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Handwriting Change in Breast Cancer Patients

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Abstract

Introduction: Breast cancer is the most common cancer. In the course of cancer progression, there are specific neuromuscular disturbances that directly affect coordination. Hand-writing is regarded as a vital constituent when it comes to the tracing of neuromuscular coordination.

Aim of the study: The study aimed to study handwriting analysis in female cancer breast patients trying to find simple useful, non-invasive ways to help in early detection, diagnosis, and follow-up.

Subjects and methods: 160 participants were included in the study. Participants were asked to write the same text (two Arabic sentences and her name in the Arabic language) and draw lines on another paper, and then all handwriting samples were scanned and examined.

Results and Conclusion: Our study shows that many handwriting changes such as Tremor, wide spaces between words, heavy writing pressure, slope or slant of writing upward slant or down slant, and heaviness of Initial and terminal strokes were observed. These changes were in samples of the patient received multiple lines of treatment, in patients with metastasis, or had another associated type of tumor such as ovarian, bladder cancers or lymphoma.

Keywords: handwriting analysis; cancer breast patients; writing trait.

1. Introduction

Handwriting analysis is the window to the soul. It may be true that it can help to know about someone's personality from his handwriting. It's been said that science can be used to diagnose mental illness [1]. Hand-writing is a complex act resulted from a combination of coordinated actions between the eye, brain, and muscles of the arm, hand, and fingers; a complex perceptual-motor or a neuromuscular task [2].

Some researchers named handwriting "brain-writing". Experiments included having writers perform with their opposite hands, foot, and even mouth, which established conclusive similarities indicating that writing, was centrally organized, and the role of the writing center in the brain is that it is responsible for the mental image of writing. An example is when dictating a phrase that everyone writes according to their mental image of it in the brain. It also

gives orders to the hand as a writing tool and thus implements the mental image in the brain. Therefore, writing is brain writing and the hand is just the enforcer [3]. The main uses of handwriting and graphology include behavior analysis, forensic evidence, and disease analysis. The script reveals the exact personality of emotional status, fears, defenses, honesty, and many other individual personality attributes of a person through the strokes and patterns was revealed by the script [4].

The authenticity of a person's signature or script in the suicide note is frequently subjected to forensic document examination during the investigation to verify authorship [5-6].

Breast cancer creates from breast tissue. Signs of breast cancer may incorporate a knot within the breast, alteration in breast shape, dimpling of the skin, liquid coming from the areola, a newly-inverted areola, or a ruddy or flaky fix of skin. There may be bone torment, swollen lymph hubs, shortness of breath, or yellow skin [7].

The most common device that specialists utilize to portray the arrangement is the TNM framework. Tumor (T) Node (N): the tumor spread to the lymph hubs, and if so, where and what it measures, and how numerous? Metastasis (M) cancer spread to other parts of the body. There are five stages of breast cancer: organize (zero), which is non-invasive ductal carcinoma in situ (DCIS), and stages I through IV (1 through 4), which are utilized for obtrusive breast cancer. The organization gives a common way of depicting cancer, so

specialists can work together to arrange the most excellent medicines [8].

Early breast cancer detection is very important that helps early and proper treatment. That might de-crease the death rate due to cancer breast. That can be performed through regular self-exam of the breast, regular physical examination and investigation such as breast mammography, Contrast-enhanced (CE) digital mammography, Ultrasound, Magnetic resonance imaging (MRI). These screening tools had strengths and weaknesses [7].

In the medical field, handwriting can be used as an aid in the diagnosis and following of diseases like Alzheimer, Parkinson, and even cancers such as Kanfer neuromuscular Tests in cancer patients [9].

Handwriting changes in cases of cancers occur in case of metastasis, treatment by chemotherapy, severe pain, psychological disturbance or pressure of cancer on nerves, or any condition that affects the nervous system in the cancer patient. If a cancer patient has these conditions, handwriting changes appear, which help in the early detection of cancer and follow-up [10].

Handwriting changes as tremors are indicated by an involuntary, rhythmic, and recurrent movement of the pen from side to side. These tremulous strokes are instant changes from the desired direction of the pen lines and are attributed to nervous impulses affecting the muscles indicating a loss of control of the pen. There are many different reasons that tremor occurs in handwriting such as aging and illness [11].

Pressure refers to the hand's grasp on the writing instrument, and the amount of pressure used to push the pen across the paper. It varies for different writers from light to heavy [10-11]. Slant or slope refers

2. Subjects and methods

2.1. Study design

This study started from September 2019 to September 2020 in forensic medicine and clinical toxicology Department, faculty of medicine, aiming to study hand-writing analysis in female cancer breast patients trying to find simple, useful, and non-invasive ways to help in early detection and diagnosis and follow up of those patients.

2.2. Subjects

The local ethical committee approval was obtained before starting the study. The aim and benefits of the study were discussed with participants before the collection of handwriting samples. Written consent for participation in the study was obtained and confidentiality of all data was ensured.

160 Participants of our study are 120 breast cancer patients and 40 breast cancer with other types of cancer patients (lymphoma, bladder cancer, and ovarian cancer) attending different Fayoum hospitals

Before inclusion, personal and medical history was reported for each patient including age, educational level, job, number of siblings, her age at first pregnancy, family history for cancer, and treatment she received. At the time of testing, all patients had stabilized general

to the direction in which the writing leans. It may be on the right or the left, or it may be vertical, when a writer is a disease, there are changes in the slant, but not in all cases [10].

condition, adult age with at least primary educational level.

We excluded males' patients and any patients with diseases affecting handwriting i.e., hemodialysis patients, any neurological disease that affect hand movement as parkinsonism, CNS tumors, Thyroid disease including hyperthyroidism and thyroid tumors, Hepatic patients, Illiterate patients, and Alcohol abstinence

2.3. Materials:

White papers (A4 60 gm), college ruled paper (70 gm), Fingertip s Blue Pen (0.7 mm), Laptop, Scanner (Hp PSC 1410), Digital camera with high resolution, Compact video microscope 2000 (CMV 2000), Leica microscope MRZ 420, Stereoscopic binocular microscope, Hand magnifiers.

2.4. Methods

Each patient was asked to write the same text (two Arabic sentences and her name in the Arabic language, three times on two separate sheets of paper (one blank and one lined sheet - college ruled paper) and draw lines on another paper according to the model they gave in the same session. Subjects were asked to write on the blank sheets first and then on the lined ones, using similar blue pens (0.7 mm).

All samples of handwriting were obtained in the daylight, then the samples of the handwriting of each participant (3 sheets of paper) were kept in a file that was given a serial number from 1 to 160.

Patients were asked to bring a previous hand-writing sample before becoming diseased or receiving any treatment i.e., old signature, to be compared with handwriting samples after becoming diseased or receiving treatment

All samples were scanned using a Scanner machine (Hp PSC 1410), their digital images were collected, and collaged to gather by photo collage maker- photo editor & photo collage (a computer graphics application (version 1.28.92). That enabled the combination and editing of multiple samples. All samples (original and scanned versions) were examined, literally, by experts of handwriting in the Ministry of

3. Results

Patient age ranged from 30 – 76 years old with a mean ± SD of 50.3 ± 10.5. The studied patients were di-vided into four categories: age (30-39), (40-49), (50-59), above 60 years group 34 (21.25%), 50

Justice-Egypt, using hand magnifiers, Compact video microscope 2000 (CMV 2000), Leica microscope MRZ 420, Stereoscopic binocular microscope (giving 3D magnification). Every mark on the script or unusual movement in the trace was noted during the analysis and recorded individually for each participant.

Various writing traits were analyzed including writing speed, pen pressure grades, spacing between words, initial and terminal strokes, slop/slant, and tremors.

2.5. Statistical analysis:

The collected data were organized, tabulated, and statistically analyzed using SPSS software statistical computer package version 22 (SPSS Inc, USA). For quantitative data, the mean, standard deviation (SD), and Range were calculated.

(31.25%), 48 (30%) and 28 (17.5%) respectively. As shown in Figure 1, most cases were between 40-60 years (n=98, 61.25%), while the age groups of 30-40 years had 34 patients (21.25%).

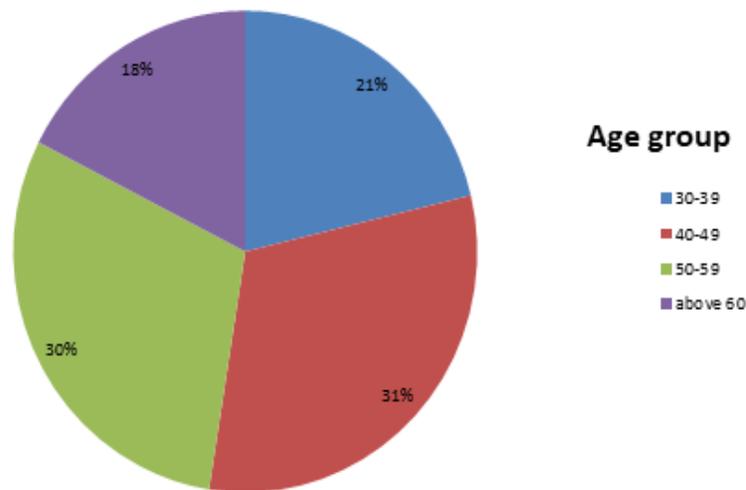


Figure 1: Frequency and percentage of age categories among the studied patients (n=160).

According to Educational level parameter, patients were divided into five groups; Illiteracy eradication program, primary, middle, secondary, graduation, and post graduates with the frequencies of 14

(8.75 %), 10 (8.75 %), 16(10 %), (80) 50 %, and 40 (25 %), respectively. Secondary level predominates 50% of all breast cancer patients, as shown in Figure 2.

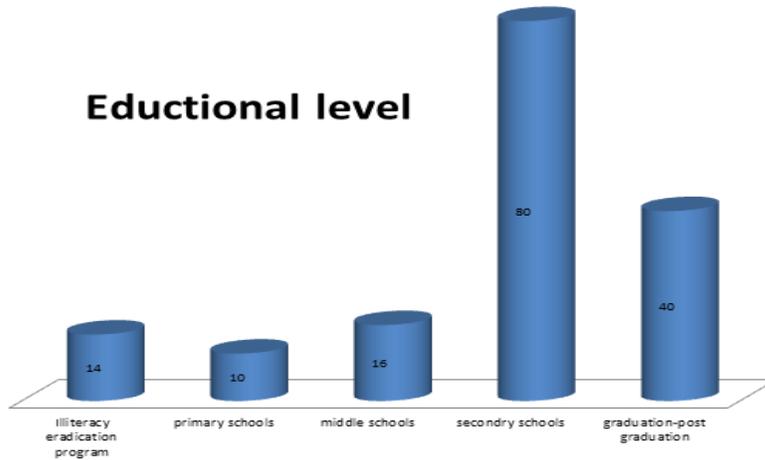


Figure 2: Frequency and percentage of educational level in the studied sample (n=160).

According to cancer stage, the samples were di-vided into three groups: group 1 (stage 0, 1, 2 TNM staging system), group 2 (stage 3, 4 TNM), and group 3 (breast

cancer with lymphoma, bladder cancer and ovarian cancer), which had frequencies of 80 (50%), 40 (25%), and 40 (25%), respectively (Figure 3).

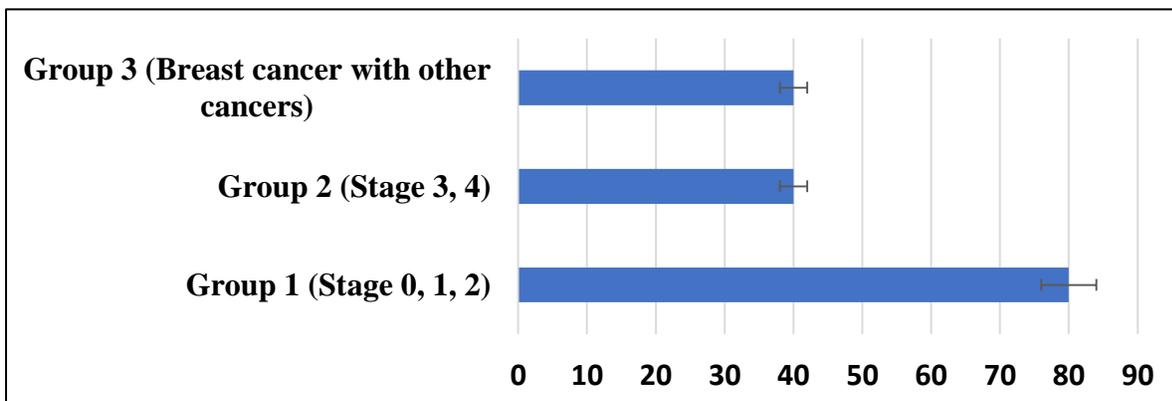


Figure 3: Frequency and percentage of cancer stage in the studied samples (n=160).

According to line of treatment used with cancer patients included in our study, our sample were grouped into seven group: group 1 (received no treatment), group 2 (underwent breast surgery), group 3 (received chemo-therapy), group 4 (received hormonal therapy), group 5 (underwent breast surgery and received chemotherapy), group 6 (underwent breast surgery and

received radio-therapy), and group 7 (underwent breast surgery, received chemotherapy, radiotherapy and hormonal therapy). They had frequencies of 48 (30%), 32 (20 %), 12 (7.5 %), 4(2.5 %), 32 (20%), 4(2.5 %), and 28 (17.5 %), respectively. Many cases were early detected and haven't received treatment yet, as shown in Table 1.

Table 1: Frequency and percentage of different treatment lines used in the studied samples (n=160).

Variable	Category	Frequency
Line of treatment	No treatment	48 (30%)
	Surgery	32 (20%)
	Chemotherapy	12 (7.5%)
	Hormonal therapy	4 (2.5%)
	Surgery+ chemotherapy	32 (20%)
	Surgery+ radiotherapy	4 (2.5%)
	Multiple lines	28 (17.5%)

The analysis of handwriting samples revealed that Tremor was observed in 20/160 writing samples (12.5%), which showed variations in the form of slight changes in writing impulses up to marked deteriorations to the level of illegibility. Few samples, 14/160 writing samples (8.75%), showed wide spaces between words. 26/160 writing

samples (16.25 %) showed heavy writing pressure. It was observed that 8 samples (5 %) showed slop or slant of writing upward slant or down slant. The observation of the beginning and end of the word revealed that 14 samples (8.75%) had heaviness of Initial and terminal strokes, as in Table 2.

Table 2: Writing changes in the studied samples (n=160).

Handwriting change	Frequency
Tremors	20 (12.5%)
Spacing between words	14 (8.75%)
Heavy pressure	26 (16.25%)
Slant	8 (5%)
Initial and terminal strokes	14 (8.75%)

After re-observation of pervious changes and make a relation between these changes and age, cancer stages and lines of treatment which received, it was noticed that these changes were in samples of patient received multiple lines of treatment, in patients with

4. Discussion

In Egypt, breast cancer occupied the second rank among different cancers [12]. Breast cancer is typically detected either during screening, before symptoms have developed, or after a woman notices a lump. Most masses seen on a mammogram and most breast lumps turn out to be benign (not cancerous). When cancer is suspected, tissue for microscopic analysis is usually obtained from a needle biopsy (fine-needle or larger core-needle) and less often from a surgical biopsy. Selection of the type of biopsy is based on multiple factors, including the size and location of the mass, as well as patient factors and preferences and re-sources [13].

Handwriting is fingerprint of the mind; therefore, handwriting analysis can serve as x-ray of in-dividual physical state. Handwriting analysis needs to be informed of any factors that could influence the handwriting being examined. The principal factors considered include age, health, substance abuse, and mechanical factors. Health factors include physical and mental health and any medication that may affect handwriting. Mechanical features cover the writing sur-face, writing instrument, and lighting. The writing position may also affect the writing act [11].

metastasis or has another associated tumor as ovarian, bladder cancers or lymphoma (5 cases had breast cancer with ovarian cancers-5 cases had breast cancer with bladder cancer-20 cases have lymphoma).

Changing your handwriting means changing life, in addition, what we write is controlled by the conscious mind, but how we write is controlled with sub-conscious mind. Cancer -or tumor- makes pressure on neurons that affects motor nervous system, controller of handwriting, which causes some dramatic changes in the patient's handwriting. Hence, we worked on early detection of cancer through handwriting [12].

A typical criterion of normal hand writing, that is a mature neuromuscular condition with a normal range of coordination. Normal handwriting is manifest-ed in the smooth, continuous flow of movement, both in the descending and ascending strokes (uniform flow of ink throughout the strokes and sharp, continuous delineations to both sides of each stroke) In case of cancer as lymphoma: The strokes have an oval shape; the turns from descending to ascending strokes are narrow, curved, and show continuity of movement throughout. A regular pattern is of heavier (wider and darker) descending strokes and lighter ascending strokes [2].

In our study, most distribution of age categories among the studied patients were 4 groups age, (30-40), (40-50), (50-60), and

above 60 years group 21.25 %,31.25 %,30 %,17.5 % respectively.

Most of cases were between 40-60 years. That agree with national cancer institute (NCI) and center of disease control (CDC) and prevention, that most breast cancers were found in women of 50 years old or older [14].

In this study, we noticed decrease in incidence rates in patients above 60 years> That agrees with American Cancer Society Surveillance Research 2019 [13].

In this study, Breast cancer patients according to educational level parameter; Illiteracy eradication pro-gram, primary, middle, secondary, graduation and post gradates withe Percentage 8.75 %, 8.75 %, 10 %, 50 %, 25 %respectively. Secondary educational level predominates 50% of all breast cancer patients. Most cases were from high level of education (secondary schools and graduates), which might be due to patient awareness about the disease, self-examination, and early asking of medical advice. In contrast, lack of disease awareness and delayed seeking medical advice appeared in lower educational levels, such as in illiteracy eradication program and primary school. That agrees with American Cancer Society Surveillance Research 2019 [13].

In our study, it was noticed that some writing samples showed changes such as tremors, wide space between words, upwards and downwards slop and heavy pen pressure, but all these changes were in patients of treated with multiple lines of treatment or cases associated with other

cancers as lymphoma, ovarian and bladder cancer or metastasis.

5. Conclusion

By general observation and analysis of samples of handwriting from breast cancer patients, there was no significant difference between breast cancer samples and normal human standards ratio, besides, no common characters in breast cancer samples (no tremors in stroke, no unusual configurations). Other studies are needed with a large number of cases to more accurate evolution of handwriting changes in breast cancer patients. We recommended using an electronic pen with a sensor to display the writing directly on the screen instead of scanning the text, sending it to the computer and uploading it to the program. More studied are required to establish clinical-radiological and graph logical coloration of cancer patient, analysis of handwriting changes in another types of cancers i.e., hepatic cancer, brain tumors, analysis of handwriting changes in Diabetes mellitus, and analysis of handwriting changes in thyroid diseases.

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Ethical Approval Statement: The protocol was approved by the Faculty of Medicine Fayoum University Research Ethical Committee Permission number 434, Fayoum, Egypt. The researcher informed the participants about the objectives of the study, the examination, investigations that were done, the confidentiality of their information, and their right not to participate in the study.

Informed Consent Statement: Written informed consents were obtained from all patients.

Conflicts of Interest: All authors declare no conflict of interest.

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