

Stroke is the second-leading cause of death worldwide, following only ischemic heart disease, and it is one of the main causes of long-term disability across the globally, with its impact continuously increasing. At present, intravenous alteplase and mechanical thrombectomy are the two recommended effective treatments for patients with acute ischemic stroke (AIS). However, additional treatment strategies are needed, as many patients are ineligible for current therapies.

Treatment of ischemic stroke (IS) in the acute stage poses significant challenges. The diagnosis of IS relies on clinical assessment and neuroimaging. Despite extensive research in the field, no single blood biomarker has been adopted in clinical practice for diagnosing or monitoring IS. As such, the utilization of blood biomarkers to predict IS outcomes, which could assist in identifying patients at risk, enhancing clinical management, and monitoring therapeutic effects, holds promise for both clinicians and researchers. Accumulating evidence demonstrates that inflammation plays a key role in the pathogenesis of IS, and it has become an intriguing target for therapeutic intervention. The pathophysiological mechanisms of neuroinflammation, angiogenesis, and neuroplasticity are currently the focal points of research in IS.

One of the project aims is a comparative analysis of the immunological profile of patients with AIS and control subjects. In addition, we will be able to correlate immunological data with clinical parameters monitored in the course of AIS management.

This clinical study will be conducted in the Department of Neurology, Medical University of Bialystok (MUB) and the Department of Regenerative Medicine and Immune Regulation (MUB). We will enroll 100 consecutive patients with IS (50 patients treated with intravenous thrombolysis and/or mechanical thrombectomy, and 50 patients who undergo conservative treatment). For the control group, we will include 60 age- and sex-matched healthy subjects.

Noteworthy, our study will predominantly focus on the evaluation of several known, yet not well-defined T and B cells subsets, including T or B regulatory cells (Treg and Breg), and their contribution to the inflammatory process associated with AIS.

Those cell populations would be monitored from initial diagnosis through subsequent stages of the AIS patients therapy. This research will undoubtedly yield fresh insights into the pathomechanisms of AIS, which have remained elusive due to the complexity of the condition. Most importantly, however, we will be able to assess the clinical significance of the immunosuppressive B and T cells in the disease onset, progression, and outcome. Because our patients with AIS would include those treated with mechanical thrombectomy or intravenous thrombolysis, the effectiveness of these therapies would be correlated with tested immune cells.

A comprehensive but still reasonably designed plan will undoubtedly allow for the determination of regulatory immune cells contribution to AIS, the establishment of their value as diagnostic and/or prognostic parameters, the role of those immunosuppressive subsets in the course of different stroke etiologies, different stroke management methods, and their efficiency.

The proposed project represents a significant milestone in the context of implementing immune profile analysis in the diagnosis and monitoring of AIS treatment. These data will serve as the basis for the development of a future large-scale research project, enabling the integration of inflammatory and immunological analyses into clinical practice. Furthermore, it will help elucidate the role of investigated regulatory immune cells in the pathogenesis of AIS and their potential significance for future utilization in innovative targeted therapies. Expanding on the topic undertaken in the Preludium project will also be an important step for science itself, incorporating the role of neuroimmunology into the network of previously better-known factors determining the occurrence and course of AIS. From the perspective of precision medicine, the future challenge lies in improving the accuracy of diagnosis, prognosis, and prediction of therapeutic responses through biomarker identification. In Poland, only a few centers are addressing the immunological aspects of stroke, particularly in relation to clinical practice. This study will provide the necessary preliminary data to apply for larger grant projects, enabling the testing of discovered relationships on larger cohorts of patients. Consequently, it will allow for the implementation of analyses of inflammatory and immunological processes in patients with AIS into clinical practice.