



Hands and Fingers Disorder as a Women's Disease- Why My Hands and Fingers Hurt or Grow Numb

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Abstract

Hand surgeons still cannot explain the mechanism of hand and finger pain in the menopause. It has been pointed out recently that such disorders may be deeply related to changes in female hormone, particularly estrogen. The reason why similar finger symptoms occur during or after the menopause and during the postpartum lactation period, despite the age gap of decades between these periods, is that the estrogen level drops over a short time span in both periods. These are the factors underlying the swelling of tendons and joints resulting from a rapid decline in the estrogen level. It is strongly inferred that, if a low-estrogen state continues during or after the menopause, it can cause swelling of the synovial membranes around joints or tendons, and this can develop into trigger finger, de Quervain disease, carpal tunnel syndrome or osteoarthritis. This article examines the background of development of tenosynovitis and osteoarthritis of the fingers as a women's disease, based on recent research results. And the effect of equol-containing food (SE5-OH) for hand and finger disorders of women is discussed.

Keywords: Menopause, Tenosynovitis, Osteoarthritis,, Estrogen receptor, Equol- containing food(SE5-OH)

Introduction

Hand surgeons know from experience that representative disorders of hands and fingers develop mainly during or after the menopause. Actually, many patients complain of finger disorders during the menopause or the postpartum lactation period. However, hand surgeons remain unable to provide a sufficient answer to patients who ask why their hands hurt, or why only they have pain, while others do not. It has been pointed out recently that such finger disorders may be deeply related to changes in female hormones, particularly estrogen.

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Mechanism of Estrogen's Effects

Female hormones consist of progesterone (corpus luteum hormone) and estrogen (follicle hormone). These two hormones are secreted based on commands from the pituitary gland and control the ovulation/menstrual cycle. Estrogen is produced by ovary granulosa cells, theca external cells, placental, adrenal cortex and testicular interstitial cells. In women, the blood concentration of estrogen declines after ovulation (luteal phase). In line with the decline, the endometrium begins to thicken, and grows thickest immediately before menstruation. Subsequently, the blood concentrations of estrogen and progesterone fall, the endometrium becomes thinner, and a menstrual period begins (Figure 1).

In order for estrogen to exhibit its effects, it needs to bind to an estrogen receptor (hereinafter referred to as "ER") [1]. There are two types of ER: ER α and ER β . ER α exists in organs such as the uterus, the ovaries, the mammary glands, the kidneys, and the adrenal glands, whereas ER β exists in organs including bones, the brain, the liver, the prostate gland, blood vessel walls, the lungs, the thyroid gland, and the bladder. An important point is that ER β is contained in large amounts in the synovial membranes of articular capsules, tendon sheaths, and ligaments [2,3]. In other words, the thickening of the endometrium shown can be directly replaced with the thickening of the synovial membrane (Figure 1). Tendons are known to be influenced by estrogen via ER β [4-6]. As the estrogen level declines after ovulation, the synovial membrane begins to thicken, and swells the most before menstruation. The reason why women feel their bodies to be heavy or their hands to become stiff before menstruation is that the synovial membrane swells due to a decline of the estrogen in the local blood level. A variety of such symptoms that affect women's daily lives are often referred to as premenstrual syndrome (PMS) [7]. Over a woman's lifetime, the estrogen concentration changes on a daily basis as mentioned above, and after peaking at around 25 years old, it starts to decrease until

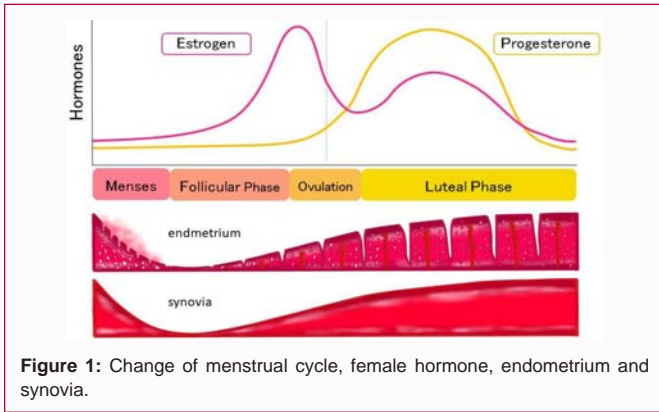


Figure 1: Change of menstrual cycle, female hormone, endometrium and synovia.

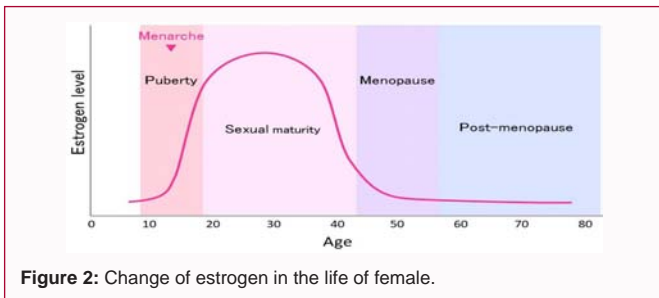


Figure 2: Change of estrogen in the life of female.

the last menstrual period that arrives at the average age of around 50. Menopause is medically defined as a state in which a woman has not had a menstrual period for 12 consecutive months. After the age of 60, the actual estrogen concentration declines to the level at the age of around 10, which is before the first menstrual period, and stays constant thereafter (Figure 2). These are the factors underlying the swelling of tendons and joints resulting from a rapid decline in

the estrogen level. Since recent studies have drawn attention to the presence of ERs [8-10], such correlation is expected to be elucidated further. For example, although correlation between hypothyroidism, hypercholesterolemia and hand disease [11-16] have been reported, these correlation may be discussed by influence of estrogen decline after menopause.

When Bouchard's Nodes Occur?

In the past, we examined the clinical presentations of 522 joints of 190 cases randomly selected from a total of 432 cases of the proximal inter phalangeal joints arthritis (so called, Bouchard's nodes), and reported the results [17,18]. In those reports, we demonstrated the following: (1) complaints of pains in and swelling of Proximal Inter Phalangeal (PIP) joints peaked at the age of 50-54, and were predominant among women; (2) such symptoms developed regardless of the patients' occupations or their dominant hand; (3) the actual joint degeneration peaked at the age of 60-64; (4) such symptoms are frequently complicated by flexor tenosynovitis, which is an important onset factor of Bouchard's nodes and (5) the period of developing such symptoms overlapped with menopausal disorders, suggesting that they are associated with fluctuations in female hormones. In general medical practice, there is a reason for often explaining that the Bouchard's nodes or other osteoarthritis that occurs during the menopause results from aging. Most of the past reports have indicated the prevalence rate by age group [19,20] and it has been misunderstood that the number of affected patients increases with age. For example, Wilder et al. [20] investigated the distribution of the PIP joint deformity of the middle finger in the general population and reported that prevalence rose with age (Figure 3a). However, this data does not mean that the finger joint deformity occurs by aging. If we convert the morbidity indicated in this report into the absolute number of patients (Figure 3b) and subtract the number

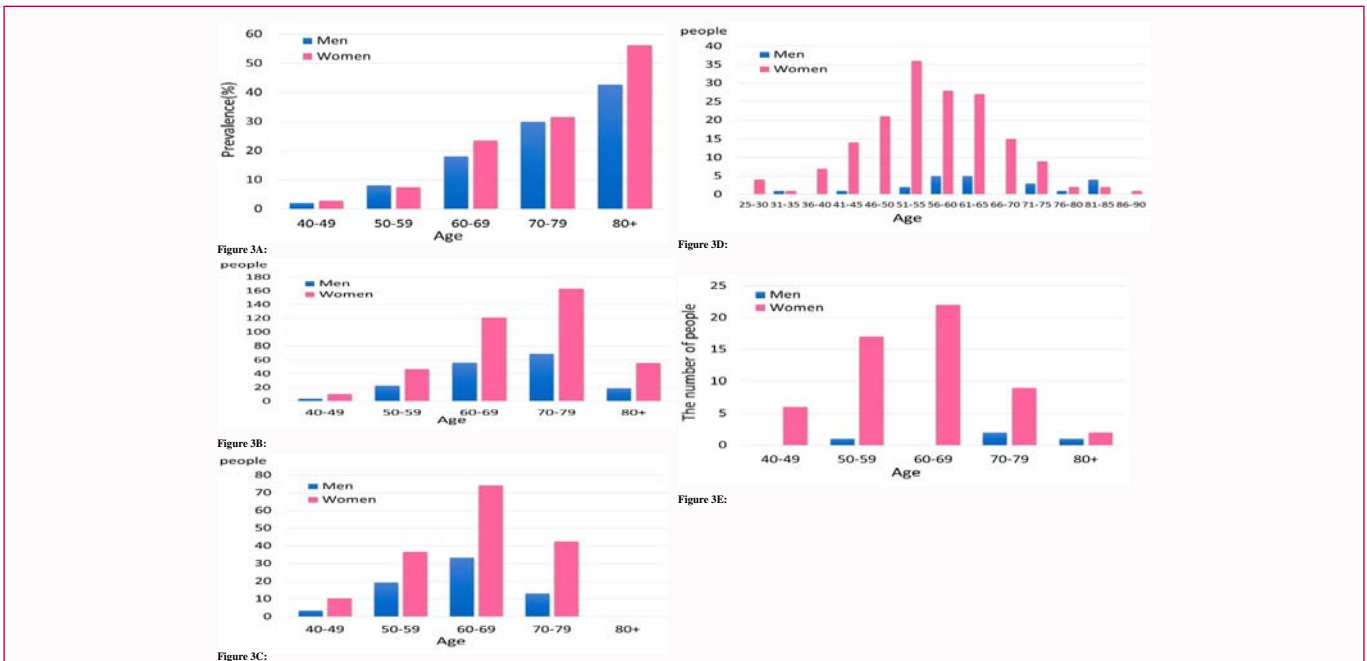


Figure 3: A. Wilder et al. reported the distribution of the PIP joint deformity of the middle finger according to the generation. B. The prevalence according to the generation is replaced with the absolute number. C. By subtraction the number of younger people from the respective age histograms, the incidence in the respective age group is inferred. Result shows that onset peaks at the age 60-64. D. We have reported about the correlation between the onset of PIP joint disorder and joint deformity [12,13]. The onset of PIP joint pain and swelling peak at the age of 50-55. E. However, the onset of PIP joint deformity recognized by X ray peaks at the age of 60-64.

of younger people from the respective age histograms, we can infer the incidence in the respective age groups. The data that has been converted through such manipulation suggests that the prevalence rate increases with age due to accumulation of cases, but onset peaks at the age of 60-64 (Figure 3c). This finding entirely coincides with the timing of onset for our cases. As we reported it before based on the data of 233 cases of Bouchard nodes 16, onset of PIP joint pain and swelling peak at the age of 50-55 (Figure 3d) and onset of PIP joint deformity recognized by X-ray peaks at the age of 60-64 (Figure 3e). In other words, if the initial swelling of or pain in a finger joint is left untreated, an irreversible change occurs in five to ten years' time.

Relationship between Onset of Surgical Diseases in Hands and Change in the Estrogen Level

In our daily medical practice, we routinely observe inside the carpal tunnels of patients with carpal tunnel syndrome by using Three-Dimensional Computed Tomography (3DCT). We have reported on a characteristic finding that can be observed in that process during the menopause [21]. There is a finding that median nerve paralysis occurs when the space between flexor tendons expands inside a carpal tunnel due to swelling of the synovial membrane, and pressure becomes hard to escape in spite of the swelling and bowing of the transverse carpal ligament (Figure 4). Or, when the estrogen level in the blood declines, flexor tendons and tendon sheath swell, causing tenosynovitis and increasing the risk of trigger finger. Then, the tension of the superficial digital flexor tendon increases in parts more peripheral than the A1 pulley, causing chronic traction of the PIP joint. If this state continues for five years or more, the cartilage of the PIP joint gradually wears away from the ulnar side, eventually developing into a Bouchard's nodes (Figure 5). Tenosynovitis and trigger finger are often observed also among pregnant women, but they rarely lead to joint degeneration or serious neuroparalysis, because these symptoms only last for less than one year. However, during or after the menopause, the low-estrogen state continues for a long time, so it is more likely to lead to serious changes such as muscle atrophy caused by neuroparalysis and joint degeneration.

In addition, low estrogen levels over a long term invite joint swelling, and lead to wearing of the joint cartilage. Then, the wearing of the joint cartilage induces narrowing of the joint space and causes the ligament to loosen and increases the risk of subluxation. Subluxation often observed in a Heberden's node or in thumb CMC joint osteoarthritis may be occurring through such process. In other words, it is strongly inferred that, if a low-estrogen state continues during or after the menopause, it can cause swelling of the synovial membranes around joints or tendons, and this can develop into trigger finger, de Quervain disease, carpal tunnel syndrome, Heberden's nodes, Bouchard's nodes, or thumb CM joint osteoarthritis (Figure 6) [22]. The factors that cause various finger symptoms include a decline in the estrogen level over a short time span during the menopause, and an absolute decline in the estrogen level for the age of 60 or over (during or after the menopause). In the postpartum lactation period, a low estrogen level can cause finger symptoms, but if the estrogen level improves after termination of breast-feeding, the finger symptoms gradually ease. The reason why similar finger symptoms occur during or after the menopause and during the postpartum lactation period, despite the age gap of decades between these periods, is that the estrogen level drops over a short time span in both periods. Women aged around 40 sometimes complain of similar

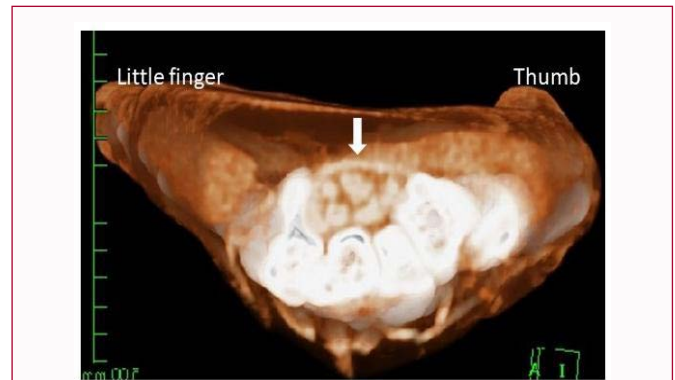


Figure 4: Typical image of idiopathic carpal tunnel syndrome. Increasing of the gap between flexor tendons is seen and bowing of the transverse carpal ligament is decreasing the pressure in the carpal tunnel.

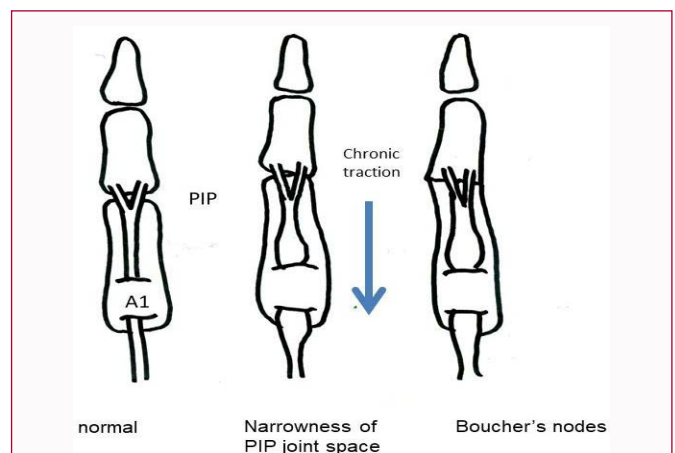
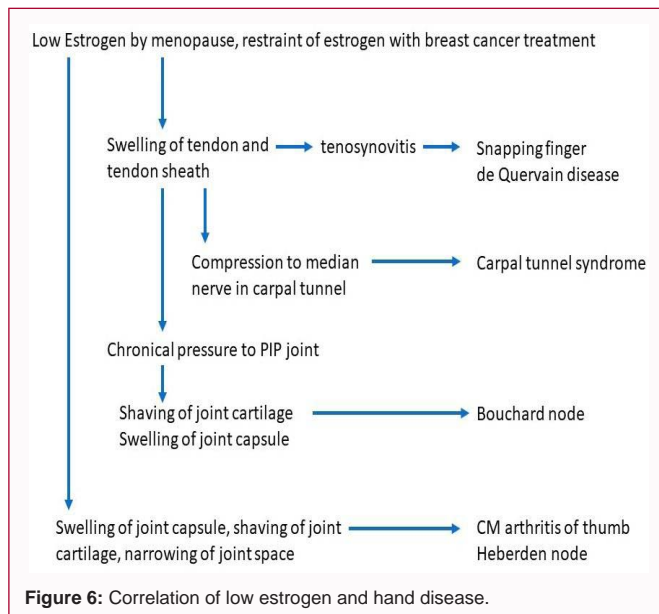


Figure 5: Untreated stenosing tenosynovitis develops into a Bouchard's node. If the A1 pulley becomes stenotic, the superficial digital flexor tendon between the A1 pulley and the PIP joint grows tense and chronically pulls the PIP joint. Eventually, the joint cartilage wears away from the ulnar side and develops into a Bouchard's node, causing the finger to be bent toward the ulnar side.

general malaise of the fingers as well. This is also considered to be a type of PMS caused by a drastic change (mostly a sudden decline) in the estrogen concentration over a short time span.

Finger Disorders as Menopausal Symptoms

When the ovarian function declines during or after the menopause and the ovary is no longer able to produce estrogen, the body tries to take in fat and produce estrogen from the fat. This is the reason why women's figures change during or after the menopause. Hypercholesterolemia in hand disease patients [13] may be explained by this reason. When the estrogen level declines, the so-called menopausal disorder appears. While the most frequently mentioned menopausal disorders are dizziness, glow and hot flashes, there are in fact a lot of symptoms including dry skin, spots, hair loss, stiff shoulders, headache, anxiety/sleeplessness, arteriosclerosis, and osteoporosis. These menopausal disorders also include joint pain, muscle pain, synovitis, and numbness in the hands and feet. As mentioned earlier, a decline in the estrogen level causes synovitis, and this induces tenosynovitis, joint pain/degeneration, and entrapment neuropathy such as carpal tunnel syndrome, and the age of onset of these diseases often coincides with the menopause. In other words, many of the degenerative diseases observed in fingers can be



considered to be a type of menopausal symptom. When doctors ask patients with a high degree of degeneration in fingers about whether they experience menopausal disorders, they often answer that they have no or only minor menopausal disorders. This is because patients misunderstand that menopausal disorders only refer to dizziness, glow and hot flashes. Patients who have developed a menopausal symptom in the form of degeneration in fingers hardly complain of dizziness or hot flashes. In other words, there is a need for clinicians to regard finger joint pain as menopausal disorders.

What Causes the Individual Differences in Symptoms?

All women's estrogen levels decline during or after the menopause. However, not all women have symptoms in their fingers. What could be the cause of such difference? If a decline in the estrogen level causes the symptoms, a simple solution would be to administer estrogen. However, there is a concern particularly among patients, that administration of estrogen poses the risk of breast cancer or ovary cancer, although the probability is low. Thus, attention has been drawn to equol [23]. Equol is produced in the process of metabolism of soy isoflavone [24]. It is made when soy food such as tofu (bean curd) is fermented in the intestines by a certain intestinal bacteria. When equol binds with ER β inside the body, it exhibits similar action as estrogen. Since it binds with ER β and not ER α , it has no risk of causing breast cancer, and has an effect of inhibiting such cancer [25]. Equol-containing food (SE5-OH) has been found to demonstrate various effects including not only alleviation of menopausal disorders [26], but also prevention of osteoporosis [27] and arteriosclerosis [28], remedy of hair loss, improvement of skin quality [29,30] improvement of metabolic syndrome [31,32], inhibition of breast cancer, improvement of hyperuricemia, and inhibition of prostatic enlargement and prostate cancer [33]. In this manner, it is known that equol, which is a metabolic product of soy, is useful for improving menopausal symptoms, but merely taking a large amount of soy as food is not effective. This is because the equol-producing ability differs by race and individual [34]. The proportion of people who have the bacteria that ferment soy is flavone inside their body differs by race and region. Thus, we investigated the presence or absence of the equol-producing ability in patients who complained

of finger disorders by conducting urine analysis. As a result, almost patients were found to be unable or low to produce equol inside their body [21]. This percentage is significantly different from the general percentage of Japanese people who are able to produce equol. The possibility that the inability to produce equol may be the principal factor inducing finger osteoarthritis or synovitis is strongly suggested. Family history is often seen in patients of Heberden and Bouchard nodes. This fact may mean that the equol-producing ability is inherited [21]. However, more investigation is necessary about the effect of equol to the osteoarthritis, correlation between equol-producing ability and occurrence of finger disorders, and inheritance of equol-producing ability.

Conclusion

Clinicians often explain to patients with Heberden's nodes or Bouchard's nodes that the symptoms have been caused by aging or overuse, and that they cannot be cured. Despite that fingers become deformed irrespective of the dominant hand or occupation, and joint degeneration mainly occurs during the age of 50–64, clinicians tend to only administer analgesics to such patients, which is practically equivalent to turning them away at the door. However, joints become deformed following a period of several years without treatment after the initial development of joint swelling and pain. Hand surgeons would have to understand that there is a problem in the clinicians' approach. Clinicians should bear in mind that joint degeneration of fingers will not be eliminated unless they realize that they are actually assisting the development of joint degeneration by imprudently explaining that the symptoms have been caused by aging and causing patients to not think any further about it, and failing to take appropriate preventive measures.

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Patient Consent and Ethical Approval

All patients underwent an informed written consent. This study was approved by the local ethical committee of Yotsuya Medical Cube on 04/06/2018.

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