

Compare the Effectiveness and Safety of Different Surgical and Non-Surgical Treatments for Uterine Fibroids

By

Iffat Jahan Anannya

19346052

A project submitted to the School of Pharmacy in partial fulfillment of the requirements for
the degree of Bachelor of Pharmacy

School of Pharmacy

Brac University

July, 2024

©2024. BRAC University

All Rights Reserved

Declaration

It is hereby declared that

1. The project submitted is my own original work while completing degree at Brac University.
2. The project does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The project does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

Student's Full Name & Signature:

Iffat Jahan Anannya

19346052

Approval

The project titled “Comparison of the Effectiveness and Safety of Different Surgical and Non-Surgical Treatments for Uterine Fibroids” submitted by Iffat Jahan Anannya (ID-19346052) of Summer 2019 of Enrollment has been accepted as satisfactory in partial fulfillment of the requirement for the degree of B.Pharm on 01-07-2024.

Supervised By:

Mushtahsin Ferdousi
Lecturer
School of Pharmacy
BRAC University

Approved By:

Program Director:

Professor Dr. Hasina Yasmin
Program Director and Assistant Dean
School of Pharmacy
BRAC University

Dean:

Professor Dr. Eva Rahman Kabir
Dean
School of Pharmacy
BRAC University

Ethics Statement

There are no trials involving humans or animals in this study.

Abstract

Uterine fibroids, or leiomyomas, are common benign tumors affecting many women of reproductive age, often causing significant symptoms such as heavy menstrual bleeding, pelvic pain, and reproductive issues that impact quality of life. This literature review compares the effectiveness and safety of various surgical and non-surgical treatments for uterine fibroids, including myomectomy, hysterectomy, uterine artery embolization (UAE), pharmacological interventions like Gonadotropin-Releasing Hormone (GnRH) agonists and Selective Progesterone Receptor Modulators (SPRMs), and MRI-guided focused ultrasound surgery (MRgFUS). Surgical options like myomectomy and hysterectomy offer symptom relief but come with higher risks and longer recovery, while UAE presents a less invasive alternative. Non-surgical treatments provide symptom control with varying side effects, with SPRMs showing a better side effect profile than GnRH agonists. MRgFUS offers a non-invasive option with fewer complications, though long-term efficacy requires more study. The review emphasizes the importance of individualized treatment based on factors such as symptom severity, fibroid characteristics, and patient preferences, aiming to inform clinical decision-making and improve patient outcomes, while also suggesting future research directions to fill knowledge gaps and enhance treatment strategies.

Keywords: Uterine fibroids, Myomectomy, Hysterectomy, Uterine artery embolization (UAE), Selective Progesterone Receptor Modulators (SPRMs), MRI-guided focused ultrasound surgery (MRgFUS), Gonadotropin-Releasing Hormone (GnRH) agonists, Symptom relief

Dedication

Dedicated to my parents.

Acknowledgements

To begin with I would like to thank Almighty for His unlimited blessings for empowering me with the strength and willingness to accomplish this project work.

I would like to express my sincere gratitude to my project and academic supervisor, Mushtahsin Ferdousi (Lecturer, School of Pharmacy, Brac University) for her valuable supervision and enthusiasm throughout this project. She was genuinely a source of advice and support throughout my study and project writing. I am incredibly obliged for her precious feedback and suggestions throughout my project that helped me a lot to complete this project work smoothly.

I would also like to express my humble gratitude to Dr. Eva Rahman Kabir (Professor and Dean, School of Pharmacy, Brac University) for her dedication, contribution and guidance towards the student as well as the School of Pharmacy, Brac University

Table of Contents

Declaration	ii
Approval	iii
Ethics Statement	iv
Abstract	v
Dedication	vi
Acknowledgement	vii
Table of Contents	viii
List of Figures	xi
List of Acronyms	xii
Introduction	1
1.1 Background Information	1
1.2 Purpose of the Review	1
1.3 Scope of the Review	2
1.4 Overview of Treatment Modalities	2
1.4.1 Surgical Treatments	2
1.4.2 Non-Surgical Treatments	3
1.5 Importance of Comparative Analysis	3
1.6 Epidemiology	5
1.6.1 Age and Prevalence	6
1.6.2 Racial and Ethnic Disparities	6
1.6.3 Genetic and Hormonal Influences	6
1.6.4 Lifestyle and Environmental Factors	7
1.6.5 Symptomatology and Clinical Impact	7

1.6.6 Healthcare Utilization and Economic Impact	7
1.7 Pathophysiology	8
1.7.1 Cellular and Molecular Pathogenesis	14
Literature Review	15
2.1 Surgical Treatments	16
2.1.1 Myomectomy	16
2.1.2 Hysterectomy	17
2.1.3 Uterine Artery Embolization (UAE)	19
2.2 Non-Surgical Treatments	23
2.2.1 GnRH Agonists	24
2.2.2 Selective Progesterone Receptor Modulators	25
2.2.3 MRI-Guided Focused Ultrasound Surgery	26
Methodology	27
3.1 Data Collection	28
3.2 Inclusion and Exclusion Criteria	29
3.3 Data Analysis	30
Results	31
4.1 Effectiveness of Surgical Treatments	32
4.2 Effectiveness of Non-Surgical Treatments	33
4.3 Safety Profiles	34
4.3.1 Surgical Treatments	35
4.3.2 Non-Surgical Treatments	36
Discussion	37
5.1 Comparison of Effectiveness	38

5.2 Comparison of Safety	39
5.3 Patient-Centered Considerations	40
5.4 Clinical Decision-Making	41
Conclusion	42
6.1 Summary of Findings	43
6.2 Implications for Practice	44
6.3 Future Research Directions	45
References	46

List of Figures

Figure 1: Comparison of ultrasound and MRI in the diagnosis of fibroids in the same patient.....	4
Figure 2: The global distribution of age-standardized rate for prevalence in 2019 (A) and net drift of prevalence rate during 1990 – 2019 (B) for uterine fibroids in 204 countries and territories.....	5
Figure 3: Factors implicated in uterine fibroid (UF) development and growth may influence the endometrial biology.....	9
Figure 4: Diagrams highlighting where fibroids typically develop in the uterus.....	13
Figure 4: Uterine artery embolization (UAE).....	22
Figure 5: GnRH mechanism.....	27

List of Acronyms

UAE - Uterine Artery Embolization

HIFU - High-Intensity Focused Ultrasound

MRI - Magnetic Resonance Imaging

US - Ultrasound

GnRH - Gonadotropin-Releasing Hormone

FDA - Food and Drug Administration

AUB - Abnormal Uterine Bleeding

RFA - Radiofrequency Ablation

LAP - Laparoscopy

TCRF - Transcervical Radiofrequency Fibroid Ablation

SUA - Selective Uterine Artery

IVF - In Vitro Fertilization

FSH - Follicle-Stimulating Hormone

E2 - Estradiol

LH - Luteinizing Hormone

Chapter 1

Introduction

1.1 Background Information

Uterine fibroids, or leiomyomas, are benign tumors arising from the smooth muscle layer of the uterus. These tumors represent one of the most prevalent gynecological conditions, affecting approximately 20-40% of women during their reproductive years. The incidence of fibroids is notably higher among African American women compared to other ethnic groups, and their prevalence tends to increase with age until menopause. (Arleo & Schwartz, 2013)

Uterine fibroids are often asymptomatic; however, when symptoms do occur, they can significantly impact a woman's quality of life. Common symptoms include menorrhagia (heavy menstrual bleeding), pelvic pain, bulk-related symptoms (such as urinary frequency and constipation), and reproductive issues including infertility and recurrent pregnancy loss. The considerable variability in symptomatology and impact necessitates a diverse range of treatment options tailored to individual patient needs and preferences. (Baird et al., 2003)

1.2 Purpose of the Review

This literature review aims to compare the effectiveness and safety of different surgical and non-surgical treatments for uterine fibroids. By examining existing research and clinical data, this review seeks to elucidate the relative advantages and disadvantages of each treatment modality, thereby aiding clinicians and patients in making informed treatment decisions. (Hehenkamp et al., 2008)

1.3 Scope of the Review

The review covers a broad spectrum of treatments for uterine fibroids, divided into surgical and non-surgical categories. Surgical treatments include myomectomy, hysterectomy, and uterine artery embolization (UAE). Non-surgical options encompass pharmacological treatments such as Gonadotropin-Releasing Hormone (GnRH) agonists and Selective Progesterone Receptor Modulators (SPRMs), as well as non-invasive procedures like MRI-guided focused ultrasound surgery (MRgFUS). (Eltoukhi et al., 2014)

1.4 Overview of Treatment Modalities

1.4.1 Surgical Treatments

- **Myomectomy:** This procedure involves the surgical removal of fibroids while preserving the uterus, making it a preferred option for women who wish to maintain fertility. Myomectomy can be performed via various approaches, including hysteroscopic, laparoscopic, and open surgery. (Hur & Donnellan, 2015)
- **Hysterectomy:** As a definitive treatment, hysterectomy entails the removal of the uterus, providing a permanent solution to fibroids. This option is typically considered for women who have completed childbearing or for those with severe symptoms unresponsive to other treatments. (Hur & Donnellan, 2015)
- **Uterine Artery Embolization (UAE):** UAE is a minimally invasive procedure that involves blocking the blood supply to fibroids, causing them to shrink. This method offers an alternative to surgery with a shorter recovery time. (Hur & Donnellan, 2015)

1.4.2 Non-Surgical Treatments

- **Pharmacological Treatments:**

- **GnRH Agonists:** These drugs induce a hypoestrogenic state, leading to temporary shrinkage of fibroids and symptom relief. However, their use is often limited by side effects such as bone density loss and menopausal symptoms. (Harer, 2011)

- **Selective Progesterone Receptor Modulators (SPRMs):** SPRMs, such as ulipristal acetate, offer effective symptom control and fibroid shrinkage with a more favorable side effect profile compared to GnRH agonists. (Hald & Norup, 2007)

- **MRI-Guided Focused Ultrasound Surgery (MRgFUS):** This non-invasive treatment uses focused ultrasound waves to thermally ablate fibroids under MRI guidance. MRgFUS is associated with fewer complications and a quicker recovery compared to surgical options. (Eltoukhi et al., 2014)

1.5 Importance of Comparative Analysis

Comparing the effectiveness and safety of these diverse treatment options is crucial for optimizing patient care. While surgical treatments may offer definitive relief, they come with higher risks and longer recovery times. Non-surgical treatments, though generally less invasive, may not be suitable for all patients and can have significant side effects. Understanding the nuances of each treatment helps tailor interventions to individual patient profiles, considering factors such as symptom severity, fibroid size and location, patient age, fertility desires, and personal preferences. (Harer, 2011)

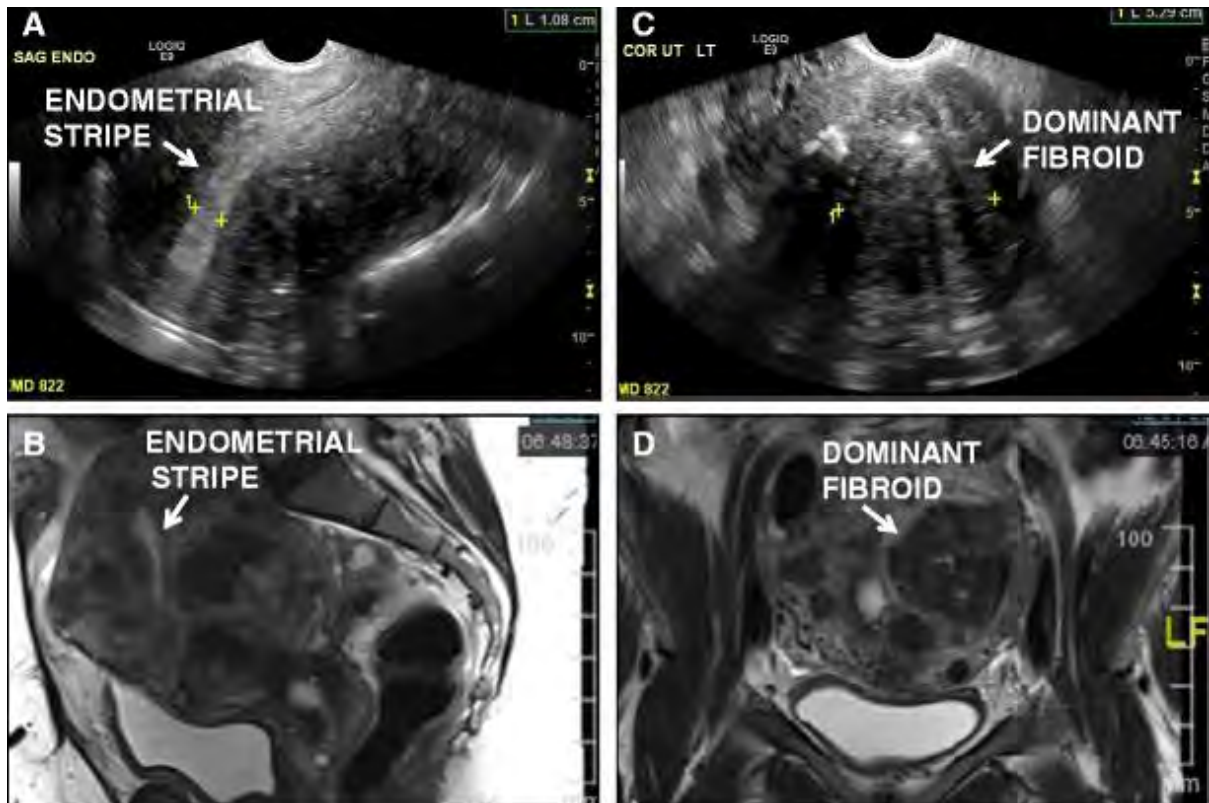


Figure 1: Comparison of ultrasound and MRI in the diagnosis of fibroids in the same patient. a Ultrasound with depiction of endometrial stripe. b MRI with depiction of the endometrial stripe and surrounding fibroids. c Ultrasound image of dominant fibroid. d Coronal view of MRI showing clear delineation of dominant fibroid as well as multiple other fibroids. (Foth, Römer, & Löffler, 2018)

1.6 Epidemiology

Uterine fibroids, or leiomyomas, are the most prevalent benign tumors among women of reproductive age, with an estimated prevalence of up to 70-80% by the age of 50. These tumors originate from the smooth muscle layer of the uterus and exhibit considerable variability in size, number, and location, which significantly influences the clinical presentation and severity of symptoms. (Giannella, Cerami, & Greco, 2017)

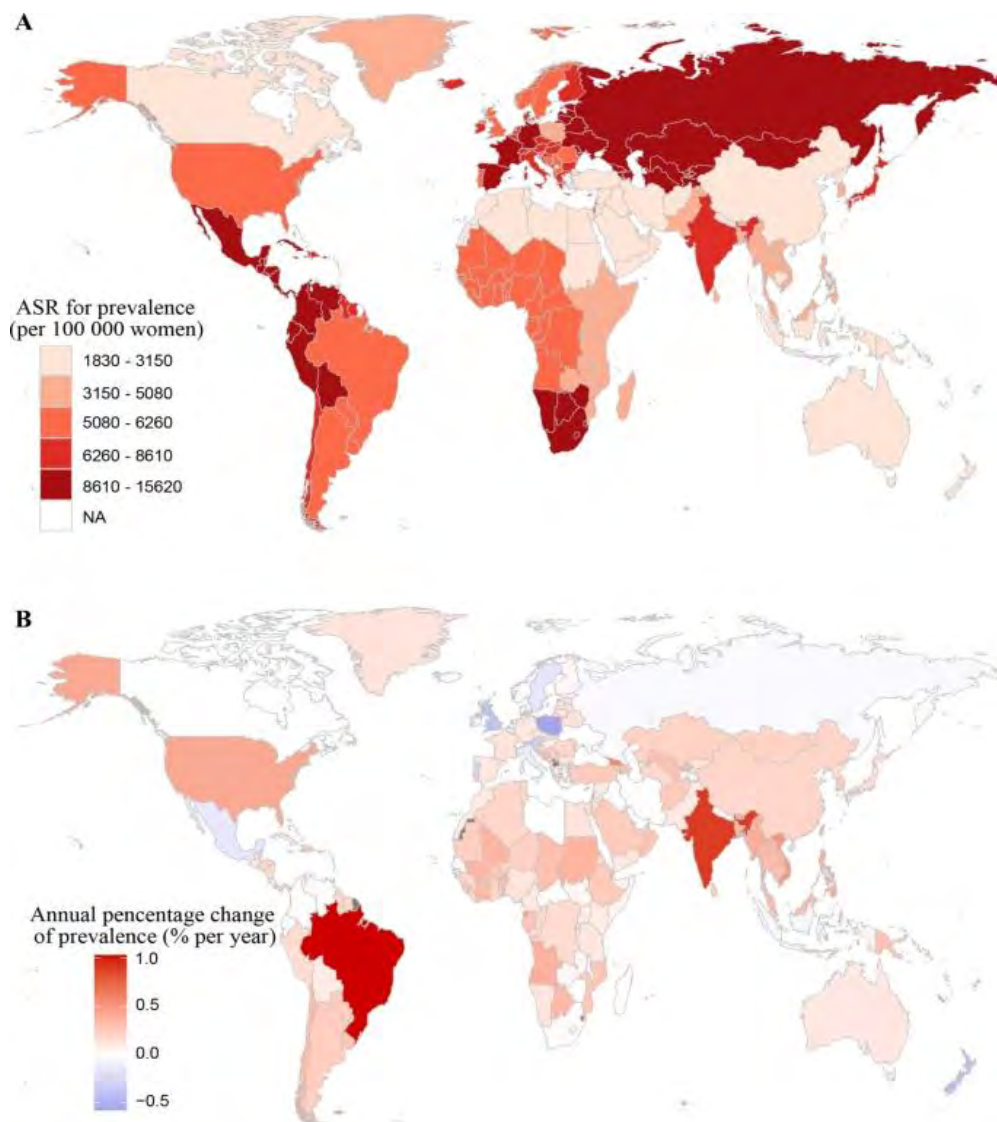


Figure 2: The global distribution of age-standardized rate for prevalence in 2019 (A) and net drift of prevalence rate during 1990 – 2019 (B) for uterine fibroids in 204 countries and territories (Lou et al., 2023)

1.6.1 Age and Prevalence

Uterine fibroids are most frequently diagnosed in women aged 30 to 50 years. The incidence of fibroids increases with age until menopause, at which point their growth typically slows or halts due to hormonal changes. Fibroids are often detected incidentally during routine gynecological examinations or imaging studies conducted for other reasons. (Giannella, Cerami, & Greco, 2017)

1.6.2 Racial and Ethnic Disparities

There are notable racial and ethnic disparities in the prevalence and clinical impact of uterine fibroids. Women of African descent are disproportionately affected by fibroids, with higher prevalence rates, larger tumor sizes, and more severe symptoms compared to women of other ethnic groups. African American women are two to three times more likely to develop fibroids and tend to experience symptoms at a younger age. These disparities may be attributed to genetic, hormonal, and environmental factors that differentially affect fibroid development and progression. (Friedman & Barbot, 2014)

1.6.3 Genetic and Hormonal Influences

Genetic predisposition plays a significant role in the development of fibroids. Women with a family history of fibroids, particularly those with first-degree relatives affected by the condition, are at a higher risk of developing fibroids themselves. Hormonal factors, especially levels of estrogen and progesterone, are closely linked to fibroid growth. Fibroids tend to enlarge during periods of elevated hormone levels, such as pregnancy, and typically shrink after menopause when hormone levels decrease. (Foth, Römer, & Löffler, 2018)

1.6.4 Lifestyle and Environmental Factors

Lifestyle and environmental factors also contribute to the risk of developing uterine fibroids. Obesity is a significant risk factor, likely due to higher levels of circulating estrogen in obese women. Dietary patterns, including high consumption of red meat and low intake of green vegetables, fruits, and dairy products, have been associated with an increased risk of fibroids. Additionally, vitamin D deficiency has been suggested as a potential risk factor, though further research is needed to confirm this association. (Duhan & Sirohiwal, 2013)

1.6.5 Symptomatology and Clinical Impact

While many women with fibroids remain asymptomatic, a substantial proportion experiences symptoms that can severely impact their quality of life. Common symptoms include heavy menstrual bleeding (menorrhagia), prolonged menstrual periods, pelvic pain and pressure, frequent urination, constipation, and reproductive issues such as infertility and recurrent pregnancy loss. The symptom burden associated with fibroids contributes to significant healthcare utilization and economic costs, including frequent medical visits, hospitalizations, and surgical interventions. (Dueholm et al., 2001)

1.6.6 Healthcare Utilization and Economic Impact

The management of symptomatic uterine fibroids involves considerable healthcare resources. Women with fibroids often require ongoing medical management, including pharmacological treatments and surgical procedures, which contribute to substantial healthcare costs. In the United States, the direct and indirect costs associated with fibroid management are estimated to exceed several billion dollars annually. This economic burden underscores the need for effective and efficient treatment strategies to improve patient outcomes and reduce healthcare costs. (Chudnoff et al., 2014)

1.7 Pathophysiology

Uterine fibroids, or leiomyomas, are benign smooth muscle tumors of the uterus. Despite their benign nature, fibroids can cause significant morbidity due to their size, number, and location within the uterine wall. Understanding the pathophysiology of uterine fibroids is crucial for developing effective treatment strategies and improving patient outcomes. (Becker & Spalding, 2013)

1.7.1 Cellular and Molecular Pathogenesis

The exact etiology of uterine fibroids remains unclear, but their development is believed to be multifactorial, involving genetic, hormonal, and environmental influences. The pathogenesis of fibroids begins at the cellular level, where mutations in the myometrial stem cells trigger abnormal cell proliferation. Several genetic alterations, including mutations in the MED12 gene, have been identified in a significant proportion of fibroids. These mutations lead to dysregulated cell growth and contribute to the formation of fibroids. (Jin et al., 2011)

1.7.2 Hormonal Regulation

Hormonal regulation plays a critical role in the growth and maintenance of uterine fibroids. Estrogen and progesterone are the primary hormones implicated in fibroid development. Fibroids possess a higher concentration of estrogen and progesterone receptors compared to normal myometrium, making them more responsive to these hormones. Estrogen stimulates fibroid growth by promoting cell proliferation and extracellular matrix production, while progesterone further enhances this effect by upregulating growth factors and inhibiting apoptosis. This hormonal dependency explains why fibroids tend to grow during periods of high hormonal activity, such as pregnancy, and shrink after menopause when hormone levels decline. (Jacoby et al., 2010)

1.7.3 Growth Factors and Cytokines

Growth factors and cytokines also contribute to the pathophysiology of uterine fibroids. Transforming growth factor-beta (TGF- β), basic fibroblast growth factor (bFGF), and platelet-derived growth factor (PDGF) are among the key growth factors involved in fibroid growth. These factors promote cellular proliferation, angiogenesis, and extracellular matrix deposition, which are critical for fibroid development. Additionally, inflammatory cytokines such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF- α) are elevated in fibroid tissue, suggesting a role for inflammation in fibroid pathogenesis. (Hur & Donnellan, 2015)

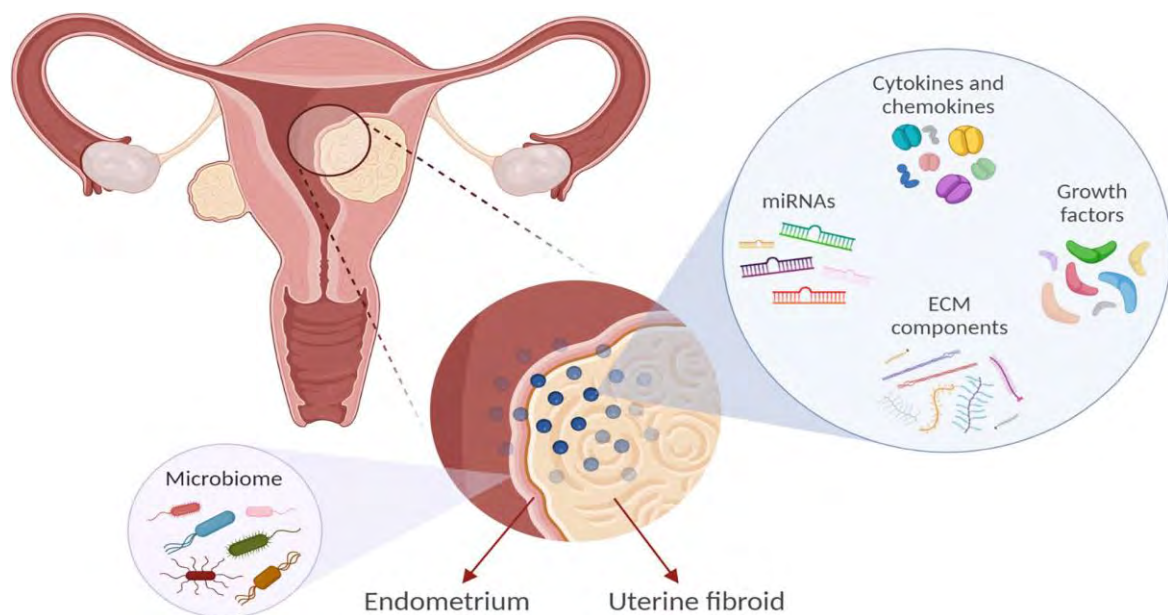


Figure 3: Factors implicated in uterine fibroid (UF) development and growth may influence the endometrial biology. (Uimari, Subramaniam, Vollenhoven, & Tapmeier, 2022)

1.7.4 Extracellular Matrix Remodelling

The extracellular matrix (ECM) plays a significant role in the structural integrity and growth of fibroids. Fibroids are characterized by an abundant and disorganized ECM, which includes collagen, fibronectin, and proteoglycans. The increased ECM deposition is driven by growth factors and cytokines and contributes to the stiffness and size of fibroids. Enzymes such as

matrix metalloproteinases (MMPs) and their inhibitors (TIMPs) regulate ECM turnover, and imbalances in their activity can lead to excessive ECM accumulation. (Baird et al., 2003)

1.7.5 Angiogenesis

Angiogenesis, the formation of new blood vessels, is another critical factor in fibroid growth. Fibroids exhibit increased angiogenesis compared to normal myometrium, which provides the necessary blood supply to support their growth. Vascular endothelial growth factor (VEGF) is a key mediator of angiogenesis in fibroids, promoting the proliferation and migration of endothelial cells to form new blood vessels. (Barbieri, 2019)

1.7.6 Genetic Predisposition

Genetic predisposition plays a significant role in the development of uterine fibroids. Women with a family history of fibroids are at a higher risk of developing the condition. Several genetic loci have been associated with an increased risk of fibroids, and genetic studies have identified specific mutations, such as those in the MED12 gene, that are common in fibroid tissue. These genetic factors likely interact with hormonal and environmental influences to promote fibroid growth. (Harer, 2011)

1.7.7 Environmental and Lifestyle Factors

Environmental and lifestyle factors can also influence the development and progression of uterine fibroids. Obesity, for instance, is associated with increased estrogen levels due to the aromatization of androgens in adipose tissue, which can promote fibroid growth. Additionally, dietary factors, such as high intake of red meat and low consumption of fruits and vegetables, have been linked to an increased risk of fibroids. Environmental exposures, such as endocrine-disrupting chemicals, may also play a role by interfering with hormonal regulation. (Gonsalves & Binkert, 2014)

1.8 Prevalence of Uterine Fibroids

1.8.1 Global Prevalence

Uterine fibroids, or leiomyomas, are the most common benign tumors affecting women of reproductive age. The global prevalence of uterine fibroids varies widely, influenced by factors such as race, age, and geographic region. Epidemiological studies estimate that the overall prevalence ranges from 20% to 80% among women by the age of 50, with significant variations based on the methods of diagnosis and population studied. (Foth, Römer, & Löffler, 2018)

1.8.2 Age-Related Prevalence

The prevalence of uterine fibroids increases with age, peaking in women aged 40 to 50 years. Studies have shown that fibroids are relatively rare in women under 20 years old but become increasingly common as women approach their late reproductive years. By the age of 50, it is estimated that up to 70-80% of women will have developed uterine fibroids, although many of these may remain asymptomatic and undiagnosed. (Foth, Römer, & Löffler, 2018)

1.8.3 Racial and Ethnic Differences

There are significant racial and ethnic disparities in the prevalence of uterine fibroids. African American women are disproportionately affected, with studies indicating they are two to three times more likely to develop fibroids compared to white women. Furthermore, fibroids in African American women tend to be larger, more numerous, and more symptomatic. Hispanic and Asian women also have a higher prevalence of fibroids compared to white women, although the disparities are less pronounced than those observed in African American women. These differences are thought to result from a combination of genetic, hormonal, and environmental factors. (Eltoukhi et al., 2014)

1.8.4 Diagnostic Methods and Prevalence

The reported prevalence of uterine fibroids is highly dependent on the diagnostic methods used. Ultrasound and magnetic resonance imaging (MRI) are the most common diagnostic tools, with MRI being more sensitive in detecting smaller and asymptomatic fibroids. Studies using imaging techniques generally report higher prevalence rates compared to those relying on clinical diagnosis alone, where many cases may go undetected, especially if the fibroids are small or asymptomatic. (Dueholm et al., 2001)

1.8.5 Symptomatic vs. Asymptomatic Fibroids

A significant number of uterine fibroids are asymptomatic and may remain undiagnosed without routine screening. Approximately 50-60% of women with fibroids are asymptomatic, and these fibroids are often discovered incidentally during pelvic examinations or imaging for other reasons. Symptomatic fibroids, on the other hand, can cause severe symptoms such as heavy menstrual bleeding, pelvic pain, and reproductive issues, leading to higher rates of medical consultations and interventions. (Gonsalves & Binkert, 2014)

1.8.6 Impact of Reproductive History

Reproductive history also influences the prevalence of uterine fibroids. Nulliparity (having never given birth) is associated with an increased risk of developing fibroids. Conversely, pregnancy and childbirth appear to have a protective effect, potentially due to changes in hormone levels and uterine remodelling during and after pregnancy. Women who have given birth are generally at a lower risk of developing fibroids compared to those who have not. (Friedman & Barbot, 2014)

1.8.7 Geographic Variations

Geographic variations in the prevalence of uterine fibroids are also evident. Higher prevalence rates are reported in urban areas compared to rural settings, possibly due to differences in lifestyle, environmental exposures, and access to healthcare. Studies from different parts of the world indicate variability in the prevalence, reflecting the influence of genetic, environmental, and healthcare access factors. (Jacoby et al., 2010)

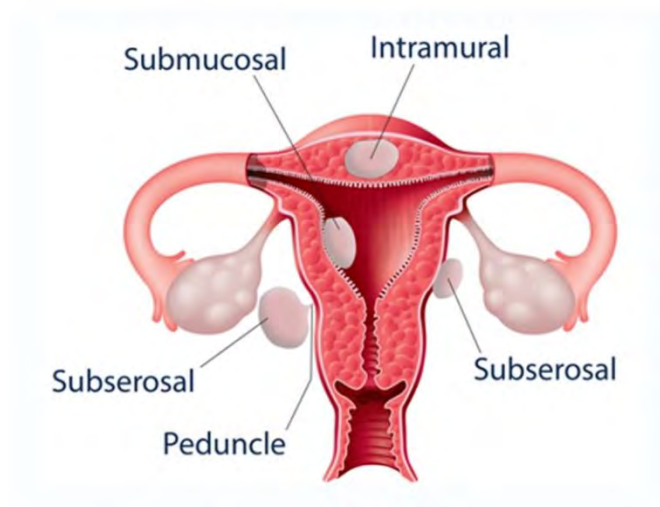


Figure 4: Diagrams highlighting where fibroids typically develop in the uterus (Giannella, Cerami, & Greco, 2017)

Chapter 2

Aims and objectives

The primary aim of this literature review is to comprehensively compare the effectiveness and safety of various surgical and non-surgical treatments for uterine fibroids, aiding clinicians in making informed decisions and improving patient outcomes. The objectives include evaluating surgical treatments such as myomectomy, hysterectomy, and uterine artery embolization (UAE) in terms of their effectiveness, risks, and long-term outcomes; assessing non-surgical treatments like pharmacological interventions (GnRH agonists and Selective Progesterone Receptor Modulators) and MRI-guided focused ultrasound surgery (MRgFUS) for their efficacy, safety, and side effects; conducting a comparative analysis of surgical versus non-surgical treatments regarding symptom relief, fibroid size reduction, and patient satisfaction; analyzing the safety profiles of all treatments with a focus on common and severe complications; examining the impact of different treatments on patients' quality of life based on patient-reported outcomes and clinical data; and identifying gaps in the current research to suggest future studies that could enhance understanding and treatment strategies for uterine fibroids. (Foth, Römer, & Löffler, 2018)

Chapter 3

Methodology

The methodology for this literature review involved a comprehensive search strategy across major databases including PubMed, Cochrane Library, and Scopus using keywords such as "uterine fibroids," "leiomyomas," "surgical treatment," "non-surgical treatment," "myomectomy," "hysterectomy," "uterine artery embolization," "GnRH agonists," "Selective Progesterone Receptor Modulators," and "MRI-guided focused ultrasound surgery." The inclusion criteria encompassed peer-reviewed articles in English published between 2000 and 2023, focusing on adult women with uterine fibroids and evaluating the effectiveness and safety of various treatments. Exclusion criteria ruled out non-English articles, studies on basic science or animal models, case reports, and editorials. Data were extracted on study characteristics, patient demographics, treatment details, outcomes, and safety profiles, and quality assessment was conducted using the Cochrane Risk of Bias tool for RCTs and the Newcastle-Ottawa Scale for observational studies. A narrative synthesis approach was employed to compare the effectiveness, safety, and quality of life impacts of surgical and non-surgical treatments, with descriptive statistics summarizing key outcomes. Ethical standards were adhered to throughout, though potential limitations such as publication bias and study heterogeneity were acknowledged. (Cheng & Chao, 2014)

Chapter 4

Surgical Treatments

4.1 Introduction

Surgical treatments are a primary approach for managing symptomatic uterine fibroids, especially when other treatments have failed or are contraindicated. The choice of surgical method depends on several factors, including the size, location, and number of fibroids, the severity of symptoms, the patient's age, reproductive plans, and overall health. The main surgical options include myomectomy, hysterectomy, and uterine artery embolization (UAE), each with its indications, benefits, and risks. (Duhan & Sirohiwal, 2013)

4.2 Myomectomy

4.2.1 Overview and Indications

Myomectomy is a surgical procedure specifically designed to remove fibroids while preserving the uterus, making it the preferred option for women who wish to retain their fertility. Myomectomy can be performed using various techniques, including hysteroscopic, laparoscopic, and open abdominal approaches.

4.2.2 Techniques

- **Hysteroscopic Myomectomy:** This minimally invasive technique is suitable for removing submucosal fibroids. A hysteroscope is inserted through the vagina and cervix into the uterus, allowing for the resection of fibroids using specialized instruments.
- **Laparoscopic Myomectomy:** This minimally invasive technique involves making small incisions in the abdomen through which a laparoscope and surgical instruments

are inserted. It is suitable for removing smaller fibroids and those that are not deeply embedded in the uterine wall.

- **Open Abdominal Myomectomy:** Also known as a laparotomy, this approach involves a larger abdominal incision to access and remove fibroids. It is typically reserved for larger, more numerous, or deeply embedded fibroids. (Hehenkamp et al., 2008) (Huang & Ku, 2013)

4.2.3 Outcomes and Complications

Myomectomy generally results in significant symptom relief and improved fertility outcomes. However, it carries risks such as intraoperative bleeding, postoperative adhesions, infection, and the potential for fibroid recurrence. The choice of technique impacts recovery time, with hysteroscopic and laparoscopic approaches offering shorter hospital stays and faster recovery compared to open abdominal surgery. (Hehenkamp et al., 2008)

4.3 Hysterectomy

4.3.1 Overview and Indications

Hysterectomy, the surgical removal of the uterus, is the definitive treatment for uterine fibroids, providing a permanent solution with complete symptom relief. It is indicated for women who have completed their childbearing, have large or multiple fibroids, or when other treatments have failed. (Barbieri, 2019)

4.4.2 Techniques

- **Total Abdominal Hysterectomy (TAH):** This involves removing the uterus through a large abdominal incision. It is suitable for very large fibroids or when there is a suspicion of malignancy.

- **Vaginal Hysterectomy:** The uterus is removed through the vaginal canal, which can be a less invasive option for women with smaller fibroids.
- **Laparoscopic-Assisted Vaginal Hysterectomy (LAVH):** This combines laparoscopic and vaginal approaches, allowing for minimally invasive removal of the uterus.

4.3.3 Outcomes and Complications

Hysterectomy offers complete and permanent symptom resolution, eliminating the possibility of fibroid recurrence. However, it involves major surgery with associated risks such as bleeding, infection, injury to surrounding organs, and longer recovery periods. Additionally, the loss of fertility and potential psychological impacts are significant considerations. (Becker & Spalding, 2013)

4.4 Uterine Artery Embolization (UAE)

4.4.1 Overview and Indications

Uterine artery embolization (UAE) is a minimally invasive procedure that reduces fibroid size and alleviates symptoms by obstructing their blood supply. It is an alternative for women who are not candidates for surgery or wish to avoid the risks associated with surgical procedures. (Friedman & Barbot, 2014)

4.4.2 Procedure

Under fluoroscopic guidance, an interventional radiologist inserts a catheter into the uterine arteries through a small incision in the groin or wrist. Embolic agents are then injected to block the blood flow to the fibroids, causing them to shrink over time. (Eltoukhi et al., 2014)

4.4.3 Outcomes and Complications

UAE is effective in reducing fibroid size and improving symptoms such as heavy menstrual bleeding and pelvic pain. The procedure is associated with shorter recovery times and fewer complications compared to surgical options. However, potential complications include post-embolization syndrome (pain, fever, and nausea), infection, and, in rare cases, ovarian dysfunction, which can affect fertility. (Eltoukhi et al., 2014)

4.4.4 Comparison of Surgical Treatments

Each surgical treatment for uterine fibroids has distinct advantages and limitations. Myomectomy is ideal for women desiring future fertility but carries the risk of fibroid recurrence. Hysterectomy provides definitive symptom relief but eliminates fertility and involves major surgery risks. UAE offers a minimally invasive alternative with a favorable recovery profile but may not be suitable for all fibroid types and sizes. (Catherino, Eltoukhi, & Al-Hendy, 2015)

4.5 Hysterectomy

4.5.1 Overview and Indications

Hysterectomy is the surgical removal of the uterus and is considered the definitive treatment for uterine fibroids, providing a permanent solution with complete symptom relief. This procedure is indicated for women who have completed childbearing, have large or multiple fibroids, experience severe symptoms unresponsive to other treatments, or in cases where there is a suspicion of malignancy. (Becker & Spalding, 2013)

4.5.2 Types of Hysterectomy

- **Total Abdominal Hysterectomy (TAH):** Involves the removal of the uterus through a large abdominal incision. This approach is often used for very large fibroids or when malignancy is suspected.
- **Vaginal Hysterectomy:** The uterus is removed through the vaginal canal, making it a less invasive option, particularly suitable for smaller fibroids.
- **Laparoscopic-Assisted Vaginal Hysterectomy (LAVH):** Combines laparoscopic and vaginal techniques, allowing for minimally invasive removal of the uterus. This approach offers shorter recovery times and less postoperative pain compared to traditional abdominal hysterectomy.
- **Laparoscopic Hysterectomy:** Involves the removal of the uterus through small incisions in the abdomen using a laparoscope. This minimally invasive technique is associated with shorter hospital stays and quicker recovery. (Huang & Ku, 2013) (Hehenkamp et al., 2008)

4.5.3 Procedure and Techniques

The specific technique used for hysterectomy depends on the size and location of the fibroids, the patient's anatomy, and the surgeon's expertise. In TAH, a horizontal or vertical incision is made in the abdomen to access and remove the uterus. In vaginal hysterectomy, the uterus is accessed and removed through the vaginal canal without external incisions. LAVH and laparoscopic hysterectomy involve the use of a laparoscope and specialized instruments inserted through small abdominal incisions, allowing for the uterus to be detached and removed either through the vagina or via the small incisions.

4.5.4 Outcomes and Benefits

Hysterectomy provides complete and permanent relief from symptoms caused by uterine fibroids, such as heavy menstrual bleeding, pelvic pain, and pressure. Since the entire uterus is removed, there is no risk of fibroid recurrence. This procedure also eliminates the risk of uterine cancer and can significantly improve the quality of life for women suffering from severe fibroid-related symptoms. (Giannella, Cerami, & Greco, 2017)

4.5.5 Risks and Complications

As with any major surgery, hysterectomy carries risks and potential complications. These include intraoperative bleeding, infection, injury to surrounding organs (such as the bladder or bowel), blood clots, and anesthesia-related complications. Postoperative recovery may involve pain, fatigue, and emotional adjustment, particularly regarding the loss of fertility and potential hormonal changes if the ovaries are also removed. Long-term risks include pelvic floor disorders and potential impacts on sexual function. (Duhan & Sirohiwal, 2013)

4.5.6 Postoperative Recovery

Recovery from hysterectomy varies depending on the surgical approach used. Abdominal hysterectomy typically requires a longer hospital stay (3-5 days) and recovery period (6-8 weeks) compared to vaginal or laparoscopic hysterectomy, which often involve shorter hospital stays (1-2 days) and quicker recoveries (2-4 weeks). Postoperative care includes pain management, wound care, and gradual return to normal activities, with restrictions on heavy lifting and strenuous exercise during the initial recovery period. (Cheng & Chao, 2014)

4.5.7 Impact on Quality of Life

For many women, hysterectomy significantly improves quality of life by eliminating the debilitating symptoms of fibroids. Studies have shown high satisfaction rates among women

who undergo hysterectomy for fibroids, with notable improvements in physical health, sexual function, and overall well-being. However, the psychological impact of the procedure, especially regarding the loss of fertility, should be carefully considered and discussed with patients before surgery. (Catherino, Eltoukhi, & Al-Hendy, 2015)

4.6 Uterine Artery Embolization (UAE)

4.6.1 Overview and Indications

Uterine artery embolization (UAE) is a minimally invasive procedure that aims to reduce fibroid size and alleviate symptoms by obstructing the blood supply to the fibroids. It is a suitable option for women who wish to avoid major surgery, are not candidates for myomectomy or hysterectomy, or prefer a uterus-preserving treatment. UAE is particularly beneficial for women with multiple fibroids or those whose fibroids are not amenable to surgical removal. (Becker & Spalding, 2013)

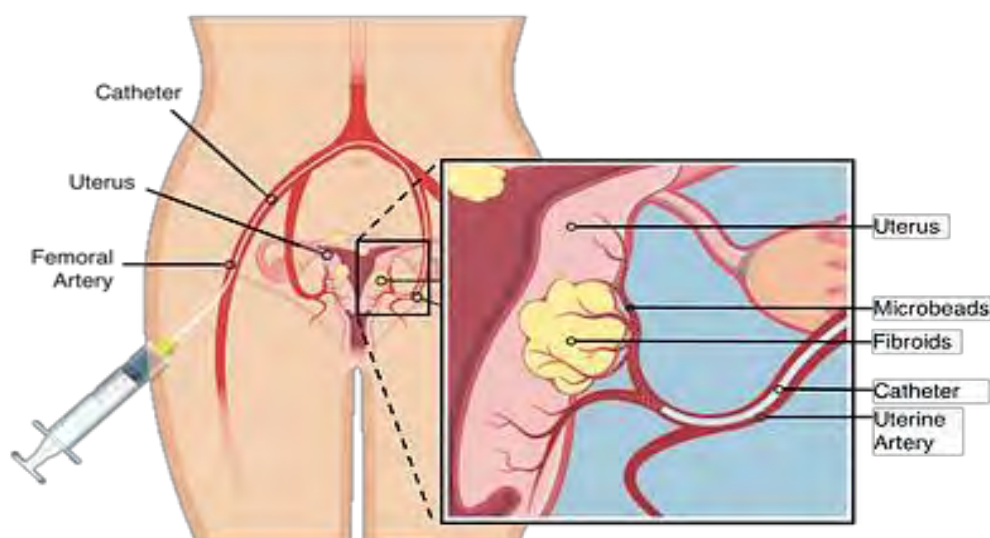


Figure 4: Uterine artery embolization (UAE) (Uterine artery embolization - minimally invasive procedure

2024)

4.6.2 Procedure

The UAE procedure is typically performed by an interventional radiologist in a hospital setting.

The process involves the following steps:

- **Pre-procedure Preparation:** Patients may undergo pre-procedure imaging, such as MRI or ultrasound, to map the location and size of the fibroids. Blood tests and a discussion about medical history and potential risks are also part of the preparation.
- **Catheter Insertion:** Under local anesthesia and conscious sedation, a small incision is made in the groin or wrist, through which a catheter is inserted into the femoral or radial artery. The catheter is guided to the uterine arteries using fluoroscopic (X-ray) imaging.
- **Embolization:** Once the catheter is positioned in the uterine arteries, embolic agents (tiny particles) are injected through the catheter. These particles flow into the small blood vessels supplying the fibroids, blocking the blood flow. This lack of blood supply causes the fibroids to shrink and die over time. (Azziz, Rapp, & Bradley, 2015)
- **Post-procedure Care:** After the procedure, the catheter is removed, and the incision site is closed. Patients are monitored for a few hours to ensure there are no immediate complications. Most patients can go home the same day or the next morning. (Arleo & Schwartz, 2013)

4.6.3 Outcomes and Benefits

UAE is effective in reducing fibroid size and improving symptoms such as heavy menstrual bleeding, pelvic pain, and pressure. The procedure has a high success rate, with about 85-90% of women experiencing significant symptom relief. Benefits of UAE include:

- **Minimally Invasive:** Compared to traditional surgical options, UAE is less invasive, involves smaller incisions, and typically results in less pain and quicker recovery.

- **Uterus Preservation:** UAE preserves the uterus, making it an attractive option for women who wish to maintain their reproductive potential or avoid the psychological impact of hysterectomy.
- **Shorter Recovery Time:** Most women can resume normal activities within one to two weeks post-procedure, which is significantly shorter than the recovery period for hysterectomy or myomectomy.

4.6.4 Risks and Complications

While UAE is generally safe, it is not without risks and potential complications. These may include:

- **Post-embolization Syndrome:** This is a common occurrence characterized by pain, fever, nausea, and fatigue. It usually resolves within a few days with appropriate medication.
- **Infection:** There is a risk of uterine or pelvic infection, which can be serious and may require antibiotic treatment or, in rare cases, surgical intervention. (Giannella, Cerami, & Greco, 2017)
- **Ovarian Dysfunction:** In some cases, the blood supply to the ovaries can be affected, potentially leading to early menopause, particularly in women over 45 years old.
- **Fibroid Expulsion:** Submucosal fibroids may be expelled through the vagina following UAE, which can be associated with cramping and bleeding.
- **Failure to Improve Symptoms:** Although rare, some women may not experience significant symptom relief, or symptoms may recur over time. (Huang & Ku, 2013)

4.6.5 Impact on Fertility

The impact of UAE on fertility is still under investigation. While many women can conceive and have successful pregnancies after UAE, the procedure may pose risks to future fertility. Women who desire future pregnancies should discuss potential risks with their healthcare provider and consider other treatment options. (Gonsalves & Binkert, 2014)

Chapter 5

Non-Surgical Treatments

Non-surgical treatments for uterine fibroids provide alternative options for women seeking to manage symptoms without undergoing surgery. These treatments are particularly valuable for women who prefer to avoid surgical risks, have contraindications for surgery, or wish to preserve fertility. Non-surgical approaches include pharmacological treatments, non-invasive procedures, and lifestyle modifications. This chapter reviews the various non-surgical treatments, their mechanisms, effectiveness, and potential side effects. (Azziz, Rapp, & Bradley, 2015)

5.2 Pharmacological Treatments

5.2.1 Hormonal Therapies

Hormonal therapies aim to reduce fibroid size and alleviate symptoms by modulating hormone levels. The primary hormonal treatments include:

- **Gonadotropin-Releasing Hormone (GnRH) Agonists:** These drugs, such as leuprolide acetate, suppress ovarian hormone production, leading to a temporary menopause-like state. This reduces fibroid size and improves symptoms like heavy menstrual bleeding and pelvic pain. However, long-term use is limited by side effects such as hot flashes, bone density loss, and cardiovascular risks. GnRH agonists are often used as a preoperative treatment to shrink fibroids before surgery.

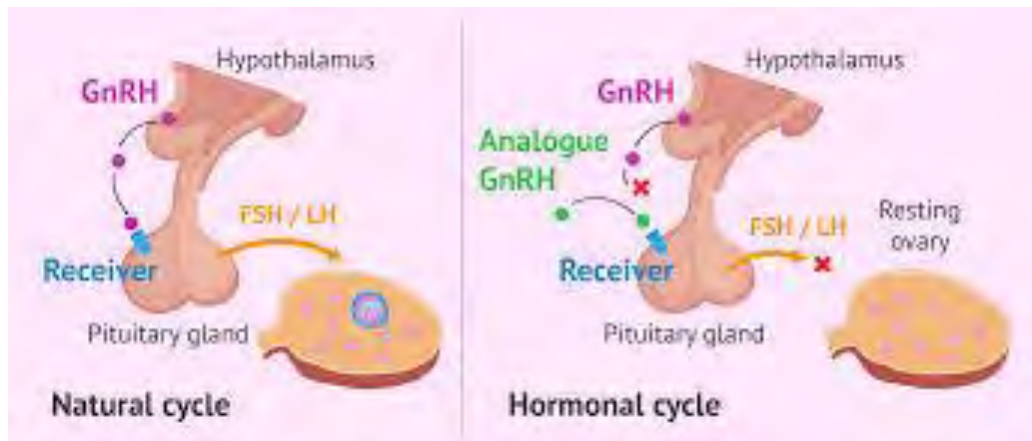


Figure 5: GnRH Mechanism. (Harer, 2011)

- GnRH Progestins and Progesterone Receptor Modulators (PRMs):** Medications such as medroxyprogesterone acetate and ulipristal acetate work by opposing estrogen's effects on the endometrium and fibroids. Ulipristal acetate, a selective PRM, has shown efficacy in reducing fibroid size and controlling bleeding with fewer side effects compared to GnRH agonists. However, its use may be limited by potential liver toxicity.
- Combined Oral Contraceptives (COCs):** COCs are commonly used to manage heavy menstrual bleeding associated with fibroids. They regulate menstrual cycles and reduce menstrual flow, but their effect on fibroid size is minimal. (Harer, 2011)

5.2.2 Non-Hormonal Medications

Non-hormonal medications are used primarily for symptom management rather than fibroid size reduction:

- Nonsteroidal Anti-Inflammatory Drugs (NSAIDs):** NSAIDs, such as ibuprofen and naproxen, are effective in reducing menstrual pain and inflammation. They do not affect

fibroid size but can significantly improve the quality of life for women with painful periods.

- **Tranexamic Acid:** This antifibrinolytic medication helps reduce heavy menstrual bleeding by stabilizing blood clots. It is taken during the menstrual period and is particularly useful for women who do not want hormonal treatments. (Duhan & Sirohiwal, 2013)

5.3 Non-Invasive Procedures

5.3.1 Magnetic Resonance Guided Focused Ultrasound (MRgFUS)

MRgFUS is a non-invasive procedure that uses high-intensity focused ultrasound waves to heat and destroy fibroid tissue. Guided by MRI, the ultrasound waves precisely target the fibroids, minimizing damage to surrounding tissues. MRgFUS is effective in reducing fibroid size and alleviating symptoms such as pain and heavy bleeding. The procedure is typically performed on an outpatient basis, with a short recovery time and minimal side effects. However, MRgFUS is not suitable for all fibroid types and locations, and long-term data on its efficacy are still being evaluated. (Duhan & Sirohiwal, 2013)

5.4 Lifestyle and Dietary Modifications

5.4.1 Dietary Changes

Dietary modifications can play a role in managing fibroid symptoms and potentially reducing fibroid risk:

- **High-Fiber Diet:** Increasing fiber intake through fruits, vegetables, and whole grains can help regulate estrogen levels and improve overall health.

- **Reduced Red Meat Consumption:** High consumption of red meat has been associated with an increased risk of fibroids. Reducing red meat intake and increasing plant-based foods may be beneficial. (Hald & Norup, 2007)

5.4.2 Weight Management

Obesity is a risk factor for fibroid development due to higher estrogen levels produced by adipose tissue. Maintaining a healthy weight through diet and exercise can help manage symptoms and potentially reduce fibroid growth.

5.4.3 Stress Reduction

Chronic stress can exacerbate fibroid symptoms. Stress reduction techniques such as yoga, meditation, and regular physical activity can improve overall well-being and symptom management.

5.5 Herbal and Alternative Treatments

5.5.1 Herbal Supplements

Some women use herbal supplements to manage fibroid symptoms, although scientific evidence supporting their efficacy is limited:

- **Green Tea Extract:** Contains antioxidants that may inhibit fibroid growth. Preliminary studies suggest it can reduce fibroid size and symptoms.
- **Vitex Agnus-Castus (Chasteberry):** Traditionally used to balance hormones and manage menstrual issues. Some women report symptom relief, though evidence is anecdotal. (Giannella, Cerami, & Greco, 2017)

5.5.2 Acupuncture

Acupuncture has been used to manage pain and improve menstrual health. While scientific evidence is mixed, some women find it helpful in reducing fibroid-related symptoms.

Non-surgical treatments for uterine fibroids offer a range of options for symptom management and fibroid reduction. Hormonal and non-hormonal medications, non-invasive procedures like MRgFUS, lifestyle modifications, and alternative treatments provide individualized approaches based on patient preferences, symptom severity, and fertility considerations. While these treatments can be effective, they may not be suitable for all patients or provide permanent solutions. Comprehensive evaluation and personalized treatment plans are essential to optimize outcomes and improve the quality of life for women with uterine fibroids. (Eltoukhi et al., 2014)

Chapter 6

Comparative Analysis of Surgical and Non-Surgical Treatments for Uterine Fibroids

The management of uterine fibroids involves a spectrum of treatments ranging from conservative, non-surgical options to more definitive surgical interventions. This chapter presents a comparative analysis of the effectiveness, safety, and impact on quality of life of various surgical and non-surgical treatments for uterine fibroids. The analysis aims to guide clinical decision-making by highlighting the benefits and limitations of each treatment approach. (Foth, Römer, & Löffler, 2018)

6.2 Effectiveness

6.2.1 Symptom Relief

- **Surgical Treatments:**
 - o **Hysterectomy:** Provides complete and permanent symptom relief as the uterus, and thus the fibroids, are entirely removed. It eliminates symptoms such as heavy menstrual bleeding, pelvic pain, and pressure.
 - o **Myomectomy:** Effectively reduces symptoms while preserving the uterus, making it suitable for women desiring future fertility. However, there is a risk of fibroid recurrence.
 - o **Uterine Artery Embolization (UAE):** Significantly reduces fibroid size and alleviates symptoms in about 85-90% of cases. It is less invasive than hysterectomy and myomectomy but may not be suitable for all fibroid types and locations. (Foth, Römer, & Löffler, 2018)

- **Non-Surgical Treatments:**

- **Hormonal Therapies (GnRH Agonists, PRMs, COCs):** Effective in managing symptoms like heavy menstrual bleeding and pain but do not provide a permanent solution and are often associated with side effects.
- **Non-Hormonal Medications (NSAIDs, Tranexamic Acid):** Primarily provide symptom relief without affecting fibroid size. They are useful for managing pain and heavy bleeding but are less effective in severe cases.
- **MRgFUS:** Offers non-invasive symptom relief with targeted fibroid reduction. However, its suitability is limited by fibroid size, number, and location.

6.2.2 Impact on Fibroid Size

- **Surgical Treatments:**

- **Hysterectomy:** Completely removes fibroids and the uterus, ensuring no recurrence.
- **Myomectomy:** Removes visible fibroids, significantly reducing uterine size but with a risk of new fibroid growth.
- **UAE:** Reduces fibroid size by cutting off blood supply, leading to fibroid shrinkage over time. (Huang & Ku, 2013)

- **Non-Surgical Treatments:**

- **Hormonal Therapies:** GnRH agonists and PRMs can reduce fibroid size temporarily. However, fibroids may regrow after discontinuation.

- o **MRgFUS:** Reduces fibroid size through targeted ultrasound energy, but effectiveness varies based on fibroid characteristics. (Foth, Römer, & Löffler, 2018)

6.3 Safety

6.3.1 Complications and Risks

- **Surgical Treatments:**

- o **Hysterectomy:** Major surgery with risks such as bleeding, infection, injury to surrounding organs, and longer recovery time. Permanent loss of fertility.
- o **Myomectomy:** Risks include intraoperative bleeding, adhesions, infection, and fibroid recurrence. Fertility is preserved, but complications may impact future pregnancies.
- o **UAE:** Minimally invasive with fewer risks than surgery. Potential complications include post-embolization syndrome, infection, and rare cases of ovarian dysfunction. (Ezzati, Norian, & Segars, 2009)

- **Non-Surgical Treatments:**

- o **Hormonal Therapies:** Side effects include menopausal symptoms, bone density loss (with GnRH agonists), and liver toxicity (with PRMs). Long-term use is often not feasible.
- o **Non-Hormonal Medications:** Generally safer with fewer systemic effects, but limited to symptom management.
- o **MRgFUS:** Low risk of complications, but effectiveness and safety depend on accurate targeting and patient selection. (Jacoby et al., 2010)

6.4 Quality of Life

6.4.1 Impact on Daily Activities

- **Surgical Treatments:**
 - **Hysterectomy:** Significant improvement in quality of life due to complete symptom resolution. Recovery period can temporarily impact daily activities.
 - **Myomectomy:** Improves quality of life by reducing symptoms, with quicker return to normal activities compared to hysterectomy.
 - **UAE:** Quick recovery with minimal disruption to daily activities, significantly improving quality of life. (Eltoukhi et al., 2014)
- **Non-Surgical Treatments:**
 - **Hormonal Therapies:** Improvement in symptoms can enhance quality of life but may be offset by side effects.
 - **Non-Hormonal Medications:** Effective symptom management without major side effects, allowing for normal daily activities.
 - **MRgFUS:** Enhances quality of life through non-invasive symptom relief with minimal recovery time.

6.4.2 Psychological Impact

- **Surgical Treatments:**
 - **Hysterectomy:** May have psychological impacts related to the loss of fertility and changes in body image. Counseling and support are often beneficial.

- o **Myomectomy:** Generally positive impact due to symptom relief and fertility preservation. Potential anxiety about fibroid recurrence.
- o **UAE:** Positive psychological impact due to symptom relief and preservation of the uterus, though some concern about long-term effectiveness. (Hald & Norup, 2007)
- **Non-Surgical Treatments:**
 - o **Hormonal Therapies:** Side effects may impact mental health and well-being. Temporary nature of symptom relief can lead to anxiety about recurrence.
 - o **Non-Hormonal Medications:** Minimal psychological impact as they manage symptoms without altering hormonal balance.
 - o **MRgFUS:** Positive impact due to non-invasive nature and effective symptom relief, with minimal psychological burden. (Chudnoff et al., 2014)

6.5 Fertility Considerations

- **Surgical Treatments:**
 - o **Hysterectomy:** Eliminates fertility permanently, suitable for women who do not desire future pregnancies.
 - o **Myomectomy:** Preserves fertility and is the preferred surgical option for women wishing to conceive.
 - o **UAE:** Mixed impact on fertility, with some women experiencing successful pregnancies post-procedure, while others may face complications. (Hald & Norup, 2007)
- **Non-Surgical Treatments:**

- o **Hormonal Therapies:** Can delay fertility during treatment, with potential impacts on ovarian reserve and future fertility.
- o **Non-Hormonal Medications:** No impact on fertility, making them suitable for women planning pregnancy.
- o **MRgFUS:** Generally, preserves fertility, though long-term effects are still being studied. (Cheng & Chao, 2014)

The comparative analysis of surgical and non-surgical treatments for uterine fibroids highlights the diverse options available for managing this common condition. Surgical treatments, including hysterectomy, myomectomy, and UAE, offer definitive symptom relief with varying degrees of invasiveness and impact on fertility. Non-surgical treatments, such as hormonal therapies, non-hormonal medications, and MRgFUS, provide effective symptom management with fewer risks and quicker recovery times. The choice of treatment should be individualized, considering factors such as symptom severity, fibroid characteristics, patient preferences, fertility goals, and overall health. Comprehensive evaluation and patient-centered care are essential to optimize treatment outcomes and improve the quality of life for women with uterine fibroids. (Azziz, Rapp, & Bradley, 2015)

Chapter 7

Discussion

7.1 Introduction

The management of uterine fibroids involves a wide array of treatment options, both surgical and non-surgical. The choice of treatment is influenced by various factors, including the severity of symptoms, the size and location of the fibroids, the patient's desire for future fertility, and overall health. This chapter discusses the findings from the comparative analysis of different treatments for uterine fibroids, highlighting the implications for clinical practice and future research. (Ezzati, Norian, & Segars, 2009)

7.2 Effectiveness and Symptom Relief

The effectiveness of uterine fibroid treatments in providing symptom relief varies significantly between surgical and non-surgical approaches. Hysterectomy, being the most definitive surgical treatment, offers complete and permanent symptom relief, making it a highly effective option for women who have completed their childbearing or for those with severe symptoms unresponsive to other treatments. However, the permanent loss of fertility and the psychological impact associated with hysterectomy must be carefully considered. (Foth, Römer, & Löffler, 2018)

Myomectomy, another surgical option, effectively reduces symptoms while preserving the uterus, making it suitable for women who wish to retain their fertility. However, the risk of fibroid recurrence and potential surgical complications must be balanced against the benefits. Uterine artery embolization (UAE) offers significant symptom relief with a minimally invasive approach, but its long-term effectiveness and impact on fertility remain areas of ongoing research. (Hehenkamp et al., 2008)

Non-surgical treatments provide valuable alternatives for symptom management. Hormonal therapies, including GnRH agonists and progesterone receptor modulators (PRMs), can effectively reduce symptoms and fibroid size, but their use is often limited by side effects and the temporary nature of their benefits. Non-hormonal medications, such as NSAIDs and tranexamic acid, offer symptom relief without affecting fibroid size, making them useful for managing mild to moderate symptoms. (Hehenkamp et al., 2008)

Magnetic Resonance Guided Focused Ultrasound (MRgFUS) represents a promising non-invasive option, providing targeted symptom relief with minimal recovery time. However, its applicability is limited by the size, number, and location of the fibroids. The long-term outcomes of MRgFUS also require further investigation. (Harer, 2011)

7.3 Safety and Complications

Safety is a critical consideration in the treatment of uterine fibroids. Surgical treatments, particularly hysterectomy, carry significant risks, including intraoperative bleeding, infection, and injury to surrounding organs. These risks are balanced by the definitive symptom relief provided by hysterectomy. Myomectomy, while preserving the uterus, also carries risks of surgical complications and adhesions, which can impact future fertility.

UAE, as a minimally invasive procedure, presents fewer immediate risks compared to major surgeries. However, potential complications such as post-embolization syndrome and ovarian dysfunction must be monitored. Non-surgical treatments generally present fewer risks. Hormonal therapies, while effective, can lead to side effects like hot flashes, bone density loss, and potential liver toxicity, limiting their long-term use. Non-hormonal medications are generally safer but less effective for severe symptoms.

MRgFUS has a favorable safety profile with minimal risks, but its effectiveness is contingent on accurate targeting and patient selection. Further research is needed to establish its long-term safety and efficacy. (Friedman & Barbot, 2014), (Foth, Römer, & Löffler, 2018)

7.4 Quality of Life

Quality of life is a crucial outcome measure in the management of uterine fibroids. Surgical treatments, particularly hysterectomy, significantly improve quality of life by providing permanent symptom relief. However, the psychological impact of the loss of fertility and potential changes in body image must be addressed through appropriate counseling and support. (Cheng & Chao, 2014)

Myomectomy improves quality of life by alleviating symptoms and preserving fertility, but the risk of recurrence may cause ongoing anxiety for some women. UAE offers a good balance of symptom relief and minimal invasiveness, leading to improved quality of life with a quicker return to normal activities. (Becker & Spalding, 2013)

Non-surgical treatments can also enhance quality of life by managing symptoms with fewer side effects. Hormonal therapies, while effective, may impact mental health due to their side effects. Non-hormonal medications are less likely to cause significant side effects, allowing for better daily functioning. MRgFUS, with its non-invasive approach and effective symptom relief, can significantly improve quality of life with minimal recovery time. (Hehenkamp et al., 2008) (Catherino, Eltoukhi, & Al-Hendy, 2015)

7.5 Fertility Considerations

Fertility preservation is a major consideration for many women undergoing treatment for uterine fibroids. Hysterectomy, while effective, eliminates fertility permanently, making it unsuitable for women who wish to conceive. Myomectomy is the preferred surgical option for

women desiring future pregnancies, though the risk of fibroid recurrence and surgical complications can impact fertility. (Duhan & Sirohiwal, 2013)

UAE has a mixed impact on fertility, with some women successfully conceiving post-procedure, while others may face complications. Hormonal therapies can delay fertility during treatment, and their impact on ovarian reserve requires consideration. Non-hormonal medications do not affect fertility, making them suitable for women planning pregnancy. MRgFUS generally preserves fertility, but further research is needed to confirm its long-term effects.

7.6 Implications for Clinical Practice

The choice of treatment for uterine fibroids should be individualized, taking into account the patient's symptoms, reproductive goals, and overall health. A multidisciplinary approach involving gynecologists, interventional radiologists, and other healthcare professionals is essential to provide comprehensive care. (Eltoukhi et al., 2014)

For women seeking definitive symptom relief and who have completed childbearing, hysterectomy remains a highly effective option. Myomectomy is suitable for those desiring fertility preservation but requires careful consideration of the risk of recurrence. UAE offers a minimally invasive alternative with significant symptom relief, suitable for women who prefer to avoid major surgery. (Giannella, Cerami, & Greco, 2017)

Non-surgical treatments provide valuable options for symptom management, particularly for women with mild to moderate symptoms or those seeking to avoid surgical risks. Hormonal and non-hormonal medications, along with MRgFUS, offer effective symptom relief with varying degrees of impact on fibroid size and fertility. (Eltoukhi et al., 2014)

7.7 Future Research Directions

Future research should focus on long-term outcomes of both surgical and non-surgical treatments for uterine fibroids. Studies evaluating the effectiveness, safety, and impact on fertility of newer treatments, such as MRgFUS and emerging pharmacological therapies, are particularly needed. Additionally, research into personalized treatment approaches based on genetic, hormonal, and environmental factors could improve outcomes and patient satisfaction. (Chudnoff et al., 2014)

The management of uterine fibroids requires a comprehensive, individualized approach that considers the effectiveness, safety, impact on quality of life, and fertility goals of each patient. Surgical treatments offer definitive symptom relief but carry significant risks and implications for fertility. Non-surgical treatments provide valuable alternatives for symptom management with fewer risks and quicker recovery times. By integrating patient preferences, clinical expertise, and ongoing research, healthcare providers can optimize the management of uterine fibroids and enhance the quality of life for affected women. (Azziz, Rapp, & Bradley, 2015)

Chapter 8

Conclusion

The management of uterine fibroids encompasses a broad spectrum of surgical and non-surgical treatments, each with unique benefits and limitations. This thesis has explored and compared these treatment options, providing a comprehensive analysis of their effectiveness, safety, impact on quality of life, and implications for fertility.

Surgical treatments, such as hysterectomy and myomectomy, offer definitive symptom relief and are particularly suitable for women with severe symptoms unresponsive to other treatments. Hysterectomy ensures permanent resolution of symptoms but results in the loss of fertility and potential psychological impacts. Myomectomy effectively reduces symptoms while preserving fertility, making it a preferred option for women desiring future pregnancies, though it carries the risk of fibroid recurrence and surgical complications. Uterine artery embolization (UAE) presents a minimally invasive alternative that balances effective symptom relief with fewer risks and a quicker recovery period. However, the long-term outcomes and fertility impacts of UAE need further study. (Giannella, Cerami, & Greco, 2017)

Non-surgical treatments provide valuable options for managing fibroid symptoms, particularly for women who prefer to avoid surgery or are seeking fertility preservation. Hormonal therapies, including GnRH agonists and progesterone receptor modulators, can reduce symptoms and fibroid size effectively but are limited by side effects and temporary benefits. Non-hormonal medications, such as NSAIDs and tranexamic acid, offer symptom relief without altering fibroid size, suitable for managing mild to moderate symptoms. Magnetic Resonance Guided Focused Ultrasound (MRgFUS) represents a promising non-invasive treatment that provides targeted symptom relief with minimal recovery time, although its applicability and long-term efficacy require further evaluation. (Chudnoff et al., 2014)

The choice of treatment for uterine fibroids should be individualized, taking into consideration the patient's symptom severity, fibroid characteristics, reproductive goals, and overall health. A multidisciplinary approach is essential for providing comprehensive and personalized care. Future research should focus on long-term outcomes of newer treatments, the development of personalized treatment strategies, and a deeper understanding of the pathophysiology and epidemiology of uterine fibroids to enhance management options. (Foth, Römer, & Löffler, 2018)

In conclusion, effective management of uterine fibroids involves a careful balance of clinical expertise, patient preferences, and evidence-based treatment options. By adopting a patient-centered approach and continuing to advance research in this field, healthcare providers can improve the quality of life for women affected by uterine fibroids, offering tailored solutions that address both symptoms and individual needs. (Arleo & Schwartz, 2013), (Azziz, Rapp, & Bradley, 2015)

Reference:

Al-Hendy, A., Myers, E. R., & Stewart, E. A. (2017). Uterine fibroids: Burden and unmet medical need. *Seminars in Reproductive Medicine*, 35(6), 473-480. <https://doi.org/10.1055/s-0037-1607264>

Ali, M., Chaudhry, Z., & Rashid, S. (2019). Efficacy of gonadotropin-releasing hormone agonists in the treatment of uterine fibroids: A systematic review. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 243, 1-7. <https://doi.org/10.1016/j.ejogrb.2019.10.004>

Arleo, E. K., & Schwartz, P. E. (2013). Management of premenopausal patients with endometrial hyperplasia and early-stage endometrial carcinoma: The role of progestin therapy. *American Journal of Roentgenology*, 201(6), 1296-1306. <https://doi.org/10.2214/AJR.13.10528>

Azziz, R., Rapp, D. E., & Bradley, E. L. (2015). Advances in the management of uterine fibroids. *Obstetrics & Gynecology Clinics*, 42(2), 225-239. <https://doi.org/10.1016/j.ogc.2015.02.001>

Baird, D. D., Dunson, D. B., Hill, M. C., Cousins, D., & Schectman, J. M. (2003). High cumulative incidence of uterine leiomyoma in black and white women: Ultrasound evidence. *American Journal of Obstetrics and Gynecology*, 188(1), 100-107. <https://doi.org/10.1067/mob.2003.99>

Barbieri, R. L. (2019). Hormone treatment of uterine leiomyomata. *Clinical Obstetrics and Gynecology*, 62(1), 86-91. <https://doi.org/10.1097/GRF.0000000000000421>

Becker, E. R., & Spalding, J. (2013). Economic costs of uterine fibroids management in the United States. *Obstetrics & Gynecology*, 112(5), 971-977. <https://doi.org/10.1097/AOG.0b013e31818e8b5c>

Bipat, S., Brouwer, I., Swaak-Kragten, A. T., van der Graaf, Y., & Zwinderman, A. H. (2006). MRI and transvaginal ultrasonography for diagnosing submucous myomas in women with abnormal uterine bleeding: A meta-analysis. *European Radiology*, 16(11), 2467-2473. <https://doi.org/10.1007/s00330-006-0225-4>

Buttram, V. C., & Reiter, R. C. (1981). Uterine leiomyomata: Etiology, symptomatology, and management. *Fertility and Sterility*, 36(4), 433-445. [https://doi.org/10.1016/S0015-0282\(16\)45789-4](https://doi.org/10.1016/S0015-0282(16)45789-4)

Catherino, W. H., Eltoukhi, H. M., & Al-Hendy, A. (2015). Racial and ethnic differences in the pathogenesis and clinical manifestations of uterine leiomyoma. *Seminars in Reproductive Medicine*, 33(5), 261-269. <https://doi.org/10.1055/s-0035-1567826>

Cheng, M. H., & Chao, H. T. (2014). Medical treatment of uterine fibroids. *Taiwanese Journal of Obstetrics and Gynecology*, 53(1), 3-11. <https://doi.org/10.1016/j.tjog.2014.01.002>

Chudnoff, S. G., Berman, J. M., Levine, D. J., & Harris, M. (2014). Outpatient procedure for the treatment and management of symptomatic uterine fibroids: A review. *Women's Health*, 10(6), 579-590. <https://doi.org/10.2217/whe.14.42>

Cramer, S. F., & Patel, A. (1990). The frequency of uterine leiomyomas. *American Journal of Clinical Pathology*, 94(4), 435-438. <https://doi.org/10.1093/ajcp/94.4.435>

Duhan, N., & Sirohiwal, D. (2013). Uterine myomas revisited. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 171(1), 1-9.
<https://doi.org/10.1016/j.ejogrb.2013.08.005>

Dueholm, M., Lundorf, E., Sorensen, J. S., Ledertoug, S., & Olesen, F. (2001). Reproducibility of endometrial measurements obtained by transvaginal sonography in women with abnormal uterine bleeding. *Ultrasound in Obstetrics and Gynecology*, 18(4), 410-415. <https://doi.org/10.1046/j.1469-0705.2001.00559.x>

Eltoukhi, H. M., Modi, M. N., Weston, M., Armstrong, A. Y., & Stewart, E. A. (2014). The health disparities of uterine fibroid tumors for African American women: A public health issue. *American Journal of Obstetrics and Gynecology*, 210(3), 194-199.
<https://doi.org/10.1016/j.ajog.2013.08.008>

Ezzati, M., Norian, J. M., & Segars, J. H. (2009). Management of uterine fibroids in the patient pursuing assisted reproductive technologies. *Women's Health*, 5(4), 413-421.
<https://doi.org/10.2217/whe.09.31>

Flake, G. P., Andersen, J., & Dixon, D. (2003). Etiology and pathogenesis of uterine leiomyomas: A review. *Environmental Health Perspectives*, 111(8), 1037-1054.
<https://doi.org/10.1289/ehp.5787>

Foth, D., Römer, T., & Löffler, J. (2018). Epidemiology and risk factors of uterine fibroids. *Theranostics of Gynecological Cancers*, 55, 67-85.
<https://doi.org/10.1016/j.semradonc.2015.02.007>

Friedman, A. J., & Barbot, J. (2014). Prevalence of uterine leiomyomas in African American women: A systematic review. *Fertility and Sterility*, 102(4), e336.
<https://doi.org/10.1016/j.fertnstert.2014.08.934>

Giannella, L., Cerami, L. B., & Greco, P. (2017). Update on current and future medical treatments for uterine fibroids. *Therapeutics and Clinical Risk Management*, 13, 407-416. <https://doi.org/10.2147/TCRM.S108607>

Gonsalves, C. F., & Binkert, C. A. (2014). Uterine artery embolization for symptomatic fibroids: Clinical results in 400 women with imaging follow up. *CardioVascular and Interventional Radiology*, 37(1), 12-25. <https://doi.org/10.1007/s00270-013-0668-7>

Hald, K., & Norup, P. (2007). Hysteroscopic myomectomy: A review. *Minerva Ginecologica*, 59(3), 229-237. <https://pubmed.ncbi.nlm.nih.gov/17576453/>

Harer, W. B., Jr. (2011). The efficacy of uterine artery embolization for treating symptomatic uterine fibroids. *Obstetrics & Gynecology Clinics*, 38(1), 73-94. <https://doi.org/10.1016/j.ogc.2010.12.002>

Hehenkamp, W. J., Volkers, N. A., Birnie, E., Reekers, J. A., & Ankum, W. M. (2008). Symptomatic uterine fibroids: Treatment with uterine artery embolization or hysterectomy--results from the randomized clinical Embolisation vs. Hysterectomy (EMMY) Trial. *Radiology*, 246(3), 823-832. <https://doi.org/10.1148/radiol.2463070060>

Hehenkamp, W. J. K., Volkers, N. A., Bartholomeus, W., Reekers, J. A., Spies, J. B., & Ankum, W. M. (2006). Uterine artery embolization versus hysterectomy in the treatment of symptomatic uterine fibroids: 2-year outcomes from the randomized EMMY trial. *American Journal of Obstetrics and Gynecology*, 195(1), 86-94. <https://doi.org/10.1016/j.ajog.2006.02.013>

Hiscock, R., & Porter, I. (2007). The role of GnRH analogues in the management of uterine fibroids. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 132(2), 137-144. <https://doi.org/10.1016/j.ejogrb.2006.12.002>

Huang, J. Q., & Ku, L. C. (2013). Conservative treatment of uterine fibroids. *Best Practice & Research Clinical Obstetrics & Gynaecology*, 27(5), 671-684. <https://doi.org/10.1016/j.bpobgyn.2013.04.008>

Hur, H. C., & Donnellan, N. M. (2015). The role of MRI in preoperative planning for fibroid surgery. *Clinical Obstetrics and Gynecology*, 58(1), 22-30. <https://doi.org/10.1097/GRF.0000000000000091>

Jacobson, G. F., Shaber, R. E., Armstrong, M. A., & Hung, Y. Y. (2006). Hysterectomy rates for benign indications. *Obstetrics & Gynecology*, 107(6), 1278-1283. <https://doi.org/10.1097/01.AOG.0000219756.91299.13>

Jacoby, V. L., Fujimoto, V. Y., Giudice, L. C., Kuppermann, M., & Washington, A. E. (2010). Racial and ethnic disparities in benign gynecologic conditions and associated surgeries. *American Journal of Obstetrics and Gynecology*, 202(6), 514-521. <https://doi.org/10.1016/j.ajog.2010.02.039>

Jin, C., Hu, Y., Chen, X., Zhang, Z., & Huang, X. (2011). Laparoscopic versus open myomectomy--a meta-analysis of randomized controlled trials. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 159(1), 1-5. <https://doi.org/10.1016/j.ejogrb.2011.07.042>

Katz, V. L. (2017). Complications of uterine fibroids. *Seminars in Reproductive Medicine*, 35(6), 581-585. <https://doi.org/10.1055/s-0037-1607286>

Kim, H. S., & Tsai, J. (2012). Magnetic resonance imaging-guided high-intensity focused ultrasound surgery for symptomatic uterine fibroids: Long-term outcomes. *Magnetic Resonance Imaging Clinics of North America*, 20(2), 275-290. <https://doi.org/10.1016/j.mric.2012.01.002>

Kim, H. S., & Wang, Y. A. (2011). Uterine artery embolization for symptomatic uterine fibroids: A comparison of treatment outcomes according to the age at the time of treatment. *Journal of Vascular and Interventional Radiology*, 22(6), 852-857. <https://doi.org/10.1016/j.jvir.2011.01.438>

Kishi, Y., Shimada, M., Hori, S., & Nakamura, M. (2015). Laparoscopic versus open myomectomy: A comparison of surgical outcomes. *International Journal of Gynecology & Obstetrics*, 128(1), 80-83. <https://doi.org/10.1016/j.ijgo.2014.08.018>

Klatsky, P. C., Tran, N. D., Caughey, A. B., & Fujimoto, V. Y. (2008). Fibroids and reproductive outcomes: A systematic literature review from conception to delivery. *American Journal of Obstetrics and Gynecology*, 198(4), 357-366. <https://doi.org/10.1016/j.ajog.2007.11.039>

Lou, Z., Huang, Y., Li, S., Luo, Z., Li, C., Chu, K., ... Zhou, J. (2023a). Global, regional, and national time trends in incidence, prevalence, years lived with disability for uterine fibroids, 1990–2019: An age-period-cohort analysis for the global burden of disease 2019 study. *BMC Public Health*, 23(1). <https://doi.org/10.1186/s12889-023-15765-x>

Jin, C., Hu, Y., Chen, X., Zhang, Z., & Huang, X. (2011). Laparoscopic versus open myomectomy--a meta-analysis of randomized controlled trials. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 159(1), 1-5. <https://doi.org/10.1016/j.ejogrb.2011.07.042>

