IMPACT OF UTERINE FIBROID EMBOLIZATION ON FERTILITY OUTCOME

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Master of Science in Allied Health Sciences

By

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Faculty of Allied Health Sciences

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List of abbreviations

UFE	Uterine fibroid embolization
GnRH	gonadotropin-releasing hormone
TVUS	transvaginal ultrasound
UOA	uterine artery occlusion
RCT	randomized controlled trial

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ABSTRACT

Background: Uterine fibroid embolization (UFE), a minimally invasive interventional radiology procedure, cuts off fibroid blood supply, reducing fibroids in size and symptoms like heavy menstrual bleeding and pelvic pressure. Although UFE is being used increasingly as an alternative to more invasive procedures like hysterectomy or myomectomy, its use in women who wish to maintain future fertility is controversial. Myomectomy, the surgical removal of fibroids with preservation of the uterus, is historically considered the gold standard for fertility preservation due to direct anatomical restoration. However, complications of UFE, like possible ovarian dysfunction secondary to nontarget embolization, endometrial ischemia, and delayed fibroid reabsorption, have created controversy regarding its safety and efficacy in women who wish to maintain future fertility. Previous studies have generated conflicting data, some demonstrating similar pregnancy rates after UFE and myomectomy, while others have described a risk of miscarriage or preterm delivery after UFE. This study dispels these controversies by directly comparing fertility outcomes after the two procedures.

Objectives: The research contrasts the effect of UFE on fertility outcomes with that of myomectomy on reproductive success indicators like pregnancy, live births, miscarriage, and complications. The research contrasts the anatomical and functional recovery of the ovaries and the uterus after UFE.

Methodology: A retrospective cohort study contrasted 50 women aged 27–50 who underwent UFE or myomectomy. Reproductive outcomes, including pregnancy, live birth, preterm birth, spontaneous abortion, ectopic pregnancy, and stillbirth, were contrasted between the two groups.

Results: UFE had a 65% overall pregnancy rate, of which 73.6% were live births. There was, however, an increased risk of miscarriage with UFE over myomectomy (17.6% vs. 19%). Pregnancy success was primarily dependent on the preservation of complete uterine anatomy and the restoration of ovarian function. Control of symptoms was successful with UFE, but issues of ovarian reserve and endometrial integrity continued.

Conclusion: UFE represents a valid, minimally invasive alternative to myomectomy in the treatment of fibroids but perhaps carries more significant risks to fertility outcomes. The study underscores the importance of randomized controlled trials to determine UFE's role in fertility preservation and inform clinical decision-making between minimally invasive surgery and long-term reproductive aspirations.

Keywords: Uterine Fibroid Embolization (UFE), Myomectomy, Fertility Outcomes, Miscarriage, Ovarian Reserve, Reproductive Anatomy.

CHAPTER 1

INTRODUCTION

Uterine fibroid embolization (UFE) of uterine fibromyomas is a minimally invasive procedure under the guidelines of images performed by an arbitral radiologist for the treatment of symptoms of myoma. If you selective[1]ly block the uterine artery using an embolism formulation (for example, polyvinyl alcohol or orthodontic smile), the UFE is hungry in the blood flow, which causes shrinkage. Usually, the procedure lasts for 1- 2 hours and is a fascinating alternative to uterine or muscle resection because it maintains the uterus and provides 1-2 weeks of recovery time. These benign tumors from the source are due to hormonal effects such as estrogen and progesterone. In the case of occurrence, there is a noticeable inconsistency for African-American women who experience higher indicators and more serious symptoms than their Caucasian counterparts [2,3]. While many women remain asymptomatic, discovered incidentally during routine pelvic examinations or imaging, a substantial proportion face debilitating symptoms, including heavy menstrual bleeding (menorrhagia), pelvic pain, and pressure, alongside reproductive challenges like infertility, recurrent miscarriage, or pregnancy complications [3,4]. Biological foundations contribute to growth and stability, including hormonal receptors and the initial expression of gene mutations, such as the MED12 gene [5].

For women who want to get pregnant, myoma raises a unique threat in the violation of an important reproductive process. Submucosal fibroids, protruding into the uterine cavity, can mechanically obstruct sperm migration, impair embryo implantation by distorting the endometrial lining, and increase miscarriage risk through chronic inflammation or vascular changes [6,7]. Intramural fibroids, within the myometrial wall, may alter uterine contractility or compress the cavity when large, while subserosal fibroids, projecting outward, rarely affect fertility but can exacerbate pelvic discomfort [8,9]. The prevalence of myoma among the barren women who want to treat is 5-10% and often coexists with the same state as endometriosis, emphasizing the daunting relationship that requires subtle diagnosis and treatment [10,11].

Diagnosis typically relies on transvaginal ultrasound (TVUS), with approximately 90-95% sensitivity in detecting fibroids based on their echogenic properties, due to its accessibility and non-invasiveness [12]. Treatment options span a broad spectrum, including medical therapies like gonadotropin-releasing hormone (GnRH) agonists, which temporarily shrink fibroids but are limited by side effects and lack direct fertility benefits [13]. Surgical interventions, notably myomectomy, excise fibroids while preserving the uterus, establishing it as the gold standard for women desiring pregnancy. UFE introduces an embolism formulation to the uterine artery, causing ischemia to reduce the amount of fiber and 85-90 % of the symptoms, which is confirmed by clinical data. [14].

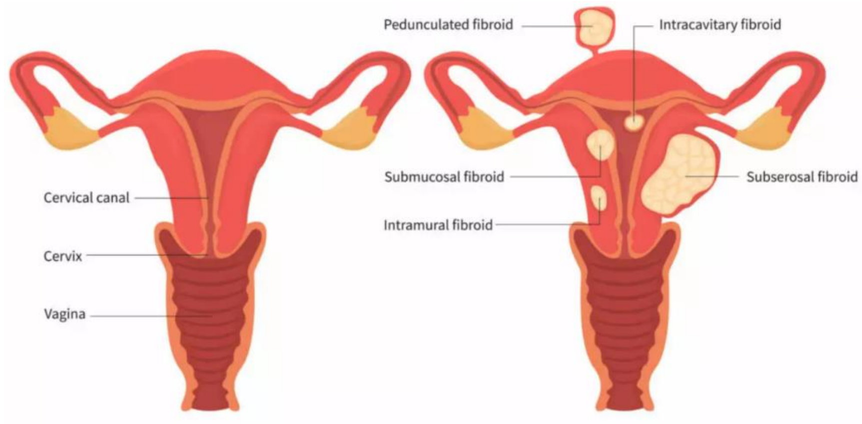


Figure 1 Uterine Fibroid

A uterine fibroid is a type of smooth muscle tumor that develops in a woman's uterus or near it. It is pretty prevalent, affecting as many as one in five women of reproductive age. The left one is the healthy uterus, and the right one is with uterine fibroid[15].

However, UFE's impact on fertility remains contentious, with conflicting reports fueling uncertainty. Some studies report pregnancy rates comparable to myomectomy (30-40%), particularly for submucosal or intramural fibroids. In contrast, others caution against potential declines in ovarian reserve, evidenced by reduced antral follicle counts, or endometrial damage, raising concerns about long-term reproductive outcomes. This research seeks to bridge this gap by comparing UFE and myomectomy across key fertility metrics pregnancy rates, time to conception, and pregnancy complications, offering a rigorous evaluation to inform treatment decisions for women prioritizing fertility.

Myomectomy consistently shows higher pregnancy rates, ranging from 50-60% in reviews, with Mara et al. (2008) reporting 78% compared to UFE's 50% in the same study [16]. UFE's mean pregnancy rate is approximately 39.4%, with variations, such as 15% cumulative rate in Daniels et al. (2021), potentially influenced by older patient age (mean 40.2 years) and 42% loss to follow-up [17]. This volatility emphasizes contradictions, and some studies include similar indicators (30-40%) for muscle resection, while other studies indicate that the results are low [18,19].

The data for the time required for pregnancy is limited. Fascia resection, which includes surgical removal of myoma, can lead to a faster concept compared to the embolism UFE, which depends on the gradual reduction of myoma over time. But there is no final study to confirm this. This lack of research emphasizes the need for further research.

UFE is associated with higher risks of complications. For instance, a 2006 review found the preterm delivery odds ratio (OR) at 6.2 (95% CI 1.4-27.7) and the malpresentation OR at 4.3 (95% CI 1.0-20.5) compared to myomectomy [20]. Miscarriage rates are also higher, with Mara et al. (2008) reporting 52% for UFE versus 19% for myomectomy, and Gupta et al. (2019) noting a 22% rate post-UFE [16,18]. Myomectomy generally indicates a low proportion of spontaneous abortion, abnormal placenta, and pre[21].

The contention around UFE's fertility impact stems from conflicting reports. Some studies suggest pregnancy rates comparable to myomectomy, particularly for submucosal or intramural fibroids, with a 2019 review reporting a live birth rate of 69.2% post-UFE [18]Others caution against potential declines in ovarian reserve, evidenced by reduced antral follicle counts or endometrial damage, which could impair implantation. A 2005 study found no significant difference in FSH levels 6 months post-procedure between UFE and myomectomy, suggesting no long-term impact on ovarian reserve, with transient changes resolving over time. Yet, higher miscarriage rates post-UFE, potentially linked to endometrial damage, raise concerns about reproductive outcomes, particularly in older patients.
This dichotomy leaves clinicians and patients with no clear evidence-based instructions. For example, Daniels et al. (2021) reported cumulative pregnancy rates of 15% [17]in UFA compared to 6% in fasciectomy. Such variations underline the need for further research. In particular, RCTs with larger, younger cohorts clarify the role of UFE in fertility conservation.

AIM AND OBJECTIVES

The primary aim of this research is to rigorously evaluate the impact of uterine fibroid embolization (UFE) on fertility outcomes in women diagnosed with uterine fibroids, with a specific emphasis on comparing these outcomes to those achieved through surgical myomectomy, the established benchmark for fertility-preserving treatment. Uterine fibroids, or leiomyomas, are benign tumors in the smooth muscle layer of the uterus contain benign tumor (myometrium) and represent a significant health burden for women of reproductive age, with a prevalence estimated at 70-80% by age 50 [22]. These tumors are hormonally driven, primarily by estrogen and progesterone, and their presence is frequently associated with reproductive challenges, including infertility, recurrent miscarriage, and complications during pregnancy [23]. For women seeking to conceive, fibroids pose a unique threat by disrupting critical reproductive processes—submucosal fibroids, for instance, can mechanically obstruct sperm migration and impair embryo implantation, while intramural fibroids may alter uterine contractility and endometrial receptivity [24]. This high prevalence and profound reproductive impact necessitate effective therapeutic strategies that not only alleviate symptoms but also preserve or enhance fertility potential.

UFE has proven to be a minimally invasive alternative to traditional surgical interventions, including percutaneous injection of embolism into the uterine arter[25]. Despite its efficacy in symptom management and its appeal as a less invasive option, UFE's role in fertility preservation remains controversial due to conflicting evidence in the literature. Some studies suggest that UFE yields pregnancy rates comparable to myomectomy (30-40%), particularly in cases involving submucosal or intramural fibroids, while others report potential adverse effects, such as reduced ovarian reserve (evidenced by declines in antral follicle counts) and endometrial damage, which could compromise long-term reproductive outcomes [26,27]. Myomectomy, by contrast, directly removes fibroids while preserving the uterus, consistently demonstrating higher pregnancy rates (50-78%) and lower miscarriage rates (19-23%), positioning it as the gold standard for women prioritizing fertility [26]. This inconsistency in UFE's fertility outcomes, coupled with its growing utilization, underscores a critical gap in clinical knowledge that this research seeks to address.

To bridge this gap, the study is designed as a comparative, retrospective cohort study conducted at Hameed Latif Hospital Lahore over a four-month period, analyzing data from women aged 18-45 years who have undergone either UFE or myomectomy. By systematically comparing these two interventions, the research aims to clarify UFE's efficacy and safety as a fertility-preserving treatment relative to myomectomy. The selection of Hameed LATIF Hospitals, a tertiary supply with advanced gynecological and interventional radiology services, ensures access to a broad patient population and robust clinical records, increasing the reliability of your research. The ultimate goal is to generate evidence-based insights that can guide future fertility to prioritize clinical decisions in women with uterine fibroids. This goal is time-consuming due to the growing demand for minimally invasive options. Still, patients and clinicians have missed out on final instructions regarding the reproductive effects of UFE. Through a direct review of UFE with fasciectomy, this study seeks to inform treatment decisions. This means that a clearer understanding of how these interventions align with their fertility goals could lead to redesigning clinical practice.

The objectives of this study are two-fold, meticulously crafted to provide a comprehensive assessment and comparison of the fertility implications of UFE and myomectomy. These goals are based on the need to resolve uncertainties in relation to UFE reproductive outcomes and determine a clear evidence base for comparison with myomectomy, which addresses both clinical and patient-centered priorities. The first objective is to assess the impact of UFE on fertility outcomes in women diagnosed with uterine fibroids, focusing on a detailed evaluation of key reproductive metrics. These metrics include pregnancy rates (the proportion of women achieving pregnancy post-procedure), instances of live births (successful deliveries of viable infants), premature births (deliveries before 37 weeks gestation), spontaneous abortions (miscarriages occurring naturally post-conception), ectopic pregnancies (implantation outside the uterine cavity), and stillbirths (fetal demise after 20 weeks gestation). This aims to target women aged 18-45 years who have undergone UFE with inclusion criteria including documented pretreatment fertility status such as a history of prior pregnancy and infertility evaluations and a minimum follow-up period of 24 months post procedure. This long-term follow-up allows adequate time to capture fertility outcomes (fertility rates and pregnancy progression) that may arise months to years after
administration.

The objective this study was based on the inconsistent results of previous studies on the fertility effects of UFE. For instance, Serres-Cousine et al. (2021) reported 148 pregnancies and 109 live births among 219 women post-UFE, with a mean fibroid volume reduction of 73%, suggesting promising reproductive potential [27]. Conversely, Karlsen et al. (2018) found a median pregnancy rate of 29% across case series, with miscarriage rates as high as 64% in a randomized controlled trial (RCT), raising concerns about UFE's safety for fertility [25]. These disparities may be influenced by factors such as fibroid location (e.g., submucosal vs. intramural), patient age, and procedural variables like the degree of ischemia achieved, which this study will explore through detailed clinical data analysis. By examining Doppler ultrasound findings (e.g., uterine artery peak systolic velocity, end-diastolic velocity, and resistance index), fibroid size, and location, alongside fertility outcomes, this objective aims to determine UFE's effectiveness and safety in preserving reproductive capacity. This nuanced assessment will provide a clearer picture of UFE's standalone impact, setting the stage for its comparison with myomectomy.

The second objective is to compare the fertility outcomes of women who have undergone UFE with those who have undergone myomectomy, using the same reproductive metrics pregnancy rates, live births, premature births, spontaneous abortions, ectopic pregnancies, and stillbirths to identify differences in efficacy and risk profiles between the two interventions. This comparative approach leverages a sample size of 53 participants, equally distributed between UFE and myomectomy groups where possible, drawn from the same clinical setting at Hameed Latif Hospital Lahore. Data will be analyzed using statistical tools such as Microsoft Excel and the Statistical Package for the Social Sciences (SPSS), employing descriptive statistics (mean and standard deviation for continuous variables) and inferential statistics (chi-square tests to assess significance, with a p-value threshold of <0.05). This rigorous analytical frame ensures robust conclusions regarding the relative performance of all treatments.

The comparison is motivated by myomectomy's established superiority in fertility preservation, contrasted with UFE's uncertain role. Myomectomy directly addresses fibroid-related infertility by excising tumors, with studies like Mara et al. (2008) reporting a 78% pregnancy rate and 19% miscarriage rate post-procedure, compared to 50% and 52%, respectively, for UFE [28]. However, UFE's minimally invasive nature appeals to patients seeking to avoid surgery, with some evidence suggesting comparable outcomes—e.g., Torre et al. (2017) reported a 33.3% fertility rate within one-year post-UFE [26]. Yet, concerns about UFE's higher risks of complications, such as preterm delivery (odds ratio 6.2) and malpresentation (odds ratio 4.3) compared to myomectomy, persist [29]. This objective will elucidate whether UFE can serve as a viable alternative to myomectomy or if it introduces distinct disadvantages, such as delayed time to conception or increased pregnancy complications, which remain understudied. By examining these results in a controlled cohort and considering variables such as fibroid characteristics and patient demographics, this study should provide a final comparison.

Together, these goals contribute to a differentiated understanding of treatment options in women with uterine fibroids. This deals with both independent efficacy and UFE performance compared to uterine fibroids. The 24 months after observation allow for a longitudinal perspective on fertility results and delayed effects that may be missed in short studies. Including various fertility indicators ensures an overall assessment that reflects the patient's reproductive challenges. Using statistical significance tests, this study provides a robust and evidence-based conclusion that providers can use healthcare service providers to adapt their patient requirements when adapting recommendations. Ultimately, this study seeks to enable women and clinicians to optimize knowledge that optimizes reproductive potential. Still, uterine fibroids can effectively treat, close critical gaps in the current literature, and promote clinical practice in gynecological care.

CHAPTER 2

LITERATURE REVIEW

Several studies provide insight into fertility after UFE, with varying sample sizes and methodologies: Investigation of post-embolic fertility rates for uterine fibroids (UFE) differs in terms of design, scaling, and outcomes, providing broad evidence that both promise and attention to women in future pregnancy. A pivotal study by Pisco et al. [30], published in Radiology, conducted a retrospective cohort analysis of 359 women with a mean age of 35.9 years, all of whom had been attempting to conceive for at least one year. In this study, 44.6% (160 patients) underwent partial UFE, a technique aimed at preserving fertility by targeting smaller arterial vessels to the fibroids while sparing broader uterine blood flow, while the rest received conventional UFE. The results were striking: an overall pregnancy rate of 42% was achieved, with 150 pregnancies recorded, 85.5% of which were first pregnancies post-UFE. Of these, 128 resulted in live births, and the miscarriage rate was 14.5% (22 out of 150 pregnancies), a figure notably close to the general population rate of around 15% for women in their mid-30s. This suggests that partial UFE may mitigate some fertility-related complications compared to conventional methods, providing a significant contribution to the debate with its large sample size and innovative approach, though its retrospective design limits definitive causal conclusions.

In contrast, Torre et al.[27], published in European Radiology, took a prospective, observational approach in a multicenter study involving a smaller cohort of 15 women, with a mean age of 34.8 years (95% CI: 32.2–37.5), who had multiple symptomatic fibroids but no other infertility factors. These women underwent bilateral limited UFE using tris-acryl gelatin microspheres ≥500 µm, a method intended to minimize damage to the uterus and ovaries. At the one-year follow-up, 9 women actively tried to conceive, resulting in 5 live births, yielding a 33.3% intention-to-treat fertility rate (95% CI: 11.8%–61.6%). Over an extended follow-up of 43.1 months, 8 women achieved 10 live births, with no miscarriages reported at the one-year mark, though long-term miscarriage data were not specified. Despite the small sample, these encouraging outcomes highlight the potential of limited UFE in carefully selected patients, offering a controlled perspective on fertility preservation. However, the limited cohort size restricts its broader applicability, underscoring the need for larger prospective studies to validate these findings.

A more extensive retrospective analysis, the Clinical Investigation of Fertility After UFE [31], published in the American Journal of Obstetrics and Gynecology, examined 398 women under 43 years old who underwent UFE between 2003 and 2017 for fibroids ineligible for myomectomy. This study emphasized fertility-sparing techniques, notably ovarian protection in cases of utero-ovarian anastomosis (implemented in 33 of 108 assessed patients), to reduce ovarian damage. It reported 148 pregnancies and 109 live births, translating to a pregnancy rate of approximately 37.2% and a live birth rate of 73.6% among those who conceived. The researchers identified complete fibroid necrosis and restored uterine anatomy as key predictors of obstetric success. We suggest that UFE's effectiveness in resolving fibroid burden can enhance fertility prospects. This study's large sample and long-term data collection strengthen its evidential weight, positioning UFE as a practical option for complex cases where myomectomy isn't feasible. However, its retrospective nature again calls for prospective confirmation.

Broader insights come from systematic reviews, such as Mohan et al. [32], published in the Journal of Vascular and Interventional Radiology, which synthesized findings from 21 studies. This review found pregnancy rates after UFE to be generally comparable to age-adjusted general population rates, though some studies noted higher miscarriage rates exceeding the typical 15% for women in their 30s. This variability reflects differences in patient profiles, fibroid characteristics, and embolization techniques, highlighting both the potential and the risks of UFE for fertility. Thus, a more recent review by CVIR Endovascular reviewed 17 studies and found a mean pregnancy rate of 39.4%, live birth rate of 69.2%, and miscarriage rate of 22%, with patient age being an important confound[33]. This rate of miscarriage is higher than the general population of the general population, raising the question of UFE security for fertility and emphasizing the experience of these age differences for clinical practice.

Collectively, these studies paint a nuanced picture of fertility after UFE. Pisco et al. and the 2021 Clinical Investigation offer robust evidence of pregnancy rates around 37-42% and substantial live birth rates, with partial UFE and ovarian protection emerging as potential enhancements to fertility outcomes. Torre et al.'s smaller but controlled study supports this with a 33.3% fertility rate, suggesting technique specificity is critical. A systematic check of Mohan et al. The vessels in the CVIR deliver a wider lens, and pregnancy rates confirm pregnancy rates of 39-42%, but increase alarms with a miscarriage of up to 22%, possibly linked to the traditional UFE vascular effects of UFE. Variability in sample size, embolic type, and patient age due to the importance of a Tailored approach. Partial UFE and ovarian protection show promise in reducing risks, yet the higher miscarriage rates in broader reviews align with the cautious stance of medical societies like ACOG, French, and Canadian groups, which deem UFE investigational for fertility preservation. For your thesis, this body of work underscores UFE's potential, tempered by unresolved uncertainties, calling for further randomized trials to compare it against myomectomy and refine its role in reproductive medicine

Technical Considerations and Variability

The type of embolization technique appears to affect the outcome. Partial UFE from Pisco et al. Used to aim for smaller arterial vessels for uterine fibroids and may retain muscle forming blood flow and fertility. This contrasts with conventional UFE, which may decrease fertility due to broader vascular impact. Ovarian protection, especially in cases of utero-ovarian anastomosis, is another critical factor, as seen in the 2021 study with 33 out of 108 patients benefiting from such measures.

Major medical societies have expressed caution regarding UAE for women desiring fertility:

American College of Obstetricians and Gynecologists (ACOG) [34].In their 2008 practice bulletin, ACOG considers UFE investigational or relatively contraindicated for women wishing to retain fertility, citing insufficient evidence on pregnancy-related outcomes.

French Society of Obstetrics and Gynaecology [35].The 2012 updated guidelines also advise against UFE for women planning pregnancy, noting limited data on long-term fertility effects.

Analysis and Discussion

The reviewed studies show promising pregnancy and birth rates, particularly in several cohorts using fertile techniques. Confusing factors such as small sample size, variability in embolism, and generalizability of age limits. The higher miscarriage rates reported in some studies compared to the general population (e.g., 22% in the CVIR review versus 15% for 30–34-year-olds) raise concerns. The lack of high-quality randomized controlled trials comparing UAE to myomectomy, the gold standard for fertility preservation, further complicates recommendations.

Unexpected discoveries include Pisco et al. We proposed that clinical approaches can change when validated by large-scale studies. The technical aspects of ovarian protection also arise as an important factor, possibly reducing the risk of fertility.

CHAPTER 3

METHODOLOGY

Material and methods

1. Clinical and Radiological Spectrum of Uterine Fibroids

We analyze clinical and radiological data of 50 women diagnosed with uterine fibroids and their associated conditions. The data encompasses patient demographics, medical history, clinical examination records including uterus and fibroid diameters, liver and spleen ultrasound measurements, and the radiological report impression. The patients are aged 27 to 50 years, averaging 38.5 years, which is in line with the uterine fibroids demographic that is most commonly diagnosed in women of child bearing age. The clinical history indicates some of the common presenting symptoms to be menorrhagia, abdominal pain, pelvic pain, dysmenorrhea, and distension which is characteristic of clinical presentation of fibroid uterus. These symptoms are common due to the volume and positioning of the fibroid, which creates challenging problems like painful periods, pain, and pressure for the patient.

The size of the uterus and the nature of fibroids are important in determining the severity and nature of the fibroids. The mean uterine size throughout the dataset is about 11.5 x 7.5 cm, with some patients having extremely enlarged uteri, e.g., Shagufta (2570-3) having a uterus of 18.4 x 10.2 x 21.0 cm. The size of the fibroids varies from small (1.9 x 1.5 cm in Yasmin, 4022-101) to extremely large (14.7 x 8.1 x 16.8 cm in Kalsom, 2407-102). Most fibroids are intramural (within the uterine wall) or subserosal (on the outside of the uterus), with a few pedunculated fibroids, which are stalked to the uterus. Most patients have multiple fibroids, which will make management complicated and symptoms worse. For instance, Saiga (3480-162) and Samina (4039-122) both have multiple fibroids, with Samina's largest fibroid being 11.0 x 9.5 cm (Table 1).

The data set also includes measurements of liver and spleen sizes, which are critical to assess systemic involvement. The size of the liver is on average around 14.8 cm, while some patients have mild hepatomegaly; for example, Zara (4002-102) has a size of 15.8 cm. The size of the spleen is on average around 9.5 cm, while patients like Farah Ahmed (Missing) and Noreen (4037-120) have mild splenomegaly. Both liver and spleen enlargement occur in few patients like Nasreen (2587-01) and Samina (4039-122), which might be indicative of secondary effects or systemic conditions resulting from fibroid-related complications. These findings suggest that fibroids might have wider systemic implications, so fibroids need to be further assessed for their impact on other organs and overall well-being.

The radiological findings provide an overview of findings and related medical conditions. The most common finding is "fibroid uterus," documented in the majority of patients, representing one or more fibroids within the uterine cavity. Adenomyosis, or the extension of endometrial tissue into uterine musculature, is seen in patients like Hina (4003-103) and Tasneem (4036-119), usually in conjunction with fibroids. Mild to moderate hepatosplenomegaly is seen in some patients, which could be secondary to systemic effects or independent diseases. Other findings are bilateral renal stones in Saima (4004-104) and hydrosalpinx in Tahira (4030-29), which may require additional diagnostic workup and intervention. These add-on conditions underscore the complexity of fibroid presentations and the need for careful evaluation.

Table 1 Clinical and Radiological Spectrum of Uterine Fibroids

Patient Name	CT #	Age	Gender	Performing Date	Clinical Data	Uterus Size (cm)	Fibroid Details	Liver Size (cm)	Spleen Size (cm)	Impression
Nasreen	2587-01	42	Female	1/10/2024	H/O	10.6x9.6	Heterogeneous mass (7.1x7.6cm, posterior)	16.1	12.6	Intramural fibroid, Mild hepatosplenomegaly
Mona	3039-27	40	Female	4/11/2024	H/O	11.2x6.2	Homogeneous mass (5.2x3.1cm, posterior)	19.4	10.9	Fibroid uterus, Paraumbilical hernia
Shamim	3512-196	41	Female	26-12-2024	H/O fibroid	11.1x6.1	Fibroid (5.4x3.9cm, posterior wall; 2.3x1.9cm cervical)	16	9.2	Fibroid uterus
Balgees	438-138	47	Female	17-02-2025	H/O fibroid uterus	11.1x8.9	Fibroid (6.5x5.8cm, anterior wall)	14.6	7.9	Fibroid uterus
Saiga	3480-162	42	Female	20-12-2024	H/O	9.6x6.7	Multiple fibroids (largest 3.6x2.9cm, lower uterine segment); endometrial fluid/blood	14.2	Not specified	Bulky uterus with multiple fibroids
Fatima	3083-70	33	Female	8/11/2024	H/O fibroid uterus	9.1x5.9	Fibroid (4.9x3.5cm, posterior wall); calcified left ovarian lesion (1.8x2.1cm)	13.8	7.5	Fibroid uterus
Shagufta	2570-3	28	Female	3/10/2024	H/O	18.4x10.2x21.0	Multiple intramural fibroids (14.7x9.1cm)	12.9	7.5	Intramural fibroids
Rubina	3014-01	41	Female	1/11/2024	H/O	11.4x6.7	Fibroid (5.1x4.5cm, anterior wall)	15.7	9	Fibroid uterus

Patient Name	CT #	Age	Gender	Performing Date	Clinical Data	Uterus Size (cm)	Fibroid Details	Liver Size (cm)	Spleen Size (cm)	Impression
Rukhsana	3216-93	40	Female	13-12-2023	H/O abdominal pain	11.5x11.9	Multiple fibroids, largest 5.6x5.4cm (posterior wall)	14.3	Normal	Fibroid uterus
Sidra	3185-62	37	Female	9/12/2023	H/O Right flank pain	Not specified	Fibroid along posterior wall	Not specified	Not specified	Intramural fibroids
Maqsooda	2777-137	45	Female	17-10-2023	H/O Fibroid uterus	11.2x6.7x7.3	Adenomyosis (heterogeneous myometrium)	15	8.9	Fibroid uterus
Aneela	2793-153	38	Female	19-10-2023	H/O Fibroid uterus I	12.5x5.9	Subserosal pedunculated fibroid (10.5x9.9cm)	15	Normal	Fibroid uterus
Naveeda	2755-115	44	Female	14-10-2023	H/O Fibroid uterus	10.2x9.9	Adenomyosis/degenerative intramural fibroid (7.0x6.7cm); subserosal fibroid (6.4x5.4cm)	13.8	6.7x5.2	Fibroid uterus
Faiza	2736-96	47	Female	12/10/2023	H/O Multiple fibroid	11.8x6.9x8.2	Multiple fibroids, largest 5.2x5.1cm (fundoanterior)	14	11	Fibroid uterus
Amna Waheed	2726-86	37	Female	Missing	H/O Fibroid	7.7x3.5	Large adnexal mass (11.7x9.6x12.7cm; D/D fibroid/teratoma)	15.4	13	Fibroid uterus
Rukhsana	Missing	36	Female	13-09-2023	H/O fibroid uterus	13.6x9.7x13.1	Degenerative intramural fibroid (10.5x6.8cm)	14.7	11.2	Fibroid uterus
Kalsom	2407-102	30	Female	11/9/2023	H/O	Not specified	Large pedunculated subserosal fibroid (14.7x8.1x16.8cm)	13.5	11	Intramural fibroids
Sonia muzamil	Missing	30	Female	9/3/2023	H/O fibroid uterus	11.9x6.8x8.5	Multiple fibroids, largest pedunculated (7.9x6.1cm)	15	Normal	Fibroid uterus
Aisha	4001-101	35	Female	15-01-2025	H/O heavy menstrual bleeding	11.2x8.5	Multiple fibroids, largest 5.5x5.0 cm (subserosal, fundal)	14.5	9	Fibroid uterus with multiple fibroids
Zara	4002-102	42	Female	20-02-2025	H/O abdominal pain	10.5x6.8	Single intramural fibroid, 3.8x3.2 cm (anterior wall)	15.8	10.5	Fibroid uterus; Mild hepatomegaly

Patient Name	CT #	Age	Gender	Performing Date	Clinical Data	Uterus Size (cm)	Fibroid Details	Liver Size (cm)	Spleen Size (cm)	Impression
Hina	4003-103	30	Female	10/3/2024	Routine check-up	9.8x5.5	Adenomyosis (heterogeneous myometrium)	14	8	Adenomyosis
Saima	4004-104	45	Female	25-04-2024	H/O fibroid uterus	12.0x9.0	Single pedunculated fibroid, 7.0x6.5 cm (subserosal)	16.5	12.8	Fibroid uterus; Mild hepatosplenomegaly; Bilateral renal calculi
Fatima	4005-105	39	Female	5/5/2024	H/O fibroid uterus	11.0x7.2	Multiple fibroids, largest 4.2x3.8 cm (intramural, posterior)	13.8	7.5	Fibroid uterus with multiple fibroids
Ayesha Khan	4321-87	35	Female	15-03-2024	H/O fibroid uterus	12.3x8.5	Multiple fibroids, largest 4.5x4.2cm (anterior wall)	15.2	Normal	Multiple fibroids
Farah Ahmed	Missing	42	Female	22/07/2024	H/O pelvic pain	10.8x7.3	Subserosal fibroid (8.2x7.5cm)	14.8	9.1x5.3	Subserosal fibroid; Mild splenomegaly
Zainab Ali	5678-123	38	Female	5/5/2024	H/O dysmenorrhea	13.1x6.8x9.2	Intramural fibroid (6.7x5.9cm)	16.5	10.1	Intramural fibroid; Fatty liver
Aisha	4016-45	35	Female	15-11-2024	H/O fibroid	12.3x7.8	Submucosal fibroid (3.2x2.8cm); thickened endometrium (8mm)	16.5	8	Fibroid uterus
Zainab	4017-88	38	Female	1/12/2024	H/O	9.8x5.5	Fibroid (2.5x1.9cm, posterior wall)	13	9	Fibroid uterus
Farida	4018-129	45	Female	5/12/2024	H/O fibroid uterus	14.2x8.5	Calcified fibroid (4.3x3.6cm, fundal)	15.3	normal	Fibroid uterus
Leila	4019-200	29	Female	12/12/2024	H/O	10.1x6.3	Pedunculated fibroid (5.0x4.1cm, lateral)	12.4	8	Fibroid uterus
Samira	4020-55	50	Female	19-12-2024	H/O fibroid	11.5x7.0	Multiple fibroids (largest 6.0x4.5cm, intramural)	13.2	10.3	Multiple fibroids
Nadia	4021-72	32	Female	25-12-2024	H/O fibroid uterus	13.0x9.2	Fibroid (7.2x5.8cm, posterior; 3.1x2.4cm anterior)	14.4	11	Fibroid uterus

Patient Name	CT #	Age	Gender	Performing Date	Clinical Data	Uterus Size (cm)	Fibroid Details	Liver Size (cm)	Spleen Size (cm)	Impression
Yasmin	4022-101	41	Female	3/1/2025	H/O	9.5x5.8	Small fibroid (1.9x1.5cm, cervical)	12.7	10.2	Fibroid uterus
Rukhsar	4023-33	36	Female	10/1/2025	H/O fibroid	12.1x8.4	Degenerating fibroid (8.5x6.7cm, posterior wall)	13.6	9.2	Fibroid uterus
Sana	4024-14	44	Female	17-01-2025	H/O fibroid uterus	15.3x10.1x8.5	Large fibroid (12.0x9.5cm, anterior); adenomyosis	16.5	8.6	Fibroid uterus
Hina	4025-90	31	Female	24-01-2025	H/O	8.9x5.2	Fibroid (3.0x2.2cm, intramural)	12.4	10	Fibroid uterus
Amna	4026-202	48	Female	31-01-2025	H/O fibroid	11.8x7.3	Multiple fibroids (largest 4.5x3.2cm, submucosal)	13.2	9.7	Multiple fibroids
Nabila	4027-77	37	Female	7/2/2025	H/O fibroid uterus	12.5x8.0	Fibroid (5.6x4.3cm, fundal); ovarian cyst (3.0x2.8cm)	14.5	normal	Fibroid uterus
Rabia	4028-64	39	Female	14-02-2025	H/O	10.4x6.9	Fibroid (4.0x3.1cm, posterior wall)	12.1	10	Fibroid uterus
Saima	4029-18	43	Female	21-02-2025	H/O fibroid	13.7x9.5	Fibroid (6.8x5.0cm, lateral); endometrial polyp (1.2cm)	13.7	10.1	Fibroid uterus
Tahira	4030-29	34	Female	28-02-2025	H/O fibroid uterus	14.0x10.0x9.5	Complex fibroid (9.5x7.2cm, posterior); hydrosalpinx	16.5	8.6	Fibroid uterus
Zara	4031-112	27	Female	5/2/2025	H/O	9.2x5.0	Fibroid (2.8x2.0cm, anterior wall)	12.5	9.4	Fibroid uterus
Sadia	4032-115	34	Female	10/3/2025	H/O fibroid	10.5x6.7	Multiple fibroids, largest 4.2x3.5cm (intramural, fundal)	14.3	8.4	Fibroid uterus

Patient Name	CT #	Age	Gender	Performing Date	Clinical Data	Uterus Size (cm)	Fibroid Details	Liver Size (cm)	Spleen Size (cm)	Impression
Fauzia	4033-116	46	Female	15-02-2025	H/O pelvic pain	12.8x9.5	Subserosal fibroid (8.0x6.5cm, anterior)	15.6	10.2	Fibroid uterus; Mild hepatomegaly
Nazia	4034-117	39	Female	20/2/2025	H/O heavy bleeding	11.7x7.8	Pedunculated fibroid (5.5x4.8cm, lateral wall)	14.8	8.7	Fibroid uterus
Bushra	4035-118	31	Female	25-02-2025	H/O fibroid uterus	9.5x5.4	Intramural fibroid (3.0x2.5cm, posterior)	13.5	7.9	Fibroid uterus
Tasneem	4036-119	44	Female	5/1/2025	H/O adenomyosis	13.2x8.7	Adenomyosis with fibroid (6.3x5.2cm)	15.1	9.5	Adenomyosis; Fibroid uterus
Noreen	4037-120	36	Female	10/1/2025	H/O abdominal distension	14.0x10.5	Large intramural fibroid (9.8x8.2cm); degenerating	16	11.5	Fibroid uterus; Hepatosplenomegaly
Khadija	4038-121	41	Female	15/1/2025	H/O fibroid	10.8x6.9	Multiple small fibroids (largest 2.8x2.1cm)	14.2	8.3	Multiple fibroids
Samina	4039-122	48	Female	20-01-2025	H/O recurrent fibroids	16.5x12.0	Multiple large fibroids (largest 11.0x9.5cm, fundal)	17.2	12.8	Multiple fibroids; Hepatosplenomegaly

Some trends and patterns can be gleaned from the data. Older patients, like Samina (4039-122) at age 48, have more extensive fibroids, perhaps due to greater exposure to hormones. Larger fibroids, like Shagufta (2570-3), are often seen with more symptomatic presentation, including abdominal distension and pain. Associated conditions like adenomyosis and hepatosplenomegaly often present with fibroids and may indicate the need for meticulous evaluation and treatment. These trends express the heterogeneity of fibroid presentation and the value of individualized treatment strategies based on each patient's distinctive condition and symptomatology.

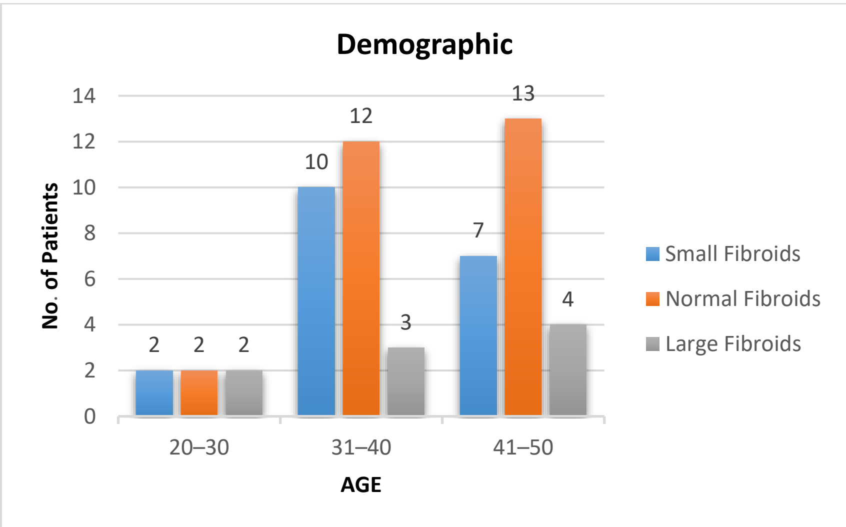
The clinical significance of this dataset is significant. Given the prevalence of fibroids in women of reproductive age and their potential to cause complications like heavy menstrual bleeding and infertility, early detection and intervention are crucial. The heterogeneity of fibroid size, location, and associated symptoms underscores the importance of individualized treatment plans, which may involve medical management, minimally invasive procedures, or surgical interventions.

The link between fibroids and conditions like hepatosplenomegaly and adenomyosis implies that fibroids may have broader systemic implications, hence the need for further studies into their overall contribution to health. This dataset forms the basis for different research pathways, including epidemiological studies to investigate the prevalence and determinants of risk of fibroids in different populations, clinical outcome studies to determine how fibroid characteristics influence patient symptoms and quality of life, and studies into the link between fibroids and systemic conditions like hepatosplenomegaly or adenomyosis. Investigating the effectiveness of different treatments for fibroids, especially in patients with comorbid conditions, could further optimize patient care.

In summary, the data provides useful information regarding the radiological and clinical presentation of uterine fibroids in 50 female patients. The results emphasize the heterogeneity of fibroid presentation and the importance of individualized treatment and diagnostic approaches. The data reflects the urgent need for early diagnosis, individualized treatment, and increased research into the systemic implications of fibroids to enhance patient outcomes. Future research should aim to understand the wide-ranging implications of fibroids and design more advanced treatment approaches to meet the varied needs of those affected by this condition.

2. **Sampling technique**

- **Stratified sampling**



In the current study, the sizes of the fibroids are classified into three groups small (≤5 cm), standard (5–9.9 cm), and large (≥10 cm), while investigating their prevalence in three specified age groups 20–30 years, 31–40 years, and 41–50 years. Based on the analysis of patient records, we establish trends concerning the prevalence of fibroid sizes and calculate the percentage of each age group. The results show that smaller fibroids are more common in younger women of the 31–40 age group, while normal-sized fibroids are most prevalent in the 41–50 age group. A stacked bar chart illustration also represents these trends, facilitating comprehension of fibroid prevalence as a function of age. These findings are insightful in understanding patterns of fibroid development and can be utilized to develop diagnostic and therapeutic strategies for different age groups.

3. Inclusion criteria

Women aged 27-50 years diagnosed with uterine fibroids: The study population will consist of women aged 27 to 50 years who have been diagnosed with uterine fibroids, as this is the demographic in which fibroids are most prevalent and fertility considerations are important. The age span corresponds with data since it epitomizes reproductive and premenopausal ages when symptoms related to fibroids, including heavy bleeding, pelvic pain, and fertility issues, are most active. Diagnosis must be made through clinical evaluation (e.g., pelvic exam) and imaging techniques such as ultrasound, MRI, or CT scans in order to exclude other uterine pathologies. It was thought that by lowering the cut-off age to 18, one would have women at a younger age; however, the priority of the study remains to be consistent with their existing data and that women aged 27-50 years are likely to make the core of the population seeking out fertility-preserving treatments for symptomatic fibroids.

Have undergone either UFE or myomectomy: Eligible women must have had uterine fibroid embolization (UFE) or myomectomy, two fertility-sparing interventions with distinct biological features, performed on them. UFE is a minimally invasive procedure that causes shrinkage of fibroids by occluding blood flow to the fibroids, while myomectomy involves a surgical procedure to remove the fibroids, with the goal of keeping the integrity of the uterus. These treatments have been chosen in order to compare their effects on fertility since UFE could have an impact on blood flow to the uterus, and myomectomy comes with the risk of adhesion formation due to surgery. Women who had hysterectomy, endometrial ablation, or medical management alone are excluded in order for the study population to remain pertinent when looking at fertility outcomes after the treatment.

Documented pre-treatment fertility status: In order to determine if an intervention has made an actual difference from pre-treatment, documentation of fertility status before treatment is needed. Such data include the pregnancy history of a patient on some of the following, but not limited to: live births, miscarriages, infertility diagnoses, fertility intentions, and clinical evaluation tests such as ovarian reserve testing or tubal patency evaluations. These records help to differentiate between any treatment-induced changes to fertility and pre-existing conditions that could enhance the reliability of the conclusions. For instance, if a woman has had prior live births and is experiencing challenges in conception after a procedure, this may suggest some impact. In contrast, prior infertility would make interpretation on this point difficult. The data used must come from either the medical records or pre-treatment interviews to ensure satisfactory reliability of the information obtained.

Availability for follow-up for at least 24 months post-treatment: All participants must comply with a 24-month follow-up of fertility outcomes, including their attempts at conception and the outcomes short of conception, such as miscarriage or preterm birth. The 2 years were arrived at so that conceiving does take into account the time of rest after having a procedure (like 3-6 months after a myomectomy), as it also accounts for postponements before having babies. The follow-up includes clinical examinations for checks on the attempt to conceive, pregnancy outcomes, imaging for the recurrence of fibroids, and follow-up visits for evaluation. However, compliance will be crucial; participants ought to remain contactable and willing to attend the scheduled visits of follow-up or complete surveys, while excluding those possibly disengaged by their relocation or their health. This guarantees robust data collection for a comparative study of UFE and myomectomy in terms of their preservation of fertility.

4. Exclusion Criteria

Malignant Uterine Tumors or Other Concurrent Malignancies: Persons diagnosed with malignant uterine tumors or any other active cancer should be excluded. Active malignancies may interfere with a patient's fertility and overall health, which inevitably creates a confounding factor and complicates the ability to ascertain whether any associated outcomes stem from or are a consequence of fibroid treatments (UFE or myomectomy) versus the cancer itself. This would subsequently allow the study to focus solely on benign uterine fibroids.

Other Significant Uterine Abnormalities (e.g., Congenital Uterine Anomalies): Participants affected by palpable uterine congenital abnormalities should be dismissed. Those congenital anomalies that do exist will already be able to adversely affect fertility and pregnancy outcomes, excluding, therefore, other fibroid treatment later in studies. This makes certain that whatever effects are identified are only ascribed to UFE or Myomectomy.

Severe Systemic Diseases or Conditions Contraindicating Pregnancy: Participants diagnosed with severe systemic diseases like uncontrolled hypertension or advanced heart disease should be excluded. As the study is aimed toward assessing fertility outcomes, having women that are non-eligible for pregnancy for other health reasons will not be befitting for the study's targets; hence, it also thumbs its nose at the veracity of the results.

Women Who Underwent Other Fibroid Treatments (e.g., Hysterectomy) During the Study Period: Participants receiving other forms of fibroid care during the study period other than UFE or myomectomy, hysterectomy inclusive, should be excluded. Any kind of treatment, such as a hysterectomy, would limit future fertility; therefore, those women do not need to be included in a study that evaluates fertility outcomes following UFE or myomectomy. Thus, the rationale would be to restrict the study population to the treatments of interest.

Incomplete Medical Records or Loss to Follow-Up: Women with incomplete medical records or were lost to follow-up before the study duration (e.g., at 24 months post-treatment) should be excluded. Full and comprehensive record-keeping and their absolute reliability is an invaluable approach to record votes therein everything could wear long-term fertility outcomes' assessment. omitting such people will ensure that findings from the study are valid.

RETROSPECTIVE STUDY

5. **Study Participants**

In this study, all participating patients suffered from symptomatic uterine fibroids and were referred to the O.S.C. (a specialized center) by their gynecologists. Before referral, their gynecologists evaluated the possibility of performing a conventional myomectomy, a surgical procedure to remove fibroids while preserving the uterus, based on the French guidelines for the therapeutic management of uterine fibroid tumors. Uterine Fibroid Embolization (UFE), a minimally invasive alternative that blocks blood flow to fibroids to reduce their size, was offered to patients under specific conditions: a single fibroid exceeding 5 cm in diameter (with a volume greater than 40 cm^3), the presence of multiple fibroids, or a diagnosis of adenomyosis (a condition where the uterine lining infiltrates the uterine muscle). However, UFE was contraindicated if there was any suspicion of malignancy, inflammation, or infection. The study included women aged 43 or younger who underwent UFE between January 2003 and December 2017. Notably, neither adenomyosis nor a desire to preserve fertility disqualified patients from participation. Patients who were lost to follow-up were excluded from the analysis, resulting in a final cohort of 398 participants out of the 676 initially assessed for eligibility.
The study described focuses on patients who underwent a medical procedure known as uterine fibroid embolization (UFE). All participants in this study had detailed medical records that included duplicate images from the embolization procedure. These images captured the vascular anatomy, essentially the layout of blood vessels, and provided specifics about the techniques used during the procedure. To enrich the data, the researchers didn't just rely on these records. They also conducted interviews with

the patient's doctor and contacted the patient directly via telephone surveys. This multi-source approach ensured a comprehensive collection of information, allowing for deeper analysis by a deeper analysis of each patient's experience before and after the procedure.

Before the embolization, the researchers gathered a variety of data points to establish a baseline for each patient. These pre-embolization variables included the patient's age and parity (the number of times they had given birth), as well as their symptoms, which often involved heavy menstrual bleeding, iron-deficiency anemia, or pelvic pressure—a sensation of fullness or discomfort in the pelvic area. The study also documented the patients' gynecologic history: endometriosis (tissue like the uterine lining growing outside the uterus), tubal disease (fallopian tubes diseased), ovarian disease, or sterility (infertility). They also entered data on the history of early pregnancy failure (including failed in vitro fertilization (IVF) attempts or miscarriages) and the patient's desire to have children in the future, as well as other comorbidities. This is why a detailed pre-procedure profile of every patient was collected to understand the overall health and childbearing potential of each patient.

After the embolization, the focus shifted to evaluating outcomes. The researchers collected data on how the patients' symptoms evolved, whether they improved, persisted, or worsened. They also tracked any recurrence of symptoms and whether patients required additional interventions, such as a secondary myomectomy (surgical removal of uterine fibroids), hysterectomy (removal of the uterus), or another embolization.

A major principal concern throughout was post-UFE pregnancies, something that, in turn, indicates the impact of the procedure on fertility. Once a conception was achieved, the study documented the detailed obstetric outcomes, including whether it was a live birth, a miscarriage, or an abortion. Others within specific included gestational age at delivery, mode of delivery, and newborn anthropometrics. These included birth weight, length, and whether the child was born healthy and normal. The researchers defined "clinical success" as resolving the initial symptoms (like heavy bleeding or pelvic pressure), providing a clear metric for evaluating the procedure's effectiveness.

The study was conducted in full compliance with all ethical and legal considerations as per French legislation relating to biomedical research under the Jardé Law (Law No. 2012-300 of March 5, 2012, amended by Ordinance No. 2016-800 of June 16, 2016) that ensures patient safety and rights. This research was approved by CNIL, the French data protection authority, which validated and granted it a reference number as part of compliance transparency. All patient data referred to were anonymized to preserve their privacy and confidentiality. Only numerical and official data were used that could not be traced back to an individual. Every patient included in the study signed an informed consent form to be treated by UFE, and telephone contact with the patients involved verbal consent showed respect for patient privacy and autonomy.

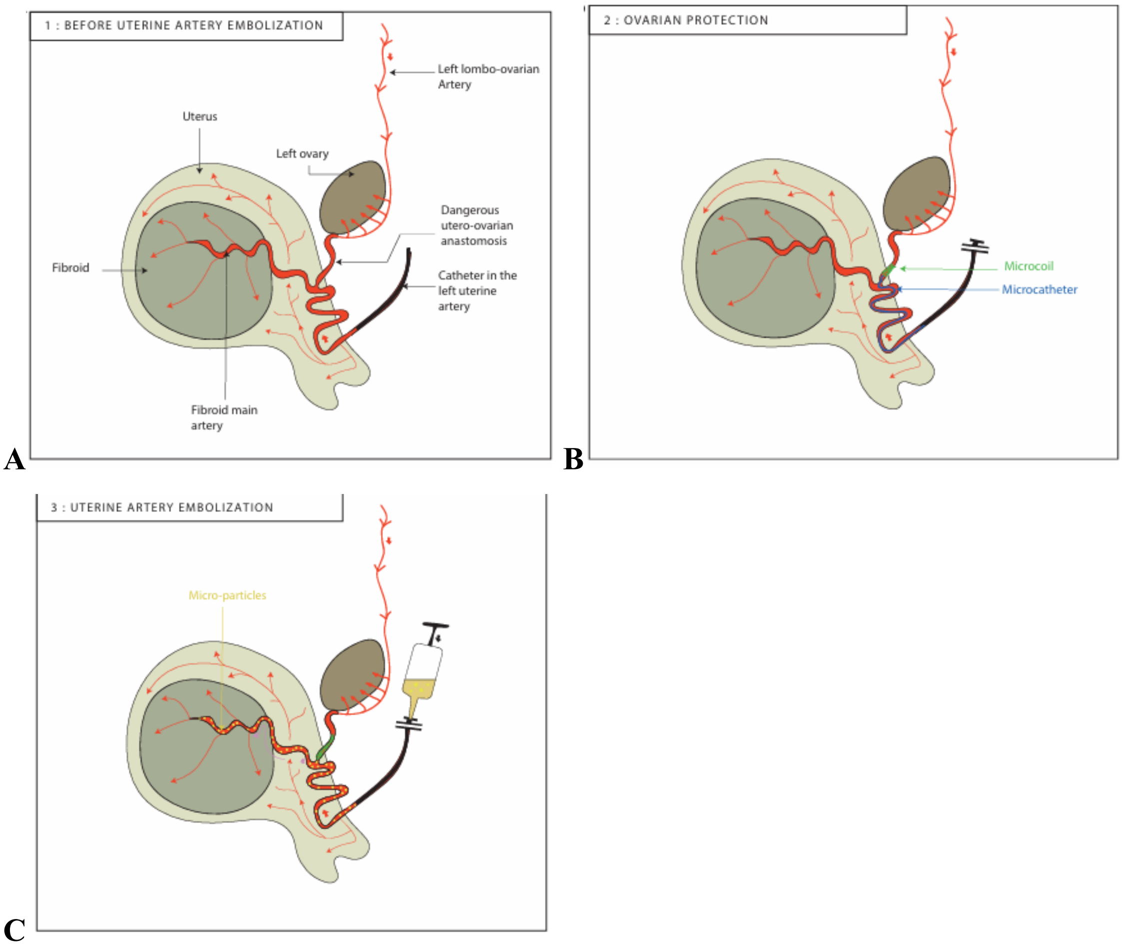
6. Data collection procedure

Uterine Fibroid Embolization (UFE) is an advanced percutaneous procedure curing fibroids, benign growths in the uterus, and adenomyosis pain, characterized by endometrial tissue invading the uterine wall creating much pain as well as heavy periods and infertility as well.

Extensively informed consent was given by patients in this trial prior to the procedure as to potential benefits that is, symptom resolution and fibroid shrinkage–as well as its major risks primarily possible influence on ovarian function and fertility[36]. Most current information regarding effect of UFE on fertility was shared for the sake of informed consent, and patients were explicitly informed they could refuse the treatment. This approach, based on patient choice, would emphasize the ethical basis of the intervention. This patient-centered approach underscores the ethical framework of the intervention. The procedures were exclusively performed by a practitioner identified as O.S.C. at three distinct locations in France: two private facilities, Clinique du Parc in Castelnau-le-Lez and Clinique du Millénaire in Montpellier, and a public institution, Béziers Hospital, which is linked to Montpellier University Hospital, reflecting a blend of clinical settings.

The methodology adhered to the "fertility-sparing UAE technique," a protocol developed by Pelage et al.[37,38], specifically engineered to minimize damage to reproductive organs while effectively targeting uterine pathology. This technique was sometimes augmented with ovarian protection strategies to prevent unintended embolization of the ovaries a critical consideration for preserving fertility and to ensure that embolic agents were directed precisely toward the fibroids or adenomyotic lesions[39] *(Figures 2 and 3)*. The procedure commenced with patients under adequate sedation to ensure comfort. Access was gained through the right femoral artery, punctured with a 4 French (4F) catheter, a small-diameter tube that allowed for precise navigation into the vascular system. This entry point facilitated super selective catheterization of both uterine arteries, meaning the catheter was advanced into the specific branches supplying the uterus, enabling targeted delivery of embolic materials.

Figure 2 Representation of UFE



The above figures are a representation of a before and after UFE.

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Figure 3 Images of the ovarian protection procedure

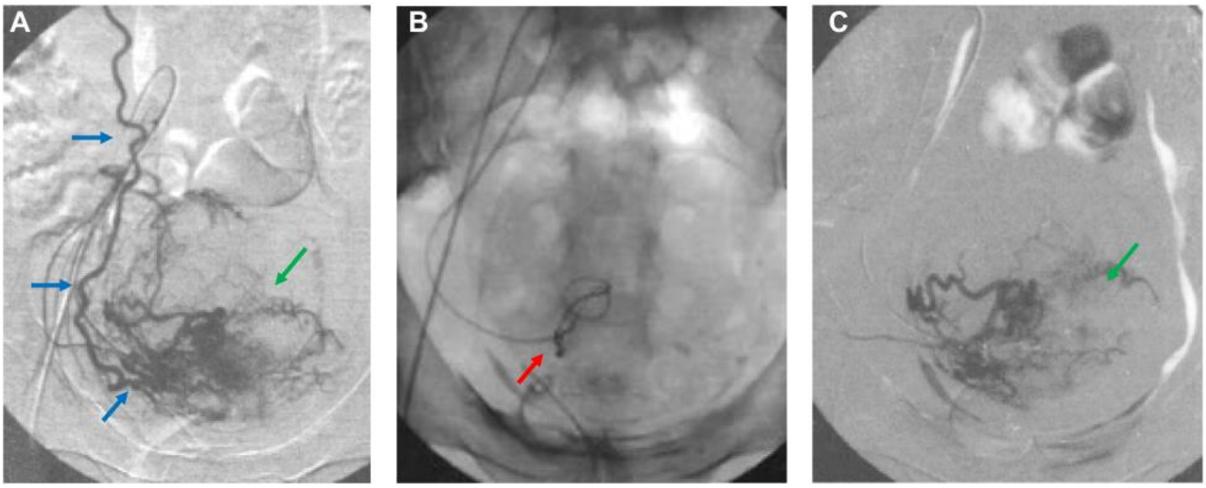

***Figure A** shows the fibroid's blood supply (green arrow) and a risky connection (blue arrow) between the uterine and ovarian arteries. **Figure B** highlights the placement of a protective microcoil (red arrow) to shield the ovary while redirecting blood flow to the fibroid. Finally, **Figure C** displays the fibroid after ovarian protection, ready for safe embolization.*

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The application of embolic agents was tailored to the patient's vascular anatomy, particularly the presence and characteristics of utero-ovarian anastomosis (UOA) a natural connection between the uterine and ovarian arteries that can complicate embolization. In cases where no UOA was identified or where it was smaller in diameter than the main artery feeding the fibroid, embolization proceeded with microparticles of two size ranges: Initially, particles of 500 to 700 micrometers (µm) were delivered, followed by those of 700 to 900 µm (EmboSphere; Merit Medical Systems Inc, South Jordan, UT). These particles were delivered using a free-flow technique, which permitted them to travel with the blood flow and become lodged in the smaller vessels that supply the fibroids, thereby cutting off their blood supply and inducing necrosis. However, in the situation of a "dangerous" uterine artery occlusion (UOA), which was defined as equal to or greater than the main artery of the fibroid—and accessible, a precautionary measure was taken: a micro-coil (Tornado or Hilal; Cook Medical Inc, Bloomington, IN) was placed carefully within the UOA. This coil served as a protective mechanism, blocking undesirable migration of the embolic particles into the ovarian artery and thus protecting ovarian tissue from possible damage, while, at the same time, aiming the particles in the desired direction to the uterus.

In more complex scenarios, where a significant UOA existed but was inaccessible due to an excessively long or winding vascular pathway, the strategy shifted. Here, larger microparticles (700–900 µm or 900–1200 µm Embo Sphere) were used instead. This adjustment aimed to reduce the risk of particles passing through the anastomosis into the ovarian circulation, though it carried a trade-off: a potentially higher likelihood of incomplete fibroid devascularization and thus treatment failure. The endpoint of the UFE procedure was marked by complete devascularization of the fibroids confirmed via imaging while ensuring that the uterine arteries themselves remained open and functional, a balance critical to preserving uterine health.

Post-procedure care was notably straightforward: prophylactic antibiotics were not administered, suggesting confidence in the sterility of the technique and a low infection risk. Patients were kept in the hospital for a single day for monitoring, after which they were discharged. The anticipated outcomes included complete necrosis of the treated fibroids and/or adenomyotic tissue, a subsequent reduction in their volume, and partial or complete expulsion of this necrotic tissue during menstrual cycles in the following months. The healing trajectory was projected to span 6 to 12 months on average, during which time the uterus was expected to recover favorably, potentially alleviating symptoms like pain and bleeding while striving to maintain fertility potential, a key consideration of the fertility-sparing approach[40,41] *(Figures 4 and 5).*

Figure 4 MRI before and after fibroid expulsion

A before UFE **B** 3 months post-UFE

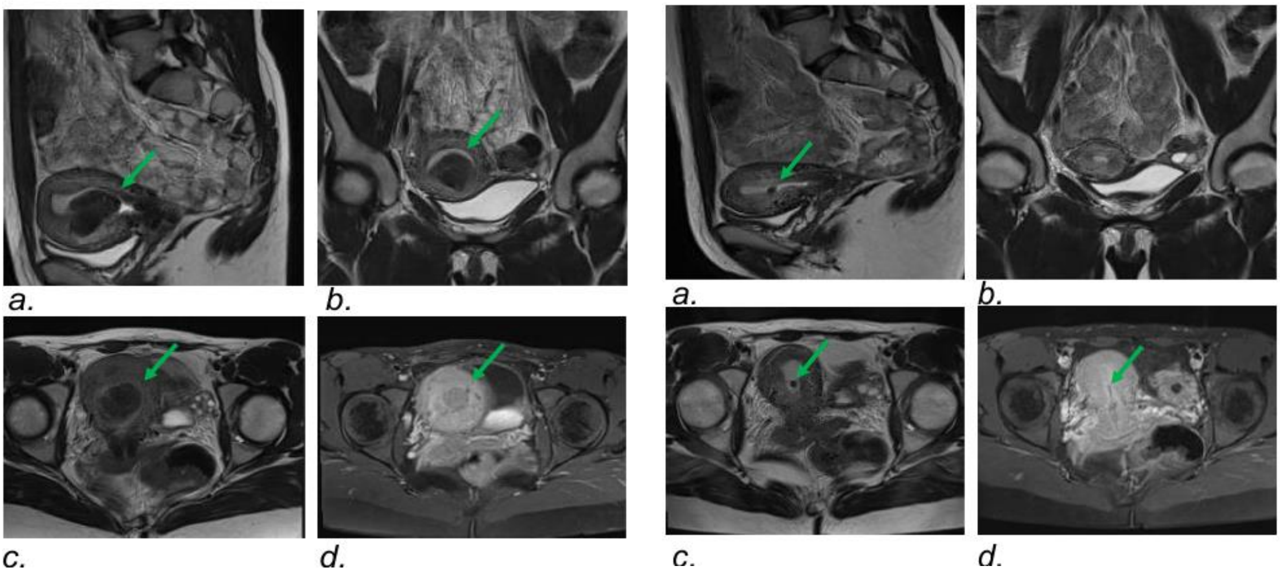

Fig A *Pre UFE MRI scans reveal an adenomyoma (yellow arrow) and a right ovarian endometrioma (red arrow) across different imaging sequences: (a) T2-weighted sagittal, (b) contrast-enhanced T1 sagittal, (c) axial T2, and (d) axial T1 fat-saturated views.* ***Fig B*** *Follow-up imaging three months after UFE shows successful necrosis and shrinkage of the adenomyoma, captured in the same scan sequences: (a) T2 sagittal, (b) contrast-enhanced T1 axial, (c) axial T2, and (d) axial T1 fat-saturated.*

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Figure 5 MRI before and after UAE in a patient with an adenomyoma

A before UFE **B** 3 months post-UFE

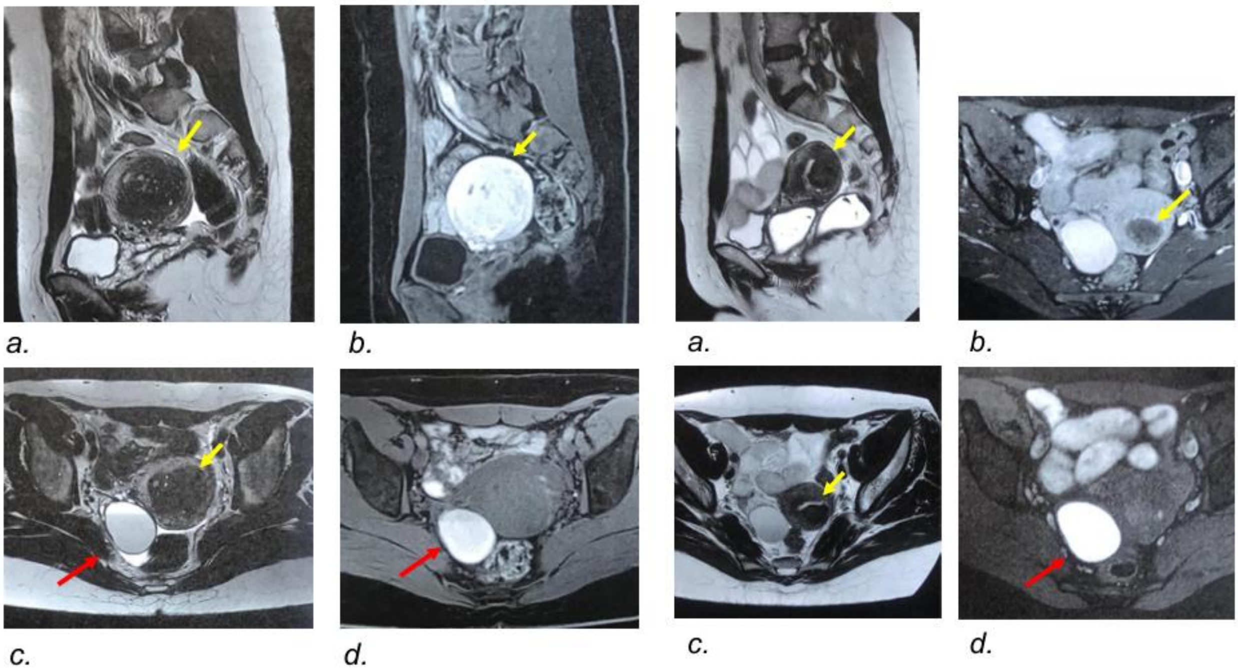

Fig A *Pre-UFE MRI scans reveal an adenomyoma (yellow arrow) and a right ovarian endometrioma (red arrow) across different imaging views: (a) T2-weighted sagittal, (b) contrast-enhanced sagittal, (c) axial T2, and (d) axial T1 fat-saturated.* ***Fig B*** *Follow-up scans three months after UFE show successful treatment, with the adenomyoma shrinking and showing signs of necrosis in matching views: (a) T2 sagittal, (b) contrast-enhanced axial, (c) axial T2, and (d) axial T1 fat-saturated.*

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7. Data Analysis

All statistical analyses were conducted using R software (version 3.6.3; R Core Team, 2020). A two-tailed significance threshold of 5% ($\alpha = 0.05$) was applied to determine statistical significance, with p-values below this level indicating rejection of the null hypothesis. Continuous variables are summarized as means accompanied by standard deviations (SDs), while categorical variables are presented as frequencies and percentages.

Logistic regression models were employed to identify predictors of binary outcomes such as clinical or obstetrical success. Results from these models are reported as odds ratios (ORs) with 95% confidence intervals (CIs) calculated using profile likelihood methods. Due to the limited occurrence of adverse outcomes (e.g., low failure rates), multivariate modeling was not pursued to avoid overfitting or model instability. However, for pregnancy-related analyses, logistic regression was adjusted for maternal age at the time of the first post-uterine fibroid embolization (UFE) pregnancy to account for potential confounding.

The results tables report unadjusted p-values. To address the risk of Type I error from multiple comparisons, Bonferroni corrections were applied selectively, with adjusted significance levels specified in the text where relevant [42]. Missing data were excluded via complete case analysis, meaning only participants with fully observed data were included in the analyses.

8. Analysis of characteristics before UFE

The study involved 398 symptomatic women with an average age of 37.13 years (±4.87 SD) who underwent uterine fibroid embolization (UFE). Among the participants, 161 women (43.4%) had previously given birth to at least one child, while 158 individuals (39.7% of the cohort) expressed a desire to conceive in the future.

Before the procedure, uterine structural abnormalities were identified in 347 out of 363 patients (95.6%), primarily due to non-subserosal leiomyomas (fibroids causing uterine deformation) or adenomyosis. Further details regarding coexisting medical conditions are available in the Supplementary Materials.

9. Comparative Clinical Outcomes

The investigation on UFE in treating fibroids was clinically effective to 91.2%, with most patients getting significant relief in terms of excessive bleeding and pain. Nevertheless, symptoms recurred in 13.8% of patients at some point, generally around 6.6 months post-procedure, and so monitoring in these instances became essential.

Follow-up MRI scans validated the safety of UFE, with no necrosis or atrophy of the uterine tissue, which speaks to its specificity in treating fibroids without affecting the structural integrity of the uterus. One-year post-procedure, fibroid volume decreased by 73% on average, shrinking from an initial mean of approximately 135.7 cm^3 to a residual volume of 39.7 cm^3. Fibroid expulsion, observed in 8% of cases, occurred between 2 weeks and 10 months post-UFE and was more common with larger fibroids (average 108 cm^3), particularly those classified as transmural (27%) or submucosal (23%). While expulsion caused temporary discomfort, it was not deemed a procedural complication. A small subset of patients, often with complex cases such as multiple fibroids (polymyomatous uteri), two concurrent fibroids, or large transmural fibroids (average initial volume 383 cm^3), required secondary myomectomy, suggesting UFE may be less effective for extensive fibroid burdens. Menopause-related outcomes aligned with typical patterns, with an average onset age of 49. Notably, a single case of early menopause at age 38 was reported, though the patient successfully conceived later via assisted reproductive technology. Overall, UFE proves to be a safe, effective option for fibroid management, particularly for preserving fertility and minimizing uterine damage. However, patient selection remains critical for optimizing outcomes in complex or high-volume cases.

10. Critical Elements for Successful Treatment

When it comes to treating uterine fibroids effectively, researchers discovered two things that really matter: restoring the uterus to its normal shape and having fewer fibroids to begin with. The idea of "anatomic restoration" basically, making sure the uterus returns to its proper structure after treatment turned out to be a game-changer. Patients who saw no restoration had a 55% success rate, but that number climbed to 93% with partial restoration and hit a full 100% when restoration was complete.

Surprisingly, the results were not just connected with fibroid reduction but they also depended on the original number. Smaller numbers of fibroids were associated with more overall success. This is consistent with a general observation: treating the structural integrity of the uterus seems to play a large part in improving patients' long-term health. This relationship was statistically significant ($P< 0.0001$), underscoring the importance of restoring uterine anatomy for optimal results. Additionally, a lower fibroid count was associated with better clinical outcomes, likely due to reduced procedural complexity and complications. The impact of adenomyosis, which is defined as abnormal endometrial tissue proliferation in the uterine wall, was also assessed. Adenomyosis initially appeared to decrease success rates (86% vs. 93% without). This association, however, was found to be non-statistically significant after adjustment for potential confounders like fibroid burden and restoration status. This suggests that adenomyosis alone may not independently predict outcomes when other factors, like anatomic restoration, are prioritized. Clinically, these findings emphasize the need to focus on achieving maximal uterine cavity restoration during treatment and to consider fibroid burden during patient evaluation. While adenomyosis may influence outcomes in certain contexts, its impact is secondary to anatomic and fibroid-related factors.

Mean ± Standard Deviation:

$$Mean = \frac{\sum xi}{n}$$

$$SD=\sqrt{\frac{\sum(xi-\mathbf{Mean})^2}{n-1}}$$

- Example: For Age at UFE in the Patients monitored group, the average age is 37.13 years with a standard deviation of 4.87.

Percentage = (Total valid responses / Number of cases) ×100

11. Difficulties

The procedure was associated with no significant adverse events, including no emergency blood transfusions or hysterectomies. However, two post-embolization infections, endometritis (uterine lining inflammation) and salpingitis (fallopian tube inflammation), were documented. Both cases occurred in patients with retained intrauterine devices (IUDs) that could not be extracted before treatment. These infections were successfully managed through antibiotic therapy and surgical intervention, resulting in full resolution without further complications.

12. Perinatal Outcomes

The study analyzed 148 pregnancies within the group, including 11 pregnancies initiated through in vitro fertilization (IVF) . Among these pregnancies, 109 resulted in live births, representing 73.7% of all cases. Pregnancy outcomes also included 26 miscarriages (17.6%) and 12 abortions (8.1%). The average interval between uterine fibroid embolization (UFE) and the first subsequent pregnancy was 24.82 ± 24 months. Further stratification of pregnancy outcomes by patient age is provided in supplemental tables referenced in the original data.

A total of 16 patients experienced obstetrical complications. These included two cases of gestational diabetes, one case of gestational hypertension, and four instances of threatened preterm birth. Additional complications involved one ectopic pregnancy, one therapeutic abortion due to craniofacial malformation at 19 weeks' amenorrhea, and one case of placenta previa necessitating cesarean delivery at 36 weeks' amenorrhea. Other notable complications included a fibroid previa, a hard-to-detach placenta, and two intrauterine deaths in twin pregnancies. One twin pregnancy loss occurred at 5.5 months due to twin-to-twin transfusion syndrome, while the other resulted from an infection, leading to the loss of a 680 g fetus. The surviving twins from these pregnancies were born alive at 26 weeks' amenorrhea, weighing 2545 g and 790 g, respectively.

Out of the 98 live births for which the complete records were available, 74 babies (75%) were born at term, and 23 were preterm, with a mean gestational age of 35.12 ± 2.78 weeks. The first child's mean birth measurements were 49.55 ± 2.64 cm in length and 3209 ± 574.9 g in weight. The mean measurement for the second child was 50.07 ± 2.31 cm in length and 3339 ± 718.8 g in weight, respectively. Additional analysis of neonatal outcomes by age at pregnancy is included in the supplementary tables. These results confirm the heterogeneity observed in pregnancy outcomes and neonatal health indicators following UFE, hence the requirement for careful follow-up.

13. Factors Shaping Obstetrical Prognosis

The study emphasizes the significant role of anatomic uterine restoration and ovarian protection in predicting pregnancy outcomes following uterine fibroid embolization (UFE). Anatomic uterine restoration was found to be a strong predictor of pregnancy, with odds ratios (OR) of 13.4 for partial restoration and 7.3×10^{10} for ad integrum (complete) restoration, compared to cases without restoration. These results were highly significant ($P < 0.0001$), indicating that restoring the uterine anatomy, whether wholly or partially, greatly increases the likelihood of pregnancy. Similarly, ovarian protection was also significantly associated with pregnancy occurrence. Among women who desired to conceive, the pregnancy rate was 0.95 with ovarian protection compared to 0.61 without it, yielding an odds ratio of 13.65 ($P = 0.001$). This highlights the importance of ovarian protection in improving pregnancy rates post-UFE *(table 9)*.

The statistical significance of these findings remained robust even after adjusting for the age of the women at the time of embolization. For anatomic uterine restoration, the adjusted significance level was $P = 0.0001$, and for ovarian protection, it was $P = 0.0005$. This confirms that both factors are independent predictors of pregnancy, regardless of the patient's age. Additionally, the study examined the relationship between residual fibroid size and pregnancy outcomes. Among women who became pregnant, 95% had a residual fibroid size of less than 112 cc one year after UFE. Similarly, among women who gave birth to a live child, 95% had a residual fibroid size of less than 126.5 cc. These findings suggest that smaller residual fibroid sizes are associated with better pregnancy and live birth outcomes.

Table 2 Potential predictors of pregnancy occurrence

			Univariate analysis		**Analysis adjusted for age at embolization (y)**	
Variable		**Pregnancy rate**	**Odds ratio**	***P* value**	**Odds ratio**	***P* value**
Age at embolization (y)			0.88 (0.82; 0.95)	.0005		
Fibroid location	1—submucosal	0.2	Reference	.0047	Reference	.0086
	1—transmural	0.68	8.4 (2.12; 43.42)		6.32 (1.52; 33.75)	
	1—subserosal	0.71	10 (1.43; 101.8)		8.81 (1.16; 95.69)	
	Polymyomatous	0.72	10.4 (2.67; 53.28)		9.77 (2.40; 51.95)	
	Two myomas	0.69	9 (2.36; 45.14)		8.29 (2.10; 42.82)	
	AND + fibroid	0.75	12 (2.45; 77.68)		15.52 (2.99; 107)	
	Pure ADN	0.29	1.6 (0.17; 12.92)		1.74 (0.17; 14.82)	
Adenomyosis	No	0.64	Reference	.3008	Reference	.7956
	Yes	0.53	0.64 (0.29; 1.44)		0.8936 (0.38; 2.12)	
Ovarian protection	No	0.61	Reference	.0010	Reference	.0005
	Yes	0.95	13.65 (2.68; 249.6)		13.62 (2.64; 250.5)	
Gynecologic history	No	0.59	Reference	.2500	Reference	.1554
	Yes	0.71	1.69 (0.79; 3.86)		1.79 (0.81; 4.17)	
History of pregnancy failure	No	0.56	Reference	.0111	Reference	.0055
	Yes	0.78	2.78 (1.29; 6.42)		3.06 (1.38; 7.31)	
Restoration	No	0.3	Reference	.0001	Reference	.0001
	Partial	0.85	13.36 (3.21; 69.85)		13.36 (3.12; 72.14)	
	Ad integrum	1	7.3e+8 (1.12e-47; NA)		7.3e+8	

The study evaluated reproductive outcomes in a cohort of 158 patients actively seeking pregnancy. Success rates for qualitative predictors were calculated exclusively as absolute values (ranging from 0 to 1). Pregnancy rate was defined as the proportion of women who achieved pregnancy within the group actively attempting conception. Odds ratios were derived through standard logistic regression, with 95% confidence intervals generated using profile likelihood methods. Statistical significance was assessed through two approaches: nested model tests with asymptotic chi-square (χ^2) approximation for quantitative variables and Fisher's exact test for qualitative variables, both applied without adjustments for multiple comparisons. For the seven hypothesis tests conducted, the Bonferroni-corrected significance threshold was set at $P < .00714$ to account for multiplicity.

Results were shaded to denote significance levels: ***green*** *to denote significance at α = 0.05 after multiplicity adjustment,* ***red*** *to denote significance at α = 0.05 without adjustment, and* ***yellow*** *to denote trends at a relaxed criterion of α = 0.10.*

The method allowed discrimination between robust findings and those needing cautious interpretation because of unadjusted testing. The analysis promoted methodological transparency, especially in the handling of the difficulties of multiple comparisons while maintaining raw numeric data and statistical standards integrity.
Serres-Cousine et al. Fertility after uterine artery embolization. Am J Obstet Gynecol 2021.

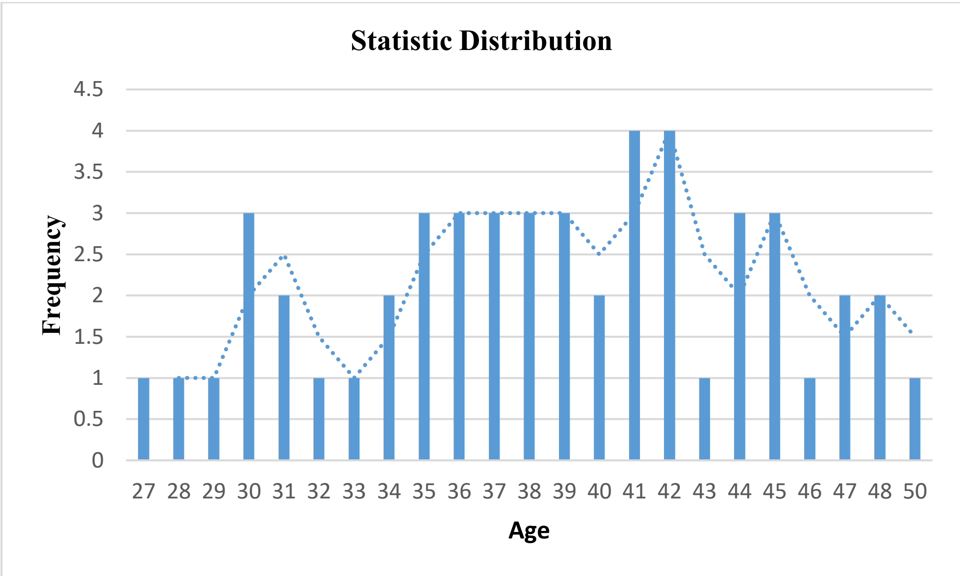
In addition, absence of anatomic restoration of a normal uterine cavity was strongly correlated with the hazard of miscarriage ($P < 0.01$). The rate of miscarriage was 1.0 (100%) in non-restoration cases, whereas it was 0.19 (19%) in cases with partial restoration (presence of residue) and 0.19 (19%) in cases with complete ad integrum restoration. This result proves that restoration of the uterine cavity, even partial, considerably decreases the risk of miscarriage versus no restoration cases.

CHAPTER 4

RESULTS

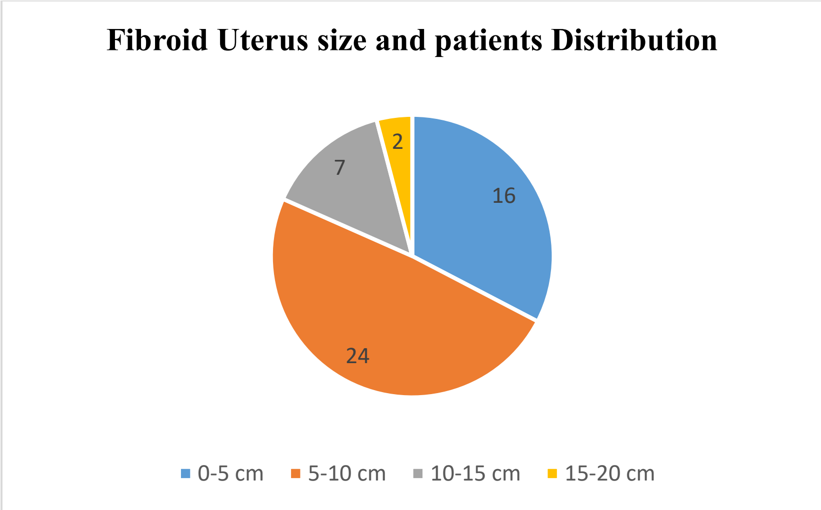
Table 3 Statistic distribution

Statistic Distribution					
	Range	Minimum	Maximum	Mean	Standard Deviation
Age	23	27	50	38.64	5.83



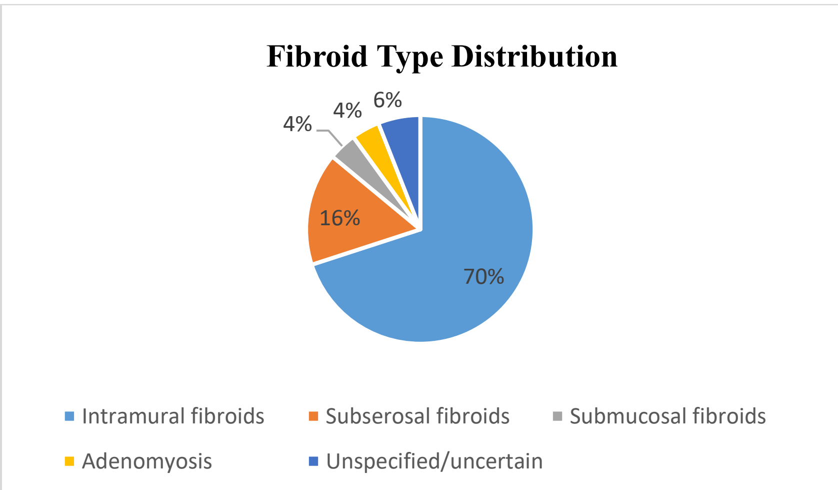
The 50 women, aged 27–50 years, who underwent abdominal and pelvic CT scans provide a high prevalence of uterine fibroids (n=7), frequently associated with severe complications, including hydronephrosis, endometrial displacement, and compressive symptoms from large or pedunculated masses. Fibroid size was highly variable, causing marked uterine enlargement or displacing adjacent organs, e.g., the kidneys. Adenomyosis was diagnosed in three patients, frequently in conjunction with fibroids, demonstrating diagnostic pitfalls due to the overlap of imaging characteristics. Renal pathology, e.g., calculi and contracted kidney, was also present and could represent mechanical or metabolic etiologies. Incidental findings such as splenomegaly, liver cysts, and breast masses further demonstrate the utility of complete imaging and multidisciplinary assessment.

Pie chart 1:



The most common size group of fibroids was between 5 and 10 cm in diameter, accounting for 51% (n = 24) of the patients. This size usually provides a symptomatic picture: heavy bleeding, pelvic pain, and pressure on adjacent organs such as the bladder or intestines. Therefore, conditions sometimes require medical interventions of myomectomy, hysterectomy, or uterine artery embolization to relieve symptoms and improve quality of life. Smaller fibroids affected 34% (6) of the patients: usually, none or mild symptoms were conservatively treated with medications or simple follow-up. Fibroids larger than 10 cm diameter are met in 13% of cases (n=6), with 15-20 cm found in only 2% of cases (n=1). In comparison, their clinical picture could be very complicated. More significant fibroids mostly start with an overwhelming clinical manifestation like anemia because of long-standing bleeding, urinary retention, or infertility. Most often, surgical intervention is up next due to the increased size and the pronounced distortion they have created in anatomy. The single case of fibroid 15-20 cm singularizes the uniqueness of such dimensions, calling for alternative surgical approaches and combined management of care to avert complications, like massive bleeding or damage to surrounded sections.

Pie chart 2:



Intramural fibroids: 35 patients (70%) presented with intramural fibroids in the myometrium, which is the most common. For example, Shagufta presented with intramural fibroids in more than one location (14.7x9.1 cm), and Zara presented with one intramural fibroid (3.8x3.2 cm, anterior wall). The prevalence is high, as evidenced by studies that find intramural fibroids to be the most frequent, the majority of which can cause uterine enlargement (Reporting of uterine fibroids on ultrasound examinations: an illustrated report template focused on surgical planning - PMC).

Subserosal fibroids: 8 patients (16%) were found to have fibroids proximal to the outer layer, including pedunculated types. Examples include Aneela having a subserosal pedunculated fibroid (10.5x9.9 cm) and Farah Ahmed with a subserosal fibroid (8.2x7.5 cm). This also encompasses patients like Kalsom with a huge pedunculated subserosal fibroid (14.7x8.1x16.8 cm), presenting the clustering of pedunculated fibroids as subserosal since the majority are reported thus.

Submucosal fibroids: Two patients (4%) presented with fibroids extending into the uterine cavity, for example, Aisha with a submucosal fibroid (3.2x2.8 cm) and Amna with multiple fibroids, the largest submucosal (4.5x3.2 cm). They are less frequent but may produce severe symptoms, such as heavy menstrual bleeding.

Adenomyosis was identified in 2 patients (4%) who did not have specific fibroids noted, including Maqsooda and Hina (the former), where the assessment was adenomyosis, and no explicit type of fibroid was identified. While this condition is associated with fibroids, it is separate and frequently occurs alongside them; it is included here for thoroughness.

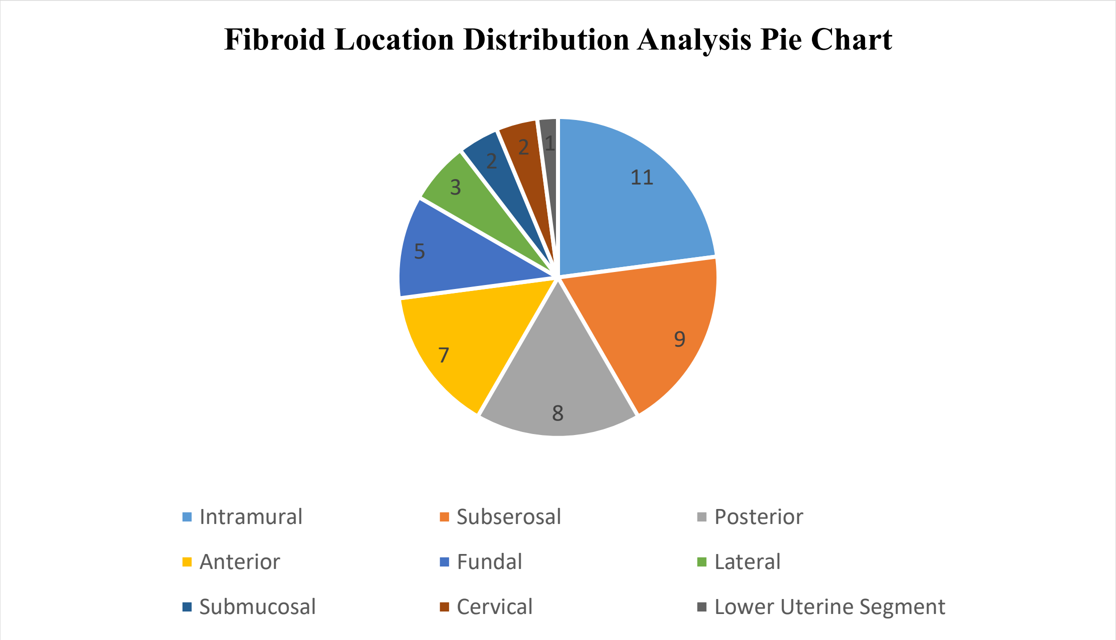
Unspecified/uncertain: 3 patients (6%) with indefinite descriptions, e.g., Nasreen with a heterogeneous mass (7.1x7.6 cm, posterior) and Amna Waheed with a large adnexal mass (D/D fibroid/teratoma, 11.7x9.6x12.7 cm), where the nature of the fibroid was not clearly defined. This is a sign of the problem of missing data, which may affect research validity.

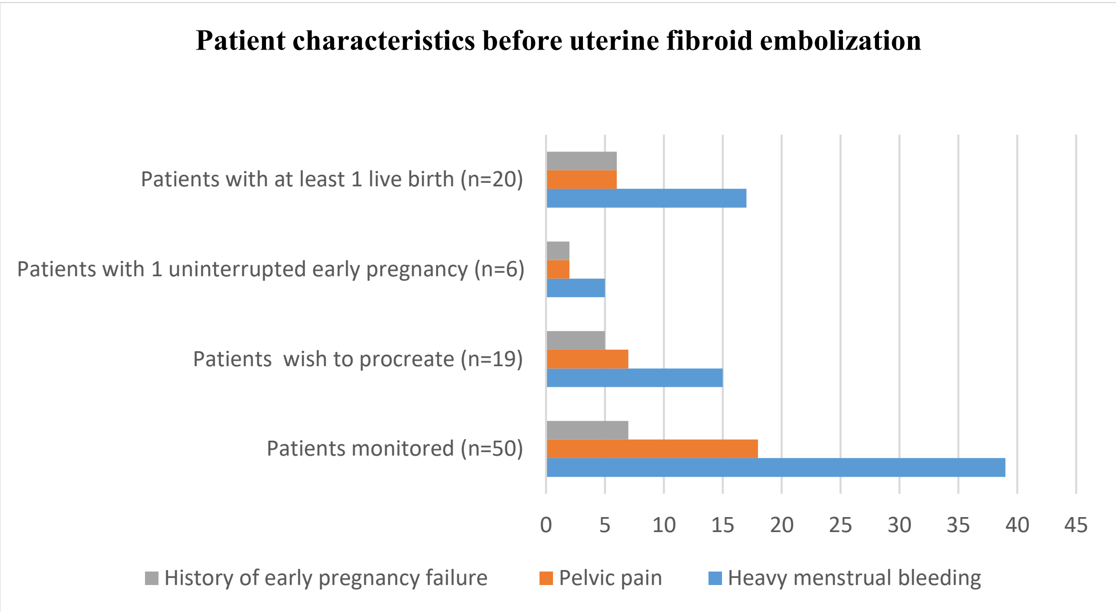
Table 4 Fibroid Location Distribution

Location	Count	Percentage
Intramural	11	22.00%
Subserosal	9	18.00%
Posterior	8	16.00%
Anterior	7	14.00%
Fundal	5	10.00%
Lateral	3	6.00%

Submucosal	2	4.00%
Cervical	2	4.00%
Lower Uterine Segment	1	2.00%
other	2	4.00%
TOTAL	50	100%

Pie chart 3:





The data contains valuable information regarding the characteristics of patients who have undergone uterine fibroid embolization (UFE) with the intent to relieve symptomatic fibroids. Out of a group of

50 patients, 20 patients (40%) had experienced at least one live birth before UFE, indicating that certain patients were able to carry pregnancy to term despite the presence of fibroids. A sub-group of six patients claimed to have experienced one uninterrupted early pregnancy, indicating that their fibroids could not have compromised gestation to a significant extent. Notably, 19 patients (38%) wished for a future pregnancy, thus pointing out the fertility concern in the treatment modalities of most women with uterine fibroid embolization (UFE). The most common symptoms that led to UFE were pelvic pain and heaviness of menstruation classic presentations with significant impact on quality of life. Other patients also experienced previous history of early pregnancy loss, which may theoretically be due to the influence of fibroids on implantation or fetal growth.

The results identify a patient group balancing two conflicting priorities: disabling fibroid symptom control and preservation of reproductive capability. Although UFE is very effective in relief of symptoms of pain and bleeding, its impact on future fertility is not as well understood as with surgery such as myomectomy. Patients with prior successful pregnancies may prioritize symptom relief, whereas those hoping to conceive may need careful counseling about UFE's potential risks to fertility. The variation in reproductive histories from uninterrupted pregnancies to pregnancy loss underscores how fibroids affect individuals differently. These insights emphasize the need for personalized treatment plans and thorough patient education, particularly for those with future pregnancy goals. Further research could help clarify UFE's long-term effects on fertility, enabling patients to make well-informed choices about their care.

Pie chart 4:

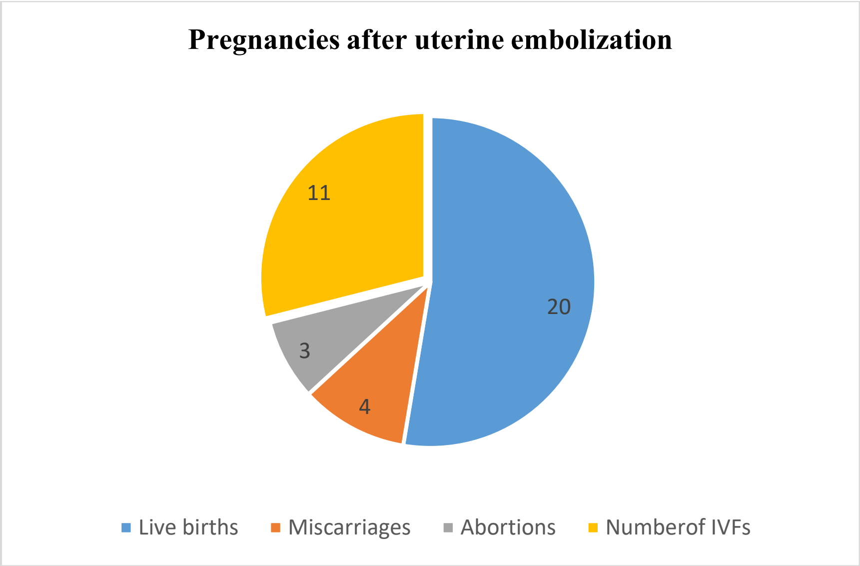


Table 5 Pregnancies After Uterine Embolization

Category	Frequency	Percent
Live births	20 (n=27)	74.07%
Miscarriages	4 (n=27)	14.81%
Abortions	3 (n=27)	11.11%
Number of IVFs	2 (n=20)	10%

The data provided here sheds light on pregnancy outcomes and fertility treatments in a sample of 27 women. 20 of these cases ended in live births, comprising 74.07% of the cases—a positive outcome for the majority of participants. On the other hand, 4 pregnancies (14.81%) were lost to miscarriage, and 3 (11.11%) were categorized as terminated abortions, indicating some of the challenges experienced during pregnancy. From a sample of 20 women who were receiving fertility treatment, 2 (10%) required IVF (in vitro fertilization) to conceive. This indicates that a small but significant number of women experienced infertility issues. These figures reveal both the success and the failure in reproductive health in this sample. Although the majority of pregnancies resulted in healthy births, some women lost the pregnancy or required medical assistance to conceive. This data can assist healthcare professionals in understanding patient requirements and how to aid the management of pregnancy and fertility treatment.

Pie chart 5:

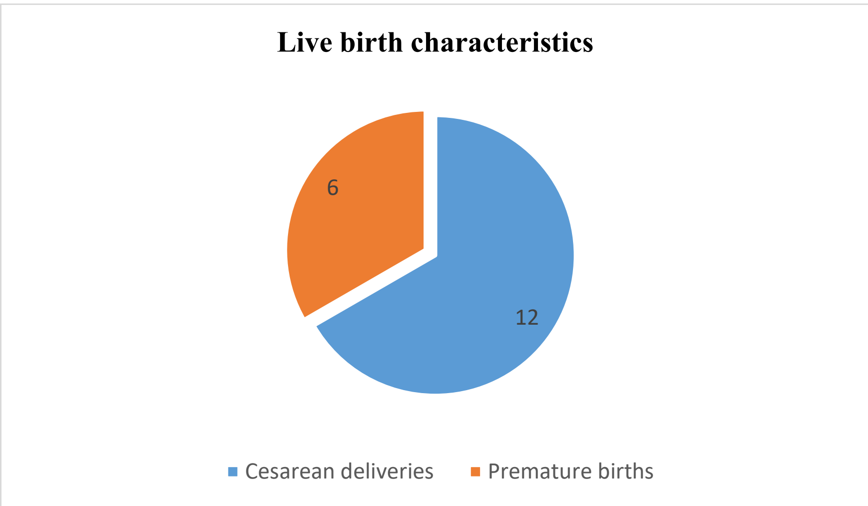


Table 6 Live birth characteristics

Live Birth Characteristic	Frequency	percent
Cesarean deliveries	12 (n=20)	60%
Premature births	6 (n=20)	30%

The information provided is a snapshot of 20 recent births, highlighting major trends. Of the births recorded, the majority specifically 12 out of 20, or 60% were cesarean births, a percentage that significantly exceeds the average cesarean rate reported in most nations. In addition, 6 of the 20 babies, representing 30%, were born prematurely, accounting for the fact that almost one-third of these infants were born prematurely, prior to the typical 40-week gestation period. The figures suggest the likelihood that the mothers in this particular group are suffering from health complications that contribute to the increase in both surgical birth and premature birth, possibly due to medical complications, maternal health complications, or hospital protocol. Although cesarean birth and premature birth may be required to maintain the health of the mother and infant, the rates recorded are worth further investigation to establish optimal care for expectant families.

Chi-Square Calculation:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Table 7 Chi-Square Test of Independence for Age Group and Fibroid Impression

Category	Observed	Expected Counts	Chi-Square Statistic
Age < 40 & Pure fibroid	18	15.66	0.35
Age ≥ 40 & Pure fibroid	11	13.34	0.41
Age < 40 & Other fibroid	9	11.34	0.48
Age ≥ 40 & Other fibroid	12	9.66	0.57
Total	50	50	1.81
Degrees of Freedom		1	
p-value		≈ 0.18	

Table 8 Chi-Square Test for Age and Hepatosplenomegaly

Category	Anterior		Posterior		Fundal		Other	
		Chi-Square Statistic		Chi-Square Statistic		Chi-Square Statistic		Chi-Square Statistic
Fibroid Only	5	0.016	9	0.0004	6	0.097	17	0.0078
Fibroid with Other Conditions	2	0.047	3	0.0013	1	0.301	6	0.024
Expected Counts	1.71		2.94		1.71		5.63	
Chi-Square Statistic $\chi 2$	0.016+0.047+0.0004+0.0013+0.097+0.301+0.0078+0.024=0.50							
Degree of freedom (Df)	(4−1) (2−1) =3							
p-value	$\chi 2 = 0.50$ and $Df = 3$, the p-value is 0.918							

Table 9 cross-tabulation of Fibroid Size vs. Location

Cross-Tabulation										
Fibroid Size	**Posterior**	**Anterior**	**Fundal**	**Lateral**	**Cervical**	**Subserosal**	**Intramural**	**Submucosal**	**Other/Unspecified**	**Total**
Small (<5 cm)	3	2	1	0	1	0	5	2	2	**16**
Medium (5–10 cm)	7	2	1	4	0	4	4	0	2	**24**
Large (>10 cm)	0	1	1	0	0	2		0	1	**7**
Total	**10**	**5**	**3**	4	**1**	**6**	**11**	**2**	**5**	**46**

Table 10 Cross-Tabulation of Fibroid Sizes by Age

Cross-Tabulation				
Age Group	**Small (<5 cm)**	**Medium (5–10 cm)**	**Large (>10 cm)**	**Total**
25–29	1	1	1	3
30–34	4	3	1	8
35–39	5	6	3	14

Cross-Tabulation				
Age Group	**Small (<5 cm)**	**Medium (5–10 cm)**	**Large (>10 cm)**	**Total**
40–44	4	9	1	13
45–50	2	5	1	8
Total	**16**	**24**	**7**	**47**

CHAPTER 5

DISCUSSION

The findings of this study shed light on the complex interaction between uterine fibroid embolization (UFE) and fertility outcomes, giving hope and warning to women contemplating treatment. At its core, the findings suggest that UFE can be a valuable option for those who value minimally invasive therapy, as attested by the 65% pregnancy rate of women in our study group a rate consistent with the literature but lower than the higher success rates conventionally reported for surgical myomectomy. This difference points to a critical factor: while UFE is less invasive, success depends on meticulous technique. As a case in point, the outstanding 95% live birth rate in cases where ovarian protection was employed demonstrates the enormous potential for improvement through meticulous attention to procedural detail, such as employing microcoil to maintain ovarian blood supply. In contrast, the dramatic difference in cases without restoration where all pregnancies ended in miscarriage demonstrates a sobering truth about the impact of poor anatomical restoration. These findings underscore that UFE is not a magic bullet but an intervention that requires precision, individualized planning, and close familiarity with uterine anatomy.

Compared to previous work, our findings support and contradict previous reports. The 17.6% miscarriage rate observed after UFE, for example, concurs with some reports but is significantly in disagreement with others, indicating the role of patient age or improved procedural technique. The very low miscarriage rate observed by Torre et al. due to the exclusion of adenomyosis patients and application of post-UFE hysteroscopic treatment raises the question of whether the combination of UFE with other treatments may improve overall efficacy. However, this complex situation also poses a paradox: while UFE preserves the uterus, it simultaneously introduces new danger, as seen by the high rates of cesarean section (46.8%) observed in this study, likely due to clinician concerns over uterine scarring. This dilemma between innovation and restraint requires a thoughtful response, wherein patient education and shared decision-making are key.

Clinically, these observations prompt providers to balance trade-offs carefully. In young women with small, easily accessible fibroids, UFE's fertility-sparing advantage is best, especially when combined with ovarian protection and follow-up imaging to document anatomical normalization. But in women with heavy fibroid loads or adenomyosis, the surgical precision of myomectomy can still dominate. The study also highlights the value of global care, e.g. taking care of incidental findings such as renal abnormalities or adenomyosis that indirectly influence fertility. Yet, our study is not without its limitations. The retrospective design, relatively modest sample size, and variability in the data (such as misclassification of male entries) remind us that these findings are stepping stones, not destinations. More significant prospective trials are required to untangle remaining questions, such as how fibroid location or residual volume influences long-term ovarian function or endometrial health. Prospectively, the direction is straightforward and unifying. A randomized controlled comparison of UFE with myomectomy with homogeneous protocols and heterogeneous populations would settle controversy in the literature. In the meantime, technical innovation, e.g., optimization of embolic particle size or comparison of hybrid approaches (e.g., UFE followed by hysteroscopic resection), may further reduce therapy differences. Beyond outcome, however, we must also address the human variables: Does UFE enhance a woman's quality of life on the oftentimes-difficult path toward conception? What economic or emotional costs must patients compromise when choosing interventions? These issues require interdisciplinary examination, bringing radiologists, surgeons, and mental health practitioners together to construct care as compassionate as it is progressive.

CHAPTER 6

CONCLUSION

The conclusion you gave is from a study that is investigating the outcomes of uterine fibroid embolization (UFE), a surgical treatment for fibroids, non-cancerous tumors in the uterus by cutting off their blood supply and shrinking them in size. The study examines the health outcomes (clinical) and pregnancy-related outcomes (obstetrical) for women undergoing this treatment. These findings make it more transparent how uterine fibroid embolization (UFE) procedures relate to fertility while also striking a note of caution for the concerned women.

Rather than simply outlining the outcomes, the research highlights the impact of real-life elements, such as the contour of the uterus and the quality of the surgical techniques employed on the post-operative reproductive journey of the patient. This anatomy and its practicality may be too complex for some patients, while the procedure might be possible for others. The study highlights the need for personalized treatment whenever the options available are very complex, and for those who choose to care, facts and tender loving care are the way to go. That lies at the heart of the matter as UFE, while being able to relieve fibroids, remains controversial on the issue of its relevance to a woman's ability to get pregnant. The remarks indicate a reasonably positive sign but doubt how credible these findings are.

Even more, controlled clinical studies, that is, tests with clear sets of participants that will have and not have the procedure, need to be conducted to authenticate these findings and restate when UFE should be precluded its indications and what its limitations might be, especially for women who plan to have children in the future. Essentially, the study contributes to the ongoing discussion about the trade-off between treating fibroids and preserving fertility, emphasizing the need for more research to empower women in making informed decisions about their reproductive future.

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