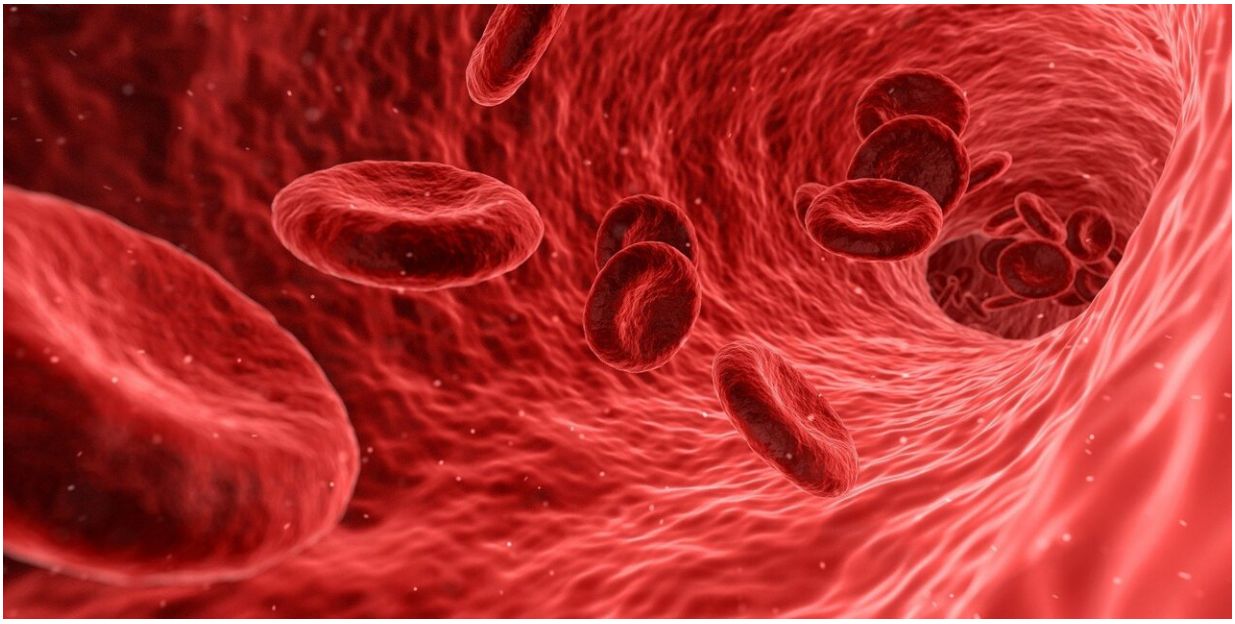
# Early warning system for intensive care units

March 22 2021



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Postoperative bleeding and acute kidney injury are among the most dangerous complications after heart or cardiovascular surgery. The earlier doctors or nurses recognize them, the greater the chance of being able to intervene successfully and save lives. "It is true that in modern cardiac surgery intensive care units, a large number of measuring instruments continuously monitor patients' bodily functions and circulatory parameters. However, even for experienced physicians, it is hardly possible to discern early signs of complications before real symptoms occur, due to the large range of monitoring data that are

continuously collected," reports Professor Alexander Meyer, physician and computer scientist at the German Heart Center Berlin (DHZB) who, together with his team, has developed software with precisely this capability.

## Data from thousands of patients used to build the system

"We trained the software with the stored, anonymized data of thousands of DHZB patients so that it could predict postoperative bleeding and acute kidney injury more and more accurately. This allowed physicians to intervene in a timely manner, mitigating the effects of these potentially life-threatening conditions with the appropriate therapies or even preventing them altogether, thereby saving lives," Meyer recounts.

Meyer initially received funding during the development and testing phase as a fellow of the BIH Charité Clinician Scientist Program, which allowed him to devote half of his working hours to research. The Validation Fund / Spark-BIH program and BIH's Digital Health Accelerator program subsequently helped him move the project from a purely scientific context to application and commercialization, and also find a CEO for his future start-up. "Our mission at BIH is clinical translation. Critical situations in daily clinical practice need to be scrutinized, and solutions need to be translated back to practice. This is exactly the process Alexander Meyer went through and we were very happy to support him," explains Professor Christopher Baum, Chair of the BIH Board of Directors and Chief Translational Research Officer of Charité.

The systems have been tested in the real clinical operations of DHZB intensive care units since April 2018 and will now be transferred into the certified medical products "x-c-bleeding" and "x-c-renal-injury," which

will be marketed by the newly founded company x-cardiac GmbH.

## Other products planned

With the new company, Alexander Meyer plans to launch several other products in the medium term: "The principle of early detection of postoperative complications based on big data using artificial intelligence can, of course, also be extended to other surgical disciplines, with their respective specific complications. We are convinced that our developments will not only significantly reduce post-surgery death rates, but also the time patients spend in intensive care. As a result, they can not only save human lives, but also help run hospitals more economically."

Along with Alexander Meyer, the management tier of the new company includes Oliver Höppner, a business studies graduate and entrepreneur based in Berlin. As CEO of x-cardiac, Höppner is responsible for the areas business development, finance and human resources. He has more than twenty years of leadership experience as a manager of numerous life science companies. The engineer Kay Brosien oversees business operations at x-cardiac. He is also responsible for quality management and regulatory affairs. Prior to x-cardiac, Kay Brosien developed diagnostic software for congenital heart disease. The Scientific Advisory Board of x-cardiac is made up of Prof. Dr. med. Volkmar Falk and Prof. Carsten Eickhoff. Volkmar Falk is Head of the Department of Cardiothoracic and Vascular Surgery and Medical Director of the German Heart Center Berlin, as well as Head of the Department of Cardiovascular Surgery at Charité - Universitätsmedizin Berlin. Falk also holds a professorship at ETH Zürich. Carsten Eickhoff is Professor of Medical AI at Brown University in Providence, Rhode Island, USA. He directs the AI Lab at Brown's Center for Biomedical Informatics and supports x-cardiac as a technical advisor. Prior to his professorship, he conducted research at Harvard University and ETH Zürich. Together

with Alexander Meyer, Carsten Eickhoff was the scientific initiator of the x-cardiac project.

Alexander Meyer completed vocational training as an IT specialist and worked as a software developer for two years before he began studying medicine at Goethe University in Frankfurt am Main. He joined the DHZB in 2015. Here Meyer established the Medical Data Science Group and, as Chief Medical Information Officer, has occupied a leading role in overseeing digitalization in medicine since mid-2020. In December 2020, he was appointed to the W2 professorship in "Clinical Applications of AI and Data Science" at Charité - Universitätsmedizin Berlin.

"Machine learning for real-time prediction of complications in critical care: a retrospective study" was published by the team led by Alexander Meyer in the journal *The Lancet Respiratory Medicine*; the scientists published "Deep-learning-based real-time prediction of acute kidney injury outperforms human predictive performance" in the Nature Partner Journal (npj) Digital Medicine.

**More information:** Alexander Meyer et al, Machine learning for real-time prediction of complications in critical care: a retrospective study, *The Lancet Respiratory Medicine* (2018). DOI: 10.1016/S2213-2600(18)30300-X

Provided by BIH at Charité

Citation: Early warning system for intensive care units (2021, March 22) retrieved 26 April 2024 from https://medicalxpress.com/news/2021-03-early-intensive.html

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