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MICROBIOLOGICAL ANALYSIS OF PATHOGENS IN PATIENTS WITH SKIN CANCER

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Abstract
In this study, microbiological investigations were conducted on 10 patients diagnosed with skin cancer. The obtained data indicate that microorganisms play a significant role in oncological processes of the skin. As a result, the presence of Staphylococcus aureus, Propionibacterium acnes, and Human Papillomavirus (HPV) infections was detected in tumor lesions.

Keywords: Skin cancer, biopsy, HPV, Staphylococcus aureus, bacterial infection, inflammation, pathogen, bacteria, virus, fungus.

Introduction

Skin cancer is currently considered one of the most widespread oncological diseases worldwide. According to the World Health Organization (WHO), millions of new cases are registered annually, most of which are associated with increased exposure to solar radiation, depletion of the ozone layer, and prolonged exposure to ultraviolet (UV) and X-ray radiation. In addition, environmental factors, unhealthy diet, weakened immune status, and lifestyle changes also contribute significantly to the development of this disease.

Recent scientific studies suggest that not only genetic and radiation-related factors but also the microbiological environment may directly or indirectly participate in the formation of skin tumors. In particular, bacteria such as Staphylococcus aureus and Propionibacterium acnes, as well as viruses like Human Papillomavirus (HPV), have been reported to be associated with tumor cells. These microorganisms can induce chronic inflammatory processes in skin tissues, leading to the accumulation of DNA mutations in cells and, consequently, the development of tumorigenesis.

In this context, the Decree of the President of the Republic of Uzbekistan on “Measures for the Implementation of the National Strategy of the Republic of Uzbekistan to Combat Childhood Cancer for 2025–2030” emphasizes increasing the one-year survival rate of children with oncological and oncohematological diseases from 34% to 90% and the five-year survival rate to at least 60%.

Materials and Methods

The study was conducted on 10 patients diagnosed with skin cancer (5 males and 5 females, aged 35–68 years). Biopsy samples were collected for microbiological analysis. Blood agar and nutrient broth were used as culture media for isolating microorganisms. Identification of cultured isolates was performed using Gram staining, catalase and coagulase tests, while viral DNA was detected by polymerase chain reaction (PCR). Statistical analysis of the obtained data was carried out using Microsoft Excel and SPSS 20.0 software, applying regression, correlation, and variance analyses.

Results

The microbiological characteristics of the 10 examined skin cancer patients are presented in Table 1. Based on the obtained results, several significant patterns were identified. Microorganisms were detected in biopsy samples of 70% of the patients.

Among the identified microorganisms, Staphylococcus aureus was the most prevalent, detected in 4 out of 10 patients (40%). This bacterium was particularly associated with pronounced inflammatory responses in male patients aged 38, 63, and 68 years.

Table 1 Microbiological analysis of skin cancer patients by age

No.	Age	Gender	Identified microorganisms	Main findings
1.	38	Male	S. aureus, HPV-16	Inflammation at tumor site
2.	44	Female	P. acnes	Mild infection
3.	52	Male	HPV-18	Strong proliferation
4.	41	Female	S. epidermidis	Neutral
5.	63	Male	S. aureus, HPV-16	Co-infection
6.	49	Female	Candida albicans	Secondary infection
7.	58	Male	HPV-6	Viral etiology
8.	35	Female	P. acnes	Active inflammation
9.	68	Male	S. aureus	Severe inflammation
10.	55	Female	HPV-18	High malignancy grade

The presence of S. aureus colonies in skin biopsies was accompanied by increased levels of inflammatory mediators and elevated numbers of neutrophils and macrophages, thereby creating favorable conditions for tumor cell proliferation. Notably, in the 63-year-old patient, simultaneous detection of S. aureus and HPV-16 indicated a co-infection, which was associated with a more aggressive progression of the tumor process.

Propionibacterium acnes was detected in 2 patients (20%), predominantly among younger female patients aged 35–44 years. This bacterium is commonly found in sebaceous glands and, under conditions of prolonged infection, may weaken immune responses and intensify inflammatory processes. Patients with P. acnes infection exhibited mild but persistent erythema and inflammation of the skin, suggesting that dysbiosis of the skin microbiota may contribute to tumor development.

A particularly important finding was the detection of HPV types. Overall, HPV infection was identified in 5 out of 10 patients (50%). The most frequently detected genotypes were HPV-16

and HPV-18, which belong to the high-risk oncogenic group. HPV-16 infection was observed in male patients aged 38 and 63 years and was associated with inflammation and necrotic changes at the tumor site. HPV-18 was detected in patients aged 52 and 55 years and was characterized by a high degree of malignancy, including nuclear atypia and increased mitotic activity in tumor cells. Numerous studies have reported that HPV contributes directly to carcinogenesis by disrupting genetic stability in skin cells.

Additionally, Candida albicans was identified in a 49-year-old female patient, indicating the presence of a secondary infection at the tumor site. C. albicans acts as an opportunistic pathogen, particularly in immunocompromised individuals, and exacerbates infectious inflammatory processes in the skin. In this patient, necrotic changes and mild fungal inflammation were observed around the tumor area.

Discussion

The obtained results demonstrate that the microbiological background plays a crucial role in skin cancer. Staphylococcus aureus can induce chronic inflammation, thereby accelerating tumor cell proliferation. Statistical analysis revealed that bacterial infections were present in 60% of cases (6 patients), while viral infections were detected in 50% of cases (5 patients). In 30% of cases, bacterial and viral infections occurred simultaneously. These findings suggest that microbiological factors involved in skin cancer development are multifactorial, with different microorganisms acting synergistically.

Patient age and gender also influenced infection prevalence, with microbiological infections more frequently detected in males than females (60% vs. 40%). This difference may be explained by increased sebum production and greater exposure to solar radiation in males. Conversely, the higher prevalence of HPV infection among females suggests favorable conditions for viral entry into epithelial cells.

Furthermore, HPV-16 and HPV-18 produce E6 and E7 oncoproteins that activate oncogenes. Thus, the synergistic interaction between bacterial and viral components contributes significantly to the development and progression of skin cancer.

Conclusion

The conducted study confirms the presence of microorganisms in tumor biopsy samples from patients with skin cancer. These microorganisms, particularly Staphylococcus aureus and oncogenic HPV genotypes, activate tumor cell proliferation mechanisms and impair the host immune system. In cases of mixed infections, this effect becomes synergistic, promoting opportunistic pathogenicity of the skin microbiota and accelerating tumor progression.

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