

Detection of changes in white blood cells after activation using density gradient

Populärvetenskaplig sammanfattning

Creation of density gradients in capillaries can make it possible to diagnose viral and bacterial infections but also autoimmune diseases.

Viral and bacterial infections are amongst the most common diseases worldwide. Autoimmune diseases, i.e. conditions where one's own body is attacking itself, are also becoming more common. Viral and bacterial infections and different autoimmune diseases may seem to be separate from each other but have in common that they lead to an activation of the immune system. There is today no fast and easy diagnostic method to evaluate if a disease is due to viral or bacterial causes or self-activation of the immune system. The most common way to evaluate if an infection, i.e. immune response due to virus or bacteria, is by measuring CRP (C-reactive protein). CRP-test will show elevated levels of CRP during infection, but it takes 8 hours after onset of illness to see a results and some medications can also affect the detection of CRP even during a serious infection. Also, a CRP-test does not show the cause of the infection [2] and because of that a blood culture, which takes over 24 hours, will be done to see if bacteria are present. Again, this method does not show virus and a separate test will be done to know if viruses are involved [3]. For conditions such as sepsis, i.e. uncontrolled activation of the immune system systemically and hence the immune cells, every second counts and false negatives can result in a patient's death.

Creating of a density gradient inside of a microcapillary, which will be put inside of a centrifuge for 2-25 minutes, may make it possible to diagnose cases such as sepsis but also other diseases affecting the immune system. The density gradient inside a microcapillary works due to differences in density depending on the cells activation levels, ways of activation but also due to intracellular content. By using a method based on density gradient it can be possible to determine if a patient's symptoms are due to a viral or bacterial infection or if they are due to an autoimmune disease since these diseases will activate the immune system differently and therefore lead to different spreading of immune cells along the capillary.

Methods available today such as CRP-test, are mostly dependent on detecting changes in levels of substances present during inflammation, e.g. C-reactive protein. For cases such as sepsis but also for patients taking some specific medications this dependency on detecting substances in the body can result in false negative readout even if the body's immune cells are fully activated. The false negative is due to sepsis and the medication affecting the production of the inflammatory substances in the body and the false negative will in turn lead to more tests being done, which take longer time, or going around with a undetected infection which

can lead to severe consequences. The proposed method can make it possible to in a fast and easy way determine if an infection is present and what it is caused by depending on the cells distribution along the density gradient created inside of the microcapillary, which is a direct quantification of their activation state. The method will also make it possible to detect the cases that otherwise would have been overlooked by the methods available today and potentially saving lives.