A Double-blind Randomized Controlled Trial of Toremifene Therapy for Mastalgia

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Hypothesis: Toremifene is effective in reducing breast pain and does not increase the incidence of adverse events as a therapy for moderate to severe mastalgia.

Design and Patients: In a double-blind randomized controlled trial, patients with moderate to severe mastalgia received toremifene citrate, 30 mg daily, or a placebo tablet for 3 menstrual cycles and were followed up for breast pain score and adverse events. The serum levels of estradiol, progesterone, and prolactin were examined before treatment and correlated with the response rate to toremifene treatment.

Results: Seventy-two (69.2%) of 104 patients receiving toremifene and 29 (31.9%) of 91 receiving placebo responded to the treatment, with reduction in breast pain score of more than 50% (P < .001). Among the patients with cyclical mastalgia, the response rate for toremifene was 76.7% (59/77), whereas the response rate for placebo was 48.1% (13/27) for toremifene and 24.0% (6/25) for placebo (P = .09). Adverse events were observed in 44 (42.9%) of 104 patients receiving placebo and 46 (50.5%) of 91 patients receiving toremifene (P = .45). A positive correlation between baseline breast pain score and serum estradiol level was observed in patients with cyclical mastalgia (r = 0.35, P = .003).

Conclusions: Toremifene effectively relieves moderate and severe cyclical mastalgia and tends to exert a positive therapeutic effect on noncyclical mastalgia. In addition, toremifene therapy does not increase the incidence of intolerable adverse event. Therefore, it is a feasible therapy for mastalgia, especially cyclical mastalgia.

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Mastalgia is a painful symptom of the breast without any specific physiological or pathological abnormality in the parenchyma or stroma of the organ. It is the most common clinical complaint in patients with benign breast disease. Approximately 66% of healthy working women have mastalgia. Based on its natural history and its response to medication, mastalgia is classified as cyclical mastalgia, noncyclical mastalgia, or chest wall pain. In addition, mastalgia that disturbs a patient’s normal life, such as sleeping, working, and sex, can also be classified according to severity as mild, moderate, or severe. Only 5% to 20% of patients with moderate to severe mastalgia need medications, whereas those with mild mastalgia can be treated with psychotherapy or diet control. Although the treatment for mastalgia already has been studied extensively, highly effective therapies are still lacking. Presently available drugs prescribed for mastalgia include danazol, bromocriptine mesylate, and tamoxifen citrate. Among them, tamoxifen is used widely because of its higher effectiveness and lower toxic effects compared with danazol and bromocriptine. Recently, toremifene citrate, a new member of the family of selective estrogen receptor modulators, has been shown to be as effective as tamoxifen in the treatment of breast cancer as adjuvant endocrine therapy but is less toxic than the latter. These data imply that toremifene also may be a feasible medication for mastalgia. Therefore, we conducted a double-blind randomized controlled study to evaluate the therapeutic and adverse events of toremifene for moderate and severe mastalgia.

METHODS

PATIENTS

Premenopausal women with regular menstrual cycles and moderate to severe cyclical mastalgia...
or noncyclical mastalgia were recruited for the study. In all patients, mastalgia lasted for at least 6 consecutive menstrual cycles and more than 7 days for each cycle. To further confirm the severity and duration of mastalgia, as well as its association with menstrual cycles, we evaluated the patients using a visual analog scale (VAS) breast pain chart for 1 extra menstrual cycle and excluded those with a score of less than 4 or those with accompanying chest wall pain. Other exclusion criteria were as follows: (1) use of sex steroids (eg, oral contraceptive pill), danazol, vitamin B, or evening primrose oil within the last 3 months; (2) use of nonsteroidal anti-inflammatory drugs within the last 3 months; (3) use of hormonal therapy; (4) possible pregnancy; (5) possible noncompensated cardiac insufficiency, severe angina, or hepatic failure; (6) history of cancer and thrombus; and (7) allergy to toremifen. All these studies were approved by an academic committee in our university with informed consent of the patients.

STUDY DESIGN

The recruited patients with mastalgia were asked to record their symptoms of breast pain using a daily VAS breast pain chart, and the sum of the daily VAS within a menstrual cycle was considered the breast pain score (BPS). After a single nonmedicated menstrual cycle, designated the baseline cycle, a baseline daily score not less than 4 (VAS $\geq$4) verifying moderate to severe mastalgia was assigned to the participant. Qualified patients then entered a single-blind run-in phase and received placebo for 1 menstrual cycle, designated the placebo lead-in cycle, and each received a new placebo lead-in score to confirm her eligibility. Except for those with BPS decreased more than 25% after the placebo lead-in cycle, eligible participants entered the subsequent double-blind randomized controlled trial, receiving either toremifen, 30 mg daily, or placebo tablets for 3 consecutive men-
Figure 2. Reduction in percentage in the breast pain score at the end of each cycle for treatment with toremifen citrate (black bars) or placebo (gray bars) (P<.001) compared with the control group at each time point. Asterisk indicates that breast pain score of the treatment group at each time point was significantly different from the control group.

Figure 3. Breast pain score evaluated in the patients receiving toremifen citrate (black boxes) or placebo (white boxes) at the end points of baseline month (day 30 before treatment); placebo lead-in month (day 0 after treatment); and the first (day 30 after treatment), second (day 60 after treatment), and third (day 90 after treatment) treatment months. Asterisk indicates P<.001 compared with placebo treatment group evaluated at the same time point and compared with placebo lead-in month in the same treatment group.

RESULTS

NUMBER OF PARTICIPANTS

From September 1, 2001, through March 31, 2004, more than 7000 women attended our center at the Sun Yat-Sen Memorial Hospital for mastalgia. Among them, 988 met the criteria of moderate and severe mastalgia according to the record of the breast pain chart after 1 baseline menstrual cycle. Of these patients, only 195 had a decrease in VAS score of less than 25% after the placebo lead-in cycle and thus were assigned randomly to placebo (91 patients) or toremifen (104 patients) treatment. During the treatment months, 72 women discontinued the therapy, including 57% of patients from the placebo group because of lack of clinical response (34 patients), adverse event (2 patients), and other reasons (5 patients) and 43% from the toremifen group because of no clinical response (10 patients), adverse event (2 patients), and other reasons (19 patients). Among the patients without clinical response, 34 from the placebo group and 10 from the toremifen group switched to treatment with danazol, 200 mg daily, for 2 menstrual cycles. In addition, among the patients with positive clinical response, 13.8% (4/29) from the placebo group and 13.9% (10/72) from the toremifen group had a relapse of breast pain and switched to danazol therapy.

THERAPEUTIC EFFECT

To determine the therapeutic effect of toremifen, the percentage of reduction in BPS after 3 treatment cycles was calculated as described in the “Statistics” subsection of the “Methods” section, and 50% reduction in BPS was considered a clinical response to the treatment. As a result, clinical response was achieved in 72 (69.2%) patients from the toremifen group and in 29 (31.9%) from the placebo group (χ2=27.32, P<.001). Furthermore, for cyclical mastalgia, the response rates with toremifen and placebo were 76.7% (59/77) and 34.8% (23/66), respectively (χ2=25.36, P<.001). In contrast, for noncyclical mastalgia, the response rates with toremifen and placebo were 48.1% (13/27) and 24.0% (6/25), respectively (χ2=3.26, P=.09).

In addition, in the toremifen group, BPS reductions for the first, second, and third treatment cycles relative to the placebo lead-in cycle were 52.9% (97/180), 73.4% (78/86), and 78.9% (66/71), respectively, whereas reductions in the placebo group were 20.9% (6/29), 35.8% (56/162), and 46.2% (44/95) (χ2=77.00, P<.001) (Figure 2). As shown in Figure 3, the BPS was reduced significantly at the end of each toremifen-treated cycle as compared with the previous cycle (P<.01) but remained unchanged in the placebo group (P>.05). Furthermore, the BPS was significantly lower with toremifen treatment as compared with placebo treatment at the end of each treatment cycle (P<.01).

At the end of the study, patients without clinical response switched to danazol, 200 mg twice a day, for 2 menstrual cycles. Subsequently, 21 patients from the placebo group and 4 from the toremifen group responded positively. Among 14 patients with recurrent breast pain after cessation of toremifen or placebo treatment, 75% (3/4) from the placebo group and 40% (4/10) from the toremifen group responded to danazol.

ADVERSE EVENTS

During the treatment cycles in our study, the adverse events in both groups were menses disturbance, dizziness, vaginal discharge, and nausea. Overall, the incidence of adverse events in the toremifen group was not different from that of the placebo group (51.0% [53/104] vs 42.9% [39/91], χ2=2.67, P=.45). Of all these adverse events, the incidence of vaginal discharge was slightly higher in the toremifen group compared with that in the placebo group, but the difference was not statistically significant (P=.05).
SEVERAL SEX HORMONE LEVELS

To further evaluate the influence of sex hormones on treatment effectiveness, we measured the serum levels of estradiol, progesterone, and prolactin in the participants before each treatment cycle. There was no mean ± SD significant difference in the serum levels of estradiol (toremifen: 115.41 ± 17.11 vs control: 93.41 ± 15.73, P > .05), progesterone (toremifen: 14.23 ± 1.04 vs control: 5.01 ± 0.65, P > .05), and prolactin (toremifen: 12.56 ± 1.41 vs control: 11.04 ± 1.30, P > .05) between patients receiving toremifen and those receiving placebo. As shown in the Table, baseline BPS correlated positively with serum estradiol (r = 0.35, P = .003) in patients with cyclical mastalgia but not in those with noncyclical mastalgia. In addition, baseline BPS was not correlated with serum progesterone or prolactin or the age of the participants (Table). Furthermore, the clinical response of toremifen treatment was not correlated with serum estradiol, progesterone, or prolactin or the age of the patients with either cyclical mastalgia or noncyclical mastalgia (Table).

<table>
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<tr>
<th>Characteristic</th>
<th>Estradiol</th>
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<th>Prolactin</th>
<th>Age</th>
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<td>P value</td>
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</table>

Abbreviation: NA, not applicable.
*Result of t test to compare the serum hormone level in patients with a clinical response to toremifen with those who did not respond.

COMMENT

Toremifen, a new member of the family of selective estrogen receptor modulators, shares most of the biological activities of tamoxifen. The therapeutic effect of toremifen is comparable to that of tamoxifen as an adjuvant endocrine therapy in breast cancer and has fewer adverse events than does tamoxifen. We hypothesized that toremifen would be a better medication than tamoxifen for mastalgia. However, studies about toremifen therapy for benign breast diseases remain rare.

In the present study, toremifen, 30 mg daily, effectively relieved moderate and severe mastalgia, with an effective rate of 69.2%. This rate is comparable to the response rate reported elsewhere, as 65.2% of patients with mastalgia responded to bromocriptine mesylate, 5 mg daily10; 65% to 92% responded to danazol, 100 to 400 mg daily10,11; and 71% to 96%8,13 responded to tamoxifen, 10 or 20 mg daily. Moreover, on the basis of our data, toremifen seems to be more effective for cyclical mastalgia, as it can significantly relieve moderate and severe cyclical mastalgia, with a response rate of 76.6%. Although the difference in effective rates between toremifen and placebo in the treatment of noncyclical mastalgia was not statistically significant, probably because of an insufficient number of cases of noncyclical mastalgia in our present study, toremifen tends to exert a positive therapeutic effect. Further study with more cases of noncyclical mastalgia is needed to address this issue.

Use of danazol and bromocriptine is limited because they induce severe adverse events, such as nausea and dizziness, with an incidence of 45%. In contrast, the most common adverse events of toremifen, 30 mg daily, are menstruation disturbance (27/104) and vaginal discharge (9/104), with a total incidence of 34.6%. Most important, as compared with placebo, toremifen does not increase the overall incidence of adverse event (P = .45), and only the incidence of vaginal discharge tends to be elevated (P = .05). Moreover, the incidence of hot flashes, frequently encountered in treatment with tamoxifen (25%), was tremendously reduced (5 [4.8%] of 104). In our study, only 2 patients discontinued toremifen therapy because of intolerable adverse events, with 1 case of alopecia and 1 case of vaginal discharge. Other than these, no serious adverse events were observed. Our data suggest that toremifen is effective, safe, and tolerable.

It is still controversial whether the onset of mastalgia is related to hormone levels because of mastalgia’s high response rate to hormonal therapy. Results of previous studies suggest that the cause of mastalgia is related to increased estrogen secretion, deficient progesterone, and hyperprolactinemia. In our study, we also investigated the relationship between severity of mastalgia and serum hormone levels. However, we found no obvious correlation between mastalgia and serum levels of progesterone and prolactin before medication; the effectiveness of toremifen therapy is not associated with sex hormone levels. Only the serum estradiol level is related to...
the baseline BPS in patients with cyclical mastalgia but not in those with noncyclical mastalgia, suggesting that we may need a more sophisticated classification of mastalgia or BPS to investigate the relationship between mastalgia and serum hormone levels.

In summary, toremifene is a feasible therapy for moderate and severe mastalgia. On the basis of our data, BPS was reduced significantly after the first treatment cycle, suggesting that toremifene can relieve mastalgia rapidly. As treatment continued, the therapeutic effect was maintained, and BPS was reduced further. However, further studies are needed to compare the therapeutic and adverse effects of toremifene therapy at different doses, for different treatment durations, and with different endocrine medicine.

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