

Cancer is currently the second most frequent cause of death in Poland. It is estimated that demographic changes in the form of the rising percentage of the elderly and the relationship between the risk of cancer and the patients' age are prognostic of an increase in the cancer incidence rate (Didkowska, 2014). These factors, along with more effective methods of oncological treatment, influence the chronic character of cancer. In Poland, more than 90% of the palliative care recipients are patients with cancer (Ciałkowska-Rysz & Dzierżanowski, 2014). It additionally emphasizes the importance and the scale of problems connected with the functioning of people suffering from oncological diseases.

Cancer significantly influences the life of patients at all stages of the disease: waiting for a diagnosis, treatment, and the periods of remission, recovery, or the end of life. The oncological disease as well as long-lasting and diverse therapeutic methods negatively influence the mood and have an impact on the quality of patients' lives (de Walden-Gałaszko, 2013).

Some of the patients with a diagnosed cancer who undergo chemotherapy complain about forgetting important information, claim that they are unable to stay focused when solving specific tasks, and believe that they experience problems with thinking and performing two simple actions simultaneously. They also say that they often have words "at the tip of their tongues." Memory, thinking, attention, and psychomotor impairments in patients suffering from somatic cancer are reflected in scientific reports (Wieneke & Dienst 1995, Schagen et al., 1999). This phenomenon is referred to as *chemobrain* or *chemofog* (Raffa et al., 2006).

Specific causes influencing the cognitive impairments in people suffering from cancer are unknown. *Chemobrain* seems to have a multifactor aetiology. As causative mechanisms of these dysfunctions, one can enumerate: metabolic changes in the central nervous system, direct damage of neurons connected with the breach of the blood-brain barrier, decrease of neurotransmitter activity, DNA damage, secretion of proinflammatory or anti-inflammatory cytokines (proteins regulating the inflammatory process in human body) such as: tumour necrosis factor (TNF- α), interleukin 6 (IL-6), interleukin 10 (IL-10) as well as vascular changes, the influence of surgery and general anaesthesia, hormonal therapy, adjuvant drugs applied in cancer treatment (analgesic, antiemetic), anaemia, comorbidities such as anxiety and depressive disorders as well as drugs applied during their treatment, genetic susceptibility (Szafryna-Kliwicka & Litwiniuk, 2011). The presence of brain-derived neurotrophic factor (BDNF), which inhibits the apoptosis of multiple myeloma cells and, therefore, conduces their survival, may also have a modifying influence on the patients' functioning (Pearse et al., 2005). However, these are first premises that attempt to explain the complex mechanism of the development of *chemobrain* requiring further verification.

The above-mentioned data are the justification of the studied subject and are directly connected with the goal of these analyses, namely with the explanation of the causes of a great differentiation of negative outcomes of cancer and oncological treatment in the form of cognitive impairments. It was assumed that the cognitive state of patients with a diagnosed cancer is an effect of the disease and treatment influencing the level of biological factors, that is proinflammatory cytokines and neurotrophin BDNF, whereas the level of the selected parameters of laboratory tests in an interaction with the level of anxiety, depression, fatigue and quality of life has an impact on the state of cognitive functioning. Research procedure will concern patients who suffer from multiple myeloma. There exists a group of people in whose case there occur reports concerning the presence of cognitive impairments resulting from chemotherapy (Potrata et al., 2010).

The study will be performed on a group of 60 people with multiple myeloma which is a haematological cancer. The group of people with a diagnosed cancer will be compared to a group of 60 healthy people. Research procedure includes the psychological testing of the selected cognitive processes (memory, attention, executive functions) and psychosocial factors (anxiety, depression, fatigue, quality of life) and the examination conducted by medical staff concerning the level of cytokines TNF- α , IL-6, IL-10, and neurotrophin BDNF. The group of oncological patients will be examined three times (T0 - before chemotherapy, T1 - after a couple of cycles of chemotherapy, T2 - after the completed chemotherapy treatment). The control group will be subject to the research procedure only once.

The results of the planned analyses as well as the resulting theoretical model will allow to understand the processes of occurrence and the changeability of symptoms of cognitive impairments in the group of oncological patients. Therefore, they will surely enrich the current state of knowledge concerning the causes of *chemobrain*. Additionally, the knowledge of mechanisms governing the cognitive dysfunctions in patients with a diagnosed cancer will have an impact on the development of psycho-oncology in terms of a better understanding of patients' state at different stages of the treatment. The results of these studies will contribute to the acquisition of a more precise knowledge concerning the causes of *chemobrain*, the discovery of the connection between the level of particular biochemical factors and selected cognitive functions, and the differentiation of the level of the functioning of memory, thinking, attention, etc. in patients with a diagnosed multiple myeloma. This knowledge will have an impact on the improvement of the quality of life of patients suffering from cancer.