancies, but although there is insufficient evidence, there is an early suggestion that patients post-uterine artery embolisation have a higher rate of miscarriages than those who had myomectomy (35% *vs* 17%).

Experimental radiologically guided treatments are also on the horizon for the treatment of uterine fibroids. Magnetic resonance-guided focused ultrasound surgery uses magnetic resonance imaging to localize and target fibroids while high intensity focused ultrasound is simultaneously targeted at the fibroid to cause a localized temperature rise leading to coagulative necrosis. Although this is a completely non-invasive technique, there are very strict inclusion criteria on the basis of the fibroid location and patient body habitus. Other emerging technologies include transcervical real time sonography with radiofrequency ablation.

Conclusions

The presence of uterine fibroids is a very common condition in many women of

childbearing age and most do not cause clinical symptoms. In patients with fibroids presenting with clinical symptoms, radiology plays a key role in diagnosing the presence and location of the fibroids while excluding other sinister pathologies. In symptomatic patients who do not respond to conservative or medical therapy, uterine artery embolisation performed under care of both the gynaecological and interventional radiology teams offers a safe, effective and minimally invasive approach. **BJHM**

Conflict of interest: none.

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