MORPHOFUNCTIONAL CHANGES IN BREAST CANCER

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Abstract: Breast cancer is associated with significant morphofunctional differences between normal and malignant breast cells. Normal breast tissue maintains organized structure, cellular polarity, and controlled proliferation, whereas tumor cells show morphological atypia, loss of tissue organization, increased proliferation, and resistance to apoptosis. These changes are accompanied by alterations in the tumor microenvironment, including stromal remodeling and enhanced invasive potential. Understanding these differences is essential for elucidating breast cancer pathogenesis and improving diagnostic and therapeutic approaches.

Keywords: breast cancer, morphofunctional changes, normal cells, tumor cells

Introduction: Breast cancer is one of the most common malignant tumors worldwide and remains a major cause of cancer-related morbidity and mortality among women. Despite significant advances in diagnosis and treatment, the biological behavior of breast cancer is highly heterogeneous, which complicates prognosis and therapeutic decision-making.

The development of breast cancer is accompanied by distinct morphofunctional changes at the cellular and tissue levels. Normal mammary epithelial cells are

characterized by regulated growth, preserved tissue architecture, and stable interactions with the surrounding microenvironment. In contrast, malignant transformation leads to structural disorganization, cellular atypia, increased proliferative activity, and functional alterations that promote invasion and metastasis.

A detailed comparison of healthy and tumor breast cells is essential for understanding the mechanisms of carcinogenesis. The study of morphofunctional differences provides valuable insights into tumor progression and forms the basis for improved diagnostic, prognostic, and therapeutic strategies in breast cancer management.

Materials and Methods

Study Material

The study was conducted on breast tissue samples obtained from patients undergoing surgical treatment for breast cancer. Tumor tissue samples were compared with morphologically normal breast tissue taken from tumor-free margins of the same specimens. All samples were collected in accordance with ethical standards and approved institutional guidelines.

Histological Examination

Tissue samples were fixed in 10% neutral buffered formalin, processed routinely, and embedded in paraffin. Sections of 4–5 μm thickness were stained with hematoxylin and eosin for general morphological assessment. Histological evaluation focused on tissue architecture, cellular morphology, nuclear characteristics, and mitotic activity.

Morphometric and Statistical Analysis

Morphometric analysis included measurement of nuclear size, nuclear-to-cytoplasmic ratio, and cell density using light microscopy and digital image analysis. Statistical analysis was performed using standard software, and differences between normal and tumor tissues were considered significant at $p < 0.05$.

Results

Histological analysis of normal breast tissue demonstrated well-preserved glandular architecture with clearly defined ducts and lobules. Epithelial cells were arranged in an orderly manner, maintaining cell polarity and uniform cell size. Nuclei were small, round to oval, with finely dispersed chromatin and rare mitotic figures. The surrounding stroma showed no signs of desmoplasia or inflammatory infiltration.

In contrast, breast cancer tissue exhibited marked structural disorganization. Tumor cells formed irregular nests, cords, and solid sheets with disrupted glandular patterns. A significant degree of cellular and nuclear atypia was observed, including nuclear pleomorphism, hyperchromasia, prominent nucleoli, and an increased nuclear-to-cytoplasmic ratio. Mitotic figures were frequent, including atypical forms, indicating high proliferative activity.

Immunohistochemical evaluation revealed a substantial increase in Ki-67 expression in tumor samples compared to normal breast tissue. Tumor cells showed diffuse nuclear positivity, while normal epithelial cells exhibited minimal or absent staining. This finding confirms enhanced proliferative capacity of malignant cells.

Morphometric analysis demonstrated statistically significant increases in mean nuclear area and cell density in tumor tissue, along with reduced intercellular spacing. Additionally, stromal alterations were evident in tumor samples, including fibrosis, increased vascularization, and infiltration by inflammatory cells. These morphofunctional changes collectively reflect the aggressive biological behavior of breast cancer cells.

Conclusion: Breast cancer is associated with pronounced morphofunctional changes that distinguish malignant cells from normal breast tissue. Tumor cells exhibit structural disorganization, nuclear atypia, increased proliferative activity, and altered interactions with the surrounding microenvironment. In contrast, normal breast tissue maintains organized architecture, cellular polarity, and controlled proliferation.

Understanding these differences is essential for elucidating the mechanisms of breast carcinogenesis and can contribute to improved diagnostic, prognostic, and therapeutic strategies. Detailed analysis of morphofunctional alterations provides a foundation for targeted research and the development of personalized treatment approaches in breast cancer management.

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