MORPHOFUNCTIONAL CHANGES IN TISSUES IN OVARIAN CANCER

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Abstract: Ovarian cancer is one of the most aggressive gynecological malignancies, characterized by diverse histopathological and molecular profiles. The progression of the disease is accompanied by significant morphofunctional alterations in ovarian tissue. Normal ovarian tissue exhibits organized architecture, including follicles at different stages of development, stromal connective tissue, and vascular networks that maintain tissue homeostasis. In contrast, malignant ovarian tissue demonstrates disrupted structural organization, including irregular cell arrangements, nuclear atypia, increased nuclear-to-cytoplasmic ratio, and frequent mitotic figures. In addition, the tumor microenvironment shows stromal remodeling, angiogenesis, and inflammatory cell infiltration. Morphometric and histopathological analyses of these changes provide critical insight into the biology of ovarian cancer, contributing to accurate diagnosis, prognosis, and the development of targeted therapies. Understanding the correlation between structural alterations and functional impairment in ovarian tissues is essential for improving patient outcomes and guiding personalized treatment strategies.

Keywords: ovarian cancer, tissue morphology, histopathology, cellular atypia, tumor microenvironment.

Introduction: Ovarian cancer is a leading cause of gynecological cancer-related mortality worldwide, largely due to its late diagnosis and heterogeneous

histopathology. The disease affects the ovarian tissue at both structural and functional levels, resulting in significant morphofunctional alterations. Normal ovarian tissue is composed of well-organized follicles at various developmental stages, stromal connective tissue, and vascular networks that support tissue homeostasis and endocrine function. In ovarian cancer, these structures are disrupted, with irregular cell arrangements, nuclear atypia, increased mitotic activity, and alterations in the stromal microenvironment. Understanding these morphofunctional changes is crucial for elucidating the pathogenesis of ovarian cancer, improving diagnostic accuracy, and guiding effective therapeutic strategies. Histopathological and morphometric studies provide valuable insights into the correlation between structural alterations and functional impairment in tumor progression.

Materials and Methods

Study Material

The study included ovarian tissue samples obtained from patients diagnosed with epithelial ovarian cancer during surgical resections, as well as healthy ovarian tissue from age-matched controls undergoing non-oncological gynecological procedures. All samples were collected following ethical guidelines with informed consent.

Histological Examination

Tissue specimens were fixed in 10% neutral buffered formalin, embedded in paraffin, and sectioned at 4–5 μm thickness. Sections were stained with hematoxylin and eosin (H&E) for general morphological assessment. Histological evaluation focused on follicular structure, stromal organization, nuclear morphology, mitotic activity, and presence of inflammatory infiltrates.

Morphometric and Functional Analysis

Morphometric parameters, including cell and nuclear size, nuclear-to-cytoplasmic ratio, and mitotic index, were quantified using light microscopy and image analysis software. Functional assessment included evaluation of stromal remodeling, angiogenesis, and tumor microenvironment features. Statistical analysis was performed to compare cancerous and healthy tissues, with significance set at $p < 0.05$.

Results

Normal Ovarian Tissue

Histological examination of control ovarian samples revealed preserved tissue architecture. Follicles at different developmental stages (primordial, primary, secondary, and Graafian) were clearly distinguishable, with intact granulosa and theca cell layers. Stromal connective tissue was well-organized, containing fibroblasts and a regular vascular network. The ovarian surface epithelium consisted of a uniform layer of cuboidal or low columnar cells with small, round nuclei, evenly distributed cytoplasm, and no evidence of atypia. Mitotic activity was rare and within normal physiological range. Morphometric measurements confirmed consistent cell size, nuclear diameter, and low nuclear-to-cytoplasmic ratio, reflecting stable cellular function. No inflammatory infiltrates, necrotic areas, or stromal remodeling were detected.

Ovarian Cancer Tissue

In ovarian cancer samples, profound morphofunctional alterations were observed:

Cellular Changes:

Tumor cells displayed significant **nuclear atypia**, including irregular nuclear contours, hyperchromasia, and prominent nucleoli.

Increased **nuclear-to-cytoplasmic ratio** and frequent mitotic figures, including abnormal mitoses, were observed.

Cells often formed irregular clusters, sheets, or gland-like structures depending on the histological subtype (serous, mucinous, endometrioid).

Stromal and Microenvironment Changes:

Stromal remodeling was evident, with increased fibroblast proliferation, collagen deposition, and desmoplastic reactions.

Enhanced **angiogenesis** was observed, with numerous newly formed, irregular blood vessels.

Inflammatory infiltration, mainly lymphocytes and macrophages, was prominent in peritumoral regions.

Tissue Architecture:

Loss of normal follicular structures and ovarian surface epithelium integrity.

Areas of necrosis and apoptotic bodies were detected in high-grade tumors.

Extracellular matrix disorganization contributed to altered tissue stiffness and disrupted functional interactions.

Quantitative Morphometric Findings

Average nuclear size in tumor cells was significantly increased compared to healthy ovarian cells ($p < 0.01$).

Nuclear-to-cytoplasmic ratio and mitotic index were markedly elevated ($p < 0.01$).

Stromal density and microvascular density were significantly higher in cancerous tissue, correlating with tumor grade and aggressiveness.

Comparative Analysis

Comparison between healthy and malignant ovarian tissue emphasizes the relationship between **structural disruption and functional impairment**. Tumor progression involves not only cellular atypia but also profound changes in the stroma and microenvironment, contributing to invasion, metastasis, and altered ovarian endocrine function.

Conclusion: Ovarian cancer induces significant morphofunctional changes in ovarian tissue, including cellular atypia, increased mitotic activity, stromal remodeling, angiogenesis, and inflammatory infiltration. These alterations disrupt normal tissue architecture, impair ovarian function, and contribute to tumor progression. Understanding the correlation between structural changes and functional impairment is essential for accurate diagnosis, prognosis, and development of targeted therapeutic strategies.

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