Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

Research Paper

Serum Levels of Metal Ions in Female Patients With Breast Cancer

Medical Science

KEYWORDS : breast cancer, trace elements.

Ravi Yadav	Dr. VMGMC, Solapur
Pranay Gandhi	Assistant professor in the Dept of community medicine, D Y Patil medical college, Kolhapur.
Lokesh KC	Dr. VMGMC, Solapur.

ABSTRACT

Aims: To estimate the serum levels of trace elements and determine their role in causing breast cancer in female patients.

Settings and Design: A case-control study on female patients with breast cancer was conducted in a private superspecialty hospital and Cancer centre situated in Southern part of India.

Materials and Methods: These cases were selected irrespective of type and stage of the disease. The age matched control subjects were drawn from apparently healthy women attending master health check at superspecialty hospital.

Results: The study was conducted on 54 female patients with breast cancer and 54 female controls with mean age of 47.2±8.14 y and 46.8±8.4 y respectively. There was statistically significant increase in serum levels of calcium, copper, iron and phosphorus in patients with breast cancer when compared to controls.

Conclusion: The estimation of serum levels of these metal ions has a potential role in early detection and monitoring of breast cancer.

Introduction

Breast cancer is the second commonest form of cancer among women. Low prevalence of breast cancer in East Asian countries has been reported in earlier studies. However, in recent years, its prevalence is increasing in alarming pace [1]. Breast cancer found to be more common in developed countries and developing countries constitute 40% of all cases [2]. In India, breast cancer is the most common form of malignancy among women in urban area. In rural area, it is the second commonest form of cancer accounting for 25 to 32% [3]. Several studies have been conducted to identify potential risk factors. However, role of trace elements or metals in causing breast cancer has not been studied to great extent [4]. Therefore, the present study was undertaken to estimate the serum levels of calcium, copper, magnesium, iron, phosphorus and zinc and determine their role in causing breast cancer in female patients.

Materials and Methods

A case-control study of serum levels of metal ions in female patients with breast cancer was conducted in civil hospital, Solapur in southern India. The study was conducted over a period of one year (2011-2012). Ethical clearance was approved for study in accordance with the ethical standards of the institutional ethics committee on human experimentation and with the revised Helsinki Declaration before starting the study. The written informed consent was taken from both patients and controls. Newly diagnosed female patients with breast cancer in the age group of 30-60 y attending Oncology clinic were included in the study. These cases were selected irrespective of type and stage of the disease. The diagnosis was established based on clinical, radiological (mammography) and histopathological features. The age matched control subjects were drawn from apparently healthy women attending master health check at superspecialty hospital. The patients or controls suffering from co-morbid conditions which affect serum levels of metal ions and other malignancies, and/or undergoing treatment for breast cancer were excluded from the study.

In all the study participants five ml of fasting venous blood was drawn from median cubital/basilic vein under strict aseptic precaution and collected in a red capped plain vacutainers. The blood sample was allowed to clot by keeping the vacutainer for 10 min at room temperature and then centrifuged at 3000rpm for 10 min using Remi8RC centrifuge. Serum was separated and tests were performed according to standard procedure for each metal ion on the same day. The estimation of metal ions was done by UV-Visible Spectrophotometer-CHEM 7 using Tulip Diagnostics (P) Limited kits.

The serum calcium was estimated by OCPC method [5], copper by Diethylbromine-PAESA method [6], magnesium by Calmagnite method [7], phosphorus by Molybdate UV method [8], iron by Ferrozo method [9] and zinc by Nitro-PAPS method [10]. The intensity of coloured complex for calcium, copper, iron and zinc was measured at Hg 578nm wave length. For phosphorus and magnesium it was measured at 340nm and 510nm wave length respectively.

Statistical Analysis

The results were analysed using Statistical Package for Social Sciences (SPSS) 16.0. Independent Samples t-test was used to calculate difference between the two means. The p-value of <0.05 was considered as significant.

Results

The study was conducted on 54 female patients with breast cancer and 54 female controls with mean age of 47.2±8.14 y and 46.8±8.4 y respectively. There was statistically significant increase in serum levels of calcium, copper, iron and phosphorus in patients with breast cancer when compared to controls [Table/Fig-1]. The increase in serum levels of magnesium was insignificant. A statistically significant decrease in serum zinc levels was observed in patient with breast cancer when compared to controls

table 1

Group Statistics of Serum Metal ions in both Controls and Breast cancer Patient

		n	Mean±Std. Deviation	Std. Error Mean	p-value
Copper	**Control**	**54**	**109.56±30.71664**	**4.18001**	
	Patients	**54**	**202.21±89.18438**	**12.13646**	**<0.001**
Iron	**Control**	**54**	**67.4870±28.24072**	**3.84308**	
	Patients	**54**	**85.4744±47.45177**	**6.45737**	**0.019**
Phosphorous	**Control**	**54**	**3.9000±.84183**	**.11456**	
	Patients	**54**	**7.2652±2.98398**	**.40607**	**<0.001**

Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

		n	Mean±Std. Deviation	Std. Error Mean	p-value
Magnesium	Control	54	1.7130±.36032	.04903	
	Patients	54	2.1876±2.22429	.30269	0.127
Zinc	Control	54	79.4704±16.44123	2.23737	
	Patients	54	52.2624±32.58669	4.43449	<0.001
Calcium	Control	54	7.4556±1.98533	.27017	
	Patients	54	9.7500±1.25032	.170150	<0.001

p< 0.05 Significant

Discussion

Trace elements and metals are known to play a vital role in metabolism. Iron, an essential trace element, acts as catalyst for generation of reactive oxygen species. In patients with breast cancer, the circulating estrogen facilitates release of free iron from ferritin storage. The iron induced oxidative stress in the breast has been attributed to alterations in cell signaling processes that control proliferation and apoptosis [11]. Similarly copper generates reactive oxygen species through activation of several organic peroxides. These free radicals induce mutations by damaging DNA. Thus, increase in serum levels of iron and copper act as compounding factors in breast carcinogenesis [12]. However, zinc as an antioxidant and magnesium through its role in cell cycle, act as protective factors against carcinogenesis. Zinc is also vital for functions of many transcription factors and proteins that recognize certain DNA sequences and regulate gene transcription. The removal of precancerous cells by immune system of the body is dependent on magnesium. Hence, low levels of zinc and magnesium are an important precondition for precancerous transformation [13]. Unlike copper, iron, zinc and magnesium, the metal ions such as calcium and phosphorus do not contribute to the process of carcinogenesis but their increased serum levels can be attributed to local and systemic changes that occur in breast cancer [14]. The interaction of free radicals with polyunsaturated fatty acids of cell membrane causes lipid peroxidation and subsequent cell damage. This leads to leakage of intracellular phosphorus into serum [15]. Increased serum calcium level has been attributed to action of parathormone related peptide, osteolytic bone metastasis and high levels of acid phosphatases in breast tumour [16].

The results of present study emphasize the role of these metal ions as compounding factors in the development of breast cancer. As these metal ions play an important role in carcinogenesis through various mechanisms, the estimation of their serum levels in high risk individuals may help in early detection of breast cancer. The individuals with abnormal serum levels can be subjected to further investigations to identify precancerous changes or early malignant changes. In such individuals, appropriate preventive measures can be advised to prevent progression of the disease. Further studies are required to establish the role of estimation of serum metal ions in this regard.

Conclusion

The present study highlights the role of calcium, copper, iron phosphorus, magnesium and zinc in the pathogenesis of breast cancer. The estimation of serum levels of these metal ions has a potential role in early detection and monitoring of patients with breast cancer.

REFERENCE

[1] Parkin DM, Bray F, Ferlay J, Pisani P. Global cancer statistics 2002. Cancer J Clin. 2005;55:74–108. | [2] Sharma BK, Ray A. Breast and prostate cancer. IJCB. 2001;15:110–17. | [3] Pink Indian statistics, Breast. Cancer. India. Trends of breast cancer in India, [Internet],http://www.breastcancerindia.net/bc/statistics/stati.html.[accessed on 20/4/14, 15:34] | [4] Adebamowo CA, Hu FB, Cho E, Spiegelman D, Holmes MD, Willett WC. Dietary patterns and the risk of breast cancer. Ann Epidemiol. 2005;15(10):789–95. | [5] Bagainski ES.Estimation of Serum Calcium. ClinChemActa. 1973;46:46. | [6] Akita Abe, Yiamashita S. Estimation of Serum Copper. Clin Chem. 1989;35(4):552–54. | [7] Gindler E. Estimation of Serum Magnesium. Clin Chem. 1971;17:662. | [8] Goodwin JF. Estimation of serum Phosphorous. Clin Chem. 1970;16(19):776. | [9] Siedel J, et al. Estimation of serum iron. Clin Chem. 1984;30:975. | [10] Tetsus Makino. Estimation of serum Zinc. ClinChemActa. 1991;197:209–20. | [11] Galaris D, Skiada V, Barbouti A. Redox signaling and cancer: the role of "labile" iron. Cancer Lett.2008;266:21–29. | [12] Linder MC, Hazegh-Azam M. Copper biochemistry and molecular biology. Am J Clin Nutr.1996;63:797s–811s. | [13] Magalora T, Bella V, Brtkova A, Beno I, Kudlackova M, Volkovova K. Copper, zinc, super oxide dismutase in precancerous, benign disease and gastric, colourectal and breast cancer. Neoplasma.1999;46:100–04. | [14] Solimando DA. Overview of hypercalcemia of malignancy. Am J Health-Syst Pharm. 2001;58(Suppl 3):4–7. | [15] Khanzode SS, Muddeshwar MG, Khanzode SD, Dakhale GN.Antioxidant enzymes and lipid peroxidation in different stages of breast cancer. Free Radic Res. 2004;38:81–85. | [16] Halabay R, Abdollahi J, Martinez ML. Acid phosphatase in human breast tumours. Breast Cancer Res.2001;3:E002.