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THE EFFECTIVENESS OF RAMAN SPECTROSCOPY AS A PROGNOSTIC MARKER DURING EXAMINATION OF WOMEN WITH INFLAMMATORY COMPLICATIONS IN THE POSTPARTUM PERIOD

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რამანის სპექტროსკოპიის, როგორც პროგნოზული მარკერის ეფექტურობა, ანთებითი გართულებების მქონე ქალების გამოკვლევის დროს მშობიარობის შემდგომ პერიოდში

მეანობა და გინეკოლოგიის კვლევითი ინსტიტუტი, ბაქო, აზერბაიჯანი

რეზიუმე

ავტორმა შეისწავლა რამანის სპექტროსკოპიის მეთოდის, როგორც პროგნოზული მარკერის ეფექტურობა მშობიარობის შემდგომ პროცესში ანთებითი გართულებების მქონე ქალებში. კვლევაში ჩართული იყო 300 ქალი. ამ ქალებიდან 250-ს ჰქონდა ორსულობის დროს ანთებითი გართულებები და ისინი შეადგენდნენ ძირითად ჯგუფს. დანარჩენ 50 ქალში ანთებითი გართულებები დაფიქსირდა მენსტრუაციის პერიოდში, ანუ ისინი პრაქტიკულად ჯანმრთელი ქალები იყვნენ და შეადგენდნენ საკონტროლო ჯგუფს. კვლევაში ჩართული ქალების სისხლის ნიმუშები გაანალიზდა რამანის სპექტროსკოპიით. კვლევის შედეგების მიხედვით, მაღალი სიხშირის მაჩვენებლის მქონე ქალების რაოდენობა იყო ნაკლები (19,2%), ხოლო 107 ქალში სისხლის შრატის სპექტროგრამის სიხშირის მაჩვენებელი იყო ნაკლები.

მიღებული შედეგებიდან აღმოჩნდა, რომ სიხშირისა და ინტენსივობის მაჩვენებლები დაბალი იყო საკონტროლო ჯგუფში შემავალ 50 ქალში. არ იყო განსხვავება ძირითადი ჯგუფის 107 ქალს შორის სპექტროგრამის დაბალი სიხშირით და საკონტროლო ჯგუფის ქალებს შორის, რაც მიუთითებს იმაზე, რომ მათ არ ჰქონდათ ანთებითი პროცესი. განსხვავება დაბალი ინტენსივობის ინდექსის მქონე ქალებსა (n=107) და საკონტროლო ჯგუფს (n=50) შორის არ იყო სტატისტიკურად მნიშვნელოვანი ($p=0.44828$, $p<0.05$). ამრიგად, ზოგადი მსგავსება იყო იმ პაციენტების სისხლის ნიმუშების სპექტროგრამებში, რომლებსაც აღენიშნებოდათ ანთებითი გართულებები ორსულობის დროს.

The development of diagnostic criteria is manifested in the use of new scientific and technical achievements for this purpose. In this connection, it is appropriate to mention Raman spectroscopy as a factor contributing to the development of diagnostic criteria [1,2].

Spectroscopy is an "optical biopsy" and was carried out in the mode of express diagnostics with the help of a medical spectrometer [3].

Purpose of study. Using the possibilities of Raman spectroscopy of blood serum, we determined the effectiveness of differentiation of women with inflammatory complications during pregnancy.

Research materials and methods. 300 women were included in the study. 250 of these women had inflammatory complications during pregnancy, and they made up the main group. In the remaining 50 women, inflammatory complications were observed during the menstrual period, that is, they were practically healthy women and made up the control group. The blood samples of these women included in the study were analyzed using Raman spectroscopy.

Results and their discussion. Graphic and digital registrations were analyzed in a complex hardware program.

Thus, on the basis of different indicators of the amplitude of normal peaks in inflammatory diseases, which develop during the period of inflammation with different forms and degrees of severity, it is possible to draw a conclusion about the presence or absence of inflammatory processes. So, against the background of the development of inflammation, when examining the blood serum of pregnant women, additional peaks appear at certain wavelengths, which provide information about the degree of inflammatory processes, its chemical composition, and the quantitative composition of lipids, proteins and carbohydrates in a certain concentration. Such indicators as the peak of the combination scattering of

light, amplitude, width and number of long waves are very informative. Peaks, their shape, convexity and smoothness of spectral curves are registered on their basis.

Analyzing data obtained by Raman spectroscopy of blood serum of 300 pregnant women included in the study, it was established that there are differences between the frequency and intensity of the highest peaks. In the control group, that is, practically healthy women, these indicators of frequency and intensity were lower. The results obtained in the main group were authors. Also, on the basis of the obtained indicators, we organized relative groups of women with high, medium and low frequency. It is established that there were women with a higher frequency of peaks, medium and low frequency. The obtained quantitative indicators are reflected in table 1.

Table 1. Quantification of frequency and intensity of Raman spectrogram of pregnant women after labor included in the study

Pregnant women after labor	High frequency		Middle frequency		Low frequency	
	Abs	%	Abs.	%	Abs.	%
Main group (n=250)	48	19,2	95	38	107	42,8
Control group (n=50)	-	-	-	-	50	100

As can be seen, the number of women with higher frequency was less, it was 19.2% in total, and in 107 women, the frequency indicator of blood serum spectrogram was less. From the obtained results, it was found that the frequency and intensity indicators were low in 50 women included in the control group.

We also determined the average indicators of the frequency and intensity of the highest peaks in pregnant women included in the study. The obtained results are shown in table 2.

Table 2. Mean frequency (M±SD) of Raman spectrogram in pregnant women after labor included in the study groups

Pregnant women after labor (n=300)	Average of frequencies, cm^{-1}	p
Main group: 250 women		
48 women	1581.7124±2.404	p<0.00001
95 women	1471.8071±23.36	p<0.00001
107 women	1370.342±22.77	p<0.00001
Control group: 50 women	1362.1774±37.280	p=0.27093

In the group of women with higher spectrogram frequency (n=48), the differences between the group with moderate spectrogram frequency were statistically significant (p<0.00001). The difference between the group with moderate spectrum frequency (n=95) and women with lower spectrum frequency was statistically significant (p<0.00001). The difference between women with lower frequency spectrum (n=107) and control group (n=50) was not statistically significant (p=0.27093, p <0.05). As can be seen, there were no differences between the 107 women in the main group with a low spectrogram frequency and the women in the control group, which indicates that they did not have an inflammatory process.

Table 3. Means (M±SD) of Raman spectrogram intensities in pregnant women after labor included in the study groups

Pregnant women ater labor (n=300)	Average intensity, MVt/cm^2	p
Main group: 50 women		
48 women	8953.8543±9018.7595	p<0.00001
95 women	6539.0854±776.550	p<0.00001
107 women	6040.219±930.2501	p<0.00001
Control group: 50 women	6066.4287±1029.0914	p=0.44828

Statistical calculations show that the difference between the group of women with high spectrogram intensity (n=48) and women with moderate intensity (n=95) was statistically significant ($p<0.00001$). There were statistically significant differences between moderate intensity women (n=95) and low intensity women (n=107). The difference between women with low intensity index (n=107) and the control group (n=50) was not statistically significant ($p=0.44828$, $p<0.05$).

The differences recorded in the intensity of the spectral peaks of the combined light emission show that there are significant differences in the metabolic profile of women with inflammatory complications during pregnancy. From the conducted research, it is known that there was a change in the metabolic profile depending on the presence or absence of inflammatory complications.

Thus, there were general similarities in the spectrograms of the blood samples of patients who showed inflammatory complications during pregnancy (as can be seen from the graphic images).

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SUMMARY

The author studied the effectiveness of the Raman spectroscopy method as a prognostic marker in women with inflammatory complications in the postpartum process. 300 women were included in the study. 250 of these women had inflammatory complications during pregnancy, and they made up the main group. In the remaining 50 women, inflammatory complications were observed during the menstrual period, that is, they were practically healthy women and made up the control group. The blood samples of these women included in the study were analyzed using Raman spectroscopy. According the results of research the number of women with higher frequency was less, it was 19.2% in total, and in 107 women, the frequency indicator of blood serum spectrogram was less. From the obtained results, it was found that the frequency and intensity indicators were low in 50 women included in the control group. There were no differences between the 107 women in the main group with a low spectrogram frequency and the women in the control group, which indicates that they did not have an inflammatory process. The difference between women with low intensity index (n=107) and the control group (n=50) was not statistically significant ($p=0.44828$, $p<0.05$). Thus, there were general similarities in the spectrograms of the blood samples of patients who showed inflammatory complications during pregnancy.

Keywords: Raman Spectroscopy, prognosis, marker, postpartum, inflamation