Aromatase Inhibitors in Gynecologic Practice

ABSTRACT: Aromatase inhibitors have been used for the treatment of breast cancer, ovulation induction, endometriosis, and other estrogen-modulated conditions. For women with breast cancer, bone mineral density screening is recommended with long-term aromatase inhibitor use because of risk of osteoporosis due to estrogen deficiency. Based on long-term adverse effects and complication safety data, when compared with tamoxifen, aromatase inhibitors are associated with a reduced incidence of thrombosis, endometrial cancer, and vaginal bleeding. For women with polycystic ovary syndrome and a body mass index greater than 30, letrozole should be considered as first-line therapy for ovulation induction because of the increased live birth rate compared with clomiphene citrate. Lifestyle changes that result in weight loss should be strongly encouraged. Aromatase inhibitors are a promising therapeutic option that may be helpful for the management of endometriosis-associated pain in combination therapy with progestins.

Recommendations

The American College of Obstetricians and Gynecologists supports the following recommendations and conclusions:

- For women with breast cancer, bone mineral density screening is recommended with long-term aromatase inhibitor use because of risk of osteoporosis due to estrogen deficiency.
- Based on long-term adverse effects and safety data, when compared with tamoxifen, aromatase inhibitors are associated with a reduced incidence of thrombosis, endometrial cancer, and vaginal bleeding.
- For women with polycystic ovary syndrome and a body mass index (BMI) greater than 30, letrozole should be considered as first-line therapy for ovulation induction because of the increased live birth rate compared with clomiphene citrate. Lifestyle changes that result in weight loss should be strongly encouraged.
- For women with unexplained infertility (regular menstrual cycles, all known male or female factors excluded), a large multicenter study demonstrated that ovulation induction with letrozole resulted in lower live birth rates and multiple gestation rates compared with gonadotropins; however, live birth and multiple gestation rates did not differ significantly between ovulation induction with letrozole compared with clomiphene citrate.
- Aromatase inhibitors are a promising therapeutic option that may help manage endometriosis-associated pain in combination therapy with progestins.

This Committee Opinion revision provides updated information on the use of aromatase inhibitors in breast cancer, ovulation induction, and endometriosis, and long-term follow-up data from relevant studies. Aromatase is a microsomal cytochrome P450 hemoprotein-containing enzyme (P450arom, the product of the CYP19 gene), and it is widely expressed in tissues, such as brain, breast, placenta, ovary, testes, endometrium, skin, bone, and fat. Within these tissues, aromatase mediates the conversion of androstenedione to estrone and the conversion of testosterone to estradiol in situ. Thus, for tissues that express this enzyme, conversion of circulating androgens from an adrenal or ovarian source will significantly increase the in situ estrogen concentrations...
and provide these tissues with a proliferative advantage. In postmenopausal women, inhibitors of the aromatase enzyme reduce circulating estradiol levels from 20 pg/mL to less than 1–3 pg/mL. Based on these varying effects, aromatase inhibitors have been used for the treatment of breast cancer, ovulation induction, endometriosis, and other estrogen-modulated conditions.

Three aromatase inhibitors are currently commercially available in the United States. Exemestane is a steroid-derived aromatase inhibitor that binds irreversibly to aromatase and permanently inactivates the available enzyme. Letrozole and anastrozole are reversible inhibitors of aromatase that compete with androgens for aromatase binding sites. All three aromatase inhibitors are available in pill form and appear to have similar clinical efficacy despite differences in pharmacologic properties.

**Breast Cancer**

Because estrogen is theorized to play an important role in the pathogenesis and proliferation (or growth) of breast cancer, one treatment strategy for hormone-sensitive breast cancer is to decrease circulating estrogen levels. Aromatase inhibitors are one class of drugs used for this purpose. Additional guidance on the management of gynecologic issues in women with breast cancer can be found in the American College of Obstetricians and Gynecologists' Practice Bulletin No. 126, *Management of Gynecologic Issues in Women With Breast Cancer* (3).

**Postmenopausal Women**

In postmenopausal women, aromatase inhibitors were first introduced for the treatment of advanced breast cancer. The early success of studies led to clinical trials of aromatase inhibitors in breast cancer patients with resectable, estrogen receptor-positive tumors. The largest of these trials has compared anastrozole alone with tamoxifen alone, or the combination (4), as adjuvant treatment in women with early breast cancer after surgical resection. The 10-year follow-up study results demonstrated that anastrozole is better than tamoxifen in the prevention of recurrence of breast cancer in postmenopausal women with early-stage hormone receptor-positive tumors (5). Additional studies have shown the effectiveness of aromatase inhibitors in other breast cancer clinical scenarios, including ductal carcinoma in situ (6). Specific guidelines can be accessed at National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (7) and the 2014 American Society of Clinical Oncology Clinical Practice Guidelines (8).

**Premenopausal Women**

Aromatase inhibitors should not be used alone in women with breast cancer who have preserved ovarian function. There is a growing body of evidence that supports effective use of aromatase inhibitors with ovarian suppression in select populations, such as women who remained premenopausal after completing chemotherapy and who were at sufficient risk of recurrence to warrant adjuvant chemotherapy (9). Aromatase inhibitors should be avoided in premenopausal women who have chemotheraphy-induced amenorrhea with breast cancer because ovarian function can resume after the initiation of an aromatase inhibitor regimen, which renders the treatment ineffective (10, 11). Numerous trials have evaluated combinations of therapies with aromatase inhibitors alone or with other agents and, thus, gynecologists who work with breast cancer patients and survivors should become familiar with the patient’s specific protocol in order to best provide appropriate care and support.

**Chemoprevention of Breast Cancer**

Studies have shown the effectiveness of aromatase inhibitors for the prevention of breast cancer in high-risk patients (12). The U.S. Preventive Services Task Force recommends that clinicians engage in shared, informed decision making with women who are at increased risk of breast cancer about medications to reduce their risk; the U.S. Preventive Services Task Force recommends against the routine use of medications, such as tamoxifen or raloxifene, for risk reduction of primary breast cancer in women who are not at increased risk of breast cancer (13).

**Adverse Effects**

The short-term and long-term adverse effects of aromatase inhibitors in postmenopausal women are related to lack of estrogen action at aromatase-targeted tissue sites. These adverse effects include hot flushes, vaginal dryness, arthralgia, decreased bone mineral density, and an increased fracture rate (4). Nonhormonal methods, such as moisturizers, should be considered as first-line therapy for women with localized vulvar or vaginal symptoms (3). A case–control study of women with breast cancer who used vaginal estrogen did not show an increase in recurrence with local estrogen use compared with nonuse (14). The use of vaginal estrogen in women with a history of estrogen-dependent tumors may be considered in symptomatic women after discussion of quality of life and risks and benefits (15). The entire medical team, including the treating medical oncologist, should be included in this discussion (15).

For women with breast cancer, bone mineral density screening is recommended with long-term aromatase inhibitor use because of the risk of osteoporosis due to estrogen deficiency. The National Comprehensive Cancer Network recommends baseline and periodic follow-up bone density testing for women treated with aromatase inhibitors (7). To reduce the risk of osteoporosis in high-risk patients, bisphosphonates are typically co-administered to patients during long-term treatment with aromatase inhibitors (16). Potential risks of bisphosphonates reported after marketing include osteonecrosis of the jaw, seizures, atypical fractures of the femoral shaft, and esophageal cancer. A precise understanding of the
true risk of these events has been difficult to determine because of the lack of data on the incidence of these problems in the general population. Although rare cases of osteonecrosis of the jaw have been reported in patients using bisphosphonates for osteoporosis, it has been seen most commonly after dental extractions in those being treated with large intravenous doses of bisphosphonates in association with supportive cancer therapy (17). Use of bisphosphonates for this population may require a consultation with a specialist. More recently, an anti-RANK-Ligand (Receptor Activator of Nuclear Factor κ B ligand) antibody has been used to prevent bone loss in women receiving aromatase inhibitors (18). The RANK-Ligand is the essential mediator of osteoclast activity and bone resorption, and is produced by bone cells in the skeleton (18, 19).

Based on long-term adverse effects and safety data, when compared with tamoxifen, aromatase inhibitors are associated with a reduced incidence of thrombosis, endometrial cancer, and vaginal bleeding (20, 21). Aromatase inhibitors have been shown to have adverse effects on the cardiovascular system and lipid profiles compared with tamoxifen (20, 21). Most of those who discontinue the use of aromatase inhibitors do so because of musculoskeletal symptoms, fatigue, forgetfulness, or sleep disturbances (20–22).

**Ovulation Induction**

The gonadotropin-stimulating action of letrozole has been used off-label in the treatment of patients with ovulatory dysfunction, such as polycystic ovary syndrome, and to increase follicular recruitment in women who are already ovulatory (23–25). If prescribing letrozole, the starting dose is 2.5 mg/day for 5 days typically starting on day 3, 4, or 5 after a spontaneous menses or progestin-induced bleed. If ovulation does not occur, the dose can be increased to 5 mg/day for 5 days with a maximum dose of 7.5 mg/day. Doses higher than 7.5 mg/day have been associated with thinning of the endometrium as seen with clomiphene citrate (26).

For women with unexplained infertility (regular menstrual cycles, all known male or female factors excluded), a large multicenter study demonstrated that ovulation induction with letrozole resulted in lower live birth rates and multiple gestation rates compared with gonadotropins. Although letrozole and clomiphene citrate demonstrated similar live birth and multiple gestation rates, the study was not powered to detect a difference between these two medications (27). Further trials are needed to determine which is better for the treatment of unexplained infertility.

Letrozole also has been used for ovulation induction for women with polycystic ovary syndrome (PCOS). In an early meta-analysis of four published trials that included 662 women with PCOS, pregnancy rates were similar between women treated with clomiphene citrate and women treated with letrozole (relative risk, 1.02; 95% confidence interval, 0.83–1.26) (28). However, in a more recent randomized controlled trial, letrozole was more effective than clomiphene citrate with a higher live birth rate (27.5% versus 10.1%, \( P = .007 \)), and cumulative ovulation rate (61.7% versus 48.3%, \( P < .001 \)) (29). In women with a BMI greater than or equal to 30.3, ovulation induction with letrozole resulted in a higher live birth rate when compared with clomiphene citrate (29, 30). Therefore, for women with PCOS and a BMI greater than 30, letrozole should be considered first-line therapy for ovulation induction because of the increased live birth rate compared with clomiphene citrate. Although ovulation induction is very effective, it is important to recognize that for obese women with PCOS, lifestyle changes that result in weight loss should be strongly encouraged. A 7% decrease in BMI may result in spontaneous ovulation and avoid the need for therapy for ovulation induction (31, 32). For an obese patient, lifestyle changes should always be encouraged; weight changes as little as 5% of body weight may improve reproductive function (31). More information on polycystic ovary syndrome can be found in the American College of Obstetricians and Gynecologists’ Practice Bulletin No. 108, *Polycystic Ovary Syndrome* (33).

A number of studies have shown that letrozole appears to have a role in the treatment of clomiphene-resistant patients; 50–80% of clomiphene nonresponders have been shown to ovulate after using letrozole (34–36). Some of these studies have raised concerns about this off-label use because letrozole may disrupt the normal aromatase activity in tissues during early fetal development and can be potentially teratogenic if administered inadvertently during early pregnancy. Although studies have demonstrated that newborns whose mothers achieved pregnancy by using letrozole for ovulation induction showed no significant difference in rates of congenital malformations compared with those newborns whose mothers used the clomiphene citrate treatment (29, 37), long-term data are needed to confirm this finding. It should be noted that letrozole and clomiphene citrate are pregnancy category X. When prescribing letrozole for ovulation induction, patients should be counseled that unlike clomiphene citrate, letrozole is not approved by the U.S. Food and Drug Administration for ovulation induction.

**Endometriosis**

Aromatase inhibitors are a promising therapeutic option that may help manage endometriosis-associated pain in combination therapy with progestins. The recent demonstration that aromatase is expressed at higher levels in endometriosis implants compared with normal endometrium has led to pilot studies using anastrozole co-administered with progestins in patients with endometriosis resistant to conventional medical and surgical therapies (38). Efficacy has been demonstrated for relief of pelvic pain when aromatase inhibitors were combined
with combination oral contraceptives (39), or when aromatase inhibitors were given concomitantly with a GnRH agonist (40). The combination of letrozole and norethisterone acetate was more effective than norethisterone acetate alone in reducing pain and deep dyspareunia in women with rectovaginal endometriosis (41). A systematic review of the use of aromatase inhibitors for the treatment of pain associated with severe endometriosis concluded that aromatase inhibitors significantly reduced pain compared with GnRH agonists alone (42). The use of aromatase inhibitors with add-back progestin or oral contraceptives does not appear to be associated with significant bone loss after 6 months of treatment and, based on the available data, may be suitable for long-term (greater than 6 months) use (43).

References


33. Huber-Buchholz MM, Carey DG, Norman RJ. Restoration of reproductive potential by lifestyle modification in obese polycystic ovary syndrome: role of insulin sensitiv-
ity and luteinizing hormone. J Clin Endocrinol Metab 1999;84:1470–4. [PubMed] [Full Text] 


40. Soysal S, Soysal ME, Ozer S, Gul N, Gezgin T. The effects of post-surgical administration of goserelin plus anastrozole compared to goserelin alone in patients with severe endo-

