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IDENTIFYING PATIENTS WITH COLON NEOPLASIAS WITH GAS DISCHARGE VISUALIZATION TECHNIQUE

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Objective: Initial assessment of the potential of using Gas Discharge Visualization (GDV) technique to identify patients with colon neoplasias.

Materials and Methods: The Gas Discharge Visualization (GDV) camera was used to assess subjects. A colonoscopy was performed on each of the 78 subjects, followed by a GDV scan The control group consisted of 22 people. An endoscopic examination identified colon tumors in the remaining 56 people. The age of the subjects ranged from 45 to 86 years (mean 64.6 ± 1.2 years). The study analyzed GDV images of each subject's fingers, as well as separate sectors corresponding to the organs in question.

Results: There were a significant number of differences between the control group and the group of patients with colon tumors. We examined the dynamic of the parameters as the level of tumor dysplasia (neoplasia) varied. The values of the following parameters: normalized luminescence area, internal noise, contour radius, and average luminescence intensity - decrease in the control group as compared to patients with cancerous polyps. The values of the following parameters: radius of the inscribed circle, contour line length, area of luminescence, contour line fractality, contour line entropy, form coefficients – increased by comparison.

Conclusion: The pilot study demonstrated a statistical difference between the GDV parameters of patients with colon tumors as compared with the control group. This warrants a more in-depth study of the potential for GDV technique utilization in screening programs.
Key Words: cancer, electromagnetic fields, energy, research, oncology

Introduction

According to the International Agency for Cancer Research colon lesions rank third for incidence rate and rank fourth in the world for the number of deaths[1]. Overall, the lifetime risk of developing colorectal cancer (CRC) is about 1 in 20 (5%). It is expected that CRC will be responsible for more than 50,000 deaths during 2015[2]. In Russia, for all types of cancer, incidence of colorectal cancer ranks third, and second for death rate. Further, in 2011, the prevalence of malignant neoplasms of the colon was 200 per 100,000 people[3]. Despite the fact that over 50% of all cancer cases are diagnosed in people aged 60 years and older, the disease is increasingly diagnosed at a young age, especially for the patients' families and hereditary forms.

Timely detection of precancerous changes is vital in determining the length of the patient's life and success or failure of the treatment. Most relevant in the fight against cancer are screening programs for diagnosing diseases at an early stage before the development of the classical presentation of the disease. Occult blood test, often used for mass screening for colorectal cancer, unfortunately, does not have the desired accuracy, sensitivity and specificity. That is why there has been growing worldwide focus on finding other non-invasive screening methods. Along with molecular-biological methods, CT-colonography and videocapsule colonoscopy, increasing attention is being paid to electrophysiological methods.

EPI/GDV Technique

Application of computer technology in the processing of electrophysiological information can standardize the procedure, significantly accelerate access to research results, and reduce the influence of subjectivity. Electro-diagnostic techniques such as Electro-encephalogram and Electro-cardiogram are extensively used in medical practices worldwide[4]. A promising method, already utilized in sixty-two countries to great success, is bioelectrography based on the Kirlian effect. This effect occurs when an object is placed on a glass plate and stimulated with current; resulting in the presentation of a visible glow, the gas discharge. With EPI/GDV bioelctrography cameras, utilizing electro-photonic imaging through gas discharge visualization, the Kirlian effect is quantifiable and reproducible for scientific research purposes. Captured images (Bio-grams) of all ten fingers of each human subject provide detailed information on the subject's psycho-somatic and physiological state[5]. The EPI/GDV camera systems and their accompanying software are currently the most effective and reliable instruments in the field of bioelectrography[6,7,8,9,10]. EPI/GDV applications in other areas are being developed as well[11,12,13,14,15,16,17,18,19]

Through investigation of the fluorescent fingertip images, which dynamically change with emotional and physical health states, one can identify areas of congestion or health in the whole system. Each generated fingertip photograph is analyzed by sector division, according to acupuncture meridians. Dr. Peter Mandel, in Germany[20], and Dr. Voll, over many decades, have developed this intricate and well-defined method of seeing into the entire body through the fingertips. EPI/GDV technique researchers created a diagnostic table based on years of their own clinical field-testing, the sector basis of which differs slightly from that of Dr. Mandel[21].

The parameters of the image generated from photographing the surface of a finger under electrical stimulation creates a neurovascular reaction of the skin, influenced by the nervous-humoral status of all organs and systems. Due to this, images captured by EPI/GDV register an ever-changing range of states[22]. In addition, most healthy people's EPI/GDV readings vary only 8-10% over many years of measurements, indicating a high level of precision in this technique. Specialized software converts these readings into parameters which elucidate the subject's state of wellbeing at that time[23].

One of the first studies of cancer diagnosis using GDV was the work of B.L.Gurvits et al[24]. The material for the study were plasma samples of patients with cancer of various organs, both with the absence and the presence of distant metastasis, as compared to blood samples of healthy donors. It was found that for all samples the values of discharge parameters of blood for cancer patients were significantly higher than values for healthy people. R.S.Chouhan et al[25] examined the Bio-grams of fingers of patients in different stages of cervical cancer, showing a significant difference from the image parameters of healthy patients. R. Vepkhvadze et al.[26] by GDV monitoring of patients with squamous cell lung cancer, showed that the results of GDV evaluation and monitoring of the functional status of the patients correlate with clinical, laboratory and instrumental studies in 90-96% of cases. W.Seidov[27] identified some correspondence between GDV parameters and the presence of tumors in different parts of the colon. However, systematic research related to the diagnosis of colon tumors using GDV-graphy has not been found.

The aim of our study was to investigate the possibility of using the gas discharge visualization technique to identify patients with colon tumors.

Material and methods

To achieve this goal, we used the GDV technique to investigate the differences between patients in the control group (no precancerous conditions and changes according to videocolonoscopic evaluation), and cz

78 people, including 25 men and 43 women, ages 45 to 86 years (mean 64.6 ± 1.2 years) were studied. The control group consisted of 22 people. Of the remaining 56 subjects, colon polyps were detected in 45 patients, cancer in 11.

Computer analyses of GDV-grams were performed using the GDV-based “Bio-Well” device (www.bio-well.com). Groups were tested for normality using the Kolmogorov-Smirnov test and the presence of differences using Student's t-test using «SPSS Statistics 17.0» program. Left and right index fingers were imaged, as in accordance with the principles of Traditional Chinese Medicine, acupuncture channels correlated with the state of the different parts of the colon are located at these fingers. In accordance with these principles, GDV software calculates parameters of the particular sectors of the GDV image, corresponding to different parts of the colon system. Both the whole images of the index fingers (fig.1), and sectors correlated to the colon system: caecum, ascending, transverse colon, descending, sigmoid colon, rectum; as well as the parts of the spine, which are relevant to the innervation of the colon: lumbar department, sacrum, and coccyx, were studied, for a total of 216 indicators. A description of the parameters used is presented in the Appendix.

Fig.1. GDV image (Bio-gram) of a finger with some indicated parameters.

Results

In accordance with the first objective of our assessment, the differences between the control group and all patients with neoplasms of the colon were revealed. Statistically significant differences ($p < 0.05$) had 76 of 216 indicators, 21 of which had a very high level of significance ($p < 0.001$).

The differentiating parameters are the radius of the inscribed circle, normalized area, percentage of internal noise and shape form characterizing the irregularity of the outer contour of the GDV-images.

Differences were largely found for the sectors "transverse colon" and "ascending colon." This can be explained by the fact that the majority of the surveyed patients had pathological changes in these parts of the colon. Table 1 shows the averaged values of the parameters and their relative frequency of occurrence between all significant parameters in different studied groups with increase in the degree of tumor neoplasia.

Table 1. Patterns of change in the parameters of the study groups with increasing degree of tumor neoplasia (average values) (* p <0.01, ** p <0.001)

Parameter	Control	Polypus	Cancer
Control > Polypus > Cancer			
Normalized Area	1.41 ± 0.12	1.27 ± 0.06*	1.09 ± 0.04**
Inner noise	40.90 ± 3.00	31.11 ± 2.51*	23.32 ± 2.01*
Isoline radius	14.21 ± 0.45	11.46 ± 0.32*	10.45 ± 0.42*
Intensity	86.65 ± 0.12	78.04 ± 0.08*	75.19 ± 0.05*
Control < Polypus < Cancer			
Inner circle radius	46.05 ± 1.53	54.45 ± 1.63*	59.37 ± 1.04*
Form Coefficent	11.14 ± 0.54	17.46 ± 0.60*	20.52 ± 0.45**
Isoline fractality	1.60 ± 0.02	1.63± 0.04*	1.71 ± 0.01*
Isoline entropy	1.57 ± 0.03	1.65± 0.02*	1.74 ± 0.01*
Isoline length	950 ± 27	1025 ± 16*	1105 ± 40*
Area	9620 ± 225	10760 ±21*	11427 ± 11*

As one can see from Table 1, parameters have different tendencies in the line Control => Polypus => Cancer. Collection of a larger database of specific cases will allow us to use these parameters to create a mathematical model to distinguish different groups.

In conclusion, dynamics of GDV parameters in the development of the disease was traced. We have found same tendency as demonstrated in Table 1: values of the radius of the inscribed circle, contour length, form coefficient and area increased, while the normalized area and the percentage of internal noise was reduced.

In Table 1 parameters presented characteristic for the whole image of the index finger averaged on right and left hand. Same tendency we've found for the specific sectors related to colon system. Fig.2 presents a comparison of the Inner Circle Radius parameter for different sectors ($p < 0.05$).

Fig.2. Comparison of the Inner Circle Radius parameter for different sectors: 1 – whole image; 2 – ascending colon; 3 – transverse colon; 4 – descending colon; 5 – sigmoid colon; 6 – rectum.

Discussion

We have performed a statistical analysis of GDV parameters for 7495 people whose data is stored in our database; a varied population ranging from 18 to 100 years old, both men and women, most generally healthy, with some having chronic diseases. Data obtained in this study was not included. Fig.3 shows a histogram of the radius of the Inner Circle Distribution. Vertical lines denote the averaged value and standard deviations. This range may be accepted as typical parameters for generally healthy people. An arrow indicates the range of parameters for colon cancer. As we see, this range is clearly distinguishable from the norm band, which confirms the validity of the obtained data.

At the same time, we need to point out that these high values of the radius indices may be specific not only for cancer, but for other health issues as well. Further research will demonstrate whether it would be possible to distinguish cancer based on multiple GDV parameters.

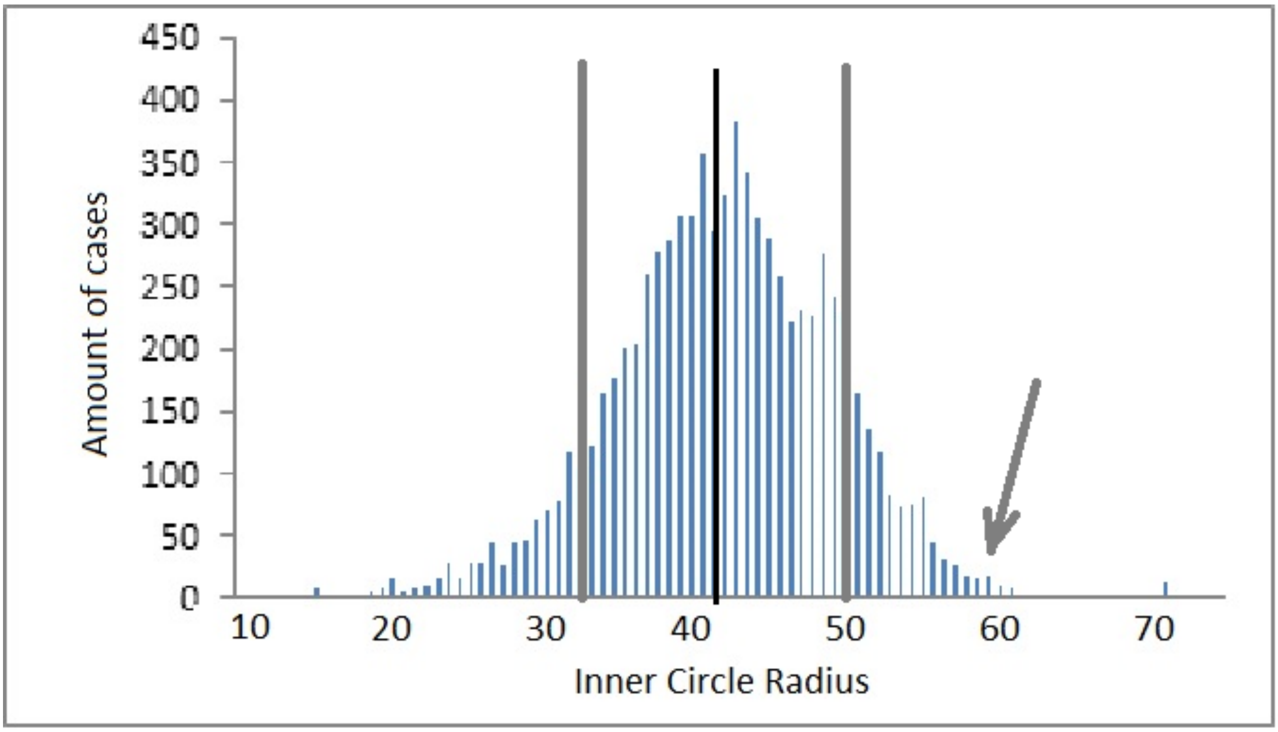

Fig.3. Histogram of the radius of the Inner Circle Distribution based on analysis of 10,000 patients.

The stage of neoplasia correlates with decreased intensity of luminescence. Further, decreasing percentages of internal noise characterizes the level of scattered biophotons radiating from the skin. The lower the activity of physiological systems, the weaker the biophotonic radiation. The value of the parameter Normalized Area, which reflects the extent of adaptation of the organism, decreases as well. The smaller this value is, the less bodily resources for adaptation. As the stages of neoplasia progress, entropy increases; this reflects the balance of regulation. So it can be argued that the distinguished regularities of the GDV parameters dynamically reflect a feature of the physiological systems of the body.

Table 2. Characteristics of different methods of non-invasive diagnosis of colon polyps [29].

Method	Sensitivity	Specificity
Gemokkult test	30,95	80,17
Immunochemical test	37,68	88,76
Erythrocyte sedimentation rate	43,48	78,99

Conclusion

The pilot study showed the feasibility of using the GDV technique to identify patients with colon neoplasias. The main distinguishable parameters for all groups were: the radius of the inscribed circle, normalized area, percentage of internal noise and form coefficient. These initial positive results encourage the consideration for more in-depth and detailed studies of GDV, with the potential of eventual use in screening programs.

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Appendix 1

Computer processed GDV image represented by a luminescent halo around the finger (fig.1). The following parameters of a GDV image were calculated based on the principles of image processing:

Luminescence Area. Amount of light quanta generated by the subject in computer units - pixels (the number of pixels in the image having brightness above the threshold).

Normalized Luminescence area. The ratio of image area to the area of the inner oval (representing fingerprint).

Internal noise. Amount of light in the inner oval (fingerprint).

Isoline radius. Average radius measured from the center of an image to the external contour.

Intensity. Relative brightness of image pixels measured in computer units from 0 to 255.

Inner circle radius. Radius of the circle inscribed in the inner oval (fingerprint).

Isoline length. The length of the external contour of an image.

Isoline fractality. Fractal dimension of the external contour represented as quasi-infinite line.

Isoline Entropy. The ratio of an image's external contour to its internal contour.

Form Coefficient. Calculated according to the formula: $FC = Q = k*L^2/S$, where L is the length of an image's external contour and S is the image area.

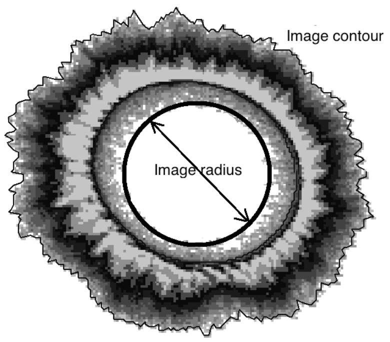

Fig.1. EPI image of a finger with some indicated parameters.

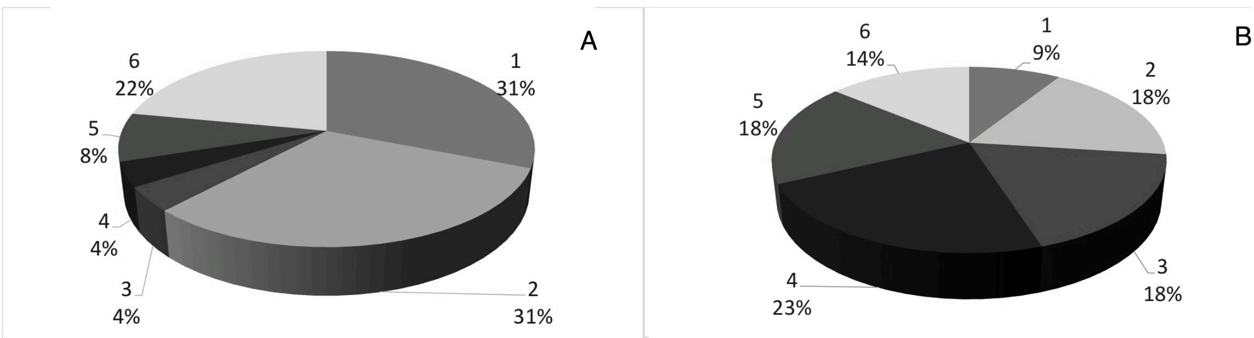

Fig.2. The frequency of using of different parameters (A) and different sectors of the EPI images of the index fingers (B) in the decision rules. A: 1 - Inner noise; 2 - Radius of inscribed circle; 3 - Form coefficient; 4 – Intensity; 5 – Area; 6 - Normalized Area. B: 1 – lumbar; 2 – sacrum; 3 – coccyx; 4 – cecum; 5 - ascending colon; 6 - transverse colon.