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GENERAL ASPECTS OF HISTOPATHOLOGY OF GLIOBLASTOMA

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Glioblastoma (GBM) is the most aggressive and common primary malignant brain tumour in adults, categorized by the World Health Organization (WHO) as a Grade 4 astrocytoma. It originates from glial cells and primarily affects the cerebral hemispheres, though it can occur in any part of the brain or spinal cord. The hallmark of this malignancy is its highly infiltrative nature, where tumour cells migrate along white matter tracts and blood vessels, making it nearly impossible to define a clear boundary between the tumour and healthy brain tissue. From a histopathological perspective, glioblastoma is characterized by extreme cellular pleomorphism and high mitotic activity. The presence of pseudopalisading necrosis (areas of dead tissue surrounded by crowded tumour cells) and microvascular proliferation (the formation of abnormal, leaky blood vessels) are the defining features that distinguish it from lower-grade gliomas. These characteristics reflect a highly metabolic and rapidly growing environment that creates significant intracranial pressure and neurological disruption.

Glioblastoma is characterized histopathologically by prominent cellular atypia, nuclear pleomorphism, strong mitotic activity, microvascular proliferation, necrosis, and frequently pseudo palisading patterns. These features set glioblastoma apart from astrocytoma of lower grade. The information that is currently available suggests that the quantity and quality of the tissue sample may have an impact on these characteristics' appearance and presence. Important characteristics like necrosis or microvascular growth may not be seen in insufficient or restricted samples. Significant intratumoral heterogeneity is another characteristic of glioblastoma, which means that various parts of the tumor may show different histological patterns. Therefore, underrepresentation of more aggressive components may result from inadequate sample. Therefore, adequate and representative tissue sampling plays a crucial role in accurately reflecting the tumour's histopathological features.

The results often focus on the biological significance of these morphological features. For instance, the presence of pseudo palisading necrosis is discussed as a reaction to acute hypoxia; as cells move away from oxygen-depleted areas, they create the characteristic crowded appearance, which is a strong indicator of the tumour's aggressive nature. The microvascular proliferation is interpreted as a maladaptive angiogenic response to high levels of Vascular Endothelial Growth Factor (VEGF) secreted by the hypoxic tumour cells.

Modern diagnosis now integrates histopathology with molecular markers, specifically requiring an Isocitrate Dehydrogenase (IDH)-wildtype status to formally classify a tumour as glioblastoma. Key genetic alterations, such as O6-methylguanine-DNA methyltransferase (MGMT) promoter methylation, serve as critical indicators for chemotherapy response, while mutations in the telomerase reverse transcriptase (TERT) promoter or epidermal growth factor receptor (EGFR) amplification allow for a definitive Grade 4 diagnosis even when traditional physical markers like necrosis are absent in small biopsies.

In conclusion, glioblastoma remains a profound oncological challenge due to its extreme heterogeneity and infiltrative growth. The transition from purely morphological evaluation to integrated molecular profiling highlights the necessity of representative tissue sampling. Ultimately, combining microscopic hallmarks with genetic data is essential for accurate grading and tailoring personalized treatment strategies to improve patient outcomes in the face of this aggressive disease.