

Fluctuating Asymmetry of Hand Dermatoglyphics in Female Breast Cancer Population

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Abstract:

Background: Breast cancer being a common cancer in women among reproductive age, effective screening criteria should be in practice to keep apart the high risk population for breast cancer and thereby prevention of the disease.. The present study identifies the FA of digital and palmar dermatoglyphic variables specific for breast cancer, which can be utilized to set apart the population at risk, take preventive and early therapeutic measures. **Methods:** The participants are grouped in to 50 each based on selection criteria. Data collected in the form of digital photographic images of the digits and palm of the right and left hand and the variables are analyzed visually with assistance of computer. The Student t' test is applied to examine the quantitative variables and to measure the FA between dermal ridges of the right and left hand. **Results and Conclusion:** The typical dermatoglyphic variables that can be utilized to insulate the high risk population includes FA Thumb, FA Ring finger and FA A-B ridge count. The overall observation of the results obtained from the study demonstrated a substantial divergence in the fluctuating asymmetry of dermal ridge patterns of healthy participants from the high risk and breast cancer group and the patterns followed in high risk and breast cancer group helps to categorize to some extent the familial origin of chest malignant neoplastic disease.

Key words: Fluctuating asymmetry; Dermatoglyphics; Breast cancer; Ridge count; Genetic instability.

Introduction

Breast cancer is a common cancer in women among reproductive age, effective screening criteria should be in practice to keep apart the high risk population for breast cancer and thereby prevention of the disease.⁽¹⁾⁽²⁾ Dermatoglyphic analysis can be utilized as a screening process to identify the population at risk based on genetic origin. Breast malignant neoplastic disease is one such disease which has genetic predisposition and may show peculiar dermatoglyphic patterns in populations at risk ⁽³⁾⁽⁴⁾. The risk factors are the hereditary based, which accounts for approximately 10% of the incidence ⁽⁵⁾ and the lifetime risk factors, especially the hormone based life events which account the major part ⁽⁴⁾. Both transmitted and the assumed causes of breast cancers are suggested to have to genetic base. The genetic instability within the DNA are likely to be contemplated in the dermal ridge patterns. The term fluctuating asymmetry (FA) describes the degree of asymmetry or instability between the right and left hand of an individual. It is the meter reading of environmental disturbance ^(6, 7) which in turn appears to reflect the epigenetic modification of genes. The fluctuating asymmetry is hypothesized to reflect the genomic instability in breast cancer population. The present study identifies the FA of digital and palmar dermatoglyphic variables specific for breast cancer, which can be utilized to set apart the population at risk, take preventive and early therapeutic measures.

Materials & Methods:

Participants are divided into groups based on their selection criteria. The group I consists of females who have been histopathologically diagnosed with breast cancer as their primary site of malignancy. Females in Group II are considered to be at high risk for breast cancer because of their family history (mother, sister, or daughter) or any two criteria based on endogenous oestrogen exposure, which includes History of menstruation (early menarche below 12 years, late menopause above 50 years) Nulliparity (first full-term pregnancy (FFTP) after 30 years of age), parity status Personal fibro-adenoma history, obesity, and hormone replacement therapy (HRT) ^(8, 9, 10, 11, 12). Females in Group III are typical and healthy. Breast carcinomas developed as secondary sites from primary sites elsewhere, populations exposed to chemotherapy or radiotherapy, populations affected by any other major ill health, male participants, and people who don't have proper visible dermal ridges due to their job are all excluded from group I and II. Personal or family history of breast cancer, Personal or family history of non-malignant tumour, populations exposed to chemotherapy or radiation therapy, populations affected by any other major health problem, Male participants, and those who do not have proper visible dermal ridges due to their job are all exclusion criteria for group III.

Data Collection Procedure:

The data collected from the participant after giving a detailed explanation about the procedure and their cooperation and willingness are obtained with an informed consent. The demographic status of the patient is collected as part of their subjective assessment. Information gathered in the course of digital photographic images of the fingers and palm of the right and left hand and the variables are analyzed utilizing the computer visually. The fluctuating asymmetry is the amount of difference in quantitative parameters between homologous digits of the right and left hand |R-L|. The variables used as an outcome measure to analyze the fluctuating asymmetry are fluctuating asymmetry of Finger Ridge Count (FRC) of the thumb, index, middle, ring and little finger, A-B Ridge Count, ATD angle and main line index (MLI). All the variables are assessed by a trained rater who is blind to the study and group status.

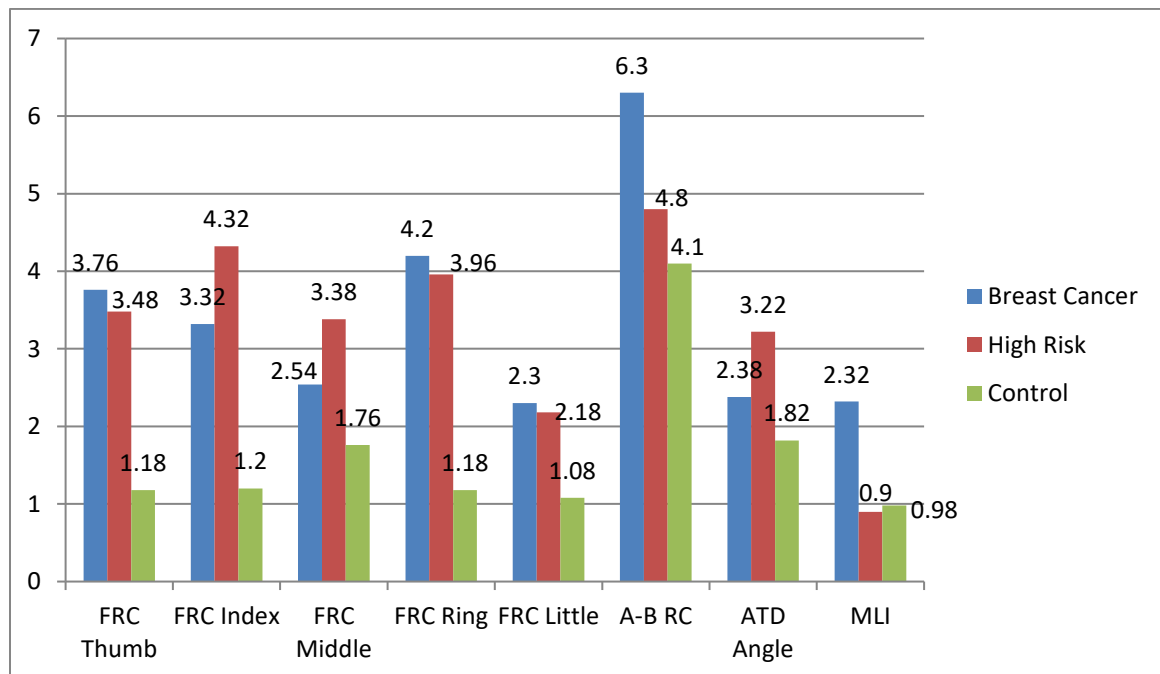
Data Analysis:

The Student t' test is used to analyze the quantitative variables and to measure the FA between dermal ridges of the right and left hand. The average of the difference in ridge count between right and left |R-L| hand is used as a measure of fluctuating asymmetry.

Table – 1: Association between Fluctuating Asymmetry of dermatoglyphic variables and Breast Cancer Risk.

Variables	Breast cancer & High risk group	High risk & Control group	Breast cancer & Control group
FA Thumb	NS	P<0.0001	P<0.0001
FA Index finger	NS	P<0.0001	P<0.0001
FA Middle finger	NS	P<0.0001	P<0.006
FA Ring finger	NS	P<0.0001	P<0.0001
FA Little finger	NS	NS	NS
FA A-B RC	P<0.06	NS	<0.004
FA ATD angle	P<0.05	P<0.0001	NS
FA MLI	P<0.005	NS	P<0.0001

*NS – Not significant

Figure – 1: Association between Fluctuating Asymmetry (mean difference) and Breast Cancer Risk.

Results:

The average difference of ridge count between homologous digits of the right and left hand are examined to assess fluctuating asymmetry. The FA of mean finger ridge count of

thumb, index and ring finger showed significant difference between breast cancer and control group and between high risk and control group ($p < 0.0001$). Fluctuating asymmetry of A-B ridge count showed significant difference between breast cancer and control group alone ($p < 0.004$). Fluctuating asymmetry of ATD angle showed significant difference between breast cancer and high risk group and between high risk and control group ($p < 0.05$). FA of the Main line index showed significant difference between breast cancer and high risk group and between breast cancer and a control group ($p < 0.05$). The typical dermatoglyphic variables that can be utilized to insulate the high risk population includes FA Thumb, Ring finger and FA A-B ridge count. (Table - 1, Figure -1)

Discussion:

The present study has taken effort to identify the differentiating dermal ridge parameters between high risk group and the breast cancer group and compared the result with normal healthy participants. The overall observation of the results obtained from the study demonstrated a substantial divergence in the dermal ridge patterns of healthy participants from the high risk and breast cancer group, and the patterns followed in high risk and breast cancer group helps to categorize to some extent the familial origin of chest malignant neoplastic disease. All these facts acts as an evidence for the hypothesis that dermatoglyphic patterns represent the genomic instability in breast cancer, which can be of familial origin or due to environmental disturbances in the womb during developmental stage that involves the gene expression through epigenetic mechanism. A-B ridge count and main line index can be used to isolate the breast cancer population and ATD angle for isolating the high risk group.

Very few studies are reported which describes the Fluctuating Asymmetry of dermal ridge pattern in breast cancer. There is possibly genetic and epigenetic base for dermal ridge pattern and the genomic instability that is likely to be reflected in the fluctuating asymmetry⁽¹³⁾. Though many high risk factors are defined, the fluctuating asymmetry of dermal ridge patterns acts as an additional factor which reflects the DNA damage and help to take preventive measures and early therapeutic effects. Genes are usually symmetrical in their optimal state. As the two eyes, ears, hands, etc., which shows symmetry, our dermal ridge patterns too should represent bilateral symmetry. Department of medical genetics and cell biology, china 2009, reported significant differences in FA of digits and ATD angle which is in agreement with the present study. Any deviation or disturbance in the phenotype representation of bilateral symmetry reflects the genomic instability.⁽¹⁴⁾ Each area of dermal ridge patterns of the hand represents the status of specific genes at the time of development.^(1, 15)

The alternation in the epigenetic mechanism in the prenatal period may be caused by the epigenetic disruptors which are said to be reflected in the dermatoglyphics. Oxidative stress is produced when the ROS level over weighs the antioxidants or deficiency of antioxidants. Oxidative stress causes DNA damage which turns the initial step in carcinogenesis. Studies suggest that environmental factors of mother like high psychological stress and lack of balanced

nutrition, raise the ROS level and can influence the epigenetic mechanism of the developing fetus. This gene - environment interactions play a critical part in the growth of breast malignant neoplastic disease. The normal cell function is maintained by the effective genetic repair systems, consequently any deficiency in its function may result in irreparable harm. Keeping the level of Oxidative stress proteins and the gene repair protein protects the normal cells from destructing effects of ROS^(16,17). There is a saying about aging 'Every Hour Hurts, The Last One Kills', and every day thousands of DNA damages occurs in our physical structure. The efficient DNA repair pathways play a critical part in restoring the damages. Insufficiency in the DNA repair system, results in an assemblage of more DNA damages, a major factor resulting in carcinogenesis. Another pivotal event that occurs is epigenetic silencing of DNA repair pathways which happens in addition to polymorphism can initiate tumorigenesis. Epigenetic alternations control the gene expression status that is likely to be reflected in the dermatoglyphic patterns. They do not require any alteration in the DNA sequence instead regulates the construction status. Epigenetic inactivation of DNA repair pathways in cancer has been described for various DNA repair pathways. This is a vital event in cancer initiation^(18,19). To investigate the hypothesis the present study analysis the effectiveness of a non-invasive, anatomical marker

Conclusion:

The concept of fluctuating asymmetry presented to be more sensitively reflected in dermal ridge pattern of hands in breast cancer. The various parameters represent the different genetic complexes. Thus fluctuating asymmetry of dermal ridge pattern can be used as a powerful and sensitive tool for screening breast cancer population. The dermatoglyphics can be utilized as an efficient tool in mass screening program for breast cancer risk.

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