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Complications Of Uterine Leiomyomas: A Comparative Review of Uterine Fibroid Embolization and Myomectomy in Management and Outcomes

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ABSTRACT

Uterine leiomyomas (fibroids) are the most common benign gynaecological tumors in women of reproductive age and may result in significant complications. Uterus-preserving treatment options recommended by the American College of Obstetricians and Gynaecologists (ACOG) and central to this review are Uterine Fibroid Embolization (UFE) and myomectomy. This review compares UFE and myomectomy in terms of recurrence, fertility preservation, and quality-of-life outcomes. A comparative analysis was conducted using major electronic databases, including PubMed, Google Scholar, Scopus, and Science Direct, with searches restricted to human studies published in English between January 2013 and May 2025. Fibroids are most prevalent among women aged 30 to 50 years and disproportionately affect Black women. Myomectomy, though more invasive, is preferred in women desiring future fertility. UFE has a higher intervention rate (OR 1.84; 95% CI 1.62–2.10; P < 0.01; I2 = 39%), hysterectomy rate (OR 4.04; 95% CI 3.45–4.72; P < 0.01; I2 = 59%), and symptom-severity score (OR − 4.02; 95% CI 0.82, 7.22; P = 0.01; I2 = 0%) compared to myomectomy at a four-year follow-up. UFE has a lower risk of early complications (OR 0.44; 95% CI 0.20-0.95; P = 0.04; I 2 = 25%) and readmission rate (OR 1.16; 95% CI 1.01-1.33; P=0.04; I 2 = 0%) in comparison with myomectomy. Both procedures effectively relieve symptoms and preserve the uterus, but data on fertility outcomes are inconclusive. Treatment decisions should be personalized based on patient preferences and clinical context.

KEYWORDS: Uterine Fibroid Embolization; Fibroids; Myomectomy; Fertility Preservation; Minimally Invasive Procedures

INTRODUCTION

Uterine leiomyomas (fibroids) are the most common benign gynecological tumors in women of reproductive age and often impair quality of life and reproductive potential.[1] They pose a major global health concern, constituting a large portion of gynecological visits, surgical procedures, and healthcare costs. Globally, fibroids account for as much as 70% of hysterectomies, with around 30% of women impacted needing active treatment due to intense symptoms, such as anemia, infertility, or discomfort related to mass size.[2] Despite being common and having significant effects, the clinical practice guidelines for their management are still inconsistent. This inconsistency is indicative of the lack of strong comparative data and leads to differences in treatment methods among various institutions and regions. This review explores the complications associated with uterine fibroids and compares Uterine Fibroid Embolization (UFE) and myomectomy in terms of recurrence rates, fertility outcomes, and effects on quality of life. For patients unresponsive to

medical therapy and who desires uterine preservation, UFE and myomectomy offer viable therapeutic options. Given the overlapping indications yet differing outcomes of UFE and myomectomy, this review addresses a central question: Which uterus-preserving intervention yields more favorable long-term outcomes in terms of recurrence, fertility preservation, and patient satisfaction in symptomatic fibroid cases? Through an examination of existing epidemiological and clinical data, this analysis aims to support informed decision-making among patients and clinicians.

METHODOLOGY

A comparative analysis was conducted using existing epidemiological data, clinical guidelines, and outcome-based research on the use of uterine fibroid embolization (UFE) and myomectomy in the management of uterine fibroids. A systematic search was conducted across major electronic databases including PubMed, Google Scholar, Scopus, and Science Direct. Relevant articles were retrieved using a combination of search terms and Medical Subject Headings (MeSH) such as "Uterine Fibroids" OR Leiomyomas", "Uterine Fibroid Embolization" OR "UFE", "Myomectomy", "Complications", "Fertility", and "Recurrence". Searches were limited to human studies published in English between May 2013 and May 2025. Inclusion Criteria Include: Original peer-reviewed studies, studies comparing UFE and Myomectomy in symptomatic fibroids, and studies reporting on outcomes such as recurrence, fertility preservation, complication rates, and recovery time. Exclusion criteria were: Non-English publications, Studies not focused on UFE or myomectomy as treatments of uterine fibroids, opinion pieces, non-peer-reviewed materials, and studies with insufficient or irrelevant outcome data.

EPIDEMIOLOGY AND PREVALENCE

Uterine leiomyomas are the most prevalent benign gynecological tumors, affecting approximately 30% of women globally, predominantly between the ages of 30 and 50.[1] They occur three to four times more frequently in Black women, with an estimated 80% lifetime incidence. While many women remain asymptomatic, around 30% develop severe symptoms.[3] A Nigerian tertiary institution study reported that uterine fibroids accounted for 6.4% of all gynecological admissions and 22.3% of major gynecological surgeries.[3] In Ghana, incidence rates ranged from 66.77 to 92.40 per 100,000 women annually, peaking among women aged 35 to 39.4 In the United States, uterine fibroids affect approximately 70% of women, surpassing the prevalence of several other female-specific conditions.[5]

PATHOPHYSIOLOGY

Uterine fibroids develop from a single smooth muscle cell in the myometrium that undergoes a somatic mutation, resulting in monoclonal tumour growth. The growth of fibroids is influenced by hormonal factors, primarily oestrogen and progesterone, which promote cellular proliferation and extracellular matrix accumulation. Growth factors such as transforming growth factor-beta (TGF-beta), epidermal growth factor (EGF), and insulin-like growth factor (IGF) have also been implicated in fibroid development and progression. Multiple molecular studies have identified distinct gene mutations linked to the development of leiomyomas, with the most frequently observed being mutations in the MED12 gene, located on the X chromosome at position q[13.6,7] This gene encodes a subunit of the mediator complex [subunit 12], which plays a critical role in regulating RNA polymerase II activity. Alterations in MED12 are found in approximately 70% of uterine leiomyomas. Additionally, mutations in the fumarate hydratase gene are associated with hereditary leiomyomatosis and renal cell carcinoma [HLRCC] syndrome, which can involve uterine leiomyomas. However, these hereditary forms are significantly less common than the sporadic leiomyomas typically driven by MED12 mutations. Other notable genetic alterations implicated in leiomyoma pathogenesis include mutations in high mobility group AT-hook 1 and 2 [HMGA1 and HMGA2], as well as collagen type IV alpha 4 and 6 [COL4A4 and COL4A6] genes.[8] Uterine fibroids are composed of extracellular matrix made up of collagen, fibronectin, and proteoglycan. They are relatively avascular, having a blood supply arising from the pseudo-capsules of surrounding myometrial tissue, and are hypersensitive to oestrogen. The course of the fibroid depends largely on the location of the fibroids, the size, the number of fibroid nodules, and the prevalent hormonal milieu.[9]

COMPLICATIONS

Although benign, fibroids may cause complications that significantly affect quality of life. Common manifestations include heavy menstrual bleeding, pelvic pain, urinary frequency, and constipation. In addition to these symptoms, uterine fibroids are associated with infertility, adverse perinatal outcomes, postpartum hemorrhage, and maternal anemia. Submucosal fibroids are particularly associated with higher complication rates due to their intrauterine location, which disrupts implantation and exacerbates bleeding. Large fibroids can impinge on adjacent pelvic organs, leading to bladder and bowel dysfunction.[10]

MANAGEMENT OF UTERINE FIBROIDS

The American College of Obstetricians and Gynecologists (ACOG) and the National Institute for Health and Clinical Excellence (NICE) have both established safe, effective, and reliable standards for fibroid management. The two bodies recommend an individualized, symptom-driven approach that considers the severity of the patient's symptoms, the patient's age, reproductive plans, and preferences. They both recommend medical therapy as the first-line for bleeding and pain, while minimally invasive measures and surgery are available when conservative measures are insufficient to control patients' symptoms. Uterine fibroid embolization (UFE), myomectomy, and hysterectomy are the recommended non-medical treatment options. Myomectomy and UFE are the management options that will be the focus of this review.[10]

MYOMECTOMY IN FIBROID MANAGEMENT

Myomectomy is the surgical removal of uterine fibroids with the sole aim of preserving fertility and reducing complications of fibroids. The uterus is preserved due to the patient's desire for fertility. Studies done on the prevalence of uterine fibroid resection amongst women with this condition suggest a myomectomy rate of 14.6 per 10,000 patients over the last year. While myomectomies have given women with fibroids a chance at preserving their fertility, hysterectomy due to uterine fibroids accounts for 40-60% of all hysterectomies, raising a question as to why hysterectomy due to fibroids is still a common procedure, especially since the advent of myomectomies.[11] Hysterectomy is the surgical removal of the uterus and the cervix, which can be due to several factors relating to the uterus that can pose a threat to the patient's life. While this surgery is recommended for women who have completed childbearing and post-menopausal women, the presence of cancers, fibroids, and other pathologies of the uterus could be indications for a hysterectomy. While most women would still prefer to preserve their fertility by doing a myomectomy, hysterectomy is a more definitive way of treating uterine fibroids, and several factors like the site, size, and quantity of the fibroids can be decisive in considering the treatment option to take.[12] Doing a myomectomy in situations where the fibroid is too large that a reasonable repair of the uterus would not be possible or the fibroid has implanted too deep into the myometrium and endometrium, would pose a great risk and patients are counselled on the possibilities of doing an hysterectomy, taking into consideration their desire for fertility.

UTERINE FIBROID EMBOLIZATION

As an addition to the procedures for treating uterine fibroids, uterine fibroid embolization (UFE) has been introduced as a treatment for fibroids under the umbrella of uterine artery embolization (UAE). This procedure has brought a less invasive way of taking care of uterine fibroids, which does not require large abdominal incisions, but rather uses an image-guided approach through blood vessels in the groin or wrist to reach the blood supply of the fibroid.[13]

INDICATIONS FOR UFE

- UFE is an effective procedure, but it may not necessarily be done on every patient who presents with uterine fibroids. Patients who benefit from UFE are:
- Patients who are experiencing uterine fibroid symptoms
- Patients who are not viable for surgery (obesity, bleeding disorders, anemia)
- Patients who want to retain their uterus
- Patients who refuse to collect blood or blood products

- Patients who do not want to undergo surgery

CONTRAINDICATIONS FOR UFE

- Patients who are not experiencing fibroid symptoms
- Patients who have gynaecological cancers (cervical, endometrial, or ovarian)
- Patients with active pelvic infections
- Patients who desire fertility preservation
- Patients with impaired renal function who have not yet undergone dialysis

COST AND ACCESSIBILITY CONSIDERATIONS

Beyond clinical outcomes, financial considerations and health system availability can influence the choice between UFE and myomectomy. Myomectomy, especially via open or laparoscopic approaches, may require specialized surgical teams and longer hospital stays. UFE, though less invasive, involves access to interventional radiology suites, which may be unavailable in lower-resource settings. A study done over a 2-year time horizon discovered that UFE was associated with higher mean costs when compared to myomectomy. The same study looked at the outcome over four years, and UFE was associated with a higher mean cost. It was concluded that myomectomy was a cost-effective option for the treatment of uterine fibroids in comparison to UFE, though the differences in costs are small.14 Insurance coverage and local expertise often dictate the accessibility of either treatment.

UFE PROCEDURE

In uterine fibroid embolization, the patient is initially sedated, and the interventional radiologist then inserts a thin catheter into an artery in the groin or wrist. With the help of imaging, the catheter is carefully mobilized to the uterine artery, where embolic agents are released to block blood supply to the fibroid. Imaging is done to ensure the arteries are blocked, the catheter is removed, and pressure is applied to the incision site.[15] This procedure leads to the shrinking of the fibroids due to the reduction in their blood supply. The fibroids are said to shrink by about 50% of their original volume, with several research studies indicating a 20% reduction in diameter. Results are not immediate, as shrinkage of the fibroids can take up to several months, but signs of relief can be seen in most patients after six months.[16] But how exactly is it different from myomectomy in terms of recurrence, fertility preservation, and an increase in quality of life? Due to this procedure being less invasive and having a shorter recovery time, it is generally believed that UFE is a better option than myomectomy in all areas of consideration. The reasons can be said to be the presence of minimal scarring, shorter hospital stays, and the preservation of the uterus, excluding important factors like age and desire for childbirth. Several research studies have presented a better assessment of the two procedures, putting important factors and outcomes into consideration.

UFE VS MYOMECTOMY

UFE and myomectomy both have specific patient interests they appeal to, and both are great options for managing the symptoms that complicate uterine fibroids. Taking into account various factors such as age, interest in childbearing, cosmetics, and the time it takes for recovery, patients can choose which of the two procedures best appeals to their interests. UFE has been advised against in women who still consider childbearing, but it is a good management option for older women who are done with childbearing or women who do not desire future fertility.[17] Having a shorter time to recovery makes it a perfect management option for patients who cannot stay away from work for too long, and presents them with an opportunity to return to normal activities in good time. Considering cosmetics, UFE has a better cosmetic appeal as there are no surgical incisions on the abdomen that could cause patients to be mindful of any scars that surgery might leave. Myomectomies, on the other hand, may not be best for a quicker or a more cosmetically pleasing outcome, but it is considered the best option for women who still choose to preserve their fertility, making it a good option for younger patients.[18] The 2021 ACOG guidelines recommend myomectomy as the preferred option for women desiring fertility, and also caution on the use of UFE as it may affect fertility.[10] Several studies have been done to compare UFE and myomectomies and assessed them based on recurrence, fertility preservation, and improvement in quality of life. The findings suggested that myomectomy was a better option for fertility preservation, but UFE was a

quicker and less invasive way of taking care of the complications that arise from fibroids.[18] Table 1 below highlights the major differences between UFE, myomectomy, and hysteroscopy.

LONG-TERM OUTCOMES AND FOLLOW-UP

Long-term follow-up studies have shown variable outcomes for both myomectomy and UFE, stating that the risk of intervention after 5 years (60 months) was 12.2% and 14.4% for myomectomy and UFE, respectively.[19] A recent meta-analysis comprising of 13 studies (9 observational and 4 randomized controlled trials), highlighted that UFE presented with a higher intervention rate (OR 1.84; 95% CI 1.62–2.10; P < 0.01; I2 = 39%), hysterectomy rate (OR 4.04; 95% CI 3.45–4.72; P < 0.01; I2 = 59%), and symptom-severity score (OR − 4.02; 95% CI 0.82, 7.22; P = 0.01; I2 = 0%) compared to myomectomy at a four-year follow-up. But also stated that UFE was associated with lower risks of early complications (OR 0.44; 95% Cl 0.20-0.95; P = 0.04; I 2 = 25%), and readmission rate (OR 1.16; 95% Cl 1.01-1.33; P+0.04; I 2 = 0%) in comparison with myomectomy.[20] Post-operatively, patients are seen for follow-up 2-6 weeks after their surgery. 21 A pelvic exam is performed at 3 months, 6 months, and 1 year to assess for recurrence.[22] Due to symptom recurrence, UFE may require repeat embolization or eventual surgical intervention. Both groups benefit from scheduled imaging and symptom-based follow-up. Regular gynaecological care remains essential for detecting regrowth, new fibroid formation, or other complications, such as endometrial changes.[23]

Table 1. Comparative Characteristics of Uterine Fibroid Embolization (UFE), Myomectomy, and Hysterectomy in the Management of Uterine Fibroids

Category	UFE (Uterine Fibroid Embolization)	Myomectomy	Hysterectomy
Invasiveness and procedure type	Minimally invasive (catheter via groin/wrist); imaging-guided, performed by an interventional radiologist	Invasive (open, laparoscopic) surgical removal of fibroids, performed by a gynaecologic surgeon	Most invasive (abdominal, laparoscopic) surgical removal of the uterus, performed by a gynaecologic surgeon
Uterus Preservation	Uterus preserved; good for avoiding surgery, not focused on fertility	Uterus preserved; preferred for fertility preservation	Uterus removed; no future pregnancy possible
Fertility Impact	May reduce fertility; risk to ovarian function or uterine lining	Best for preserving fertility; recommended for women trying to conceive	Eliminates fertility; suitable for women past childbearing age
Symptom Relief and Recurrence	Good relief; recurrence possible;14.4% recurrence, may need repeat treatment	Excellent relief; 12.2% recurrence in 5 years, especially in younger women	Complete and permanent relief; no recurrence
Recovery Time	1–2 weeks; minimal hospital stays (often outpatient)	2–6 weeks, depending on type; hospital stay varies	4–8 weeks; hospital stay 2–5 days
Cosmetic and Physical Impact	Minimal scarring; cosmetically preferred	Visible scars (especially open surgery); less cosmetic	Scars vary by method; they may have hormonal/physical effects
Cost and Accessibility	Higher upfront cost; needs interventional radiology; limited access in low-resource areas	Cost-effective over time; requires surgical facilities	High initial cost but definitive, widely available
Ideal Candidates	Women seeking relief without surgery, not focused on fertility	Women wanting to preserve fertility and manage fibroid conditions	Women done with childbearing, severe symptoms, or high malignancy risk

(This table outlines crucial clinical, surgical, and patient-centred factors associated with each procedure, including their invasiveness, effects on fertility, symptom relief, recovery duration, cosmetic results, financial considerations, and the profiles of ideal candidates. Both UFE and myomectomy are options that preserve the uterus, whereas hysterectomy is a definitive procedure that removes fertility. The choice of treatment should be guided by the patient's goals, the characteristics of the fibroids, and the resources available)

CONCLUSION

Both Uterine Fibroid Embolization (UFE) and myomectomy remain important uterus-sparing treatment options for women dealing with complications caused by uterine fibroids. Myomectomy is still the preferred method for those seeking to preserve fertility, providing more favourable reproductive outcomes, while UFE is more appealing to individuals looking for a less invasive option with a quicker recovery period. Clinical decisions should be personalized, considering patient goals, characteristics of the fibroids, existing health conditions, and the availability of resources. Looking ahead, there is an urgent need for comprehensive, large-scale, multicenter randomized controlled trials to thoroughly assess long-term fertility outcomes and recurrence rates associated with UFE. Current research is constrained by varying methodologies, brief follow-up durations, and an inadequate representation of women actively seeking pregnancy. Comparative studies that account for the type and location of fibroids, as well as the age of patients, are crucial for refining selection criteria and accurately assessing the risks and benefits of each treatment option. Creating clearer, evidence-based guidelines based on high-quality data will facilitate more customized, effective, and patient-centred approaches in the treatment of uterine fibroids.

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