შეფასება ქვედა კიდურების კუნთების ძალასა და კუნთების მინიმალურად აუცილებელ ძალაზე ნორმალური ნაბიჯის შესრულებისათვის.

სიარულის ანალიზი ჩატარდა პროგრამით OpenSim 4.0. მოდელირების საფუძვლად გამოყენებული იყო მოდელი gait2394. საწყისი მოდელის დეფორმაცია განხორციელდა ძირითადი იზომეტრული ღერძის გადახრით ლატერალური მიმართულებით 15°-, 30-° და 45°-ით.

ბარძაყის ძვლის ქვედა მესამედის დონეზე დეფორმაციის დროს ირღვევა დაზიანებული კიდურის პრაქტიკულად ყველა კუნთის მუშაობა; განსაკუთრებით ზიანდება მომზიდავი კუნთების ჯგუფი. დეფორმაცია იწვევს მუხლის სახსრის ვარუსულ გაჩერებას, რაც ასევე აისახება მუხლის სტაბილიზაციაზე პასუხისმგებელ და სიარულის დროს ბარძაყის მომზიდავ კუნთებზე; აღინიშნება წვივის კუნთების მუშაობის დარღვევები, რაც ღრმავდება დეფორმაციის გამოხატვის ხარისხის ზრდასთან ერთად. მუხლის სახსრის ვარუსული გაჩერების დროს ტერფი იღებს ვალგუსურ დეფორმაციას, რაც იწვევს დისბალანსს ტერფის მასტაბილიზებელი კუნთების მუშაობაში, ხოლო კიდურის ფუნქციური დამოკლება დიდი დეფორმაციების დროს უფრო მეტად აუარესებს ამ კუნთების მდგომარეობას, განსაზღვრავს რა მათ მუდმივად დაძაბულ მდგომარეობაში ყოფნას. ბარძაყის ძვლის ვარუსული დეფორმაცია განაპირობებს მთლიანად ქვედა კიდურის კუნთების მუშაობის ცვლილებებს. ეს ეფექტი ვლინდება მინიმალური დეფორმაციის დროს (15°) და პირდაპირ არის დამოკიდებული მისი კუთხის გაზრდაზე.

DEPENDENCE OF PROSTATE TISSUE PERMEABILITY ON THE WAVELENGTH OF RADIATION IN THE INFRARED RANGE OF THE SPECTRUM

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Among oncological diseases, prostate cancer (PC) ranks second in mortality among men after lung cancer [1]. Therefore, there is a lot of research on this disease by the leading scientists in the world. An important role in the recovery of the patient is given to the early diagnosis of prostate cancer, which allows timely, effective and adequate treatment.

A pivotal role in the diagnosis of prostate cancer has been the discovery of prostate-specific antigen, an enzyme that is produced directly by the prostate gland and is part of the prostate secretion [2,6,8]. There is an insurmountable barrier for this enzyme between the stroma of the prostate gland and the blood vessels, which is violated in the development of prostate cancer and its level rises in the blood serum (norm <4 ng/ml) [4].

Determination of prostate-specific antigen and the digital-rectal examination of prostate the are the studies that allow us to suspect the prostate cancer. Suspicion is substantiated by transrectal biopsy of the prostate gland, during biopsy 12 to 24 specimens of the prostate gland should be taken and their histomorphological and immunohistochemical examination should be performed. However, prostate biopsy is not a complete study either, as in 30-34% of cases patients need to have a repeated biopsy to confirm the diagnosis [3,9,10], which, as you know, is a very invasive method. In addition, after the diagnosis of prostate cancer, it is necessary to conduct imaging studies to study the spread of the tumor, these studies are: magnetic resonance imaging, radioisotope scan of the bones, etc. [5,6].

Objective: The objectives of our research are:

1. Develop a more accurate imaging method of prostate cancer using infrared radiation;
2. Using this method, determine the localization of the tumor area on the prostate gland
3. Develop a computer program that will be able to process the received image and detect prostate cancer tissue at 95% confidence intervals
4. Scan the prostate cancer tissue with different degrees of aggressiveness through a computer program
5. The obtained data should be processed statistically.

Material and methods. In order to achieve this goal, the following tasks were set, to study the dependence of the permeability of prostate tissue on the wavelength of radiation in the infrared range of the spectrum.

Experiments have shown that visible light does not pass through the prostate tissue; This tissue is permeable to infrared rays. Studies have shown that the permeability of infrared rays depends on the wavelength. It was experimentally determined that the highest permeability was found in the wavelength range 840-860 nm. It has also been found that benign prostatic hyperplasia and prostate cancer tissue are characterized by varying permeability to infrared radiation. Healthy tissue has been shown to have the highest permeability to infrared radiation. Tumor tissue permeability is much lower than that of healthy tissue. Prostate tissue permeability with benign hyperplasia is between the permeability of healthy and tumor tissues. The first figure shows the results of this study.

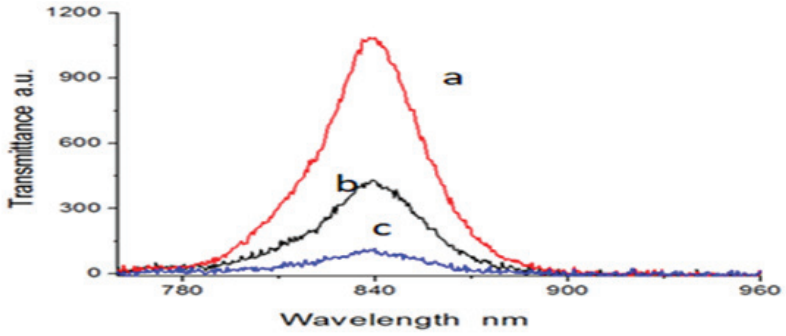

Fig. 1. The dependence of the permeability of prostate tissues of the same thickness on the wavelength of radiation. Graph A- is a graph of the dependence of healthy tissue on the wavelength of permeability. The maximum value of penetration is 1100 conditional units (C.U). Graph C - The graph corresponds to the permeability of the cancerous tissue - the maximum value is 140 C.U. Graph B- corresponds to benign hyperplastic tissue. Maximum permeability 480 C.U. The wavelength of the radiation is measured on the abscess, the permeability to the ordinate in "conditional units (C.U)

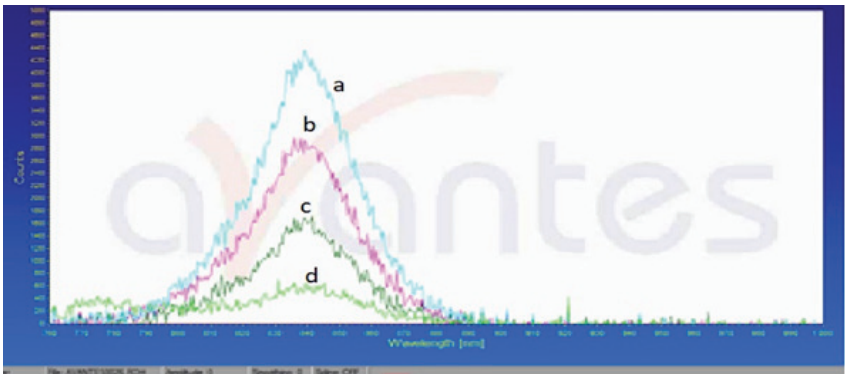

Fig. 2. Permeability coding with tissue thickness for healthy prostate tissue. A - Graph corresponds to 2 mm thick tissue, B - Graph corresponds to 6 mm thick tissue, C- Graph corresponds to 8 mm thick tissue, D - 15 mm thick tissue. The corresponding maximum permeabilities are 435 C.U, 300 C.U, 160 C.U and 50 C.U

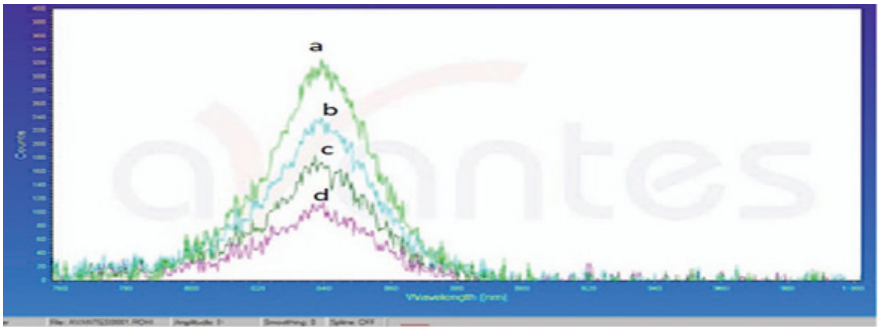

Fig. 3. Correlation of permeability with tissue thickness. Following tissues are non-cancerous (benign hyperplasia). A - The graph corresponds to a 5 mm thick tissue, with a maximum penetration value of 320 C.U. B - corresponds to 10 mm thick tissue, maximum penetration value 220 C.U, C - corresponds to 15 mm thick tissue, maximum penetration value 170 C.U. In all cases the maximum permeability will be set at 840 nm. On the axis of the abscesses is given the wavelength of the radiation nm, on the axis of the ordinates - permeability C.U

Thus, the maximum permeability for all three weaves is observed at the same wavelength, namely 840 nm.

The dependence of the permeability of infrared radiation on prostate tissue to tissue thickness was studied. Experiments have shown that the permeability of infrared rays depends on the thickness of the prostate tissue. The greater is the thickness, the less is permeability and vice versa. Figure 2 shows the thickness-dependent infrared radiation for healthy prostate tissue.

It has been experimentally found that in the case of non-cancerous prostate tissue, the dependence of the maximum value of permeability on the thickness of the tissue is linear. Figure 3 shows this relationship for benign prostatic hyperplasia tissues.

The dependence of the maximum value of permeability on the tissue in this case is approximately linear, similar to that of healthy tissue.

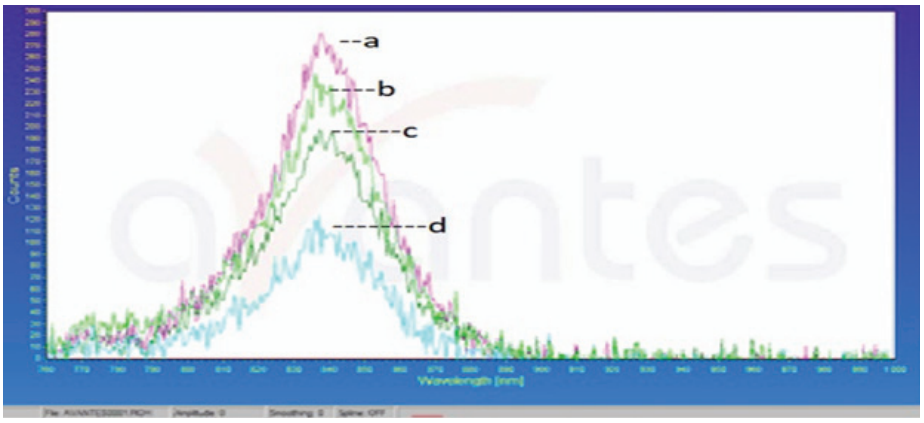

Fig. 4. Permeability dependence of tissue thickness for prostate cancer tissues. A - corresponds to 2 mm thick tissue permeability, B - corresponds to 4 mm thick tissue, Ch - corresponds to 6 mm thick tissue, D - corresponds to 10 mm thick tissue. The corresponding maximum permeability for each schedule is 280 C.U., 240 C.U., 185 C.U. and 90 C.U. respectively

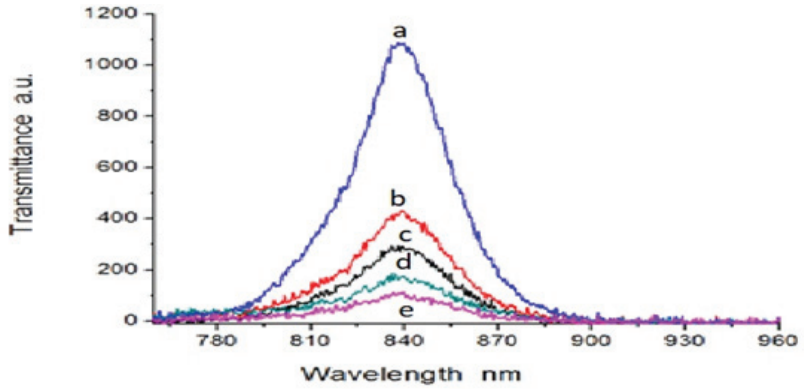

Fig. 5. The dependence of permeability on the intensity and wavelength of radiation emitted by a source. In all cases the maximum transmittance was observed at a wavelength of 840 nm. A - corresponds to the case of a source when the maximum radiation intensity is equal to 160 MW / steradian. B - corresponds to the source intensity at 35 MW / steradian. C- corresponds to the source power at 25 MW / steradian, D - corresponds to the source power at 10 MW / steradian, E - corresponds to the source power at 4 MW / steradian

For prostate cancer tissue, the above relationship is not linear. Figure 4 shows the dependence of tumor tissue permeability on tissue thickness.

The dependence of permeability on the intensity of infrared source radiation was studied. For this purpose, emitters of different power were used in the experiments, While the emitted infrared wavelength and the tissue thickness were constant. Figure 5 shows one example of this relationship.

Conclusion. Thus, experiments have shown that infrared radiation penetrates well into the prostate tissue. Maximum permeability will be observed in the range of 840-860 nm wavelengths. The permeability of cancerous, noncancerous and healthy prostate tissues is different: the highest permeability is characterized by healthy tissue. Cancerous tissue permeability is minimal. Permeability management can be performed by adjusting the radiation intensity of the radiation source. Dependence of permeability on tissue thickness is linear for healthy tissue and sharply non-linear for tumor tissue.

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SUMMARY

DEPENDENCE OF PROSTATE TISSUE PERMEABILITY ON THE WAVELENGTH OF RADIATION IN THE INFRARED RANGE OF THE SPECTRUM

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Prostate biopsy is considered to be one of the most aggressive and invasive methods in the diagnosis of prostate cancer. The researchers' efforts are aimed at using alternative and less invasive methods to manifest this disease at an early stage.

The authors propose infrared radiation as a method of such research, which, as studies have shown, is characterized by different permeability to tumorous, healthy and hyperplastic prostate tissue, in particular, the more damaged the prostate tissue, the lower its degree of permeability.

Experimentally determined that the highest permeability was found in the wavelength range 840-860 nm. It has been found that cancerous, non-cancerous and healthy prostate tissues are characterized by different permeability to infrared radiation. Healthy tissue has been shown to have the highest permeability to infrared radiation. Cancerous tissue permeability is much lower than that of healthy tissue. Prostate tissue permeability with benign hyperplasia is between the permeability of healthy and tumor tissues.

Infrared beam transmittance control can be performed by adjusting the radiation intensity of the emitting source. Dependence of permeability on tissue thickness is linear for healthy tissue and sharply non-linear for tumor tissue.

Keywords: infrared beam transmittance control, permeability of the infrared beam in the prostate gland, tissue thickness, prostate cancer.

РЕЗЮМЕ

ЗАВИСИМОСТЬ ПРОНИЦАЕМОСТИ ТКАНЕЙ ПРОСТАТЫ ОТ ДЛИНЫ ВОЛНЫ ИЗЛУЧЕНИЯ В ИНФРАКРАСНОМ ДИАПАЗОНЕ СПЕКТРА

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Биопсия простаты считается одним из самых агрессивных и инвазивных методов диагностики рака простаты. Усилия исследователей направлены на использование альтернативных и менее инвазивных методов для выявления этого заболевания на ранней стадии.

В качестве метода такого исследования авторы предлагают инфракрасное излучение, которое, как показали исследования, характеризуется различной проницаемостью для опухолевой, здоровой и гиперплазированной ткани простаты, в частности, чем больше повреждена ткань простаты, тем ниже степень ее проницаемости.

Экспериментально определено, что самая высокая проницаемость обнаружена в диапазоне длин волн 840-860 нм. Выявлено, что раковые, незлокачественные и здоровые ткани простаты характеризуются различной проницаемостью для инфракрасного излучения. Доказано, что здоровые ткани имеют самую высокую проницаемость для инфракрасного излучения.

Проницаемость раковой ткани намного ниже, чем здоровой. Проницаемость ткани простаты при доброкачественной гиперплазии находится между проницаемостью здоровой и опухолевой тканей. Контроль проницаемости инфракрасного луча может осуществляться путем регулировки интенсивности излучения источника. Зависимость проницаемости от толщины ткани является линейной для здоровой ткани и резко нелинейной - для опухолевой ткани.

რეზიუმე

პროსტატის ქსოვილის განჭოლვადობის დამოკიდებულება გამოსხივების ტალღის სიგრძისაგან სპექტრის ინფრაწითელ დიაპაზონში

ს.აბაზაძე, ა.ხუსკივაძე, დ.ქოჩიაშვილი, ბ.ფარცვანია

თბილისის სახელმწიფო სამედიცინო უნივერსიტეტი, უროლოგიის დეპარტამენტი, საქართველო

პროსტატის კიბოს დიაგნოსტიკაში პროსტატის ბიოფსია ერთ-ერთ აგრესიულ და ინვაზიურ მეთოდად ითვლება. მკვლევართა ძალისხმევა მიმართულია ალტერნატიული და ნაკლებად ინვაზიური მეთოდების გამოყენებით ადრეულ ეტაპზე მოხდეს აღნიშნული დაავადების მანიფესტირება.

ავტორები ასეთი კვლევის მეთოდად გვთავაზობენ ინფრაწითელ გამოსხივებას, რომელსაც, როგორც კვლევებით დადგინდა, ახასიათებს სხვადასხვა განჭოლვადობა სიმსივნური, ჯანმრთელი და ჰიპერპლაზირებული პროსტატის ქსოვილის მიმართ, კერძოდ, რაც უფრო მეტად არის დაზიანებული პროსტატის ქსოვილი, მით ნაკლებია მისი განჭოლვადობის ხარისხი.

კვლევები ტარდება ოპერაციულ მასალაზე. შექმნილია მოდელი და კომპიუტერული პროგრამა, რო-

მელიც საშუალებას იძლევა მომავალში მეთოდიკა გამოყენებული იყოს პაციენტებში. ინფრაწითელი სხივის განჭოლვადობის მართვა შესაძლებელია შესრულდეს გამომსხივებელი წყაროს გამოსხივების ინტენსივობის რეგულირებით. განჭოლვის დამოკიდებულება ქსოვილის სისქისაგან წრფივია ჯანმრთელი ქსოვილისათვის და მკვეთრად არაწრფივი - სიმსივნური ქსოვილისათვის.

TRACKING PREGNANCY OUTCOMES: DATA FROM BIRTH REGISTER OF GEORGIA

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Reliable and high quality data are critical to identify issues related to maternal health and factors affecting the reproductive health as well as to measure progress towards the Sustainable Development Goals [1-3].

In high-income countries there is a practice of comprehensive national vital statistics and health register systems [4-6]. While demands for reliable and timely data are growing, information systems in most low- and middle-income countries (LMICs) are currently not adequate to the task [7,8]. They couldn't provide countries with reliable and timely data on all factors, affecting fertility and reproductive health needed for assessing the impact of some health programs for female population.

In LMICs nationwide surveys have been the main source for reproductive health policies and planning. Three rounds of nationwide Reproductive Health Surveys (RHS), developed by the U.S. Centers for Disease Control and Prevention (CDC) and financed by UN, were conducted in Georgia, the last one in 2010. Set within the context of overall social and economic development in Georgia, the aim of the 2010 survey was to obtain the national and regional estimates of basic demographic and reproductive health indicators. Since 2010, there was a lack comprehensive information on reproductive health status and utilization of reproductive and maternal health care [9].

In 2016, an electronic case-based system for antenatal and obstetric services, so called "Georgian Birth Registry" (GBR), which provides continuous monitoring of pregnant women from the first antenatal visit until childbirth, was introduced throughout the country. GBR was established in collaboration with Norwegian partner (The Arctic University of Norway) having a rich experience of working on registry systems. DIKU founded Project „Georgian-Norwegian Collaborative in Public Health" aimed to enhance the knowledge transfer in register-based epidemiology for using large database of BR as an evidence for identification of emerging issues of maternal and child health in the antenatal and perinatal phases and for improving maternal and child health in the country [10]. It was an innovative approach and important step forward, as it gave the possibility to describe maternal and child health, as well as reproductive health issues in correlation with different social factors, which influenced the fertility and pregnancy outcomes [11].

The correlation between women's education and reproductive health is strongly observed across the regions and time, but differs by countries [12,13]. There is also a growing literature on the relationship between female employment and fertility. Some studies argue that the causal effect travels from female labor participation to fertility and other studies argue the opposite [14]. It would be useful for policymakers in Georgia to understand the mechanisms through which female education or socioeconomic factors such as an employment status and place of residence affect fertility in the contexts in which these outcomes are observed. In Georgia there is a lack of study addressing pregnancy outcomes. The aim of the research is to study influence of education, employment status and place of residence on pregnancy outcomes among women in Georgia.

Material and methods. Georgian Birth Registry (GBR) data from 2018 has been used for this study. The majority of variables of the database contain empty values for some records. Thus, only valid values were taken for the analysis (empty values were skipped).

Results and discussion. The total number of all pregnancies with the outcome (delivery or abortive outcome) in 2018 was 73726, among them the share of deliveries was 68%, abortions - 31%. More than half (52%) of all pregnancies with the outcome in 2018 were indicated as unplanned. Higher percent of unplanned pregnancies was indicated among rural women (51%), less educated (67%) and temporally unemployed (87%) women.

The total number of deliveries in Georgia significantly decreased from 61928 in 2010 to 50468 in 2018. Lower share of deliveries revealed in employed women. 38% of deliveries with the outcome in 2018 were indicated as unplanned, among them 58% was indicated in women with low educational level, 83% - in temporally unemployed and 57% in urban women.

Eight antenatal visits are financed by the government of Georgia in the frame of state program (Ministry of Labor, Health and Social Care of Georgia 2017). Out of the total number of deliveries, deliveries with the timely initiated first visit (<12 weeks) was 73%. Timely initiation of first visit was more common in urban areas than in rural areas (76% vs. 71%), among women with university education (79%) and employed women (82%).

The share of all caesarean section out of total number of deliveries has been carried out by 42% in Georgia. Since 2000, the number of caesarean sections has been increased almost 5 times and the rate of C-Sections in Georgia is one of the highest among all countries of WHO European Region (15). The share of C-Sections performed without indication in all age groups didn't exceed 14%, although it was the much higher in the age group under 20 years – 25%. Share of C-Sections performed without indication was more common in less educated (52%) and temporally unemployed women (79%), in urban areas (60%).