Spectroscopic evaluation of the blood supply to the tracheal tissues during surgeries with anastomosis application

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Introduction: An important parameter during operations with anastomosis is the level of blood supply to the sutured tissues, which determines the outcome of the surgical procedure and the risk of postoperative complications. Accordingly, the availability of a method that allows intraoperative assessment of blood supply can improve the results of surgical operations.

Purpose: The aim of this work was to assess the state of the tracheal tissues during surgical operations with anastomosis, as well as to study the features of light propagation in this organ.

Materials and Methods: Assessment of oxygen saturation of the tracheal tissues was performed using the analysis of the recorded diffuse scattering spectra. The measurements were carried out using a spectrometric setup, which includes a spectrometer “LESA-01-BIOSPEC”, a broadband light source, an optical fiber, and a computer with the special software “Uno Momento”. The mathematical simulation of light propagation in the layers of the organ under study was also conducted for various parameters using the Monte Carlo method.

Results: This study involved the participation of 8 patients with malignant neoplasms or tracheal stenosis. In each case, a surgical procedure was performed to remove the affected part of the organ. Saturation measurements were carried out at several stages: before the tracheal intersection, after its crossing, and after the anastomosis application. The results of measurements at each stage were compared to determine changes in the level of blood supply to the organ. There was only one anastomosis failure that was caused by mechanical damage. The mathematical simulation results for different layer thicknesses and saturation levels were also analyzed.

Conclusion: Assessment of the blood supply to the tracheal tissues by determining the level of saturation by diffuse scattering spectroscopy can be applied in clinical conditions in real time.

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