

The Cause of Vasomotor Symptoms: Resonance Phenomena in the Vascular Bed

Keiko Uohashi

Department of Mechanical Engineering and Intelligent Systems, Faculty of Engineering, Tohoku Gakuin University, Miyagi, Japan

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ABSTRACT

This paper describes the probable cause of vasomotor symptoms during climacterics and before menstruation/ovulation. We propose that sex hormones imbalance changes the elasticity, resonance frequencies, and resonance peaks of vascular beds primarily in the uterus/intestines. It is also explained that vasomotor symptoms occur in the locations which resonate blood flow from the uterus/intestines for the above reason.

KEYWORDS: *Vasomotor symptom, menopausal symptom, premenstrual symptom*

INTRODUCTION

This paper describes the probable cause of vasomotor symptoms during climacterics and before menstruation/ovulation.

THE PROBABLE CAUSE OF VASOMOTOR SYMPTOMS

We proposed the concept of resonance phenomena in the vascular bed as a probable cause of vasomotor symptoms in the Japan Society for Menopause and Women's Health, JMWH2019, and in the Society of Instrument and Control Engineers, SICE2020.

CONCEPT

Variations in sex hormone balance alter the compliance (inverse of elasticity, accumulation effect, C) and inertance (inertia, pump effect, L) of the vascular bed generally, and primarily in the uterus or intestines. The resonant frequency of blood flow leads to hot flashes, cold feelings, sleeplessness, sweating, and pain appearing in organs with an amplified blood flow. The resonant frequency determines the location of the complaint, and the amplification factor determines the degree of the complaint, which differs from the climacteric index.^[1]

The resonance phenomena of the vascular system are based on the principle of physics and have been studied using electric circuit analogs.^[2-4] However, a lower frequency than the cardiac frequency and time transition

of the compliance/inertance have not been investigated in detail.

In particular, we focus on digestive blood flow, which changes significantly and is difficult for patients to notice.^[5,6] For blood flow, short-term or long-term changes correspond to high or low frequency, respectively, if changes are not periodic.

During climacterics and before menstruation/ovulation, if the elasticity is relatively lower than the inertance in the uterine vascular bed, vasomotor symptoms are presumed to appear due to an increase in the amplification factor. Since estrogen thickens the endometrium and progesterone proliferates capillaries, symptoms appear when the estrogen level is relatively low. In the case of a person without a uterus, symptoms are presumed to appear due to the intestinal vascular bed, in which capillaries are well-developed, and the endothelium is moderately hard.

Some patients have symptoms, while others do not, even if they have the same estrogen level.^[7,8] This fact is explained by differences in the compliance/inertance of the vascular bed in the uterus/intestines.

This concept is obtained from a literature survey and a case study and applies to vasomotor symptoms.

Address for correspondence: Prof. Keiko Uohashi,

Department of Mechanical Engineering and Intelligent Systems, Faculty of Engineering, Tohoku Gakuin University, Tagajo, Miyagi 985-8537, Japan.

E-mail: uohashi@mail.tohoku-gakuin.ac.jp

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SYMPTOMS TO WHICH THIS CONCEPT IS APPLIED

Adolescents tend to feel cold rather than hot. Approaching climacterics, more people feel hot flashes, sweating, and pain in tendons/muscle ends. The cause seems to be that the elasticity of the uterine/intestinal vascular bed decreases, and the location of symptoms changes to one with a lower elastic vascular bed.

Dizziness often occurs when there is a short term increased blood inflow to the digestive tract after a heavy meal. When the short-term high blood inflow of the digestive tract is amplified to a greater degree, the muscles feel cold. Given that the blood outflow of the digestive organ takes a longer time than inflow, patients feel hot flashes when lower-frequency flow, that is, longer-term flow, is amplified. If the longer-term blood outflow of the digestive system is amplified, the blood flow at the muscle ends is amplified. Then, patients feel warmth for a longer time, sweating, muscle end pain, and sleeplessness due to the amplified blood flow around the eyes.

An association between menopausal insomnia and hot flashes has been reported.^[9] Conversely, insomniac young people often feel cold or have no cold/hot sensations.^[10] Blood flow around the eyes directly affects insomnia.

The endometrium of older women is atrophied and stiff. During atrophy, the elasticity of the endometrium decreases temporarily, and menopausal symptoms are presumed to appear.

Although estrogen replacement therapy reduces sweating and insomnia, it often increases cold sensation. This is because the resonant frequency of the uterus/intestines increases and the blood flow of more rigid tissues is amplified.

The exact mechanism applies to cancer treatments that decrease or increase serum levels of sex hormones.

DISCUSSION

It is desirable to investigate the mechanism of vasomotor function, which is not limited to the autonomic nervous system and includes nonmorbid conditions. To solve the following problems, we should develop techniques for sequentially measuring the blood flow of each location over several hours or days.

Is hyperhidrosis caused by the decreased resonant frequency of the intestines and increased blood flow due to tension overlap? Is sweating by exercise a resonance phenomenon for long-term blood flow generated by muscles?

Do sleepiness, bleariness (“Kasumi” in Japanese), and blurring (“boyake”) occur in edemas due to slowly increased blood flow around the eyelids? We should study the influence of facial blood flow on sleep and affective symptoms.

Dizziness and headaches were experienced in various age groups. Do resonant frequencies of the uterus/intestines change the kinds of dizziness and locations of headaches (e.g., the whole, temples, the coronal, and around the eyeballs)?

If cold sensations occurred due to decreased blood flow in high-thermogenesis tissues, would the correlation between cold senses and basic energy metabolism be below? Is the cause of paradoxical undressing greatly amplified blood flow in the digestive organs?

Do palpitations occur due to the short-term high blood inflow to the heart?

Are premenstrual/climacteric irritability and some affective symptoms caused by itches of muscle ends in the head, face, toes, anus, and so on? Are their sensations of hunger when the stomach moves through a lot of blood flow?

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Conflicts of interest

There are no conflicts of interest.

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