Prognostic effect of serum Estradiol hormone Levelin premenopausal and postmenopausal women with breast cancer

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DOI: https://doi.org/10.33545/26174693.2021.v5.i2a.66

Abstract

Aim: To evaluate serum Estradiol level in pre and postmenopausal women with breast cancer.

Method: The breast cancer female patients were recruited from OPD/IPD of Surgery and Oncology department of SMS Hospital, and evaluated serum Estradiol. Patients were divided into two group’s premenopausal and postmenopausal women with breast cancer.

Results: Serum Estradiol level significantly high in postmenopausal women as compared to premenopausal women of breast cancer. The result was significantly high. (p<0.001).

Conclusion: Serum Estradiol level can predict breast cancer in postmenopausal women. Risk of breast cancer is increased with increase in estradiol level in postmenopausal women.

Keywords: Estradiol, breast cancer, postmenopausal women

Introduction

Breast cancer is the formation of a malignant tumor that has developed from cells in the breast. The bio-logical progression of breast cancer is based on the inability of differentiation, loss of contact inhibition, uncontrolled growth, the ability to migrate, invasion, angiogenesis, metastasis, and the ability to avoid immune control of tumor cells [1]. Lifetime risk of developing breast cancer in every woman in the United States is 12.4% or one in eight women [2]. Globally, breast cancer accounted for 2.08 million out of 18.08 million new cancer cases (incidence rate of 11.6%) and 626,679 out of 9.55 million cancer-related deaths (6.6% of all cancer-related deaths) in 2018 [3]. Estradiol (E2) is an estrogen steroid hormone and the major female sex hormone. It is also known as 17β-estradiol. It is involved in the regulation of the estrous and menstrual female reproductive cycles. Estradiol is responsible for the development of female secondary sexual characteristics such as the breasts, widening of the hips, and a female-associated pattern of fat distribution and is important in the development and maintenance of female reproductive tissues such as the mammary glands, uterus, vagina during puberty, adulthood and pregnancy [4]. Serum estradiol level is significantly lower in premenopausal than in postmenopausal women. Premenopausal women have been consistent in E2 levels without variation according to menstrual cycle. Estradiol in the blood is linked to an increased risk of breast cancer in women after menopause [5]. High estrogen levels in the serum or urine, and low levels of sex hormone binding protein (SHBG), resulting in high bioavailability of free estradiol also point for an important role for endogenous and exogenous estrogens in the risk of breast cancer [6]. In this study we evaluate serum estradiol level in pre and postmenopausal with breast cancer.

Material and Method

The present comparative study was conducted in the Department of Biochemistry, in association with the Department of Surgery and Oncology SMS Medical College and Attached group of Hospitals, Jaipur. Total 90 subjects included in this study and divided into two groups as follows: Group 1 included 45 premenopausal and Group 2 included 45 postmenopausal women with breast cancer. Female patients (age >20 years) diagnosed with breast cancer were included in this study.
Exclusion Criteria was taken to rule out other diseases which can alter the result of the study like patients having other cancer, previously diagnosed case of breast cancer who is taking chemotherapy or radiotherapy, History of OCP & Pregnancy. Patients with benign breast diseases. Venous blood sample was withdrawn for investigations taking all aseptic precautions. Serum was separated and investigated for Estradiol (E2) by ELISA method [7].

**Ethical approval and Informed consent**
The Protocol was approved by institutional Ethics committee. Informed written consent was obtained from all study subjects.

**Statistical Analysis**
The data was analysed using SPSS version 20 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages, means and standard deviations were calculated. The statistical tests applied for the analysis were oneway ANOVA. The confidence interval and pvalue were set at 95% and ≤ 0.05 respectively.

**Results**
Table 1: Demonstrates serum Estradiol mean value in pre and postmenopausal female with breast cancer groups. These were 229.53±81.56 &547.88±209.61 respectively. The mean value of Estradiol was higher in postmenopausal breast cancer women as compare with premenopausal breast cancer women. (Figure 1) The result was significantly high. (p< 0.001)

Table 1: Serum Estradiol (ng/ml) level in premenopausal and postmenopausal women with breast cancer.

| Estradiol | Menopausal-status | Case group | N | Mean | Std. Deviation |
|-----------|-------------------|------------|----|------|---------------|
|           |                   |            |    |      |               |
| Pre-menopause | 45  | 229.5333 | 81.56303 |
| Post-menopause | 45  | 547.8889 | 209.61873 |
| t-value |                  | -9.495     |
| p-value |                  | 0.001 (Sig.) |

Independent sample t-test

Discussion
The findings of our study show Estradiol was higher in postmenopausal breast cancer women as compare with premenopausal breast cancer women. The result was significantly high (p< 0.001). Our results are in agreement with previous study of Hankinson SE [8], who also demonstrate the association between breast cancer and circulating levels of estradiol among postmenopausal women. Serum Estradiol did not show a significant association with premenopausal breast cancer risk which confirm by Kaaks et al. [9] finding, Estradiol is considered the most significant breast cancer risk factor because of its direct role in stimulation breast cell division or via its effects on other hormones and due its support of the growth of estrogen-responsive tumors [10]. Postmenopausal women with high plasma estrogen levels have twice the risk of developing breast cancer as women with low levels [11].

Our study results also shows Estradiol levels in different stages of pre and postmenopausal women with breast cancer. No significant results of Estradiol were found in different stages of pre and postmenopausal women with breast cancer. Similar study conducted by the Jouda J et al. [12] who observed Estradiol levels were significantly lower in-patient group stage 2 than those in stage 3. Although, no study has clearly demonstrated a relationship between breast cancer and estrogen levels in premenopausal women. This is largely due to variation in sex steroid hormone levels, particularly estrogen over the menstrual cycle.

**Table 2: Estradiol in different stages of premenopausal and postmenopausal women with breast cancer.**

| Character | Tumor Stage | N | Premenopausal Mean±SD | Postmenopausal Mean±SD |
|----------|-------------|---|-----------------------|------------------------|
| Estradiol (ng/ml) | I | 15 | 249.66±83.44 | 510.33±98.19 |
| | II | 25 | 227.38±89.25 | 547.16±261.17 |
| | III | 25 | 222.08±75.98 | 530.92±209.05 |
| | IV | 25 | 229.28±85.76 | 599.45±231.45 |

F value: 0.149  p value: 0.930  Mean±SD

Test applied: One-way ANOVA
Premenopausal women experience changes in their serum estrogen levels throughout their menstrual cycles \cite{13}. In contrast, postmenopausal women have been more consistent in estradiol (E2) levels, because of the absence of the variability of hormone levels with the menstrual cycle. Therefore, analysis of the difference of prognosis according to serum estradiol (E2) level in premenopausal women, constant measure of estradiol(E2) in time is important \cite{14}. Thus, further assessments are needed to evaluate the association between estradiol level and breast cancer risk among females.

**Conclusion**

Most breast cancer are detected after menopause in female. This suggests that most breast cancers have an enzyme system efficient enough to produce active estrogens in situ from circulating precursor enzymes modulating tissue steroid availability. These may play an important role in the initiation and progression of breast cancer. In our results Estradiol levels increased in postmenopausal women with breast cancer while premenopausal women did not show any association with estradiol and breast cancer risk. Our findings are hypothesis suggesting that an estradiol rich microenvironment facilitate the progression of breast cancer in postmenopausal women. These findings could support the notion of altering estrogen metabolism through lifestyle modifications or chemo-preventive strategies as a means of breast cancer prevention.

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