Medical Science

To Cite:
Markuszka K, Polityńska K, Samuła K, Sarzyńska M, Szabat M, Lepak S, Irzyk Z, Ruszel D, Goc E, Rogała J. Gonadotropin-releasing hormone antagonism treatment of endometriosis - new perspectives. *Medical Science* 2026; 30: e114ms3857
doi: https://doi.org/10.54905/disssi.v30i172.e114ms3857

Authors' Affiliation:
[1]Faculty of Medicine, University of Rzeszów, Rzeszów, Poland.
[2]Clinical Provincial Hospital No. 2, Rzeszów, Poland.

***Corresponding author:**
Katarzyna Markuszka,
Faculty of Medicine, University of Rzeszów, Rzeszów, Poland,
E-mail address: kasiulamarkuszka@gmail.com

Peer-Review History
Received: 18 February 2026
Reviewed & Revised: 03/March/2026 to 16/June/2026
Accepted: 21 June 2026
Published: 29 June 2026

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

Gonadotropin-releasing hormone antagonism treatment of endometriosis - new perspectives

Katarzyna Markuszka[1]*, Kinga Polityńska[1], Klaudia Samuła[1], Martyna Sarzyńska[1], Mateusz Szabat[2], Sylwia Lepak[1], Zuzanna Irzyk[1], Dominika Ruszel[1], Emilia Goc[1], Julia Rogała[1]

ABSTRACT

Endometriosis is an inflammatory, estrogen-dependent disorder that affects women of reproductive age. Pain management continues as a challenge as there has been limited progress in this area; however, oral GnRH antagonists are proving to be potent, safe, and well-tolerated options. The objectives of this paper were to evaluate the efficacy. and tolerability of the GnRH antagonists (relugolix, elagolix, linzagolix) for pain associated with endometriosis, and to determine their effects on patients' occupational functioning. Researchers analyzed patient-reported outcomes, adherence, and the long-term benefits of these drugs in light of the need for individualized therapies. To be eligible, patients had to have at least one of the following endpoints: pain reduction, safety profile, or impact on occupational functioning. Phase III clinical trials demonstrated that combination therapy with relugolix significantly reduced the severity of dysmenorrhea and non-menstrual pelvic pain compared with placebo. Researchers showed that relugolix is as effective as leuprorelin. However, relugolix has a better safety profile. Patients experienced fewer vasomotor symptoms and lower bone mineral density loss. Studies also demonstrated that elagolix improved work performance. It reduced absenteeism and presenteeism, which resulted in financial benefits for both employers and patients. GnRH antagonists are an effective and safe therapeutic option for the treatment of endometriosis-associated pain. In addition to improving clinical outcomes, their use has been shown to improve occupational functioning significantly. These therapies may play a key role in the long-term, individualized management of endometriosis, offering an alternative to traditional hormonal and surgical treatments and consequently broadening therapeutic options.

Keywords: endometriosis, relugolix, linzagolix, elagolix, GnRH antagonist

1. INTRODUCTION

Endometriosis is a gynecological condition, chronic, inflammatory that affects about 10% of women of reproductive age and 2–4% of postmenopausal women worldwide. The pathomechanism of this disease involves the growth of uterine lining tissue outside the uterine cavity and the muscular layer, leading to a chronic

inflammatory reaction. Endometriosis is an estrogen-dependent disease, so ectopic tissue produces menstrual material in sync with a woman's cycle, which accumulates in abnormal locations. Abnormal tissue and the normal uterine lining secrete and develop in a manner very similar to the normal uterine lining (Ellis et al., 2022). The pathogenesis of endometriosis remains largely unknown and is the subject of intense scientific research. Scientists have presented many hypotheses to explain the development of endometriosis – mechanistic theories that explain the mechanisms underlying the disease, particularly the ability of endometrial cells to implant and proliferate in the peritoneal cavity and to spread beyond the pelvic area.

The most prominent theories include: the transplantation theory proposed by Sampson (based on the phenomenon of retrograde menstruation through the fallopian tubes, observed in nearly all women, which may result in the implantation of endometrial fragments in ectopic locations), the metaplasia theory by Waldeyer, the induction theory by Levander and Norman, and the tissue injury and repair (TIAR) theory proposed by Leyendecker and Kunz. However, none of these theories fully accounts for the complexity of the disease's clinical and biological features, denoting a multifactorial etiopathogenesis (Zondervan et al., 2020). Endometriosis is clinically classified into three main types. Superficial peritoneal endometriosis includes small lesions located within the pelvic cavity. Ovarian endometriosis is associated with the presence of endometriomas. Deeply infiltrating endometriosis refers to lesions extending at least 5 mm below the peritoneal surface. Endometriotic lesions may also occur in extrapelvic locations, including the intestines, diaphragm, urinary bladder, thoracic wall, abdominal wall, as well as the peripheral and central nervous systems (Saunders and Horne, 2021).

Patients who suffer from endometriosis report painful periods, chronic pelvic pain, pain during intercourse, pain during bowel movements (dyschezia) or urination (dysuria), constipation, diarrhea, chronic fatigue, and depression are symptoms of endometriosis (Abulughod et al., 2024). Infertility affects up to 50% of patients. The symptoms mentioned above have a significant impact on quality of life and work performance (Della Corte et al., 2020). Epidemiological studies indicate an increased risk of selected malignancies (ovarian cancer, breast cancer, and melanoma) in women with endometriosis.

Endometriosis is also associated with several comorbidities. Common examples include autoimmune diseases, allergies, irritable bowel syndrome, migraines, asthma, cardiovascular diseases, and other gynecological disorders (Kvaskoff et al., 2015). Classifying endometriosis is difficult because people have different symptoms, and the severity of the disease does not always match how much pain they feel (Chapron et al., 2022). Several systems are used to classify the disease, including the revised American Society for Reproductive Medicine (rASRM) score (which measures lesion size, location, extent, and adhesions); the ENZIAN classification (which focuses on the shape and depth of lesions); the Endometriosis Fertility Index (EFI); and the latest system from the American Association of Gynecologic Laparoscopists (Pašalić et al., 2023).

Endometriosis treatment is multifaceted. Treatment includes pharmacotherapy, surgical procedures, and supportive care. Modern therapeutic methods emphasize a personalized approach to each patient. They focus on the patient's uniqueness—their reproductive goals, age, and symptoms. Hormone therapy is the cornerstone of conservative treatment and is the first step. Its main purpose is to prevent ectopic endometrial tissue from growing by altering brain hormone signals and reducing estrogen levels. The most common drugs are combined oral contraceptives. These prevent ovulation and stabilize the uterine lining, which lessens pain. Progestogens (such as dienogest, medroxyprogesterone acetate, and norethindrone acetate) are another option. Progestogens inhibit endometrial proliferation and modify uterine tissue. Thereby contributing to reduced pain, inflammation, and lesion regression (Kim et al., 2024). If the effect of these drugs proves ineffective, they are changed to analogs or antagonists of gonadotropin-releasing hormone. Mentioned above medications lower the production of gonadotropins, which in turn creates a low-estrogen (hypoestrogenic) state. Although gonadotropin-releasing hormone analogs help alleviate symptoms, they have side effects. Doctors must combine GnRH with other medications or shorten their duration of administration (Othman et al., 2024).

In recent years, oral gonadotropin-releasing hormone antagonists such as elagolix, relugolix, and linzagolix have become a source of interest for many researchers, because these medications work fast. Allow doctors to control hormones precisely. They have been shown to reduce pain and are safer than the older gonadotropin-releasing hormone analogs (Wang et al., 2025). Relugolix is a non-peptide gonadotropin-releasing hormone receptor antagonist that works by binding to gonadotropin-releasing hormone receptors in the pituitary gland, thereby preventing the natural gonadotropin-releasing hormone from binding. This interaction leads to a reversible, dose-dependent suppression of luteinizing hormone and follicle-stimulating hormone secretion, as well as reduced ovarian production of progesterone and estradiol (Miwa et al., 2011). Linzagolix is an orally active, non-peptide GnRH receptor antagonist. The half-life is approximately 15–18 hours. The substance is readily absorbed after oral administration and is poorly distributed throughout

the body. The drug's absorption is independent of food intake and has no significant effect on typical liver enzymes or transport proteins (Pohl et al., 2018).

2. REVIEW METHODS

We have searched the PubMed//MEDLINE and the National Institutes of Health (NIH) database for scientific articles published between January 2016 and January 2026 using the different combinations of the following MeSH terms and keywords: "endometriosis," "GnRH antagonist," "relugolix," "elagolix," and "linzagolix." Individual terms were combined using the Boolean operators "AND" and "OR." We selected meta-analyses, randomized controlled trials, prospective and retrospective observational studies, and case reports. During the selection of searched articles, we excluded animal model studies, papers without full-text access, and papers in languages other than English. We removed duplicate records before the inspection stage. Finally, we enrolled 56 records. Then we selected articles for inclusion in the qualitative synthesis. The publication selection process was conducted according to the PRISMA 2020 guidelines to ensure methodological integrity (Figure 1).

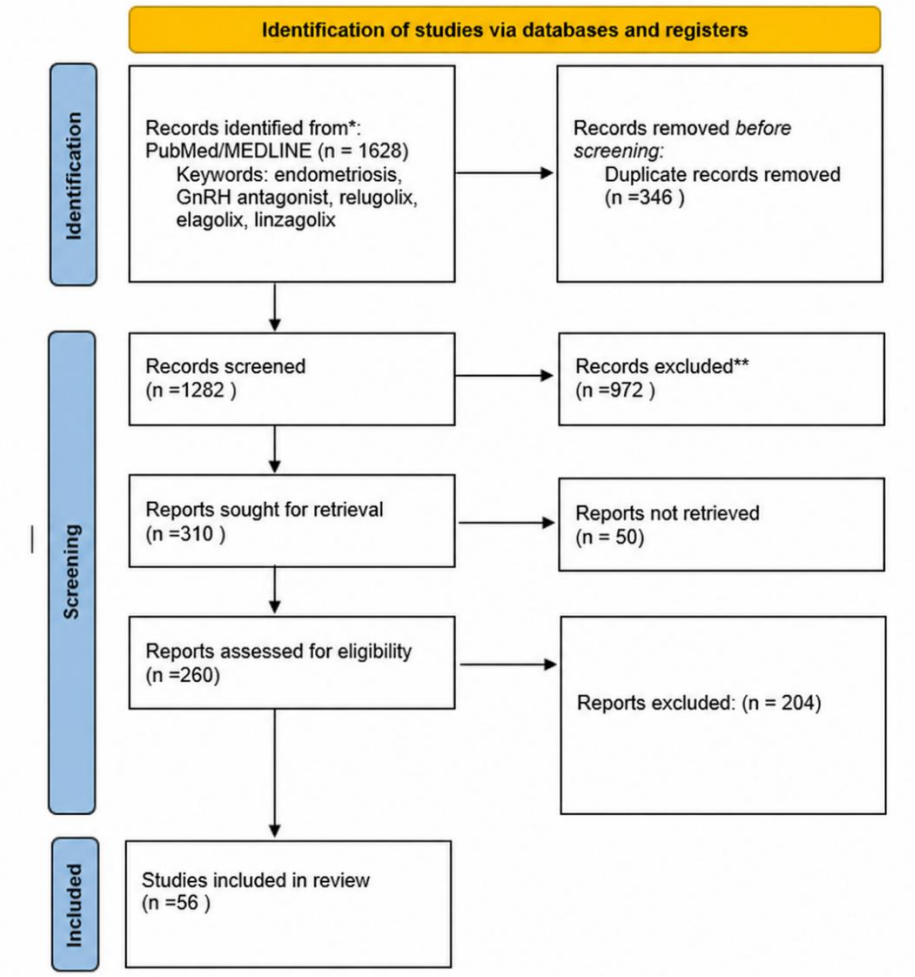

Figure 1. PRISMA flow diagram

3. RESULTS & DISCUSSION

Management of Endometriosis-Associated Pain

The researchers conducted a multicenter, randomized, double-blind, phase 3 clinical trial (SPIRIT 1). Inclusion criteria included women aged between 18 and 50 years with a diagnosis of endometriosis confirmed histologically or surgically within the previous 10 years, and dysmenorrhea or non-menstrual pelvic pain rated 4 or more on the Numerical Rating Scale (0 = no pain; 10 = worst possible pain) during the preceding month. A total of 638 patients participated in the SPIRIT 1 trial. Patients were divided into 3 groups: Relugolix

combination therapy (213 patients receiving Relugolix 40 mg, estradiol 1 mg, and norethisterone acetate 0.5 mg), placebo (213 patients), or delayed Relugolix combination therapy (213 patients receiving Relugolix monotherapy 40 mg followed by combination therapy, each for 12 weeks). The treatment period was 24 weeks. Ninety-eight patients discontinued the study prematurely. In the clinical trial, the percentage of patients achieving a therapeutic response for dysmenorrhea was 158/212 (75%) in the relugolix combination therapy group, compared with 57/212 (27%) in the placebo group, corresponding to a treatment effect difference of 47.6% (95% CI: 39.3–56.0; $p < 0.0001$). In the combined therapy group, 128/212 (58%) met the criterion for reduced nonmenstrual pelvic pain compared with 84/212 (40%) in the placebo group, resulting in a treatment difference of 18.9% (95% CI: 9.5–28.2; $p < 0.0001$). The most commonly reported side effects were nasopharyngitis and hot flashes. The results confirm the significant efficacy of oral combination therapy with relugolix in relieving endometriosis-related pain and indicate its aptitude for long-term treatment of this disease (Giudice et al., 2022).

Another multicenter, randomized, double-masked, active-controlled study was a phase III clinical trial in Japanese patients with endometriosis. Patients included in the study were ≥20 years old, had regular menstrual cycles lasting 25–38 days, and had a diagnosis of endometriosis confirmed surgically, radiologically, or clinically. Additional criteria included moderate to severe pelvic pain or dysmenorrhea, as assessed by the Biberoglu and Behrman scale, and a baseline visual analog scale (VAS) score >30. The study enrolled 335 patients and randomized them 1:1 to receive relugolix (171 patients; 40 mg orally once daily) or leuprorelin (164 patients; 3.75 mg or 1.88 mg subcutaneously every 4 weeks) for 24 weeks. Sixteen patients discontinued engagement due to adverse events. With respect to the primary endpoint—change in maximum pelvic pain intensity measured using the VAS—both groups manifested significant pain reduction: −52.6 ± 1.3 in the relugolix group and −57.5 ± 1.4 in the leuprorelin group. The maximum value of the 95% confidence interval for the difference between groups was 8.7, which was below the predefined noninferiority margin ($\Delta = 10$), thereby confirming the noninferiority of relugolix compared to leuprorelin. Pain reduction was observed as early as the first month of treatment and was maintained consistently throughout the study period. The results of the study showed that Oral relugolix therapy is as effective as standard GnRH analog therapy in relieving endometriosis-related pain. It can represent a potential long-term treatment option (Harada et al., 2022).

Table 1. Summary of the mechanisms of action of GnRH antagonists and their clinical effects

Mechanism of action	Description	Clinical benefits
Competitive blockade of GnRH receptors in the pituitary	GnRH antagonists directly block GnRH receptors, leading to immediate suppression of LH and FSH secretion	Rapid and reversible suppression of the HPG axis and reduction of estrogen levels
Suppression of estrogen production (hypoestrogenism)	Decreased LH/FSH → decreased ovarian stimulation → decreased estradiol	Reduced proliferation of endometriotic lesions and pain relief
No “flare-up” effect	Unlike GnRH agonists, there is no initial increase in LH/FSH and estrogen levels	No temporary worsening of symptoms
Dose-dependent effect (estradiol suppression)	Degree of estradiol suppression depends on drug dose	Possibility of individualized therapy (balance between efficacy and side effects)
Use of add-back therapy	Addition of low doses of estrogen/progestin	Reduction of side effects (e.g., bone loss) while maintaining efficacy
Analgesic effect (via hormonal and inflammatory pathways)	Reduced estrogen levels lead to decreased inflammation and lesion activity	Reduced dysmenorrhea, chronic pelvic pain, and dyspareunia

An international, multicenter, randomized, double-masked, placebo-controlled phase IIb clinical trial (EDELWEISS) was conducted to evaluate the efficacy and safety of linzagolix and to determine the optimal dosing range in patients with endometriosis-associated pain. Inclusion criteria for the study were gender, age 18–45 years, premenopausal, with surgically confirmed endometriosis within the last 10 years, and moderate to severe pelvic pain. A total of 328 patients were recruited, of whom 327 received at least one dose of the investigational medicinal product and were subsequently included in the safety analysis. Participants were equally assigned to 6 treatment groups: placebo (switching to linzagolix 100 mg after 12 weeks), a fixed dose of linzagolix (50 mg, 75 mg, 100 mg, or 200 mg), and a dose-titration regimen starting at 75 mg with subsequent adjustments based on estradiol levels. The treatment duration was 24 weeks. The primary endpoint was a 30% or greater reduction in mean pelvic pain after 12 weeks of therapy. Secondary endpoints

included reductions in pain on bleeding and non-bleeding days, changes in the severity of dyspareunia and dyschezia, analgesic use, quality-of-life measures, and the frequency of amenorrhea. The results showed that linzagolix significantly relieved pain associated with endometriosis. Effects that increase with dosage.

The mechanism of action of linzagolix involves carefully lowering estradiol levels, consistent with the "estrogen threshold" concept - this mechanism aids in maintaining pain relief while limiting hypoestrogenic side effects. Regarding treatment compliance, 88.1% of patients completed 12 weeks of therapy, and 77.1% completed the full 24-week period. Collectively, these results prove that linzagolix is a beneficial therapeutic alternative. It has the advantages of being effective in treating endometriosis-related pain, providing effective symptom relief, and potentially having a more favorable safety profile than conventional GnRH analogs (Taylor et al., 2017). Table 1 summarizes the mechanisms of action of GnRH antagonists and their benefits (Dick et al., 2025; Othman et al., 2024).

Impact of GnRH Antagonist Therapy on Work Productivity and Occupational Activity

In Patients with endometriosis, given the significant burden of pain associated with the condition, recent studies have assessed not only clinical outcomes but also the implications of treatment for patients' ability to maintain daily work activities and overall job productivity. Table 2 summarizes the symptoms and their frequency in patients with endometriosis.

Table 2. Summary of endometriosis symptoms and their prevalence

Symptoms	% Women with Endometriosis	Notes
Dysmenorrhea	70–87%	most common symptom
Chronic pelvic pain	50–80%	often coexists with other symptoms
Dyspareunia	30–70%	depends on lesion location
Dyschezia	20–60%	more common in bowel endometriosis
Dysuria	10-30%	less common
Infertility	30-50%	very common manifestation
Severe pain (high-intensity pain symptoms	60-68%	refers to significant pain burden
Psychological symptoms (anxiety, depression)	50-60%	often underrecognized
Asymptomatic	20-25%	important for underdiagnosis

A post hoc analysis was accomplished using data from two multicenter, randomized, placebo-controlled phase 3 clinical trials (EM-I: NCT01620528 and EM-II: NCT01931670) evaluating the efficacy of elagolix and its impact on work productivity in women with moderate-to-severe endometriosis-associated pain. Participants were women aged 18–49 years with surgically confirmed endometriosis and moderate to severe disease-related pain. The analysis included working patients (full-time or part-time) from the intent-to-treat population: 672 in study EM-I and 626 in study EM-II. Participants were randomly assigned to one of three groups: placebo, elagolix 150 mg once daily, or elagolix 200 mg twice daily for 6 months. The primary assessment was conducted three months after treatment began.

The study used the Health-Related Productivity Questionnaire (HRPQ) to assess work hours and activity limitations. The questionnaire measures both absenteeism (time absent from work) and presenteeism (reduced work productivity). At baseline, the mean weekly time lost from work was 16.5 ± 11.4 hours in the EM-I study and 15.2 ± 11.3 hours in the EM-II study, representing 45.3% and 43.7% of scheduled work time, respectively. The most important cause of the decline in productivity was presenteeism (around 12–13 hours per week), while absenteeism was around 3 hours per week. After three months of treatment, the elagolix groups showed statistically significant reductions in work productivity loss, including both absenteeism and presenteeism, compared to the placebo group ($p < 0.05$). Treatment was associated with reduced total lost work hours and improved occupational productivity. Effects were observed with both dosing regimens, but greater benefits were observed with the 200 mg twice-daily dose. Additionally, an economic analysis found that improved work productivity translated into prospective direct cost savings for employers, resulting from reduced lost working hours (Pokrzywiński et al., 2019). Table 3 summarizes the research from the above article.

Table 3. Summary of the clinical studies described in the article.

Study	Drug / intervention	Population	Key efficacy outcomes	Clinical conclusions
SPIRIT 1 (Giudice et al., 2022)	Relugolix + E2 + NETA vs placebo	n = 638, endometriosis + pain ≥4 NRS	Dysmenorrhea: 75% vs 27% (Δ 47.6%, p<0.0001); NMPP: 58% vs 40% (Δ 18.9%, p<0.0001)	Strong analgesic efficacy; particularly in dysmenorrhea
Harada et al., 2022	Relugolix vs leuprorelin	n = 335	Pain reduction: −52.6 vs −57.5 (VAS); non-inferiority achieved	Relugolix is as effective as GnRH agonist therapy
EDELWEISS (Taylor et al.)	Linzagolix (multiple doses)	n = 328	≥30% pain reduction; dose-dependent effect	Enables estradiol control ("estrogen threshold")
EM-I / EM-II (Pokrzywiński et al., 2019)	Elagolix vs placebo	n=1300	Reduced work productivity impairment and improved functional capacity (p < 0.05)	Demonstrates real-world functional and economic benefits

4. CONCLUSION

Clinical trial results show that oral gonadotropin-releasing hormone (GnRH) antagonists, including relugolix, elagolix, and linzagolix, are highly effective in treating pain associated with endometriosis. Relugolix—particularly in combination with estradiol and norethisterone acetate—significantly improved both dysmenorrhea and non-menstrual pelvic pain compared with placebo and demonstrated a remarkable safety profile. Linzagolix produced significant dose-dependent pain reduction while also reducing side effects associated with hypoestrogenism (e.g., bone mineral density loss and vasomotor symptoms). Elagolix alleviated pain symptoms and improved work performance and daily functioning. Post-hoc analyses showed that elagolix reduced absenteeism and presenteeism, thereby improving work performance and suggesting significant socioeconomic benefits associated with symptom control. Overall, current evidence suggests that GnRH antagonists play an important role in the pharmacological treatment of endometriosis.

GnRH antagonists offer a rapid onset of action, oral administration, dose-dependent hormone suppression, and improved tolerability. Prescribing these medications aligns with the principles of patient-centered medicine, allowing treatment to be tailored to individual patient characteristics, symptom severity, and reproductive goals. They help improve the quality of life and occupational function. Treatment with these medications can improve daily functioning and quality of life, including long-term disease control, and reduce the clinical and social consequences of endometriosis.

Acknowledgments

There are no acknowledgments to disclose.

Authors' Contributions

Katarzyna Markuszka - contributed to the study conception and design, conducted the literature search and data analysis, wrote the manuscript, and approved the final version for publication.
Zuzanna Irzyk - conducted the literature search and data analysis.
Emilia Goc - conducted the literature search and data analysis.
Mateusz Szabat- conducted the literature search and data analysis.
Klaudia Samuła - conducted the literature search and data analysis.
Dominika Ruszel - conducted the literature search and data analysis.
Julia Rogała - conducted the literature search and data analysis.
Kinga Polityńska - conducted the literature search and data analysis.
Martyna Sarzyńska - conducted the literature search and data analysis.
Sylwia Lepak - conducted the literature search and data analysis.

Informed consent
Not applicable.

Ethical approval
Not applicable. This article does not contain any studies with human participants or animals performed by any of the authors.

Funding
This research did not receive any external funding like specific grant from funding agencies in the public, commercial, or nonprofit sectors.

Conflict of interest
The authors declare that they have no conflicts of interest, competing financial interests or personal relationships that could have influenced the work reported in this paper.

Data and materials availability
All data associated with this study will be available based on the reasonable request to corresponding author.

REFERENCES

1. Abulughod N, Valakas S, El-Assaad F. Dietary and nutritional interventions for the management of endometriosis. Nutrients 2024;16(23):3988. doi:10.3390/nu16233988.
2. Chapron C, Marcellin L, Borghese B, Santulli P. Rethinking mechanisms and management of endometriosis. Nat Rev Endocrinol 2022;18(11):666–682. doi:10.1038/s41574-022-00710-z.
3. Della Corte L, Di Filippo C, Gabrielli O, Reppuccia S, La Rosa VL, Ragusa R, Fichera M, Commodari E, Bifulco G, Giampaolino P. The burden of endometriosis on women's lifespan: a narrative overview on quality of life and psychosocial wellbeing. Int J Environ Res Public Health 2020;17(13):4683. doi:10.3390/ijerph17134683.
4. Dick A, Matok I, Gutman-Ido E, Lessans N, Dior UP. GnRH analogues and dienogest for second line treatment of endometriosis-associated pain: a systematic review, meta-analysis, and network meta-analysis. Eur J Obstet Gynecol Reprod Biol 2025;312:114093. doi:10.1016/j.ejogrb.2025.114093.
5. Ellis K, Munro D, Clarke J. Endometriosis is undervalued: a call to action. Front Glob Womens Health 2022;3:902371. doi:10.3389/fgwh.2022.902371.
6. Giudice LC, As-Sanie S, Arjona Ferreira JC, Becker CM, Abrao MS, Lessey BA, Brown E, Dynowski K, Wilk K, Li Y, Mathur V, Warsi QA, Wagman RB, Johnson NP. Once daily oral relugolix combination therapy versus placebo in patients with endometriosis-associated pain: two replicate phase 3, randomised, double-blind studies (SPIRIT 1 and 2). Lancet 2022;399(10343):2267–2279. doi:10.1016/S0140-6736(22)00622-5.
7. Harada T, Osuga Y, Suzuki Y, Fujisawa M, Fukui M, Kitawaki J. Relugolix, an oral gonadotropin-releasing hormone receptor antagonist, reduces endometriosis-associated pain compared with leuprorelin in Japanese women: a phase 3, randomized, double-blind, noninferiority study. Fertil Steril 2022;117(3):583–592. doi:10.1016/j.fertnstert.2021.11.013.
8. Kim J, Lee HJ, Lee JE, Kim MR. Effects of hormonal therapy on ovarian endometriomas: a systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol 2024;292:123–130. doi:10.1016/j.ejogrb.2023.11.018.
9. Kvaskoff M, Mu F, Terry KL, Harris HR, Poole EM, Farland L, Missmer SA. Endometriosis: a high-risk population for major chronic diseases? Hum Reprod Update 2015;21(4):500–516. doi:10.1093/humupd/dmv013.
10. Miwa K, Hitaka T, Imada T, Sasaki S, Yoshimatsu M, Kusaka M, Tanaka A, Nakata D, Furuya S, Endo S, Hamamura K, Kitazaki T. Discovery of 1-{4-[1-(2,6-difluorobenzyl)-5-[(dimethylamino)methyl]-3-(6-methoxypyridazin-3-yl)-2,4-dioxo-1,2,3,4-tetrahydrothieno[2,3-d]pyrimidin-6-yl]phenyl}-3-methoxyurea (TAK-385) as a potent, orally active, non-peptide antagonist of the human gonadotropin-releasing hormone receptor. J Med Chem 2011;54(14):4998–5012. doi:10.1021/jm200216q.
11. Othman ER, Al-Hendy A, Mostafa R, Lambalk CB, Mijatovic V. Oral GnRH antagonists for pain relief associated with endometriosis. Int J Womens Health 2024;16:309–321. doi:10.2147/IJWH.S442357.
12. Pašalić E, Tambuwala MM, Hromić-Jahjefendić A. Endometriosis: classification, pathophysiology, and treatment

options. Pathol Res Pract 2023;251:154847. doi:10.1016/j.prp.2023.154847.
13. Pohl O, Marchand L, Fawkes N, Gotteland JP, Loumaye E. Gonadotropin-releasing hormone receptor antagonist mono- and combination therapy with estradiol/norethindrone acetate add-back: pharmacodynamics and safety of OBE2109. J Clin Endocrinol Metab 2018;103(2):497–504. doi:10.1210/jc.2017-01875.
14. Pokrzywinski RM, Soliman AM, Chen J, Snabes M, Diamond MP, Surrey E, Coyne KS. Impact of elagolix on work loss due to endometriosis-associated pain: estimates based on the results of two phase III clinical trials. Fertil Steril 2019;112(3):545–551. doi:10.1016/j.fertnstert.2019.04.031.
15. Saunders PTK, Horne AW. Endometriosis: etiology, pathobiology, and therapeutic prospects. Cell 2021;184(11):2807–2824. doi:10.1016/j.cell.2021.04.041.
16. Taylor HS, Giudice LC, Lessey BA, Abrao MS, Kotarski J, Archer DF, Diamond MP, Surrey E, Johnson NP, Watts NB, Gallagher JC, Simon JA, Carr BR, Dmowski WP, Leyland N, Rowan JP, Duan WR, Ng J, Schwefel B, Thomas JW, Jain RI, Chwalisz K. Treatment of endometriosis-associated pain with elagolix, an oral GnRH antagonist. N Engl J Med 2017;377(1):28–40. doi:10.1056/NEJMoa1700089.
17. Wang JY, Zhang Y, Ding J. Oral gonadotropin-releasing hormone antagonists in the treatment of endometriosis: advances in research. J Clin Med Res 2025;17(6):299–308. doi:10.14740/jocmr6236.
18. Zondervan KT, Becker CM, Missmer SA. Endometriosis. N Engl J Med 2020;382(13):1244–1256. doi:10.1056/NEJMra1810764.