ISSN: 0975 -8542

Journal of Global Pharma Technology

Available Online at: www.jgpt.co.in

RESEARCH ARTICLE

Introducing Optosonographic Surgical Monitoring Into Clinical Practice

Zoltan M. Sigal[1], Olga V. Surnina[1*], Olga A. Sigal[2], Vladimir V. Bryndin[3]

1. *Izhevsk State Medical Academy 281 Kommunarov Str., Izhevsk, Udmurt Republic, 426034, Russia.*
2. *Republican Clinical Diagnostic Center of the Ministry of Health of the Udmurt Republic 87B Lenin Str., Izhevsk, Udmurt Republic, 426009, Russian Federation.*
3. *City Clinical Hospitals of the Ministry of Health of the Udmurt Republic 5 Novoazhimov Str., Izhevsk, Udmurt Republic, 426010, Russia.*

***Corresponding Author: Olga V. Surnina**

Abstract

Materials and methods: In the period from 2010 to 2017 quite a few people were examined, i.e. a ‘comparison’ group of 200 people and an observation group, i.e. 1667 people. The results were as follows. Optosonographic monitoring in 935 patients (56%) revealed surgical thyroid disease, in 732 patients (44%) revealed a surgical pathology of the mammary glands. Among the identified neoplasms, 741 (79%) were benign ones, and 194 (21%) were malignant ones. The number of patients with mammary neoplasms was 732 patients. Of these, 634 were benign ones (87%) and 95 were malignant ones (13%). Results: The sensitivity in the differential diagnosis by optosonographic method of benign thyroid neoplasms is increased from 63% to 95%, malignant neoplasms from 66% to 96%. Reliability increase from 60% to 98% for the diagnosis of benign breast neoplasms, for malignant ones from 37% to 98%. This allows the use of non-invasive optosonographic monitoring to verify the diagnosis.

Keywords: *Optosonographic method, Implantation, Mammary gland, Thyroid gland.*

Introduction

Over the past decade, there has been a continuous increase in the pathologies of the thyroid and mammary glands, which take second place among cancerous diagnosed diseases [1]. A huge selection of diagnostic equipment is provided in specialized clinics; however, the problem of the correct diagnosis remains relevant for the surgical treatment and diagnostic tactics for organ pathology [2]. In the diagnosis of benign and malignant neoplasms of thyroid and mammary glands, there are both false positive and false negative results, a large number of postoperative complications and relapses after surgical procedures [3].

Issues related to new technologies have been poorly studied. There is very little guidance on the most effective way to introduce new technologies into medical practice. Surgery is a great example of how new technologies are changing the practice of medicine. The introduction of new technologies in health care, such as monitoring, is a complex process in which many disciplines are involved. The implementation process should include the translation and integration of scientific data that takes into account the context for developing recommendations on whether and under what conditions new technologies will be implemented [4]. However, developing a program to support such decisions may require significant time and resources.

It is necessary to develop a system with the help of which a new technology can be introduced in order to guarantee its safety, efficiency and availability. Our role is to minimize patient costs and maximize benefits when introducing new methods [5].With the introduction of optosonographic monitoring, there is an improvement in treatment results, prediction and prevention of postoperative complications in the near and distant periods. The development of optosonographic monitoring has provided the effectiveness of a new diagnostic and treatment tactics for focal pathology in surgery. The advantages of the proposed method include atraumaticity and its universal informational content in benign and malignant pathologies, in degenerative, dystrophic, inflammatory processes, injuries and their complications [6, 7]. With the introduction of optosonographic monitoring, there is an improvement in treatment results, prediction and prevention of postoperative complications in the near and distant periods.

The development of optosonographic monitoring has provided the effectiveness of a new diagnostic and treatment tactics for focal pathology in surgery. The advantages of the proposed method include atraumaticity and its universal informational content in benign and malignant pathologies, in degenerative, dystrophic, inflammatory processes, injuries and their complications [6, 7].This method can serve as an objective study in diseases of the mammary glands, thyroid gland, joints, gastrointestinal tract and other organs and systems.

In this case, both specific and nonspecific signs of the viability of organs and tissues, focal pathology, the drug effectiveness and surgical interventions were found. Clinical observations reveal the absolute safety of the optosonographic method [8].Study purpose: the introduction of optosonographic surgical monitoring in clinical practice of healthcare to reduce false positive and false negative diagnostic results, the prevention of iatrogenic complications after a biopsy and after surgery.

Materials and Methods

The work was performed at the Department of Operative Surgery and Topographic Anatomy of the Federal State Budgetary Educational Institution of Higher Education ‘Izhevsk State Medical Academy’, based on the Republican Clinical Diagnostic Center, City Clinical Hospitals No. 6 and No. 9. For the period from 2010 to 2017, the following groups were examined. A comparison group around 200 people and an observation group about 1667 people. Optosonographic monitoring in 935 patients (56%) revealed a surgical pathology of the thyroid gland, in 732 (44%) a surgical pathology of the mammary glands.

Among the detected formations in 741 (79%), benign ones were morphologically verified, malignant formations in 194 (21%). The number of patients with neoplasms of the mammary glands equals 732 patients. To be more exact, 634 were benign neoplasms (87%) and 95 were malignant ones (13%). When determining the junction of arterial flows in this study, 941 patients revealed a new criterion for organ viability based on changes in the spectrum of arterial arches both normal (464 people) and of surgical pathology.

All patients underwent diagnostic methods for tissue viability, including X-ray, ultrasound imaging, cytology and morphology. When determining the viability of organs at the junction of contralateral flows, the authors obtained contralateral blood flow with a mirror image of it below the basal line with the presence of systolic peaks, constant multidirectional signals, with signs of arterial blood flow on spectral echograms with a diastolic component with a h eight of at least 1 mm and not more than 2 / 3 from the systolic component.

The comprehensive examination of patients in the pre- and postsurgical period included examination by a clinician, laboratory and instrumental examinations (such as ultrasound, CT, transillumination pulsometry, magnetic resonance imaging (MRI), scintigraphy, radiography (ductography and mammography)). Ultrasound examination was carried out with the Esaote MyLab 70 series, computed tomography scan (CT) was performed with a SIEMENS Somatom Sensation-40, computer tomograph, X-ray examination on a Dixion Diamond apparatus, magnetic resonance imaging on a GE SignaHDxt 1.5T appliance.

The method of transillumination pulse optometry is based on the registration of changes in pulse and non-pulse optical density. During the study, pulse characteristics and optical density were determined in normal areas and in pathological formations. It is worth noting that ultrasound was, among other things, a navigation method for determining the pathological site. Registration of the variable component of the optical density of the organ was carried out using a modified ammeter.

Optometry for recording hemodynamic parameters was carried out using the device and method of Sigal Z.M. (Figure 1).

Figure 1: Transilluminational pulsomotography device

Electrocardiographs of 'ELKAR-6' or EK1T - OZM type with amplification of electrical signals of 10 and 20 mm/mV were used as graphic recording devices. For the simultaneous registration of hemodynamic and motor parameters, a paper tape speed of 5 mm was used. Optical monitoring was carried out by fixing the recording device by applying it to the area during the study. Optical calibration allows comparing the detected data in the clinic. The pulsogram differentiated the pulse waves in the studied departments with the calculation of pulse oscillation amplitudes in mm (Figure 2).

Figure 2: Determination of hemodynamic parameters by a pulsogram. APO or amplitude of pulse oscillations

Optosonographic monitoring includes ultrasound imaging of focal pathologies of various tissues with subsequent determination of pulse and non-pulse optical density. All studies in patients and practically healthy people were carried out with their full knowledge and consent in accordance with Articles 30,31,32,33 of the Legislation Fundamentals of the Russian Federation on the Protection of Citizens of 07/22/93 No. 5487-1, with the patient's consent to perform an invasive study, intervention, operation, in accordance with the World Health Organization (WHO) international ethical requirements (GCP rules-Global Clinical Practice) for medical research involving humans (Geneva, 1993).

Research approved by the Local Ethics Committee (application number No. 626) Federal State Budgetary Educational Institution of Higher Education 'Izhevsk State Medical Academy' Health Ministry of Russia. Statistical data processing was carried out in the 'Statistica' program. To assess the predictive ability of the proposed method in solving the problem of diagnosing intestinal viability, an receiver operating characteristic (ROC) analysis was carried out with the area under the curve expressing the ratio of the level of true and false detections. When constructing the ROC curve, the operational characteristics were calculated, i.e. the area under the curve (AUC), sensitivity and specificity, positive and negative likelihood ratios, indicating their 95% confidence intervals. To determine Student's difference criterion, the differences were calculated, i.e. the arithmetic difference, the standard deviation of the difference, the standard error of the difference of the means, as well as Student's statistics value: X±dx, y±dy –mean value; Sx, Sy – standard error, t – reliability, p – significance level (error probability), t<2 → p>0,05 – not statistically significant differences, t>2 → p<0,05 –statistically significant differences. The null effect hypothesis was rejected if the value of the sign criterion statistics or Student t statistics exceeded 5% of the distribution point of the sign statistics or Student's statistics with (n-1) degrees of freedom (critical level of significance – p <0,05).

Results

The optosonographic method introduction, helped reduce iatrogenic complications (i.e. blood vessels damage, milk ducts, hematomas and infection), false-positive and false-negative results of differential diagnosis of benign and malignant neoplasms of the mammary and thyroid glands and determination of organs and tissues viability are reduced. (Table 1)

Table 1: The result of treatment and diagnostic tactics in % according to traditional methods (1) and optosonographic monitoring (2)

Results	Thyroid		Mammary gland	
	1	2	1	2
Iatrogenic complications	0.2 - 57	0-5	0.35 - 12	0 – 0.2
False results	1.08 – 24.18	0	3 – 25.8	0 - 1
Complications	0.1 – 30.12	0 – 0.8	0 – 15.9	0 – 4.3
Relapses	2.04-4.67	0.5 – 3.1	2.3-10	0.02 – 4.5

The sensitivity and reliability of optosonographic monitoring for differential diagnosis of nodular formations of breast is higher compared to other methods, which allows making an accurate diagnosis (Table 2).

Table 2: The result of treatment and diagnostic tactics (%) according to optosonographic monitoring data (1) and data from traditional methods (2)

Organ	Objects		x±dx y±dy	Sx Sy	Comparison effect Δ±dΔ; SΔ	T P
Thyroid	Benign new formations	Sensitivity 1	86.6±1.1	4.2	7.3±3.9	15
		Sensitivity 2	74.4±0.6	2.2	0.5	<0.05
		Reliability 1	58±2.9	10.9	4.2±5	6.9
		Reliability 2	51±0.3	1.2	0.6	<0.05
		Accuracy 1	70.5±2.8	10.4	5.2±5.1	8.2
		Accuracy 2	61.7±0.3	1.2	0.6	<0.05
	Malignant tumors	Sensitivity 1	89.5±0.5	1.9	0.4±0.4	6.6
		Sensitivity 2	88.9±0.6	2.4	0.05	<0.05
		Reliability 1	68.4±2.7	10.1	10±6.7	11.8
		Reliability 2	51.7±0.3	1	0.85	<0.05
		Accuracy 1	73.4±1.9	3.8	9.3±4.9	15.1
		Accuracy 2	50.7±0.5	1.6	0.6	<0.05
Mammary gland	Benign new formations	Sensitivity 1	89.1±1	3.8	9.3±4.9	15.1
		Sensitivity 2	73.7±0.4	1.6	0.6	<0.05

Organ	Objects		x±dx y±dy	Sx Sy	Comparison effect Δ±dΔ; SΔ	T P
		Reliability 1	94.7±0.1	0.5	11.9±6.3	15.1
		Reliability 2	74.9±0.92	3.5	0.8	<0.05
		Accuracy 1	94.1±0.5	1.7	10.6±5.6	15
		Accuracy 2	76.4±1.2	4.3	0.71	<0.05
	Malignant tumors	Sensitivity 1	93.2±0.7	2.6	2.6±1.3	15.3
		Sensitivity 2	88.9±0.6	2.4	0.17	<0.05
		Reliability 1	91.4±0.3	1.2	4.4±2.3	15.1
		Reliability 2	84±0.5	2	0.29	<0.05
		Accuracy 1	88.9±0.5	1.9	4.3±2.2	15.4
		Accuracy 2	81.7±0.6	2.4	0.3	<0.05

For timely differential diagnosis of surgical pathology of the thyroid gland, the study of local pulse and non-pulse optical density is recommended (Table 3, Table 4).

Table 3: Comparative characteristics of non-pulse optical density of thyroid gland formations (n = 935) and mammary glands (n=732)

Objects	x±dx y±dy	Sx Sy	Comparison effect Δ±dΔ; SΔ	T P
Cyst Thyroid malignancy	47.5±4.9 16.6±2.8	2.1 8.7	32.6±2.8 8.6	3.8 < 0.05
Malignancy Thyroid adenoma	16.6±2.8 42.1±2.5	8.7 7.1	-5.0±6.5 9.7	-1.5 < 0.05
Mammary cyst Malignant breast cancer	0.05±0.03 0.5±0.1	0.01 0.03	-0.4±0.1 0.03	-15.9 < 0.05
Mammary cyst Breast adenoma	0.05±0.03 0.3±0.1	0.01 0.04	-0.3±0.1 0.03	-6.8 < 0.05
Malignant breast cancer Breast adenoma	0.5±0.1 0.3±0.1	0.03 0.04	-0.1±0.2 0.05	4.4 < 0.05

As it could be seen from Table 3, in the study of the thyroid gland, the lowest optical density was determined in malignancy. The highest optical density was in the cyst. In the study of the mammary gland, the greatest value of the amplitude of pulse oscillations was observed in fibro adenoma. A comparatively functional indicator with the smallest amplitude of pulse oscillations was observed in the cyst

Table 4: Comparative characteristics of the pulse optical density of thyroid gland formations (n = 935) and mammary glands (n=732)

Objects	x±dx y±dy	Sx Sy	Comparison effect Δ±dΔ; SΔ	T P
Thyroid cyst Thyroid malignancy	10.0±0.6 44.7±1.8	1.2 5.4	1.3±2.3 5.15	-2.1 < 0.05
Thyroid malignancy Thyroid adenoma	10.0±0.6 39.5±4.8	1.2 6.1	-4.9±5.1 10.2	-2.6 < 0.05
Thyroid cyst Thyroid adenoma	8.0±0.5 17.3±3.4	1.2 5.8	-5.7±4.9 9.9	-2.3 < 0.05

As it could be seen from table 4, the largest amplitude of the pulse oscillations was observed in malignant thyroid gland, and in the mammary gland in fibro adenoma. A comparatively functional indicator with the lowest amplitude of pulse oscillations was observed in the breast cyst

Ultrasound monitoring of various organs vessels in the area of arterial arches normally produced multidirectional blood flow, which corresponds to the junction of the interaction of contralateral arterial flows. This interaction can be observed, including in the projection of the intestine arcade vessels. The blood flow is normal at the level of the arches of the intestinal arteries is characterized by a mirror image of the arterial flow under the baseline.

Normally, in the arterial arch, both of these flows are the same in severity of the spectrum, but are located at one point of the vessel. An echogram of the intramural vessels of the small intestine of a healthy patient demonstrates the presence of bidirectional blood flow symmetrical on both sides of the basal line, which was proved during surgical interventions for surgical pathology of other organs (Figure 3).

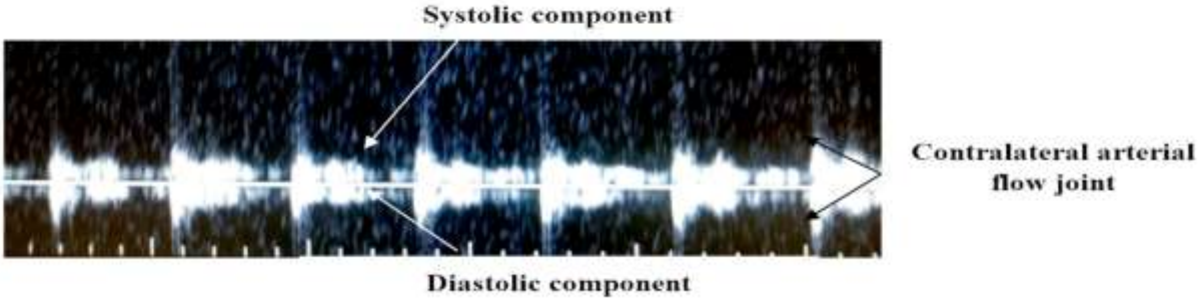

Figure 3: Contralateral arterial flow joint in the intramural arteries of the small intestine Bidirectional blood flow

In this work, we studied changes in the resistance of the vessel wall during surgical pathology (Table 5).

Table 5: Indicators of resistance index in the junction of contralateral arterial flows in various vessels in normal and pathological conditions

Objects	x±dx y±dy	Sx Sy	Comparison effect Δ±dΔ; SΔ	T P
1 2	0.45±0.2 0.56±0.3	0.005 0.0075	0.14±0.2 0.03	0.31 >0.05
1 3	0.5±0.3 0.76±0.2	0.0075 0.005	0.34±0.2 0.03	0.72 >0.05
1 4	0.64±0.5 0.7±0.3	0.0125 0.0075	-0.09±0.4 0.07	0.1 >0.05
1 5	0.65±0.2 1.1±0.1	0.005 0.0025	0.5±0.2 0.03	2.01 <0.05
1 6	0.7±0.2 1.3±0.1	0.005 0.0025	0.59±0.16 0.03	2.68 <0.05

Note: 1 - normal, 2 - strangulation intestinal obstruction, 3 - duodenal ulcer, 4 - acute cholecystitis, 5 - renal artery embolism, 6 - radial artery embolism

Only the radial artery and the renal artery embolism were statistically significant differences in the resistance index. To confirm the reliability of optosonographic monitoring and the need for its introduction, ROC-curves were constructed and methods for the study of pathological thyroid neoplasms were compared. When constructing the ROC-curve, the operational characteristics were calculated: the area under the curve (AUC), sensitivity and specificity, positive and negative likelihood ratios, indicating their 95% confidence intervals (Figure 4). Significance level P <0.0001) indicated that the results are statistically significant, and the null hypothesis should be rejected.

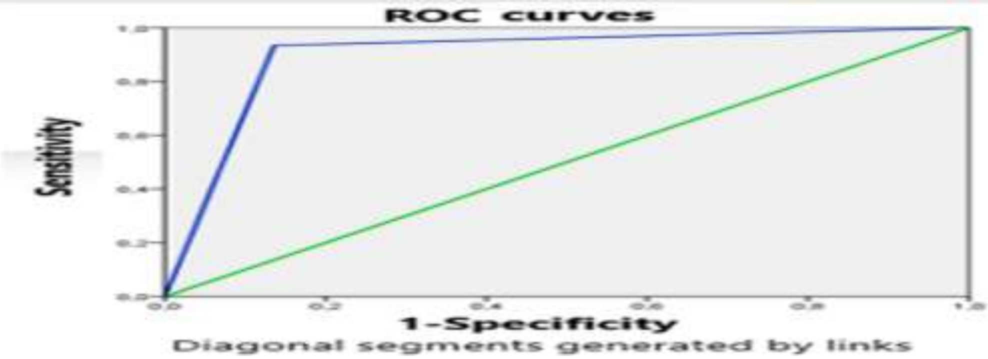

Figure 4: ROC-curve of optosonographic monitoring, reflecting prognostic capabilities

When conducting ROC analysis during comparison, it was found that the AUC (area under the curve) of Bethesda cytology was 0.435 ± 0.033, ultrasound 0.375 ± 0.2, MRI 0.38 ± 0.4, CT 0.47 ± 0.6, scintigraphy 0, 49 ± 0.1, and optosonographic monitoring - 0.955 ± 0.008. It can be argued that the optosonographic method is a method with excellent quality and has shown the best predictive capabilities in thyroid tumors. Other methods showed insufficient prognostic capabilities. Based on the data obtained, ROC-curves were constructed and methods for the study of breast cancer were compared

When constructing the ROC-curve, the operational characteristics were calculated, i.e. the area under the curve (AUC), sensitivity and specificity, positive and negative likelihood ratios, indicating their 95% confidence intervals (Figure 5). Significance level P <0.0001) indicated that the results are statistically significant, and the null hypothesis should be rejected.

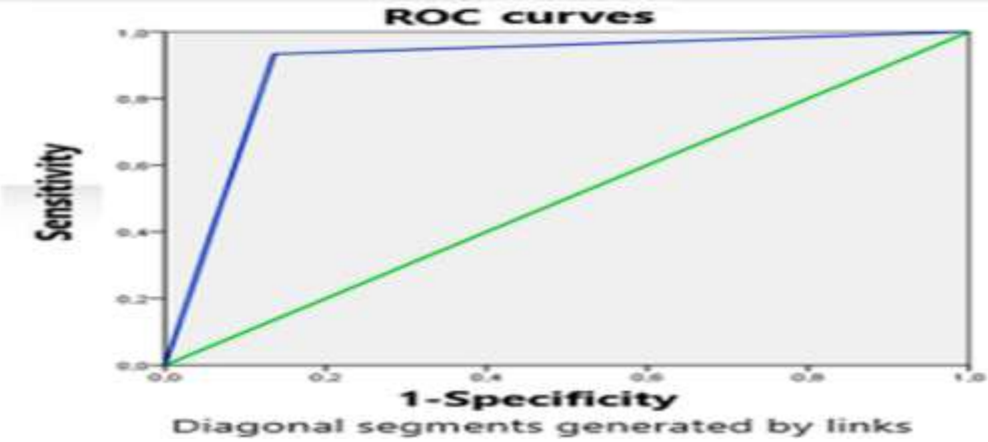

Figure 5: ROC-curve reflecting the predictive capabilities of optosonographic monitoring

During the ROC analysis, it was found that the AUC (area under the curve) of MRI is 0.80 ± 0.04, mammography is 0.89 ± 0.023, ductography 0.70 ± 0.13, and Bethesda cytology is 0.86 ± 0.021, ultrasound 0.90 ± 0.22, and opnosonographic monitoring - 0.98 ± 0.006. It can be argued that despite the fact that these methods are of excellent quality, the introduction of optosonographic surgical monitoring may provide better predictive opportunities for breast cancer

Based on the data obtained, ROC-curves were constructed and methods for studying the viability of organs in identifying the junction of the contralateral arterial flow were compared. All patients with organ viability were combined into one group; the second were patients with non-viability. When constructing the ROC-curve, the operational characteristics were calculated, i.e. the area under the curve (AUC), sensitivity and specificity, positive and negative likelihood ratios, indicating their 95% confidence intervals. Significance level P <0.0001) indicated that the results are statistically significant, and the null hypothesis should be rejected. When conducting ROC analysis of ultrasonic duplex scanning, it was found that the AUC (or area under the curve) is 0.86 ± 0.021, (95% = 0.84–0.92). When identifying the junction of the contralateral arterial flow to determine the viability of the organs, the sensitivity of the ultrasound method was 90%, specificity 85%, accuracy 87%. Based on the scale of AUC values reflecting the quality of the diagnostic test, it can be argued that this method is a method with excellent quality (AUC = 0.86). Considering the fact that the area under the ROC-curve is an integral measure of diagnostic efficiency, we can say that this method showed good predictive capabilities in diagnosing organ viability based on the junction of contralateral arterial flows (i.e. solved the main problem) (Figure 6)

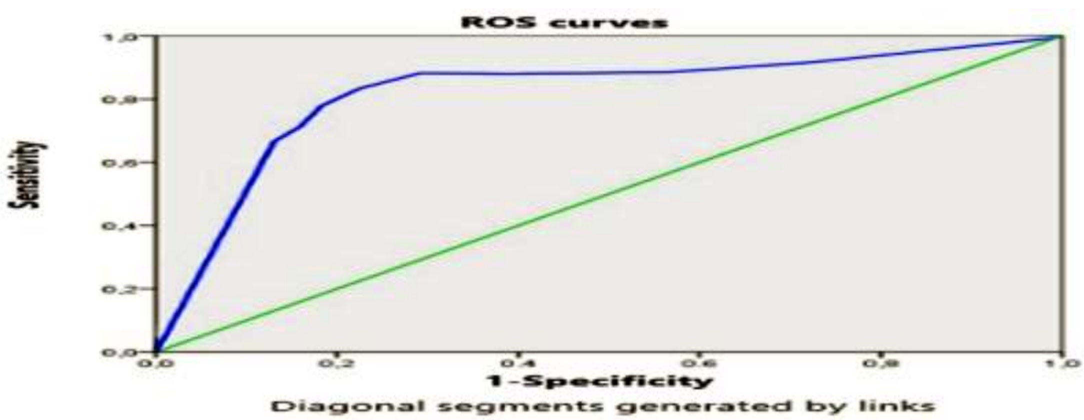

Figure 6: ROC-curve of ultrasonic duplex scanning, reflecting the prognostic capabilities of the method

When conducting the ROC analysis of the X-ray method with the phenomenon of the junction of contralateral arterial flows, it was found that the AUC (area under the curve) is 0.70 ± 0.13 (95% = 0.44–0.96), sensitivity 71%, specificity 70% , accuracy of 70.6%. When conducting a ROC analysis of the contralateral arterial flow junction, it was found that the AUC (area under the curve) histology 0.90 ± 0.22, ultrasound - 0.86 ± 0.021, x-ray - 0.70 ± 0.13. It can be argued that the most accurate diagnostic tests are histology and ultrasound

Discussion

The introduction of optosonographic surgical monitoring into the clinical practice of healthcare for the mammary and thyroid glands surgical pathology made it possible to develop additional indications for organ-preserving surgical interventions on the thyroid gland, while the importance of pulse and non-pulse optical density should be taken into account.

Additional indications for radical operations using specific pathotopographic signs of focal pathology- deformation of adjacent tissues, replacement of healthy tissue with a pathological focus and neoplasm, taking into account specific indicators of pulse and non-pulse optical density. The use of these additional indications reduced the number of iatrogenic complications, such as hematoma from 57% down to 0%, difficult swallowing from 19.5% down to 5%, inflammation from 30% down to 1%, infection from 1% down to 0%. The introduction of optosonographic monitoring during surgical interventions on the thyroid gland allowed reducing the risk of complications in the early stages.

The development of laryngeal paresis decreased from 4% down to 0.2%; suppuration of the wound from 0.4% down to 0.1%. When investigating complications after organ-preserving operations on the mammary gland using optosonographic monitoring, the percentage of complications, such as lymphorrhea and lymphostasis, decreased from 5% down to 3%, bleeding from 4% down to 0.5%, wound suppuration from 0.6% down to 0, 4%, the infected process from 5% down to 1%, necrosis of the edges of the wound from 4% down to 0%.

In this case, additional indications for organ-preserving surgical interventions on the mammary gland, such as the value of local pulse and non-pulse optical density, were taken into account. Additional indications for radical operations are pathotopographic signs, visualization of the formation itself with the deformation of adjacent structures of the skin, subcutaneous fat, milk ducts, amplitude of pulse oscillations from 10.7 to 14.57 mm and non-pulse optical density of more than 0.5.

In patients who underwent surgical treatment without using our additional indications, a complications increase is observed. After organ-preserving operations on the thyroid gland in the observation group, complications revealed laryngeal paresis in 0.2%. The comparison group leads in the number of possible complications. Up to 4% of patients had laryngeal paresis. In addition, bleeding was detected in 30% of the operated patients, suppuration of the postoperative wound in 0.4%.

After undergoing radical thyroid surgery among patients of the observation group from postoperative complications, 0.8% of patients had laryngeal paresis and suppuration of the postoperative wound in 0.1% of the total number of operated patients. The comparison group after this surgery revealed an increase in complications compared with complications after organ-preserving operations on the thyroid gland. In 22% of patients, larynx paresis was observed, and bleeding in 30%. In addition, frequent complications were cases with wound suppuration in 0.4% cases. When compared with the number of complications after similar operations on the mammary gland without the use of additional indications, an increase in complications is observed.

During organ-preserving operations on the mammary gland, bleeding was observed in 12 people (4%), lymphorrhea and lymphostasis were observed in 15 patients (5%), which could cause secondary infection of the wound surface; wound suppuration was observed in 2 cases (0.5%), necrosis of the wound edges was found in 12 people (4%). After radical operations on the mammary gland, the following complications were observed, i.e. lymphorrhea and lymphostasis were not observed in patients; bleeding was also not observed; in 1 case, wound suppuration was observed (3%), and in 50 cases an infectious process (16%), necrosis of the wound edges was found in 1 case (3%).

In case mammary and thyroid glands surgical pathology, surgeons need to introduce puncture biopsy into clinical practice with ultrasound examination of all neoplasms to prevent iatrogenic complications, false positive and false negative results, marking it on the skin and displaying the distance between the skin and neoplasm on the scanner screen no more than 1 cm and between the needle and blood vessels at least 1 cm. The puncture needle is inserted at right angles to the skin, and to the neoplasm at an angle of 45° with the needle visualization.

The specificity and accuracy of optosonographic monitoring in the differential diagnosis of nodular thyroid formations is highest compared to the cytological data obtained with fine needle aspiration biopsy, which allows the use of non-invasive optosonographic monitoring to verify the diagnosis. The introduction of optosonographic surgical monitoring in clinical practice for surgical pathology of the mammary and thyroid glands allowed us to reduce the number of developed iatrogenic complications, such as hematoma from 57% down to 0%, difficult swallowing from 19.5% down to 5%, inflammation from 30% down to 1 %, infection from 1% down to 0%. In addition, for the timely differential diagnosis of surgical pathology of the thyroid gland, a study of local pulse and non-pulse optical density was introduced.

To characterize the information content of diagnostic research methods, the indicators of sensitivity, specificity, accuracy were calculated. When examining breast diseases in 94-98% of cases, deviations were revealed, this indicates a high sensitivity of these methods in terms of diagnosing breast diseases. We can say that these studies are one of the main ways to detect breast diseases. However, it is worth noting that with ultrasound, the specificity (65%) and accuracy (92%) are slightly reduced in relation to the pulse and non-pulse optical densities (90% and 93%, respectively).

It can be concluded that with the introduction of the optosonographic method, the risk of false positive and false negative results is lower, but this does not exclude the possibility of ultrasound. The specificity and accuracy of optosonographic monitoring in the differential diagnosis of nodules of the thyroid gland became the highest, which made it possible to use non-invasive optosonographic monitoring to verify the diagnosis.

Thus, the specificity of detection increased with the differential diagnosis of fibro adenoma from 53% to 73%, cysts from 78% to 81%, malignant neoplasms from 53% to 84%. The accuracy in differential diagnosis increased with fibro adenoma from 37% to 84%, with a cyst from 55% to 64%, with malignant neoplasms from 35% to 85%.

Differential diagnosis of surgical pathology of the breast should be carried out using data of local pulse and non-pulse optical density, since the sensitivity and reliability of optosonographic monitoring for differential diagnosis of nodular formations of the mammary gland is higher compared to other methods, which allowed the introduction of optosonographic monitoring to make an accurate diagnosis.

Therefore, there is an increase in sensitivity in the differential cysts diagnosis from 67% to 75%, fibro adenomas from 62% to 95%, malignant neoplasms from 66% to 96%. The increase in reliability with a cyst from 64% to 98%, with fibro adenoma from 60-70% to 96.9%, with malignant neoplasms from 37% to 98%. When implementing optosonographic monitoring, Sigal Z. M. and Surnina O. V. proposed the phenomenon of contralateral arterial flows. Which includes mechanisms for increasing blood flow in the arteries of the next caliber, using hemodynamic models of the distribution of material and energy aggregates? Based on this phenomenon, which helps determine the viability of organs and tissues, the authors proposed a method containing ultrasound in the duplex scanning regime of blood vessels in the region of arterial arches.

An organ or tissue is considered viable in the presence of contralateral intramural blood flow by mirroring it below the basal line with the presence of systolic peaks, constant multidirectional signals, with signs of arterial blood flow on spectral echograms with a diastolic component at least 1 mm high and not more than 2/3 of the systolic component (RF patent No. 2705940).

Optosonographic surgical monitoring is recommended to be used in the educational process for training students and doctors of the surgical profile, differential diagnosis of benign and malignant surgical diseases of the thyroid and mammary glands, to ensure effective treatment and diagnostic tactics for focal pathology, to develop optimal indications for organ-preserving and radical operations, surgical navigation manipulations, prevention of relapse and surgical complications. Optosonographic monitoring for the differential diagnosis of malignant and benign neoplasms has a number of advantages, first, the ability to evaluate topographic and pathotographic anatomy in real time, which is important for determining surgical access.

Accompaniment of surgical manipulations with these methods is not possible during puncture interventions or operations, which entails iatrogenic complications (i.e. bleeding, paresis, infection, and wound suppuration). While visualizing the neoplasms in a certain topographic area, false positive and false negative diagnostic results may be received, as well as it leads to the inadequate volume of surgical intervention, relapses and others, the place of the surgical incision is determined for neoplasms.

In hospitals providing emergency surgical care, postoperative mortality in acute surgical diseases is still high. The main reason for the high mortality rate is the lack of control over the operation. Lack of monitoring before, during and after surgery or its superficial and less detailed conduct leads to relapse of diseases and postoperative complications. Preoperative monitoring allows you to create the clearest picture of organ pathology, to build the right tactics during surgery and in the postoperative period. Monitoring during the operation allows you to monitor the reaction of the patient to surgical intervention.

The intensity of postoperative monitoring depends on the severity of the patient's condition and the complexity of the surgical procedures performed. In a limited resources era and ever-increasing medical opportunities, every healthcare system is faced with problems in determining which new medical technologies, including medical devices, should be introduced into clinical practice [9]. While technology can increase safety and have other benefits, it eliminates new risks and helps reduce the cost of medical care. Ideally, healthcare organizations should have a systematic process both to collect relevant scientific information about the safety and technology effectiveness, and to decide that optosonographic technologies are necessary for the local population.

The decision-making process for introducing new technologies can be improved at the institutional level. The implementation of optosonographic monitoring can reduce duplication of efforts, save resources, increase the awareness of medical personnel and promote constructive interaction with the clinic, which increases the legitimacy of evidence-based recommendations for the introduction of new healthcare technologies.

Conclusion

- Optosonographic monitoring of focal pathology and organ viability includes pulse and non-pulse optical density and ultrasound using special criteria and specific diagnostic parameters in the context of pathotography, sonographic navigation.

- The introduction of optosonographic surgical monitoring in clinical practice is recommended for the prevention of iatrogenic complications of puncture interventions, the reduction of false diagnostic results of focal pathologies of the mammary and thyroid glands, for the diagnosis of benign and malignant neoplasms, and for the prevention of postoperative complications and relapses after organ-preserving and radical operations.

- The joint phenomenon of contralateral arterial flows, detected by optosonographic monitoring, is effective in surgery for determining the viability of organs during surgery and without surgery, as well as for the prevention of sutures of anastomoses of intestinal stumps and ischemic necrosis.

References

1. Sechopoulos I, Hendrick RE (2012) Mammography and the Risk of Thyroid Cancer. American Journal of Roentgenology, 198(3): 705-707. https://doi.org/10.2214/AJR.11.7225
2. Palter VN, De Montbrun SL (2020) Implementing new surgical technology: A national perspective on case volume requirement for proficiency in transanal total mesorectal excision. Canadian Journal of Surgery, 63(1): E21-E26. https://doi.org/10.1503/cjs.001119
3. Gulov MV, Rasulov AV (2015) Diagnostika I lecheniye dobrokachestvennykh uzlovykh obrazovaniy shchitovidnoy zhelezy [Diagnosis and treatment of benign thyroid nodules]. Health of Tajikistan, 4(327): 75-82. Retrieved from https://www.elibrary.ru/item.asp?id=25620423
4. Su H, Li S, Jin Y, Xian Z, Yang D, Zhou W, Kerman K (2017) Nanomaterial-based biosensors for biological detections. Advanced Health Care Technologies, 3: 19-29. https://doi.org/10.2147/AHCT.S94025
5. Lipworth W, Axler R (2016) Towards a bioethics of innovation. Journal of Medical Ethics, 42(7): 445-449. https://doi.org/10.1136/medethics-2015-103048
6. Sigal Zh M, Surnina OV, Zolotarev KE, Babushkin FG (2018) Transillyuminatsionnyy opticheskiy monitoring v grudnoy i bryushnoy khirurgii [Transillumination optical monitoring in thoracic and abdominal surgery]. Bulletin of the Dagestan Medical Academy. Issue II. Materials of the All-Russian Conference of Surgeons with International Participation Innovative Technologies in Surgery Dedicated to the 60th Anniversary of Pr. G. Askerkhanov. Retrievedfromhttps://docplayer.ru/88263972-Innovacionnye-tehnologii-v-hirurgii.html
7. Surnina OV, Sigal ZM (2017) Differentsial'naya diagnostika dobrokachestvennykh I zlokachestvennykh novoobrazovaniy molochnoy zhelezy [Differential diagnosis of benign and malignant neoplasms of the mammary gland]. Povolzhy Oncological Newsletter, 4(31): 44-53.
8. Surnina OV, Sigal ZM, Surnina OV, Bryndin VV, Sigal SZ (2018) Razrabotka intraorgannogo transillyuminatsionnogo i ul'trazvukovogo monitoringa pri revmatoidnom artrite [Development of intraorgan transillumination and ultrasound monitoring for rheumatoid arthritis]. Diary of the Kazan Medical School, 1(19): 40-46.
9. Ali S, Taylor B, Schlachta C (2015) Evaluation of pilot experience with robotic-assisted proctectomy and coloanal anastomosis for rectal cancer. Canadian Journal of Surgery, 58(3): 188-192. https://doi.org/10.1503/cjs.013814

