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Leiomyomas: An Essential Component of Women's Evolution and Gynecology

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Introduction

Uterine leiomyomas, also known as fibroids, are benign tumors originating from smooth muscle cells within myometrial tissue. These tumors are frequently identified in women of reproductive age, with a prevalence of 70–80 percent. Despite their common occurrence, the pathophysiological basis of this condition remains somewhat enigmatic; hence, the current review aims to synthesize existing data on this topic.

1. Uterine leiomyoma are among the most common benign tumors with a lifetime risk of 60–70% among women in their reproductive years. Although reliable estimates of lifetime incidence are not available, epidemiologic data suggest considerable variation by ancestry. A recent study conducted in the United States has reported a decreasing trend in age-specific incidence rates for women of African ancestry that requires further exploration. Notably, despite their high frequency and potential clinical consequences, these tumors have received limited attention in medical education and gynecologic research regarding the variations across different populations (Fitzgerald, et al. 2020).

2. Historical and Evolutionary Aspects Uterine leiomyomas represent the most common type of benign tumor found within the female reproductive tract; thus, it significantly affects management decisions pertaining to female health. These tumors have been documented in several species including nonhuman primates indicating their evolutionary importance. The modern female experiences two to three more menstrual cycles and ovulatory events than her ancestors' females during their lifetime resulting in increased remodeling of the uterus with formation and loss of tissue which may predispose neoplastic change. The evolutionary origin for uterine leiomyomas is uncertain but they have been proposed as either nonadaptive by-products or adaptations for maternal–fetal fitness.321 Endoplasmic reticulum dilation and Golgi fragmentation may be involved in smooth muscle remodeling leading to hyperplasia and necrosis of tissues; fibroids do not arise from normal smooth muscle stem cells but rather from a cell type more resembling primitive mesenchymal or multipotential progenitors. Estimates for prevalence place fibroids at 33% clinically, 50% by ultrasound examination, and 77% among specimens obtained from hysterectomy operations performed on patients presumed to have symptomatic disease. Postmenopausal atrophy will fully resolve them while significant growth does not occur until at least one or two years after menarche suggesting that real figures might be higher among preadolescent and peri-retirement girls.

3. Pathophysiology and Epidemiology Uterine leiomyomas (fibroids) represent the most common tumors among women in the United States typically developing by menopause and noted in one-third of cases. Despite their high frequency, little has been known until recently regarding the etiology and pathogenesis of these lesions. Fibroids are associated with significant morbidity such as pressure effects on adjacent organs, excessive bleeding, and other sequelae including infertility; they constitute a principal indication for hysterectomy in this country accounting for approximately one-third of all such procedures performed here. 3 The etiology of fibroids has been the subject of much inves-

tigation; their epidemiology, genetics, hormonal and molecular biology have all been studied. The development of tumors may be due to predisposing or risk factors, initiators and promoters. Epidemiological studies can assist in identifying risk factors for possible prevention. Genetic changes may initiate fibroids but the exact role is not known. Ovarian hormones estrogen and progesterone are important for promoting growth as supported by clinical findings and laboratory experiments. Research continues on growth factors related to stimulation of hormone-induced fibroids. 2 Leiomyomas are benign tumors of the uterus that mostly affect women during their reproductive years; about 80% of women have some experience with them. They arise from changes in myometrium due to various physiological and pathological conditions. Most women harboring fibroids do so asymptomatically, which leads to an underestimation of the true prevalence since it varies with the mode of diagnosis--ultrasound being more accurate. Pathogenesis leans heavily on genetic factors and promoters though data is somewhat conflicting. It involves a multiplicity of elements that influence growth as well as interaction with both endometrium and sub endometrial myometrium 1.

4. Clinical Presentation and Diagnostic Approaches Uterine leiomyomas constitute a major global health problem among reproductive-age women; up to 33% have been diagnosed at clinical examination, 50% by means of transvaginal ultrasound, and 77% at hysterectomy histology. In spite of these figures, underdiagnosis and hence underreporting continue basically due to lack of awareness regarding physical as well as emotional burdens entailed. Fibroid clinical presentation, myoma location, and effects on the endometrium are very important since there is no literature that provides a systemic approach toward its diagnosis. Early diagnosis is very important for better management of uterine myomas as recommended by detailed characterization of symptoms, diagnostic techniques, inspection of the pelvic area, etc.

5. Uterine leiomyomas may be asymptomatic or present with a variety of clinical problems like abnormal bleeding, dysmenorrhea, pain, pressure sensation in addition to infertility. Symptoms usually depend on the site and size of myomas as well as their rate of growth. Most common signs are premenstrual bleeding followed by menstrual then postmenstrual bleeding; this can suggest myomas. Pressure and pain can also be felt in the pelvis or urinary tract or lower back particularly if the myomas are large in size 2.

6. Leiomyomas and Reproductive Health Leiomyomas affect gynecologic health at different stages throughout life, including stages that involve reproduction; though there is no evidence to decisively determine their effects on fertility or conception or pregnancy outcome during such times when they do become relevant. The latter must be noted because mainly management concerns about preserving fertility will arise when these tumors are found in women seeking assistance toward conception rather than those who may harbor them incidentally during early reproductive life. Substantial data indicate that leiomyomas significantly contribute to gynecologic disorders, ranking as a leading cause of morbidity among premenopausal women with the clinical burden peaking before menopause. Despite this, a long-standing belief persists that fibroids do not affect reproductive health after childbearing. These factors highlight the need for a deeper understanding of how leiomyomas interact with reproductive health. Given the adverse effects of untreated disease on women's health, prioritizing research on this interaction is crucial for informing tumor management recommendations. 45 At each point in the childbearing trajectory, the secondary fertility endpoint remains a consideration relevant to closely spaced pregnancies and to women who remain childless despite longstanding or ongoing partnerships without prevention, and for these who remain childless despite longstanding or ongoing partnerships without prevention.

7. Research Gaps and Future Directions Uterine leiomyomas are the most common gynecological tumors in women; however, distinguishing between the AMS and pre-reproductive phase has been debated by evolutionary biologists. Some suggest that these tumors may have originated from changes in uterine musculature during the reproductive stage which coincided with the split of the clade leading to nonhuman primates. A controversial interpretation relates development of leiomyomas to evolution of H. sapiens. 2 Throughout evolutionary history within genus Homo, amplitude as well as frequency regarding utero-remodellings may have diminished so as to restore conditions for reproduction among females closer to pre-reproductive phase; in gyneco-pediatric clinics, this pre-reproductive phase might be extended beyond twelve years for a deeper phylogeographic study regarding population gauge markers. Modern humans have been resuming second meiotic division pertaining to human egg - ideally continuing until fertilization - for approximately three hundred thousand years. This is an open question for evolutionists about the three-hundred-thousand-year-old pre-reproductive clade; therefore, it is still relevant to think about evolution when considering principles of obstetrical medicine in early gyneco-pediatrics [1-5].

Conclusion U

Terine leiomyomas, better known as fibroids, are a common type of benign tumor arising from a complex interplay of onco-embryogenic mechanisms and various homeostatic forces within the context of female reproduction. These tumors have an extraordinary capacity to take advantage of the pathological features associated with the uterus to greatly improve maternal fitness strategies. They play an essential role in determining the intricate evolution of selective mech-

anisms that operate between fetus and mother, which will ultimately determine women's reproductive success. The benign nature of these tumors can be seen even under diverse evolutionary pressures and is further supported by the particular disconnect between reproductive events and tumor development, emphasizing their possibly partially adaptive nature in the complex landscape of reproductive health. Reproductive dysregulation might create situations where these tumors could be viewed as maladaptive in some women's groups; however, there are also particular cases in which uterine leiomyomas may actually increase reproductive fitness among other populations—a stark contrast. This complicated duality underscores how delicately balanced uterine leiomyomas are across such a wide range of biological contexts and varying scenarios during a woman's lifetime of reproduction. In the end, it would be apt to say that uterine leiomyomas manifest partial coadaptation as they not only react but also mirror different lines of evolutionary pressure throughout the various phases in a woman's reproductive life. It serves to further illustrate their complex and multifaceted role within the dynamics of reproductive health, raising important questions and considerations regarding their underlying mechanisms and impact on women's wellbeing.

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