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# **TABLE OF CONTENTS**

SI No	TITLES AND AUTHORS	Page No.
01.	<b>Complex Analysis of Rheological, the Electro-physical Properties of Blood, and some Factors of Iron Metabolism in the Blood in Gastric Cancer</b> ➤ <i>Ekaterine Labadze, Maia Mantskava, Nana Momtselidze, Carlota Saldanha, Giorgi Kuchava, Nugzar Narsia, Alexander Tsalugelashvili</i>	<b>1-4</b>
02.	<b>A Keyword Spotting Approach using Agglomerative Hierarchical Clustering Method</b> ➤ <i>Sushma S N, Sharada B</i>	<b>5-10</b>
03.	<b>Automated Tool for Scheduling Cases in Judiciary</b> ➤ <i>Manish Kumar, Prashanth M V</i>	<b>11-16</b>
04.	<b>A Comparative Study of Machine Learning Algorithm to Predict Used Car Prices in India with EDA</b> ➤ <i>Rakesh Sharma, K.T Thomas</i>	<b>17-23</b>
05.	<b>The Effects of Job Retention Schemes on Employment Preservation during the COVID-19 Epidemic in Euro Area Countries</b> ➤ <i>Anton Rop</i>	<b>24-32</b>
06.	<b>Recycling Spent Coffee Waste for Innovative Thermo-Plasters: Development of a Prototype</b> ➤ <i>Manfredi Saeli, Tiziana Campisi</i>	<b>33-40</b>
07.	<b>The Antecedents of Customer Loyalty in the Café Industry: Physical Environment, Service Quality, Food Quality, Beverage Quality</b> ➤ <i>Ryo Sakiyama</i>	<b>41-45</b>
08.	<b>Digital Preservation: A Need of Tomorrow</b> ➤ <i>Sumeet, Nisha</i>	<b>46-48</b>
09.	<b>Does Personality Matter? A Study of Retail Banks in Hong Kong</b> ➤ <i>Ho, Shirie Pui Shan, Chow Matthew Yau Choi</i>	<b>49-51</b>





## **EDITORIAL**

It is my proud privilege to welcome you all to the Academics World International Conference at Abu Dhabi, United Arab Emirates. I am happy to see the papers from all part of the world and some of the best paper published in this proceedings. This proceeding brings out the various Research papers from diverse areas of Science, Engineering, Technology and Management. This platform is intended to provide a platform for researchers, educators and professionals to present their discoveries and innovative practice and to explore future trends and applications in the field Science and Engineering. However, this conference will also provide a forum for dissemination of knowledge on both theoretical and applied research on the above said area with an ultimate aim to bridge the gap between these coherent disciplines of knowledge. Thus the forum accelerates the trend of development of technology for next generation. Our goal is to make the Conference proceedings useful and interesting to audiences involved in research in these areas, as well as to those involved in design, implementation and operation, to achieve the goal.

I once again give thanks to the Academics World, Institute of Research and Journals & TheIIR for organizing this event in Abu Dhabi, United Arab Emirates. I am sure the contributions by the authors shall add value to the research community. I also thank all the International Advisory members and Reviewers for making this event a Successful one.

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# COMPLEX ANALYSIS OF RHEOLOGICAL, THE ELECTRO-PHYSICAL PROPERTIES OF BLOOD, AND SOME FACTORS OF IRON METABOLISM IN THE BLOOD IN GASTRIC CANCER

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**Abstract** - Research of different clinical parameters of different systems of the body in gastric cancer is very needed because gastric cancer is one of the most terrible diseases cancers of the modern world. The aim of our work was to study the rheological properties of blood in gastric cancer, along with the electrophysical properties of blood and iron metabolism in patients with gastric cancer. The research methods were modern and original. The study included patients with stomach cancer and a control group of healthy volunteers. The average age in the studied groups corresponded to each other. All patients were included in the study according to an informed agreement. In patients with gastric cancer before surgery, the content of iron and hemoglobin was reduced, transferrin and ferritin remained within normal limits. On the 7th day after the operation, ferritin increased twice, hemoglobin was close to control values. Transferrin and iron remained reduced on the 7th postoperative day. The erythrocyte aggregability index in patients with gastric cancer before surgery was increased by one and a half times compared to the control. On the 7th day after the operation, the erythrocyte aggregability index improved and was increased by only 30% compared to the control. The index of electrophysical properties in gastric cancer before surgery was changed compared to control values, on the 7th day after surgery, it was also changed. This approach, along with a thorough study of these routine analyzes in gastric cancer, is very important. It turned out that the seven-day postoperative interval was insufficient to normalize the studied parameters. The analysis of such data will make it possible to personalize the therapy of patients with stomach cancer, which is very important for each patient, their loved ones, and public health in general.

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**Keywords** - RBC Aggregation; Electroclinical Blood Property; Iron; Transferrin; Ferritin

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## I. INTRODUCTION

In the modern world, gastric cancer is one of the most common cancers in the modern world. Georgia and Portugal are no exception in this regard. Important and topical are all the fundamental and applied papers devoted to the issues. The rheological parameters of blood play a special role in the functioning of organs, tissues, and body systems. The amount of iron in the blood, as well as the electrophysical properties of the blood, determine the profile of the blood flow, which cannot but affect the rheological status. In oncological diseases, the violation of blood circulation and blood flow has a certain character. These changes affect the transport of toxic agents and may contribute to the spread of the tumor. The course of gastric cancer is often accompanied by anemia and changes in iron metabolism. It is also known that erythrocyte aggregation is impaired in gastric cancer. This is the basis of the violation of blood rheology. On the other hand, the electrophysical properties of blood cells determine the kinetics of aggregation processes suspension stability of blood [1,2], blood viscosity and the nature of the dependence of viscosity on shear rate [3], the processes of blood

coagulation, vascular thrombosis [4], and any others. All this forms the fluidity of the blood. The electromagnetic properties of cells affect the features of the flow of cell suspensions. For its part, iron deficiency anemia significantly worsens the condition of patients with gastric cancer and complicates antitumor therapy [5]. At the same time, excess iron may be involved in the development of the malignant process [6, 7, 8]. Our work aimed to study the rheological properties of blood in gastric cancer, along with the little-studied electrophysical properties of blood and iron metabolism in patients with gastric cancer. In such a causal relationship, this issue has not been considered in modern literature. The relevance of the topic is primarily associated with the spread of stomach cancer, with high mortality and the percentage of disability in the population from stomach cancer. Along with the standard routine parameters that are examined by patients with gastric cancer, it is very interesting to monitor the rheological, electrophysical properties, as well as to investigate the iron metabolism in the blood of such patients. Research in all areas that will shed light on the pathogenesis of the disease, as well as give practical recommendations to oncologists,

chemotherapists, radiologists, and clinical rheologists, is especially timely and valuable.

## II. MATERIALS AND METHODS

By the official standard of healthcare, patients need a set of certain tests to manifest stomach cancer. Before being included in our study, all patients underwent the following routine laboratory and instrumental analyzes: endoscopy with biopsy of stomach tissue, general and biochemical blood test, ultrasound of the abdominal organs, X-ray of the digestive tract, computed tomography, tumor markers: Cancer Antigen 19-9, Gastrointestinal Cancer Antigen, Carcino Embryonic Antigen. It is a clinical standard that is carried out outside of this work. Our focus was jailed on a new complex study, which **united** erythrocyte aggregation index as the rheological marker and electrophysical properties, as well as investigated the iron metabolism such as hemoglobin, transferrin, ferritin, iron in the blood in patients group with stomach cancer. The target group of the study was men and women with cancer gastric. The average age of the control group strictly corresponded to the mean age of the patient group, and the distribution of men and women in the control group was the same as in the patient group. The study included data on 20 patients with stage II–III locally advanced gastric cancer who underwent radical interventions: subtotal resection or gastrectomy combined with extended D2 lymphadenectomy. We studied the laboratory data before the operation and after it after 7 days. As a comparison group (control group), 20 people without oncological diseases were used. The average age in the study group was  $54 \pm 9.1$  years, the average age in the control group was  $50 \pm 6.1$  years. In blood serum, ferritin (in ng/mL), transferrin (in g/L), and iron (in  $\mu\text{mol/L}$ ) were determined using a Cobas Integra 400 plus analyzer (Roshe Diagnostics, Switzerland). The indicators were analyzed using Excel applications. The clinical

parameter of erythrocyte aggregation was studied using the "Georgian method". RBC aggregation index counts as the area of aggregated erythrocytes divided by the full area of the erythrocytes in the volume unit. This new innovative method is famous in the world as direct, numeral, and exact, has the name of the Georgian method. Blood samples were centrifuged and about 0.1 ml blood was diluted 1:200 in own plasma in the Thoma pipettes preliminary rinsed with 5% sodium citrate solution without addition of any other anticoagulants to the blood under study. Following standard mixing the diluted blood was placed into a glass chamber 0.1 mm high. The quantitative index of erythrocyte aggregation, which was assessed with a special program at the Texture Analysis System (TAS-plus, Leitz, Germany), represented itself the relationship of the aggregated and unaggregated red cells [9]. A rotational viscometer Contraves LS30 (Switzerland) with MS 1/1 standard measurement system and the concurrent measuring system MS 1/1 was used to investigate electrophysical properties of blood simultaneously [10]. Time variation of whole blood conductivity  $\sigma$  and shear stresses under transient flow at rectangular and trapezium-shaped Couette viscometric flow were investigated under an electric field of 2 kHz. after being subjected to shearing for 30 seconds to disperse all aggregates, RBC suspension was stopped or decreased to allow RBCs aggregation. Immediately after beginning and complete stoppage of shearing kinetics of conductivity and torque signals were recorded. If the higher shear rates had no further effect on  $\sigma$  values measured during shearing, the applied shear rate was sufficiently high for complete dispersion of the aggregates [10,11,12]. This process was described by the so-called index of electrophysical properties. The obtained data on the kinetics of the whole blood conductivity in both studied groups of patients with gastric cancer before surgery, after 7 days of surgery, and in blood samples of patients from the control group.

## III. RESULTS

We examined patients with stomach cancer before surgery and after surgery on the 7<sup>th</sup> day. The same indicators were studied in the control group. See Table 1.

Parameters	Cancer (beforesurgery)	Cancer (after surgery 7 <sup>th</sup> day)	Control group
Hemoglobin, g /l	110±5*	122±2	124±6
Transferrin, g /l	2.7±0.62	2.9±0.5	2.9±0.5
Ferritin, ng/ml	119±26	300±68*	116±30
Iron, $\mu\text{mol/l}$	8.9±6.1*	9.1±5.0*	17±5.0
RBC Aggregation Index, %	45±4.6*	41±3.1*	30±2.1
Index of electrophysical properties, un	2,4±0,06	2.5±0,05	1.5±0.04

\*Uncertainty ( $p < 0.05$ )

**Table 1. Hemoglobin, Transferrin, Ferritin, Iron, RBC Aggregation Index, Index of Electrophysical properties in group with patients with stomach cancer before surgery and after surgery and in control group.  $M \pm m$**

In patients with gastric cancer before surgery, the content of iron and hemoglobin was reduced, transferrin and ferritin remained within normal limits. On the 7th day after the operation, ferritin increased twice, hemoglobin was close to control values. Transferrin and iron remained reduced on the 7th postoperative day. The erythrocyte aggregability index in patients with gastric cancer before surgery was increased by one and a half times compared to the control. On the 7th day after the operation, the erythrocyte aggregability index improved and was increased by only 30% compared to the control. The index of electrophysical properties in gastric cancer before surgery was changed compared to control values, on the 7th day after surgery, it was also changed.

#### IV. DISCUSSION

A comprehensive analysis of iron metabolism, erythrocyte aggregation, and electrophysical properties of blood in patients with gastric cancer before and after surgery after 7 days showed significant changes in the content of iron and proteins of the iron metabolism system, which may be a response reaction to stress connected with surgery. This may be due to the mechanism of ferritin synthesis, as well as due to the release of intracellular ferritin into the serum, where it has attached iron to itself. According to some authors, this can explain the sharp decrease in iron content. Considering the detoxifying role of ferritin, it can be concluded that the detoxifying ability of the body increases in the postoperative period. The cytotoxic effect of ferritin on many cell types is also known [5]. In patients with gastric cancer compared with controls, blood aggregation was increased. However, on the 7th day after the operation, aggregation remained increased, but there was a trend of improvement compared with the preoperative period in patients with gastric cancer. This is possibly caused by the removal of the tumor. Apparently, a smaller number of toxic substances, which contribute to the enhancement of the aggregation process, enter the bloodstream. The electrophysical properties of blood in patients with gastric cancer were disturbed before surgery compared to the norm and almost did not improve on the 7th day after surgery. Apparently, gastric cancer, as well as any pathological processes, is accompanied by cell damage and hydration, which leads to a change in the capacity of the cell and intracellular membranes. There is an additional macrostructural polarization in the blood. Macrostructural polarization ensures the movement of positive and negative ions [5]. They move under the action of an external electric field in opposite directions, reach the surface of impenetrable objects, where they accumulate, creating additional dipole moments. The relaxation times of the macrostructural polarization are not very long ( $10^{-3}$ – $10^{-8}$  sec), therefore, at the

corresponding low frequencies, a significant reactive (capacitive) resistance is manifested in biological media. It was assumed that erythrocytes, their total volume and total area play an important role in the formation of the physicoelectric properties of blood [12]. But we saw that with the improvement of aggregability on the 7th day after the operation, the electrophysical properties of the blood did not approach the control values. The degree of activity of inflammatory processes correlates with the content of leukocytes and protein molecules with characteristic electrical conductivity. Apparently, it is leukocytes that form changes in the conductive and dielectric properties of blood. This work describes for the first time a comprehensive study of the electrophysical properties of blood along with monitoring of iron metabolism and blood rheology (by the example of erythrocyte aggregation) before surgery and on the 7th day after surgery. This approach, along with a thorough study of these routine analyzes in gastric cancer, is very important. It turned out that the seven-day postoperative interval was insufficient to normalize the studied parameters. Is the slight improvement that we observed on the 7th day after the operation the beginning of the regulation of the amount of iron, erythrocyte aggregation, and electrophysical properties, or is it just a temporary improvement? It is necessary to monitor the proposed parameters on the 14th, 21st days after the operation. The analysis of such data will make it possible to personalize the therapy of patients with stomach cancer, which is very important for each patient, their loved ones and public health in general.

#### V. CONCLUSIONS

Continuation of research in this direction is very promising in medicine for assessing the structure, condition, and viability of tissues, as well as determining the intensity of the pathophysiological processes occurring in them.

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