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RESEARCH ARTICLE

Correlation between Eustachian Tube Function and Estrogen Levels

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Abstract**Objective:** We aimed to study if there is any effect of estrogen levels on the function of eustachian tube**Patients and Methods:** A total number of 35 women undergoing induction of ovulation. All women were studied by daily evaluation of serum estrogen and progesterone levels. All women underwent tympanometry to test the Eustachian tube function. The test was performed in the upright sitting position, and women were instructed to refrain from talking, chewing, or swallowing while the probe tip was in place.**Results:** All women had an initial estradiol level of <50 pg/ml and a progesterone level of <1 ng/ml. The maximal estradiol level measured in the study group was 2700 pg/ml.

In 28 women eustachian tube function did not change significantly with estradiol levels at the physiologic range (25–300 pg/ml) as well as at levels highly beyond that range.

Four patients showed significantly decreased function with increasing estradiol levels while three patients showed a mild increase in eustachian tube function with increasing estradiol levels.

As for the whole group, there is a moderate decrease in function with increasing serum estrogen levels.

Conclusion: There is a poor correlation between estrogen levels and eustachian tube function over a wide range of estrogen levels.

However, a moderate decrease in eustachian tube function with high blood levels of estradiol in a small number of women may explain the symptomatology encountered in various physiologic or pathologic situations.

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Introduction:-

The pregnant woman holds a special place in Medical Science. Physiological and hormonal (estrogen and progesterone levels) changes related to pregnancy can significantly affect every organ system to some degree. Many of these changes lead to symptomatology, on most of the cases, symptoms are mild and treatment is easy. However, some can become pathological and can cause uneasiness, discomfort and anxiety in which the woman should definitely visit an otolaryngologist. Thus, it is important for the otolaryngologist to be familiar with the physiological changes associated with pregnancy and how these changes are manifested in the head and neck in order to recognize the etiology of these symptoms to manage and assure the patient.

The management of these disorders is also complicated by the gravid state and therefore a thorough understanding of the medical and surgical effects of our therapeutic interventions on both mother and fetus is imperative.¹

Nasal obstruction during pregnancy, or rhinitis of pregnancy, has been accepted as a distinct and very common pathological and clinical entity for many years.² It is believed to occur in anywhere from 5-32% of pregnant women and most commonly is first noted during the end of the first trimester, and may persist up to the time of delivery or a

few weeks afterward. The nasal obstruction is associated with clear rhinorrhea and physical exam shows edematous nasal mucosa. This condition is caused by a number of related factors. The generalized increase in interstitial fluid volumes seen during pregnancy also affects the nasal mucosa, and is made worse by the direct effect of estrogen on the nasal mucosa, which causes increased vascularity and mucosal edema. Electronmicrographic and histochemical studies performed by Toppozada on the respiratory epithelium of pregnant women have suggested that an overactivity of the parasympathetic system leading to increased glandular secretion and vascular congestion is responsible for the state of nasal congestion. This overactivity of the parasympathetic system may be an allergic response to placental proteins, fetal proteins or a women's own sex hormones.³⁻⁷

The eustachian tube, the only pressure regulating mechanism of the middle ear, is lined for most of its part by the same pseudostratified columnar ciliated "respiratory" epithelium as the mucosal lining of the nose and sinuses.⁸ Being histologically the same, one would expect similar hormonal influence on the mucosal lining of the eustachian tube as previously described for the nasal mucosa. Congestion of the lining mucosa of the tubal walls would eventually lead to its dysfunction. However, pregnancy and oral contraception are reported to be associated with abnormal patency of the eustachian tube,^{9,10} pregnancy being described as the second most common etiologic reason for the rare patulous eustachian tube syndrome.¹¹ Still, it is our clinical impression that pregnant women complain more commonly of mild tubal obstruction than of the contrary. Difficulties in withstanding rapid air pressure changes are frequently encountered in our practice from pregnant women who did not suffer from this problem either before or after pregnancy. In this study we aimed to study if there is any effect of estrogen levels on the function of eustachian tube.

Material and Methods:-

The sample of this study was carried out on a total number of 35 women undergoing induction of ovulation.

Ovulation was induced by human menopausal gonadotropins and human chorionic gonadotropins according to standard protocols. Monitoring of response was achieved by daily sonographic evaluation of ovarian follicular size and serum hormonal levels.

All women were studied by daily evaluation of serum estrogen and progesterone levels.

All women negated a history of ear disease and were checked to have normal-appearing ear drums and clear external canals.

Exclusion criteria were Women suffering from upper respiratory symptoms during the study period.

All women underwent tympanometry to test the Eustachian tube function. The test was performed in the upright sitting position, and women were instructed to refrain from talking, chewing, or swallowing while the probe tip was in place.

After performing a baseline tympanometry (T1), external canal pressure was increased to +400 mm H₂O, the women were instructed to take three big swallows of water, and a second tympanogram (T2) was performed. After returning middle ear pressure to baseline by swallowing three times with canal pressure 0, external canal pressure was decreased to -400 mm H₂O. The patient repeated her swallowing, and a third tympanogram (T3) was recorded.

For each woman, the daily average of T1–T2 and T1–T3 peak difference for both ears was calculated and plotted against the patient's estrogen level on that day.

Results:-

All women had an initial estradiol level of <50 pg/ml and a progesterone level of <1 ng/ml. The maximal estradiol level measured in the study group was 2700 pg/ml.

In 28 women eustachian tube function did not change significantly with estradiol levels at the physiologic range (25–300 pg/ml) as well as at levels highly beyond that range.

Four patients showed significantly decreased function with increasing estradiol levels while three patients showed a mild increase in eustachian tube function with increasing estradiol levels.

As for the whole group, there is a moderate decrease in function with increasing serum estrogen levels.

Discussion:-

Eustachian tube dysfunction has been estimated to affect between 5% and 30% of pregnant women and can be variable in terms of its symptomatology. Dysfunction can consist of either tubal obstruction or patulous Eustachian tubes. The signs and symptoms, which usually begin after the first trimester, depend on which form of dysfunction exists. Women with tubal obstruction report a clogged or popping sensation in their ears with muffling of sounds. In severe cases, a serous effusion may develop. Women with patulous tubes usually manifest intermittent symptoms consisting of autophony and a roaring sensation in their ears that is synchronous with respiration and is worse in the upright position or with exercise.^{9,10}

The pathophysiology of tubal obstruction is again related to edema of the respiratory mucosa.⁴ The cause of patulous Eustachian tubes is less clear. It has been noted that women with less weight gain during pregnancy are more likely to develop this condition and, ironically, any condition that leads to mucosal congestion will provide relief of symptoms.^{9,10}

Diagnosis is based primarily on history but tests of Eustachian tube dysfunction such as the patulous Eustachian tube test, in which impedance variations are seen with respiration, and sonotubometry, which measures sound transmission from the nasopharynx through the Eustachian tube to the middle ear during swallowing, may help make the diagnosis. Because symptoms are usually minimal, no treatment may be necessary. In cases in which symptoms are more distressing to the patient, increased humidity, frequent valsalva or Mueller maneuvers, and the injection of irritating substances into the peritubal space have had variable success in relieving symptoms.

In this study, we could not substantiate an association between acutely rising estrogen levels and changes in eustachian tube function.²

In contrast to the well-documented influence of sex hormones on the respiratory mucosa^{11,12} and the changes in function of the nose and paranasal sinuses in relation to pregnancy, menstrual cycle, and oral contraceptive usage,^{3,4,12} an inverse influence of rising estradiol levels on tubal function was documented in only a small number of our patients.

The normal levels of plasma estradiol ranges from 25–75 pg/ml in the follicular phase, to 200–600 pg/ml at the midcycle peak, and 100–300 pg/ml in the luteal phase. In induced ovulation estradiol levels can reach a peak of 600–3000 pg/ml or even higher. Although the finding of decreased function with increasing estrogen levels that was encountered in some patients may be related to the congestive property of sex hormones, as proposed previously, it does not entirely explain the symptomatology of patients on oral contraception or before menstruation, where estradiol levels are essentially in the physiologic range.

It may be speculated that other hormonal factors may be connected to the altered eustachian tube function in these circumstances. For example increasing progesterone levels in pregnancy or the progestational effect of oral contraceptives may be the cause of the documented mucosal changes in these circumstances. Since our study concentrated on the estrogenic effect on eustachian tube function while controlling for the progestational effect, we can assume that estrogen is not the hormonal mediator of the previously reported changes in eustachian tube function.

Conclusion:-

There is a poor correlation between estrogen levels and eustachian tube function over a wide range of estrogen levels.

However, a moderate decrease in eustachian tube function with high blood levels of estradiol in a small number of women may explain the symptomatology encountered in various physiologic or pathologic situations.

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