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Press release
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Cardiac dysfunction as a common side effect of sepsis Med Uni Graz scientists decipher molecular principles

Graz, 10 July 2023: A wide variety of infectious diseases are associated with the risk of developing sepsis, a life-threatening complication. With a mortality rate of 20%, it is a serious global health concern. Scientific research has shown that the severity of disease and mortality in sepsis patients are linked to impaired heart rate variability (HRV). Scientists at the Gottfried Schatz Research Center of the Medical University of Graz have now been able to confirm the important role played by changes in cardiac pacemaker cells.

Blood poisoning and cardiac dysfunction often occur together

Sepsis (blood poisoning or bloodstream infection) may arise as a life-threatening complication of infectious diseases, for example pneumonia and infections of the gastrointestinal and urogenital tracts. The body's reaction to infection is misdirected and may result in life-threatening organ damage. In the event of sepsis, the immune system is no longer able to localize the infection and the result is an excessive immune response. "Cardiac dysfunction frequently occurs in conjunction with sepsis, yet the underlying mechanisms have only been partially explored," says Susanne Scherübel-Posch from the Division of Medical Physics and Biophysics at Med Uni Graz. This is the subject of a Medical University of Graz scientific paper recently published in the renowned journal PNAS that provides important insights.

Imbalance: Sepsis weakens vagus nerve stimulation

Heart rate variability (HRV), the fluctuation in time intervals between heartbeats, is greatly impaired in sepsis. Because of this impaired HRV, the body is no longer able to adjust the heart rate in response to physical and mental demands. The largest nerve in the parasympathetic nervous system is the vagus nerve, which can be regarded as the regulatory hub between the brain and the organs. In sepsis, the stimulation of the vagus nerve is greatly weakened, which subsequently leads to HRV impairment.

"We assumed that impaired heart rate variability under conditions of sepsis might be dependent on reduced responsiveness of the sinoatrial node cells, the cardiac pacemaker cells," explains Susanne Scherübel-Posch. Along with Niroj Shrestha, Brigitte Pelzmann, Klaus Zorn-Pauly and other colleagues, she has now been able to confirm this assumption.

Heart rate variability as a prognostic marker in sepsis

The scientists were able to show that the sinoatrial node cells in the heart do not react normally to the release of a messenger molecule from the parasympathetic nervous system. "This messenger molecule has an anti-inflammatory effect, which in turn influences heart rate variability," explains Susanne Scherübel-Posch. The direct consequence is that heart rate variability is reduced and the heart rate-lowering effect of the parasympathetic nervous system on the cardiac pacemaker cells is impaired. Thus the anti-inflammatory effect produced by parasympathetic nervous system is very limited, which contributes to the enormous strain on the heart in sepsis and subsequently the high mortality rate of this disease.

"Current scientific findings support the use of heart rate variability as a prognostic marker in the early diagnosis of sepsis so that therapeutic measures may be introduced before this serious disease becomes full-blown," says Susanne Scherübel-Posch, summarizing the research findings.

Further information and contact

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To the publication

Lipopolysaccharide-induced sepsis impairs M2R-GIRK signaling in mouse sinoatrial node
<https://www.pnas.org/doi/10.1073/pnas.2210152120>