



## Hormones and Vestibular Disorders

By P. J. Haybach, RN, MS

Health professionals and women with vestibular disorders have often suggested that hormones might play a role in Ménière's disease and other vestibular disorders.<sup>1, 3, 10, 14</sup> Little research has been done in this area, and not much information is available in print. The exact connection, if any, between hormones and vestibular disorders and the percentage of women affected is unknown. This article explores some of the possible links.

Hormonal changes do not produce one tidy set of symptoms occurring at a precise point in time. Some of these changes have been reported to increase symptoms, and some have been reported to reduce symptoms. The idea that hormones might increase symptoms in women or cause a physical problem is not limited to vestibular disorders. Other conditions thought to be linked in some way to hormonal changes in women include:

- Migraines. These occur more often in women, and attacks have been attributed to the use of birth control pills, pregnancy and delivery, estrogen-replacement drugs, the start of the first menstrual period, menopause, and menstruation in general.<sup>11</sup>

- Autoimmune diseases. These are seen in women nine times more often than in men.<sup>3</sup>
- Acoustic neuroma. Research suggests that these tumors grow faster in female test mice given estrogen than in mice not given estrogen.<sup>17</sup>

Rheumatoid arthritis, heart disease, osteoporosis, glaucoma, and Parkinson's disease may also be affected by hormones.<sup>3, 6</sup>

### Female hormones

Hormones are chemicals produced in one body organ and carried in the blood stream to another organ, where they cause functional activity or possibly a change in a structure.

Women manufacture a number of hormones specific to them, particularly during their childbearing years. The two best-known female hormones are estrogen and progesterone, sometimes also referred to as sex hormones. These are produced predominantly in the ovaries, although the adrenal glands and the placenta of pregnant women also make them. Some research has indicated that estrogen can be manufactured in the brain as well.<sup>3</sup>

Estrogen and progesterone are referred to as female hormones because they are

found most abundantly in women, but men's bodies also produce small amounts of estrogen, and women also manufacture small amounts of the male hormone testosterone. Other female hormones include prolactin, oxytocin, luteinizing hormone, follicle-stimulating hormone, and human chorionic gonadotropin.

### **Female hormone function**

Female hormones are responsible for the physical changes of puberty, the menstrual cycle, the changes of pregnancy, and milk production for nursing. The end of their production results in menopause.

The menstrual cycle is as follows:

- Days 1-5: menstruation
- Days 6-14: increasing estrogen levels  
(estrogen stimulates egg production)
- Day 14: ovulation
- Days 15-25: increasing progesterone levels
- Days 26-28: falling progesterone and estrogen
- Days 1-5: cycle repeats if a fertilized egg is not implanted in the uterus

Estrogen levels are highest on days 10-15 and lowest on days 1-5. The time between ovulation and menstruation is sometimes referred to as the luteal phase.

### **Pregnancy**

Human chorionic gonadotropins are produced throughout pregnancy. Estrogen and progesterone are at their lowest concentrations during the first eight weeks of pregnancy. They have a large increase between weeks 12 and 24. These higher levels of estrogen and progesterone are maintained from week 24 through the birth.

Oxytocin, produced at the end of the pregnancy by the brain and the placenta, induces contractions and assists in milk production. Prolactin, which is also responsible for milk production, is produced in larger amounts near the end of the pregnancy. It may be involved in the breast growth seen in pregnancy.

### **Birth control pills**

Birth control pills contain estrogen and progestin (a hormone similar to progesterone) and are taken from day 1 of the menstrual cycle through day 24. Menstruation begins on the 29th day, which restarts the cycle. Birth control pills work by making the brain think from day 1 to day 24 that pregnancy has occurred, thus preventing ovulation. Birth control pills cause the level of prolactin to rise.<sup>13</sup>

### **Physical effects of hormones**

Although the primary effects of female hormones are related to reproduction, many of these hormones can have other effects throughout the body.

Among the general effects in the days before menstruation begins are that blood may become more viscous (thick),<sup>1</sup> appetite may be stimulated,<sup>4</sup> and the

volume of cerebro-spinal fluid may increase.<sup>9</sup> Prolactin may be implicated in the breast swelling and tenderness some woman experience before menstruation. Pregnancy can cause nasal stuffiness, nasal allergy, and other allergy problems. It predisposes some woman to motion sickness.<sup>10</sup> Swelling around the Eustachian tube and a feeling of pressure or fullness in the ears may be caused by pregnancy<sup>5</sup> and the use of birth control pills.

Progesterone is capable of causing diuresis (ridding the body of some of its water).<sup>13</sup> It may increase body temperature<sup>11, 13</sup> and can cause hyperventilation (over-breathing, often in response to anxiety).<sup>2,</sup><sup>11</sup> Progesterone can produce dizziness, faintness, and sleepiness and might also have a depressant effect.<sup>11</sup>

In some women, estrogen causes fluid retention before menstruation, during pregnancy, or while taking birth control pills. It may slightly increase serum triglycerides and decreases fasting levels of glucose and insulin in some women.<sup>11</sup> Estrogen might also have a role in brain function, such as solving spatial-orientation problems and how pain is sensed.<sup>3</sup> It might also cause a change in the auditory brainstem test.

### **Inner ear–related symptoms**

A number of inner ear symptoms have been attributed to the female hormones. Women with vestibular disorders have reported discrete episodes of vertigo, general imbalance and/or disequilibrium,

increases in tinnitus, hearing loss or change of some type, aural fullness, and ear pressure in apparent response to hormonal changes. Not only do these symptoms vary from one woman to the next, but the circumstances in which they are experienced also vary.

Andrews et al. described women experiencing dizziness, aural pressure, and low-frequency hearing loss during the premenstrual time. They also found that those experiencing the largest fluid weight gain tended to have the most severe attacks at this time.<sup>1</sup> Abdel-Nabi et al. reported on women experiencing nausea, vomiting, vertigo, and dizziness in the premenstrual time.<sup>13</sup>

Naftalin and Mallett wrote about a woman who had a remission from symptoms during the beginning of pregnancy and an exacerbation during mid-pregnancy. They also described her as having worse symptoms during breastfeeding.<sup>14</sup>

Increased symptoms or the return of symptoms have been reported during the premenstrual time, menstruation, pregnancy, the use of birth control pills, and estrogen replacement therapy. Women have also occasionally reported improvement or remission of symptoms during pregnancy, while using birth control pills, during hormone replacement therapy, or during the premenstrual time. On the other hand, some women have reported that their vestibular impairments began during pregnancy or under one or more of these other conditions.

## **Testing for hormone-provoked inner ear symptoms**

No single, specific test exists to determine whether or when a woman's inner ear symptoms are provoked by hormonal changes. In some research studies, blood levels of estrogen and progesterone have been compared with either hearing and vestibular tests or a symptom diary kept by the woman to determine whether a relationship exists. Two studies comparing electronystagmography (ENG) test results for groups of women found that their premenstrual and postmenstrual results differed. Unfortunately, this type of testing over time is seldom done. Instead, if a health care practitioner is interested, a woman might be asked to keep a diary noting her menstrual cycle and daily vestibular symptoms to determine whether the two are related.

## **Treatment for hormone-provoked symptoms**

Only one treatment has been described in the medical literature specifically for hormone-provoked vestibular and hearing symptoms. Price et al. described successful use of leuprolide acetate in one woman. Leuprolide acetate works by blocking gonadotropin-releasing hormone, a hormone partially responsible for regulating estrogen and progesterone. Unfortunately, this drug could not be used on a long-term basis because of the possibility of side effects such as heart disease and osteoporosis.<sup>15</sup>

Andrews et al. described the use of dietary sodium restriction and diuretics in a woman with Ménière's disease who experienced increased symptoms premenstrually.<sup>1</sup>

Uchida et al. described decreasing sodium intake and using a diuretic, diazepam, and isosorbide (a fluid-manipulating drug) to treat increased symptoms during one woman's pregnancy.<sup>19</sup>

Hansen et al. described giving small doses of dimenhydrinate and meclizine hydrochloride during pregnancy but avoiding diuretics in the first trimester.

Some of the treatments reported anecdotally by members of the Vestibular Disorders Association and others with vestibular disorders include the following:

- a low-sodium diet
- six small meals per day (to spread intake of food and fluid over the entire day)
- diuretics taken daily or taken during the premenstrual time
- estrogen replacement therapy
- birth control pills
- antidepressant drugs
- vestibular-suppressant drugs taken during times of increased symptoms

## **Theories about possible links**

It must be kept in mind that Ménière's disease and some other vestibular disorders can wax and wane seemingly randomly; thus the possibility exists that inner ear symptoms apparently

associated with hormonal changes in any particular woman can be explained by coincidence.

On the other hand, non-coincidental explanations have appeared in the medical literature. These include that of Abdel-Nabi et al., who attribute increased symptoms to inner ear swelling.<sup>13</sup> Also, Uchide et al. suggest that Ménière's disease might be expected to worsen during early pregnancy because suddenly decreasing serum osmolality would induce an osmotic gradient between the outer and inner endolymphatic sac. This would allow free water to enter the endolymphatic space and produce or exacerbate endolymphatic hydrops.<sup>19</sup> In other words, chemical changes that occur in the body during pregnancy cause water to move into sensitive parts of the inner ear. This additional water causes changes that produce symptoms such as disequilibrium.

Andrews et al. offer multiple explanations:

- Thyroid changes caused by female hormones cause vestibular symptoms.
- "Endolymphatic hydrops represents a fluid imbalance within the inner ear and, when combined with an additional fluid shift, may produce symptomatic dysfunction."
- Aldosterone increases during the premenstrual time as estrogen also increases and progesterone decreases. Since aldosterone (as well as estrogen)

causes water retention, the combined effect of these two substances causes a shift of water into sensitive parts of the inner ear. This produces vestibular symptoms.

### **Speculations by the author**

Here are other ideas that might explain an exacerbation of vestibular symptoms by hormonal fluctuations:

- The same factors causing increased motion sickness during the pregnancy of normal women may also cause vestibular symptoms in women with a vestibular disorder.
- Progesterone's depressant property may cause decompensation, which leads to vestibular symptoms. (Decompensation refers to a lessening of the brain's ability to compensate for incorrect balance information from a damaged inner ear. A variety of things can cause decompensation, which is usually temporary.)
- Increased triglycerides caused by increased estrogen levels during the menstrual cycle may lead to balance and hearing symptoms.
- Premenstrual blood viscosity (thickening) may compromise blood flow to the inner ear and cause changes in fluid balance. This could produce hearing and/or balance symptoms.
- Estrogen and/or progesterone might cause symptoms because of their chemical properties rather than their fluid-manipulating capabilities.
- Progesterone might cause hyperventilation during pregnancy

and/or the premenstrual period and lead to feelings of dizziness and disequilibrium because of the effect on the brain.

- The increased amount of cerebrospinal fluid in and around the brain during the pre-menstrual period might cause an increase in pressure within the head. This pressure is passed into the inner ear through the cochlear aqueduct, a natural tunnel connecting the inner ear to the space around the brain that contains spinal fluid. The pressure might cause balance and/or hearing symptoms.
- The presence of estrogen increases fluids in the body. Therefore, a woman experiencing symptoms because of a lessening of body fluids might improve temporarily whenever estrogen levels increased sufficiently.
- If prolactin can cause premenstrual breast swelling and general swelling during pregnancy, perhaps it causes the increased inner-ear symptoms women can experience at these times.
- Increases in estrogen levels perhaps cause symptoms because of an autoimmune reaction.
- Because human chorionic gonadotropins are present only during pregnancy, perhaps women who improve only during pregnancy do so because of their presence, for some unknown reason.
- Increased estrogen levels lead to a decrease in the blood sugar level, which perhaps causes dizziness and/or disequilibrium because of its effect on the brain.

- The oxytocin produced near the end of pregnancy releases prostaglandins, which might lead to hearing and/or balance symptoms.
- If a woman has balance or hearing symptoms only during lactation, perhaps oxytocin is the cause.
- The increased estrogen causes an increased appetite and increased eating. Women may eat or drink substances they are allergic to or that change the fluid balance in the inner ear and result in hearing and/or balance symptoms.
- Elevated levels of estrogen can cause swelling around the Eustachian tube, which interferes with middle ear function. This may, in some still undefined way, impact inner ear function and cause balance and/or hearing symptoms.
- A woman whose symptoms begin for the first time during labor or delivery may have suffered a perilymph fistula, an abnormal opening between the inner ear and middle ear caused by increased pressure from bearing down during delivery.

### **Summary**

Although many people have casually observed changes in hearing or balance that seem related to hormonal changes in women, it is unknown how many women are affected, precisely what changes occur, what causes them, and what, if anything, the treatments should be.

### **Further reading**

Some helpful documents available from the Vestibular Disorders Association include the following, identified by title and catalog number.

- *Ménière's Disease—What You Need to Know* (Book B-7)
- *Secondary Endolymphatic Hydrops* (Pub. F-2)
- *Perilymph Fistula* (Pub. F-3)
- *Ménière's Disease* (Pub. F-4)
- *Migraine-Related Dizziness: An Updated Understanding* (Pub. E-9)
- *Autoimmunity and the Inner Ear* (Pub. F-21)
- *Enlarged Vestibular Aqueduct* (Pub. F-28)
- *Benign Paroxysmal Positional Vertigo (BPPV)* (Pub. R-5)

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