Spectral markers and morphological features of supratentorial gliomas tissues from patients of different ages

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Histological classification of gliomas according to the World Health Organization WHO (I–IV) grades.

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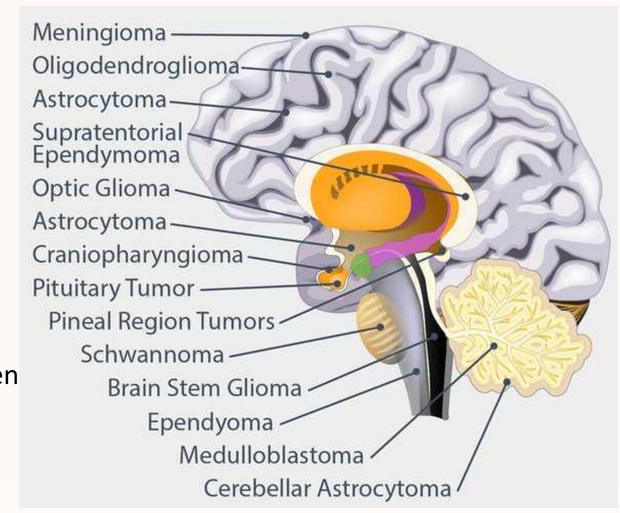
Histology / *WHO grade*	Astrocytoma	Oligoastrocytoma	Oligodendroglioma
Grade I (circumscript)	Pilocytic astrocytoma		
Grade II (low-grade)	Diffuse astrocytoma	Oligoastrocytoma	Oligodendroglioma
Grade III (diffuse, high-grade)	Anaplastic astrocytoma	Anaplastic oligoastrocytoma	Anaplastic oligodendroglioma
Grade IV (high-grade)	Glioblastoma		



What causes Glioma?

There is no specific cause of glioma, anyone can suffer from glioma, however, it is more likely seen in adult males. Some of the underlying risk factors of glioma include but not limited to;

- **Age:** Glioma can affect any age group but it is more commonly seen in adults than in children.
- **Exposure to radiation:** This is an environmental risk factor. Individuals who have had a radiation therapy for cancer in the past are also prone to developing glioma.
- **Family History:** In case anyone in the family tree was ever diagnosed with glioma, then the risk of developing glioma is more.
- **Gender:** Men are more prone to developing glioma than women.
- **Hereditary syndromes:** There are few genetic syndromes that are associated with the risk of developing glioma. Some syndromes include Cowden syndrome, Turcot syndrome, Lynch syndrome etc.

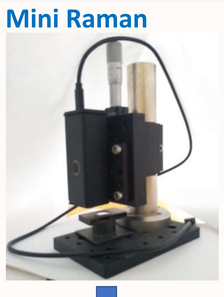
Oncological diseases of the brain are one of the most difficult problem in oncology because of the negative prognosis, their infiltrative growth and often resistance to commonly accepted treatment protocols. Glioblastoma is the most aggressive and deadly type of glioma (even brain cancer) that accounts for up to 45% of malignant brain tumors. The percentage five-year survival forecast is not promising (<5%) and has not improved in the recent 30 years. Treatment for glioma is ever evolving with newer techniques and technologies and customized individual plan including surgery, chemotherapy, stereotactic radiosurgery (radiotherapy), targeted therapy and combination therapies. The disease is fast and agile.

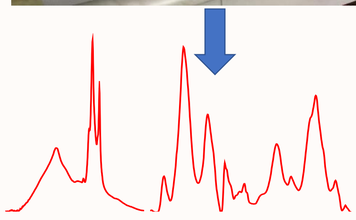
The purpose of this study was to establish the structural and molecular features of gliomas at various degrees of anaplasia and to identify possible correlations with the age of patients. Based on the obtained data, determine prognostic markers.

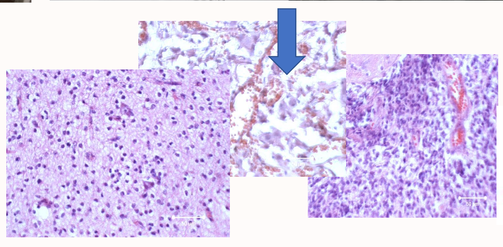
FTIR (Invenio-R)

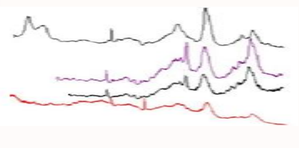
Microscopy (Carl Zeiss LSM-510 META)

Mini Raman





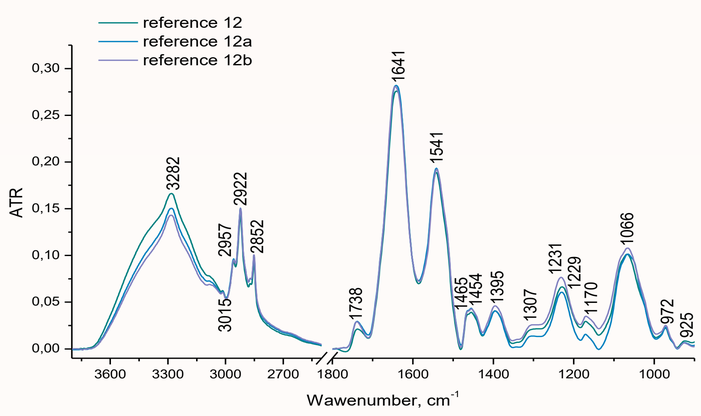


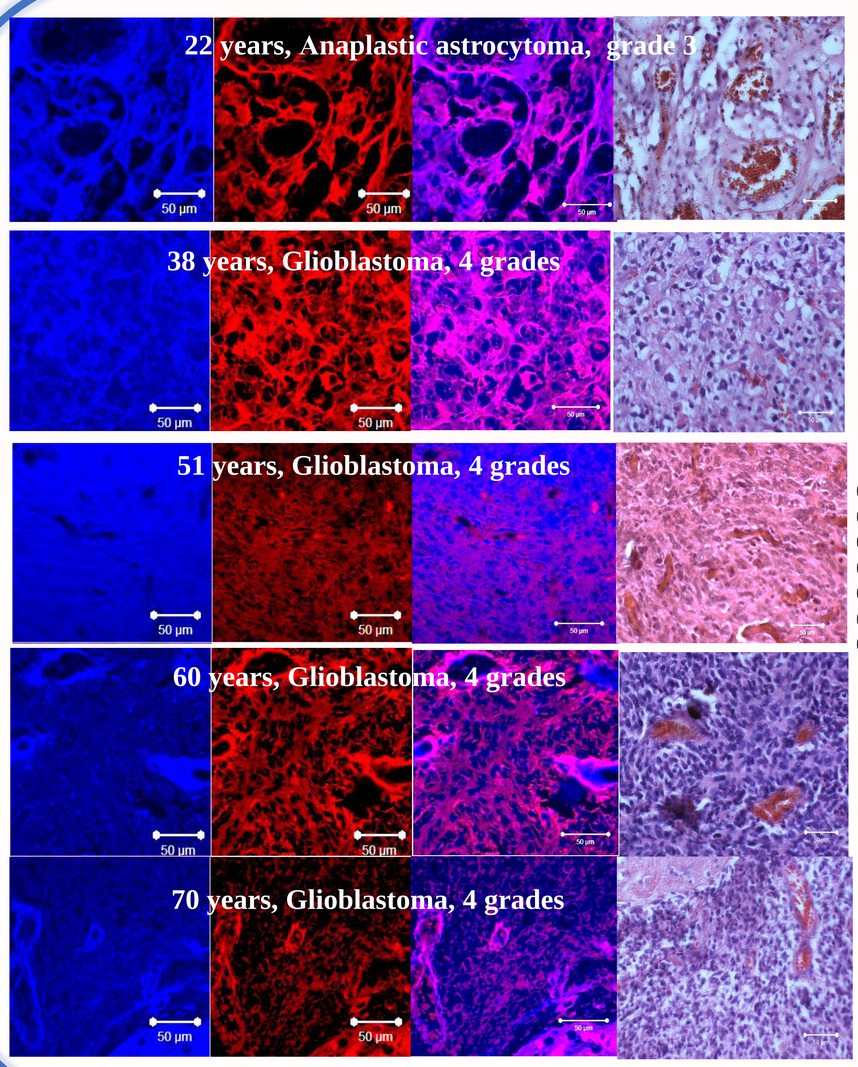


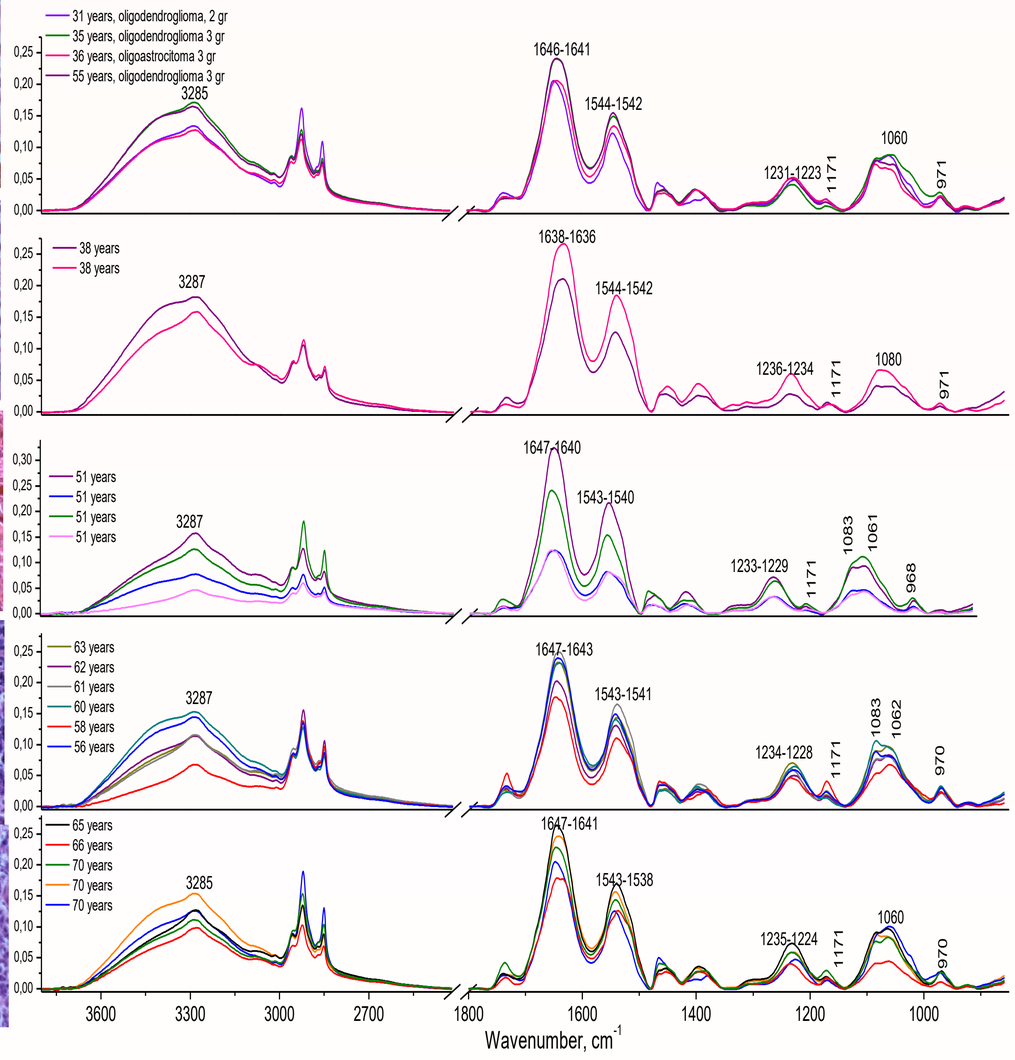
Bioptic material of supratentorial gliomas of different degrees of anaplasia from 40 operated patients were studied in this work. The age of the patients ranged from 22 to 70 years.
For IR spectroscopy, the samples were dried on the working surface of an ATP attachment. IR absorption spectra were registered on a Bruker INVENIO-R FTIR spectrometer in the region from 3800 to 600 cm-1.

Analysis of the spectral markers database

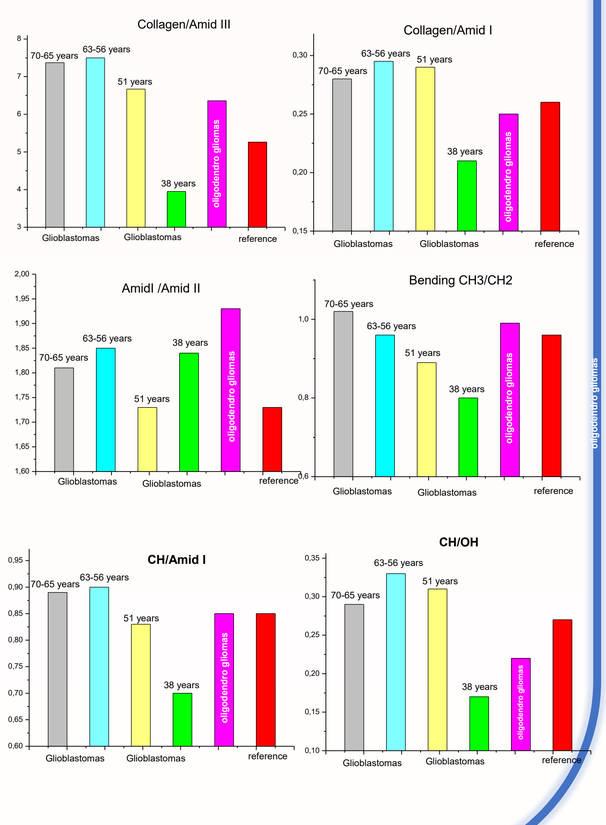
Determination of biomolecules conformations, structural changes, interactions







A number of spectral features that can be defined as spectral markers of tumour tissues (gliomas) have been identified. Namely, the increasing contribution to the absorption of CH molecular groups, the presence of the C=O band in the 1740 cm-1 region, the pronounced asymmetry of the Amide I band with the contribution of different protein conformations. The values of spectral markers for different age groups of patients are established.



Histological preparations of the studied tissues stained with hematoxylin and eosin and iron hematoxylin were used for confocal microscopy. Confocal images were obtained on a Carl Zeiss LSM-510 META confocal microscope with EC Plan-Neofluar 40x/1.30 Oil DIC objectives and a Zeiss AxioCam camera. Wavelength of lasers: 405 nm T1 30.7%, 543 nm T2 50.5%
The analysis of confocal images made it possible to reveal the morphological features of the studied samples and to conduct correlations with the data of IR spectroscopy. When analyzing the data, the peculiarities of the clinical state and treatment of patients with brain gliomas were taken into account.

Morphological features of brain tumors of patients of different age groups have been established. It is shown that older patients (65-70 years old) are characterized by a dense packing of tumor cells that are gathered in conglomerates, developed vascular systems, and persistent swelling around the cells.
At a younger age (22-38 years), tumor cells are of different sizes, there are fewer vessels.
An attempt was made to link such morphological features with spectral markers. Some of the selected indicators show an age correlation - (bending CH3/CH2), others did not reveal an age correlation (Amide I/Amide II).

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