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Guest Editorial

The Use of a Robotic Complex for the Diagnosis of Risk Factors and Early Forms of Cancer at the Pre-Medical Stage

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Abstract

Creating a digital medical robot that includes a systematic survey of patients (by the type "YES" or "NO" with illustrations of signs of tumor diseases, risk factors, as well as in the presence of melanoma-threatening nevi, studying their structures using a portable USB microscope with a magnification of at least 100 X, built into the sleeve of a robotic complex (RC) for transmission to a computer touch screen. To detect the activation of early signs of pigmented nevi and superficially spreading melanomas, they were stained with picrofuxin (patent for invention No. 2716811 of March 16, 2020). The system survey was conducted in 1638 patients with a trajectory for men and women on a touch screen. The use of RC allowed us to suspect the activation of pigmented nevi, tumors of the skin, oral cavity, thyroid gland and enlarged lymph nodes in 9.03% ± 1.3 patients, of which 31.08% ± 1.8 were able to confirm oncopathology during further examination. In the presence of complaints from the stomach on an empty stomach, 107 patients underwent a "breath test" on a spiral scan built into the RC program. The color change in the "breathing tubes" was scanned with fixation on the touch screen, in 29 of them, helicobacteriosis was detected above 10 units. with a load. 17 patients were diagnosed with grade 1 and 2 metaplasia, 4 with gastric ulcer, and 3 of them with malignancy. The results of the examination by the program of the complex with recommendations were sent via an On-line connection to the general practitioner.

Keywords: *Robotic Complex; Survey with Illustrations; "breath test"; USB Microscope; Picrofuxin*

Introduction

Although malignant tumors are extremely diverse and difficult to diagnose, a lot is known about the risk factors and mechanisms of cancer development, so that now in most cases, not only timely diagnosis and treatment, but also taking an active position in assessing the specific risk, successfully conduct prevention. The doctor should conduct a systematic examination of the patient not when something "hurts", but regularly, when nothing hurts, taking into account the risk groups, gender and age when contacting the doctor for any reason.

Early forms of cancer are preceded by a long period of carrying oncogenic viruses, Helicobacter pylori and dysplasia, which can be established and cured. At large receptions, especially in the conditions of a pandemic, with mass screening and a doctor's time limit, a systematic survey is an examination for the timely detection of malignant neoplasms by organs it seems difficult. Naturally, asymptomatic pathological processes with this approach, against the background of concomitant diseases, go into the background. And this is the

weakest link in the primary diagnosis, which requires the creation and implementation of digital technologies that increase "oncological alertness" at the outpatient stage [1,2].

Goal of the Study

The goal is to find solutions to the problems of increasing the effectiveness of detecting oncological pathology and risk factors by using a robotic complex for a system survey-examination of the main localizations to reduce the time spent by the doctor prior to his appointment.

Materials and Methods

Robotic intelligence is a technique that allows you to implement algorithms for multi-purpose and system analysis in an expert program. The study of the effectiveness of the robotic complex was conducted on the basis of a created program that includes a system survey with illustrations, a touch screen, magnifying diagnostics (including a portable USB microscope with LEDs) of visual localizations (skin, oral cavity), the definition of a "respiratory urease test", analysis and formation of recommendations with transmission via an "on-line " connection to a doctor's appointment. Previously, a large-format digital television screen is installed in the waiting hall of the polyclinic, which is associated with the prevention program and explains the tasks of the need to pass the robotic complex (like a slide show). The survey program of the robotic complex is carried out on the touch screen. At the beginning, the passport data is filled in figure 1.

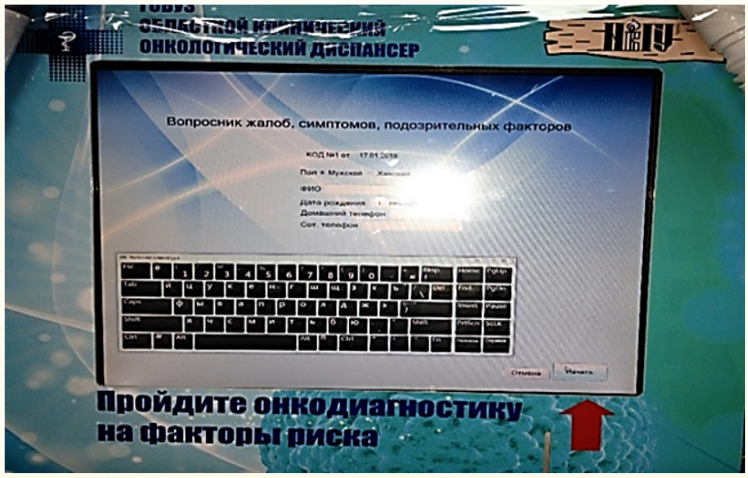


Figure 1: *Touch screen: keyboard for filling in passport data.*

Then follow the questions about the main localizations with illustrations of tumors (melanoma and non-melanoma), precancerous skin conditions, risk factors and other conditions, organ systems, lifestyle and habits with different survey trajectories for men and women.

For example:

1. Do you have any skin problems (sores, cracks, or others)?) formations that have recently:

    a. Yes, it is possible to change the shape, color or size.

b. Yes, there was a tumor spreading over the skin, in places with raised edges other changes, sometimes itching.

c. Yes, there is an ulcer on the skin that does not heal for more than 3-4 weeks*.

d. Yes, there is a formation in the form of a skin-colored plaque with a depression in the center, raised shiny pearlescent edges.

e. Yes, there are, but I do not know how to evaluate.

f. Yes, there are several signs.

g. No, nothing.

Figure 2: *Precancerous changes and basal cell forms of cancer.*

2. Do you have similar pigmented spots in the area of the skin of the face, back, neck, perineum, thigh, feet, nails or in other places that have recently begun to change color, size, assimetry has appeared? **o** Yes, **o** No.

Figure 3: *Touch screen with question and illustrations.*

Given the extremely high rate of advanced cases of oral cancer, we integrated a portable USB microscope with an LED into a flexible hose that enters the side of the body of the robotic complex to transmit pathological changes in the skin and oral cavity to the touch screen. Suspicious areas can be zoomed in or out on the screen to detect signs of malignancy.

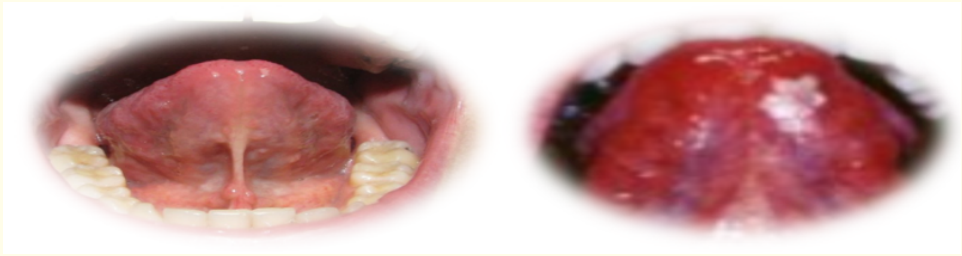
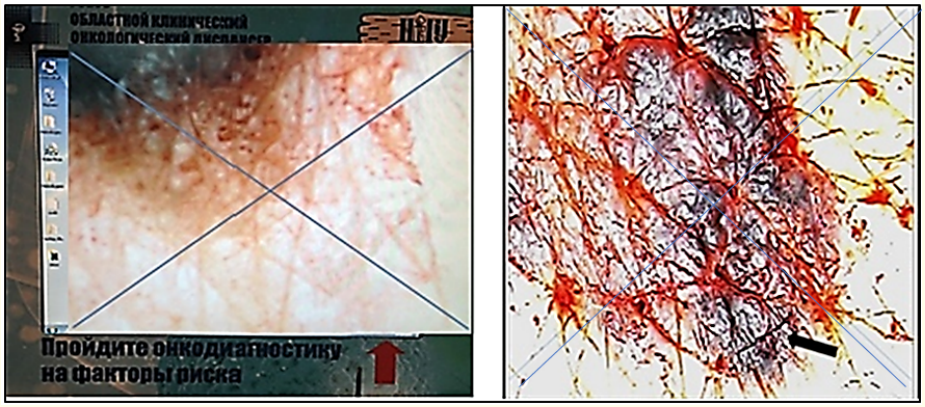


Figure 4: *Examination of the oral cavity (under the tongue).*

On the front panel of the case, a ring is fixed for a container with disposable spatulas in sterile bags in order to displace the mucous membrane of the cheek and tongue for examining the hidden places of the oral cavity.

For the accuracy of the assessment of pigmented nevi, a magnifying magnifier and a mirror were replaced with a USB portable digital microscope with pre-staining with a special dye for 10 minutes [3-5], which allows after absorption through the epithelium to detect violations of the rhomboidness of collagen fibers, the appearance of pigment globules, etc. to identify the first signs of the transformation of a pigmented nevus into a melanoma on a computer screen.



a) ***b)***

Figure 5: *Pigmented formations under a microscope with a special dye staining: a) the fibers depart diamond-shaped from a simple nevus; b) collagen fibers depart chaotically, lumps of pigment, angioneogenesis (shown by the arrow).*

The survey organizer is a specially trained nurse operator or midwife of the examination room. which includes a robotic system and code registration. The nurse operator helps to answer questions, signs or factors that cause difficulties for the patient. The survey trajectory is based on gender and clarifying factors.

As you know, stomach cancer occupies a leading place among other malignant tumors. The proven cause of stomach diseases is the bacterium Helicobacter pylori. In the presence of the slightest complaints from the stomach and other digestive organs, it is recommended to conduct a sensitive "breath test" based on the "Helik-Scan" (AMA company), built on the front panel of the robotic complex.

Two "breath tests" were performed on an empty stomach: before taking urea (basal test) and after (with exercise). In case of infection with *Helicobacter pylori*, a second test (with a load of urea or urea) on the screen, the blue bar in comparison with the basal test significantly increased in proportion to the percentage of ammonia in the exhaled air. The program in the "on line" mode reflected the change the length of the second sample on the screen, respectively, is the infection of the stomach with *Helicobacter pylori*.

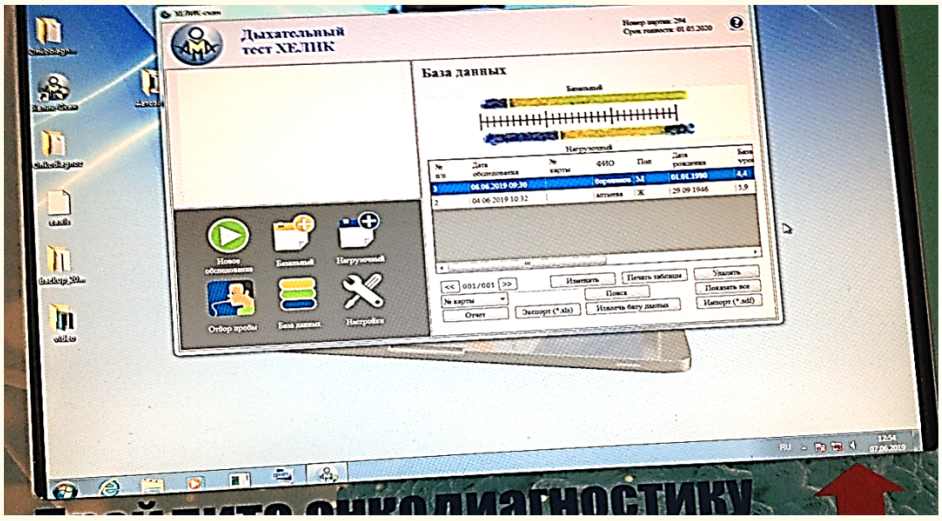


Figure 6: *Results of patient P., 42 years old.*

In figure 6 on the right in the upper rectangle, two yellow stripes are visible (the upper one - one end turned blue after basal respiration - 4.9 units; the lower one - after loading -10.8 units).

Results

The studies were conducted in 1638 patients who applied to the regional clinical oncology dispensary on the "Open Day" and after advertising exhibitions. The use of the robotic complex is suspected: tumors of the skin, oral cavity, thyroid gland, enlarged lymph nodes in (148 patients) 9.03% ± 1.3, of which (46 patients) 31.08% ± 1.8 with further examination, oncopathology was confirmed, including 3 patients with melanoma, 5 with basal cell carcinoma and in one case with thyroid cancer and in two with oral cancer. In addition, 8 patients were found to have melanoma-like nevi.

Localization	Number of patients with suspected pathology	Installed	
		Precancerous changes, milano-dangerous nevi	Malignant diseases tumors
Skin	16	8	8
Oral cavity	11	9	2
Lymph Nodes	19	19	-
Shields. iron	44	43	1
Moloch. iron	58	56	2
Total	148	135 (8,2%)	13 (0,79)

Table 1: *Survey results with illustrations and chromo microscopy.*

58 patients with complaints of certain phenomena of stomach discomfort were given a "breath test" for 6 minutes the next day, 29 of them had helicobacteriosis above 10 units. with a load. All these patients underwent fibrogastroscopy (FGS) with biopsy for atypical cells and Helicobacter pylori for reliability. 17 patients had metaplasia of the 1st or 2nd degree, 4 had gastric ulcer and 3 of them had malignancy.

All results of the RC program via the local Internet system and recommendations for further tactics should be sent to the attending physician, who, after the necessary additional examination of the patient, established the final diagnosis or referred to the necessary specialist.

Discussion

The RC and preliminary results described in this paper, taking into account the methods of targeted survey with illustrations used in the screening of persons who applied in terms of experimental examination, showed that the detection rate of malignant tumors was 0.79 ± 1.2%, precancerous changes and melanoma-threatening pigmented nevi-8.2 ± 2.2%. For the accuracy of the assessment of pigmented nevi, the magnifying glass was replaced with a USB portable digital microscope with pre-staining with. Moreover, the melanoma can not be injured and perform a biopsy.

The use of a Helik scan in a complex digital program allows you to determine the causes of gastric discomfort. When the level of Helicobacter pylori infection exceeds 10 units, eradication and fibrogastroscopy are required, in which the detectability of grade 1-2 metaplasia and peptic ulcer disease was 64.7%, including malignancy in 3 cases.

Conclusion

1. The results of the introduction of the robotic complex at the pre-medical stage allows you to save the time of a general practitioner for a systematic examination and identification of cancer risk factors and early forms of cancer (0.79% ± 1.2), precancerous changes and melanoma-prone pigmented nevi-8.2 ± 2.2%, the treatment of which is less expensive.

2. The creation of medical robotic complexes is a real breakthrough in the primary diagnosis of risk factors and early forms of cancer at the pre-medical stage, requiring interactive cooperation, further improvement and organization of their mass production.

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