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## ***ЗЛОКАЧЕСТВЕННЫЕ НОВООБРАЗОВАНИЯ (РАК): ВСЕОБЪЕМЛЮЩИЙ ОБЗОР***

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### **Аннотация**

Злокачественные новообразования, широко известные как рак, представляют собой гетерогенную группу заболеваний, характеризующихся неконтролируемым клеточным делением, инвазией и возможностью метастазирования. Данный обзор представляет подробный анализ патофизиологии, классификации, диагностики, методов лечения и новых исследований в области злокачественных новообразований. Особое внимание уделяется молекулярным механизмам, лежащим в основе опухолеобразования, современным диагностическим методам, стратегиям терапии, включая хирургическое вмешательство, химиотерапию, лучевую терапию и таргетную терапию, а также трудностям в лечении множественных первичных злокачественных новообразований (МПЗН). В статье также обсуждаются перспективные направления исследований и клинического ведения онкологических заболеваний.

**Ключевые слова:** Злокачественные новообразования, опухолеобразование, множественные первичные злокачественные новообразования (МПЗН), молекулярная диагностика, таргетная терапия, иммунотерапия, онкогены и гены-супрессоры опухолей, гистопатология, прецизионная медицина, методы лечения рака.

## ***MALIGNANT NEOPLASMS (CANCER): A COMPREHENSIVE REVIEW***

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### **Abstract**

Malignant neoplasms, commonly known as cancers, represent a heterogeneous group of diseases characterized by uncontrolled cellular proliferation, invasion, and potential metastasis. This review provides a detailed examination of the pathophysiology, classification, diagnosis, treatment modalities, and emerging research in malignant neoplasms. Emphasis is placed on the molecular mechanisms driving tumorigenesis, current diagnostic techniques, therapeutic strategies including surgery, chemotherapy, radiotherapy, and targeted therapies, as well as challenges in managing multiple primary malignant neoplasms (MPMNs). The paper also discusses future directions in cancer research and clinical management.

**Keywords:** Malignant Neoplasms, Tumorigenesis, Multiple Primary Malignant Neoplasms (MPMNs), Molecular Diagnostics, Targeted Therapy, Immunotherapy, Oncogenes and Tumor Suppressor Genes, Histopathology, Precision Medicine, Cancer Treatment Modalities.

### **Introduction**

Malignant neoplasms are a leading cause of morbidity and mortality worldwide, encompassing a broad spectrum of cancers arising from various tissues and organs. They are defined by their ability to invade adjacent tissues and metastasize to distant sites, distinguishing them from benign tumors. The increasing incidence of cancer is

attributed to aging populations, environmental exposures, lifestyle factors, and improved diagnostic capabilities. Understanding the biological basis and clinical management of malignant neoplasms is essential for improving patient outcomes.

## **Pathophysiology of Malignant Neoplasms**

Cancer development is a multistep process involving genetic and epigenetic alterations that disrupt normal cellular homeostasis. Key hallmarks include sustained proliferative signaling, evasion of growth suppressors, resistance to cell death, replicative immortality, angiogenesis, invasion, and metastasis. Mutations in oncogenes, tumor suppressor genes, and DNA repair genes underpin these changes. For example, KRAS mutations are implicated in various cancers and may contribute to multiple primary malignancies [2]. Tumor microenvironment, including immune cells and stromal components, plays a critical role in tumor progression and therapeutic resistance.

## **Classification and Types of Malignant Neoplasms**

Malignant neoplasms are classified based on the tissue of origin and histopathological characteristics:

- **Carcinomas:** Originating from epithelial cells; the most common type (e.g., squamous cell carcinoma, adenocarcinoma).
- **Sarcomas:** Derived from mesenchymal tissues such as bone, muscle, and connective tissue.
- **Lymphomas and Leukemias:** Cancers of the hematopoietic and lymphoid tissues.
- **Melanomas:** Arising from melanocytes, often aggressive with poor prognosis if metastasized [4].
- **Undifferentiated Carcinomas:** Highly aggressive tumors with poor differentiation and prognosis, such as pancreatic undifferentiated carcinoma [3].

## Diagnosis of Malignant Neoplasms

Diagnosis involves a combination of clinical evaluation, imaging, histopathology, and molecular testing. Imaging modalities include CT, MRI, PET-CT, and ultrasound, which aid in tumor detection, staging, and monitoring. Histological examination remains the gold standard for confirming malignancy and determining tumor type. Molecular diagnostics, including next-generation sequencing (NGS), identify genetic mutations (e.g., KRAS) that inform prognosis and guide targeted therapies [2; 5]. In cases of multiple primary malignant neoplasms (MPMN), comprehensive evaluation is critical to distinguish new primary tumors from metastases and to guide treatment [5].

## Treatment Modalities

Management of malignant neoplasms is multidisciplinary and tailored to tumor type, stage, and patient factors:

- **Surgery:** Primary treatment for localized tumors aiming at complete resection.
- **Radiotherapy:** Used as curative or palliative treatment, often in combination with surgery or chemotherapy.
- **Chemotherapy:** Systemic treatment targeting rapidly dividing cells; regimens vary by cancer type.
- **Targeted Therapy:** Agents directed at specific molecular targets, such as tyrosine kinase inhibitors and monoclonal antibodies.
- **Immunotherapy:** Immune checkpoint inhibitors (e.g., anti-PD-1 antibodies like Camrelizumab) have shown efficacy in cancers like melanoma and cholangiocarcinoma [2].
- **Combination Therapies:** Often necessary in advanced or multiple primary cancers to improve outcomes.

## **Multiple Primary Malignant Neoplasms (MPMNs)**

MPMNs refer to the occurrence of two or more distinct primary malignant tumors in one individual, either synchronously (within 6 months) or metachronously (after 6 months). Their incidence is rising due to improved cancer survival and diagnostic methods [5]. MPMNs pose significant diagnostic and therapeutic challenges, requiring individualized treatment plans often involving systemic therapies and multidisciplinary teams [2; 5]. Genetic predisposition, environmental factors, and previous cancer treatments contribute to MPMN development.

## **Challenges and Future Directions**

Despite advances, challenges remain in early detection, overcoming therapeutic resistance, and managing complex cases like MPMNs. Future research focuses on:

- Precision Medicine: Integrating genomic data to tailor therapies.
- Biomarkers: Identifying predictive and prognostic markers for early diagnosis and treatment response.
- Novel Therapeutics: Development of new targeted agents and immunotherapies.
- Comprehensive Care Models: Enhancing multidisciplinary approaches for complex cases.

## **Conclusion**

Malignant neoplasms encompass a diverse group of cancers with complex biology and clinical behavior. Advances in molecular biology and diagnostics have improved understanding and management, yet challenges persist, especially in cases involving multiple primary malignancies. Continued research and multidisciplinary care are essential to improve prognosis and quality of life for cancer patients.

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