Stroke is the second leading cause of death and the third leading cause of disability worldwide. Acute ischemic stroke, one of the two main subtypes of stroke, occurs due to brain ischemia caused by a blockage of a cerebral artery by a thrombus. Recent years have resulted in the development of an endovascular technique of clot retrieval called mechanical thrombectomy. This procedure utilizes direct aspiration devices or stent retrievers to recanalize an occluded cerebral artery. Mechanical thrombectomy has revolutionized treatment of acute ischemic stroke and currently is the standard of care.

Little was previously known about the thrombi that cause acute ischemic stroke, due to their unavailability. The introduction of mechanical thrombectomy devices and their widespread use have enabled the possibility of complete extraction of clots and their further investigation. Moreover, advances in radiological techniques and availability of innovative imaging methods such as micro-computed tomography allow for detailed visualization of clots.

Recent evidence suggests that histological composition of a thrombus may impact on stroke treatment. Depending on their main component, cerebral thrombi have different physical properties and behave differently during mechanical thrombectomy. The large number of mechanical thrombectomy devices currently available necessitates selection of an appropriate device for a particular clot histological type. Hence, it is crucial to conduct studies that further investigate the correlation between thrombus histology and the efficacy of stroke treatment. Our project aims at combining histological, radiological and clinical data, so that assessment of a thrombus on baseline diagnostic imaging would be sufficient enough to determine its composition.

The main goal of this project is to investigate correlations between clot histological composition and clot characteristics assessed on diagnostic imaging studies. Secondly, we aim to evaluate the feasibility of baseline imaging to predict thrombus composition before endovascular treatment. Finally, we will investigate the influence of clot composition on the efficacy of mechanical thrombectomy.

We will examine thrombi retrieved from a series of 100 patients with acute ischemic stroke treated with mechanical thrombectomy. We will perform imaging of isolated clots on computed tomography and micro-computed tomography. Micro-CT is a highly advanced imaging method that allows for three-dimensional reconstructions of analyzed objects. To the authors' best knowledge, diagnostic imaging of isolated clots from real stroke patients has not been done before. We will also analyze clot appearance on standard baseline patient imaging. To assess histological composition of the clots, regular histological and immunohistochemical staining will be performed, and clots will be examined under the microscope. We will categorize clots by their main component and compare the differences in their appearance on radiological imaging. Finally, we will analyze patient clinical data related to mechanical thrombectomy in order to assess the influence of clot composition on stroke treatment.

Currently clot histological composition is not considered in treatment decision making. However, we hypothesize that if clot composition is known before treatment, it will influence selection of the best therapy strategy. Pre-treatment assessment of thrombi composition on baseline patient diagnostic imaging will aid in choosing a proper thrombectomy device addressed for certain clot histological type. We believe that complex assessment of stroke thrombi both histologically and radiologically as proposed in our project will expand the understanding of stroke, which may improve patient care in the future.

As the subject of our project is of great clinical importance, created articles may be successful in publication in high impact journals and produced abstracts may be accepted for presentation at the most important international conferences.