Raman spectroscopy for meningioma

Unprocessed primary and recurrent solid human meningeal tissues were collected from 33 patients and underwent Raman analysis during surgeries. A total of 1180 VRR spectra were acquired from fresh solid tissues using a VRR-LRR™ analyzer. A confocal HR Evolution (HORIBA, France SAS) Raman system with 532-nm excitation wavelength was also used to collect data for part of the ex vivo samples after they were thawed from - 80 °C for comparison. The preliminary analysis led to the following observations. (1) The intensity ratio of VRR peaks of protein to fatty acid (I2934/I2888) decreased with the increase of meningioma grade. (2) The ratio of VRR peaks of phosphorylated protein to amid I (I1588/I1639) decreased for the higher grade of meningioma. (3) Three RR vibration modes at 1378, 3174, and 3224 cm-1 which were related to the molecular vibrational bands of oxy-hemeprotein, amide B, and amide A protein significantly changed in peak intensities in the two types of meningioma tissues compared to normal tissue. (4) The changes in the intensities of VRR modes of carotenoids at 1156 and 1524 cm-1 were also found in the meningioma boundary. The VRR-LRR™ analyzer demonstrates a new approach for label-free, rapid, and objective identification of primary human meningioma in quasi-clinical settings. The accuracy for detecting meningioma tissues using support vector machines (SVMs) was over 70% based on Raman peaks of key biomolecules and up to 100% using principal component analysis (PCA). [1)].

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